

Self-assessment competency tool for nurses working in critical care units: development and psychometric evaluation

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Abstract: Aim: this study aimed to develop a self-assessment competence tool for nurses working in critical care units, and to test its validity and reliability. Methods: Design: This operational action-oriented research for development of a tool include an experts group consisted of 41 senior registered senior nurses and physicians working in critical care units, jury group from academia and included 11 professors in field of specialty, a purposive sample of 50 nurses working in critical care units Data collection took place in June 2009 to September 2010 through a semi-structured questionnaire, a preliminary nursing competency list with initial 130 items pool through expert and jury opinionnaires, finally 79-item tool of clinical nurse competency was developed. Findings: Cronbach's α rang from 0.81 to 0.96 for the new tool, with total internal consistency reaching $\alpha = 0.98$. Statistically significant positive moderate to strong correlations among the various components of the tool. Statistically significant positive correlations with almost all the new tool dimensions and the standardized tool ranging between 0.256 and 0.725. statistically significant positive correlation between the two scores, with a correlation coefficient $r = 0.44$. conclusion: a self-assessment competence tool for nurses working in critical care units was developed with a high level of reliability; its content validity was demonstrated, concurrent validity was borderline acceptable. Further improvement of the developed tool is recommended through including a variety of participants, both as experts and juries, and taking a more representative sample. Also, application of the tool in a variety of similar settings would offer data that can help in improving its psychometric characteristics. Moreover, periodic evaluation of nurses' competency can provide longitudinal data that may help in assessing the new tool's predictive validity.

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1. Introduction

The arena of critical care is currently receiving increasing scrutiny regarding developing advanced practice roles. This is challenging to critical care nurses who work in a wide variety of environments and specialties such as emergency departments and the intensive care units (Coombs and Chaboyer, 2007; Hurley *et al.*, 2008).

Critical care nursing is a dynamic specialty which positively and proactively responds to meet the ever changing, complex and challenging demands of the critically ill population and the overall health care system. This has resulted in the development of a diverse range of nursing roles, such as the bedside staff nurse, nurse manager, advanced practitioner, educator, researcher and consultant nurse (DOH, 2009). As well, critical care nurses are required to make a significant contribution in enhancing the quality and experience of patient care through involvement in professional activities such as the development of self and others, service improvement and research utilization (Bell, 2008).

Competency is crucial to reduce the risk of harming patients, and is of particular importance in

the critical care units (Hurley *et al.*, 2008). The literature that discusses the concept of competency in nursing often refers to the work of Benner (1982) who referred to competency as the "ability to perform a task with desirable outcomes under the varied circumstances in the real world" (P.304). The definitions of competency may be very simplistic, such as professional standards that nurses use to guide the practice (Kaiser and Rudolph, 2003), and individual's qualities and characteristics that lead to effective work performance (McMullan *et al.*, 2003). More complex definitions incorporate all aspects of nursing performance-how it is defined, acquired, developed and assessed (King, 2005). Nurses need personal attributes and characteristics to translate these skills and knowledge into effective action (Calman, 2006).

Competency statements are often grouped according to related facts of specialist practice known as domains. These domains include enabling, clinical problem solving, professional practice, reflective practice, teamwork and leadership (ACCCN, 2002). Meanwhile, Ramritu and Barnard (2001) described eight concepts of competence, which are safe

practice, limited independence, and utilization of resources, management of time and workload, ethical practice, performance of clinical skills, knowledge, and evolving.

Nurses should be assessed in some way to be deemed competent in their nursing practice. Assessing the competence of practicing nurses is essential in order to identify areas for professional development and educational needs (Meretoja *et al.*, 2004). However, measuring or assessing whether a nurse is competent is a challenging and problematic task. Many methods of assessing or measuring competency in nursing exist, including establishing and maintaining a professional portfolio, self-report measures, knowledge-based tests, assessment within a simulated nursing environment, and assessment through clinical bedside observation (Cashin *et al.*, 2008).

Nevertheless, the reliability and validity of assessment methods are still debatable (Watson *et al.*, 2002). For instance, rating nursing competence via assessment methods that stress the functional characteristics of practice may lead to inferring too much from performance and losing the ability to differentiate between nurses with functional skills and those with deeper personal qualities (Cowan *et al.*, 2007). On the other hand, qualitative competency measurement tools are criticized for being too task-oriented, while the concepts of caring, interpersonal interactions and decision-making are perceived as things that cannot easily be measured quantitatively (Bartlett *et al.*, 2000). Furthermore, the performance and competence observation tools may be subject to bias, may become outdated, and may be insensitive to low-visibility skills such as non-verbal communication. In addition, successful performance on one day is no guarantee of it on another (Redfern *et al.*, 2002).

In consideration of how to overcome these disadvantages of assessment tools, and given the available time and resources, the self-assessment competency tools would more practical (Cowan *et al.*, 2007). The methods of self-assessment are well supported, and are based on the concept that critical reflection is positively related to quality of care making it a powerful method for assessing clinical competence (Gopee, 2000; McCaughan and Parahoo, 2000; Way, 2002; Cowan *et al.*, 2005). Self-assessment tools are quick, efficient, and cost-effective (Cashin *et al.*, 2008). Moreover, they encourage practitioners to take an active part in the learning process and facilitate continuing education (Campbell and Mackay, 2001).

However, to ensure that they will provide accurate measurement, assessment tools must possess certain basic attributes. The most important of these

are to tool validity, reliability, and usability (Quinn, 2000). Validity refers to the extent to which a tool measures what it was designed to measure, and hence the tool should be relevant to the construct being assessed (Stuart, 2003). Face validity is the least time consuming method (Polit and Hungler, 2009), but the content, criterion-related, and concurrent validity methods are more important (Stuart, 2003). Concerning reliability, it refers to the tool ability to give similar results when used on separate occasions and with different assessors (Stuart, 2003). However, the issues of stability, equivalence, and homogeneity need to be considered when measuring reliability (Polit and Hungler, 2009)

Significance of the study

Meeting the expectations of delivering safe, effective and timely health care services requires all health care professionals to identify their learning needs, refine and adapt their clinical roles through a process of ongoing self- assessment. Although the review of the literature identified several nursing competency instruments, few of them related to critical care nurses self assessment, but none of them was developed in the context of Egypt. Hence, a competency self-assessment tool would allow nurses to consider their practice within their own environment and assist them to provide high quality clinical practice. This is even more important in the critical care units. This study provides an instrument for self-assessment of competence for nurses working in critical care units.

Aim

The aim of this study was to develop a self-assessment competency tool for nurses working in critical care units, and to test its validity and reliability.

2. SUBJECTS AND METHODS

Research design

This study is an operational action-oriented research for development of a tool.

Setting

The study was conducted in the critical care units at Ain Shams University Hospital, Ain Shams Specialized Hospital, El Demerdash Hospital, and the Obstetrics Hospital.

Subjects

The study subjects consisted of an expert group, a jury group, and a group of staff nurses for concurrent validity and reliability. The experts group consisted of 41 senior registered senior nurses and physicians working in critical care units, with the

only inclusion criterion of three years of experience in these units. The jury group was from academia and included 11 professors in medical-surgical nursing (4), critical and intensive care (4), and nursing administration (3) from the Faculties of Nursing and Medicine in Cairo, Ain-Shams, Tanta, and Alexandria universities. The second group consisted of a purposive sample of 50 nurses working in critical care units for at least one year.

Research procedures and tool development

Data collection took place in June 2009 to September 2010. The first task in the process of developing the self-assessment competency tool was to review the current literature to find how the concept of competence had been used in instruments related to this concept. Then, the process of development of the tool and assessing its validity and reliability was started and involved the following six steps.

Step I:

In June 2009, a semi-structured questionnaire was developed and used to identify the concept and indicators or categories of nursing competency for nurses working in critical care. The questionnaire consisted of open and closed questions that reflect nurses' performance at the competence level, as well as the domains of nursing practice that represent the categories according to frequency of use (Shapiro 1998; Buchan 1999; Priest 1999; Lindberg, 2006; Toth, 2006). It included ten questions about functions, roles, skills, competencies, and care provided by nurses working in critical care. The experts group members were asked to complete the questionnaire. In a period of two months, they produced as many descriptions as they considered necessary for each category of competency, and created a total of 210 descriptions. The database of these descriptions was analyzed by deductive content analysis guided by Hanley and Higgins (2005), and Gill *et al.* (2006). This resulted in identification of 130 items for competent critical care nursing practice in nine domains: personal and professional development, professional and ethical practice, safety and injury prevention, comprehensive nursing care, interpersonal relationships, manage technical equipment, critical thinking and research utilization, teaching and coaching, and work management.

Step II:

Based on the forgoing, a preliminary nursing competency list was developed with the initial 130 items pool. These were classified into nine dimensions, and re-distributed to the same respondents for expert evaluation. An opinionnaire

form was designed for this purpose, and the respondent was asked to check each item on a 4-point rating scale (not relevant, somewhat relevant, quite relevant, and very relevant). Based on this assessment, the items judged to be not relevant or somewhat relevant by 50% or more of the experts were discarded. The process ended up with retention of 99 items in nine domains.

Step III:

At this step, the face validity and logical consistency of the competency domains and the appropriateness of the tool in terms of clarity, and comprehensiveness were evaluated by the jury group. They were asked to review the second list of 99 items agreed upon by the experts group. Based on their opinions, 20 overlapping items were deleted.

Step IV:

The 79-item tool of clinical nurse competence was translated into Arabic and back translated to ensure proper wording. The items were classified into the nine dimensions as follows: personal and professional development (8 items), professional and ethical practice (11 items), safety and injury prevention (6 items), comprehensive nursing care (21 items), interpersonal relationships (6 items), managing technical equipment (6 items), critical thinking and research utilization (5 items), teaching and coaching (7 items), work management (9 items). The scale of responses reflected the frequency the respondent is actually using the item in clinical practice: never, occasionally, usually, or always. The list was then re-distributed to the jury group to judge the clarity, comprehension, and accuracy of the Arabic version of the tool.

Step V: The list was distributed to ten nurses working in critical care units to evaluate its applicability as pilot testing. It was found easy to use. Cronbach α coefficient of scale categories were estimated and proved to be acceptable and so no changes were made. The tool was then finalized for data collection with the purpose of psychometric evaluation.

Step VI:

Data collection was done using the developed self-assessment competence tool. The nursing competence scale (NCS) with known validity and reliability (Meretoja *et al.*, 2004) was used for assessment of the concurrent validity of the new tool. The two tools were distributed to 50 nurses in critical care units in the study settings.

Ethical considerations

Before data collection, an approval from Ain Shams University Hospitals' authority and the Faculty of Nursing was obtained. All participants were informed about the purposes and procedures of the study. They were informed about their rights to refuse to participate or withdraw from the study at any time without being penalized. Moreover, the participants were reassured that their responses would be kept confidential and their identities would not be revealed on research tools or reports.

Data analysis

Data entry and analysis were done using SPSS 16.0 statistical software package. Cronbach alpha coefficient was calculated to assess the reliability of the developed tools through their internal consistency. Pearson correlation analysis was used for assessment of the inter-relationships among the various dimensions and total scores of the two tools and to assess the convergent validity. Statistical significance was considered at p-value <0.05.

3. Results

The personal characteristics of nurses in the study sample, (Table 1) indicate that their mean age is 28.9±5.7 years; with half of them being singles. Slightly less than half of them (44.0%) have a bachelor degree, and their mean years of experience in the unit is 5.5±5.6. The majority (85.0%) had related training courses.

Table 2 summarizes the reliability of the total components of the new and the standardized competency assessment tools as ascertained by internal consistency. As evident from the table, Cronbach's α rang from 0.81 to 0.96 for the new tool, with total internal consistency reaching $\alpha=0.98$. As for the standardized competency assessment tool, Cronbach's α rang from 0.84 to 0.94, with total internal consistency reaching $\alpha=0.97$.

A correlation matrix of the scores of the nine dimensions of the newly developed competency assessment tool is presented in Table 3. It indicates statistically significant positive moderate to strong correlations among the various components of the tool. The correlation coefficients range from 0.467 between personal and professional development and managing technical equipment domains, to 0.794 between comprehensive nursing care and work management domains.

As for the standardized tool, Table 4 shows that the correlation coefficients of the dimensions matrix range from 0.006 to 0.838. The table indicates that the first dimension of the tool (helping role) has statistically significant correlations only with the second (teaching coaching) and the fifth (therapeutic interventions) dimensions.

Table 5 describes the correlations between the scores of various dimensions of the newly developed competency assessment and the standardized competency assessment tools. It shows statistically significant positive correlations among most dimensions, reaching as high as 0.765 between helping role (standardized tool) and teaching/coaching (new tool). It is also noticed that the first component of the standardized tool (helping role) has statistically significant correlations with all the dimensions of the new tool, whereas its third component (diagnostic role) has no statistically significant correlations with any of the dimensions of the new tool. On the other hand, the first two and the seventh dimensions of the new tool are significantly correlated only to the first dimension of the standardized tool.

Table 1. Personal characteristics of nurses in the study sample (n=50)

	Frequency	Percent
Age (years):		
<30	28	56.0
30+	22	44.0
Range	19-40	
mean±SD	28.9±5.7	
Marital status:		
Single	25	50.0
Married	22	44.0
Divorced /Widow	3	6.0
Nursing qualification:		
Secondary diploma	23	46.0
Technical institute diploma	3	6.0
Bachelor	22	44.0
Experience years (total):		
<10	32	64.0
10+	18	36.0
Range	1.0-30	
mean±SD	8.6±7.0	
Experience years (in dept):		
<5	29	58.0
5+	21	42.0
Range	<1-20	
mean±SD	5.5±5.6	
Attended training courses	42	84.0

Concerning the correlations between the standardized tool total score and the newly developed tool dimensions scores, Table 6 reveals statistically significant positive correlations with almost all the new tool dimensions ranging between 0.256 and 0.509. The only exceptions were with the dimensions of personal/ professional development, professional/ethical practice, and critical thinking/research utilization, which were not

statistically significant. The same table shows statistically significant positive correlations between the total score of the new tool and most of the dimensions of the standardized tool, ranging between 0.204 and 0.725. Only the dimensions of diagnostic role and managing situations of the standardized tool have no statistically significant correlations with the total score of the new tool.

To assess the concurrent validity of the newly developed tool, the correlation between its total score and the total score of the standardized tool was done. Figure 1 is a scatter plot indicating a statistically significant positive correlation between the two scores, with a correlation coefficient $r = 0.44$.

4. Discussion

This study was carried out with the aim to develop and psychometrically evaluate a self-assessment tool to measure the competency of nurses working in critical care units. This tool was developed and proved to be a useful tool based on evidence of its reliability and validity as has been recommended by Polit and Hungler (2009).

Table 2. Reliability of the newly developed and standard tools through internal consistency

Tool components	No. of items	Cronbach Alpha Coefficient
Tool 1 (new tool) components:		
Personal / Professional development	8	.91
Professional / ethical practice	11	.90
Safety / injury prevention	6	.89
Comprehensive nursing care	21	.96
Interpersonal relationships	6	.91
Manage technical equipment	6	.92
Critical thinking / research utilization	5	.81
Teaching /Coaching	7	.94
Work management	9	.91
Total	79	.98
Tool 2 (standardized) components:		
Helping role	7	.87
Teaching-coaching	16	.92
Diagnostic role	7	.84
Managing situations	8	.88
Therapeutic interventions	10	.88
Ensuring quality	6	.85
Work role	19	.94
Total	73	.97

Table 3. Correlation matrix of the scores of the components of the newly developed tool

Tool 1 components	Pearson correlation coefficients (tool 1 components)								
	1	2	3	4	5	6	7	8	9
1. Personal / Professional development									
2. Professional / ethical practice	.500**								
3. Safety / injury prevention	.758**	.671**							
4. Comprehensive nursing care	.670**	.624**	.735**						
5. Interpersonal relationships	.590**	.705**	.710**	.576**					
6. Manage technical equipment	.467**	.557**	.607**	.608**	.574**				
7. Critical thinking / research utilization	.571**	.640**	.643**	.724**	.652**	.664**			
8. Teaching /Coaching	.717**	.572**	.737**	.787**	.695**	.736**	.666**		
9. Work management	.486**	.631**	.634**	.794**	.597**	.689**	.645**	.769**	

(**) Statistically significant at $p < 0.01$

Table 4. Correlation matrix of the scores of the components of the standardized tools

Tool 2 components	Pearson correlation coefficients (tool 2 components)						
	1	2	3	4	5	6	7
Helping role							
Teaching-coaching	.304*						
Diagnostic role	0.272	.713**					
Managing situations	0.159	.817**	.672**				
Therapeutic interventions	.296*	.751**	.684**	.710**			
Ensuring quality	0.006	.527**	.451**	.541**	.558**		
Work role	0.233	.838**	.680**	.768**	.783**	.570**	

(*) Statistically significant at $p < 0.05$

(**) statistically significant at $p < 0.01$

Table 5. Correlation of the scores of the components of the newly developed and standard tools.

Tool 1 components	Pearson correlation coefficients (tool 2 components)						
	Helping role	Teaching-coaching	Diagnostic role	Managing situations	Therapeutic interventions	Ensuring quality	Work role
Personal / Professional development	.559**	0.271	0.077	0.118	0.164	0.134	0.178
Professional / ethical practice	.464**	0.167	0.179	0.159	0.246	0.244	0.173
Safety / injury prevention	.592**	.330*	0.176	0.098	0.278	0.213	0.253
Comprehensive nursing care	.637**	.377**	0.198	0.213	.378**	0.231	.341*
Interpersonal relationships	.590**	0.27	0.212	0.165	.315*	0.249	0.271
Manage technical equipment	.564**	.308*	0.167	0.211	.391**	.320*	.406**
Critical thinking / research utilization	.558**	0.13	-0.016	0.081	0.198	0.248	0.125
Teaching /Coaching	.765**	.498**	0.235	.293*	.405**	0.257	.420**
Work management	.694**	.335*	0.224	0.242	.363**	.334*	.375**

(*) Statistically significant at $p < 0.05$

(**) statistically significant at $p < 0.01$

Table 6. Correlation between the total score of each tool and the components of the other tool .

	Pearson correlation coefficients	
	New	Standardized
Tool 1 (new) components		
Personal / Professional development		0.256
Professional / ethical practice		0.26
Safety / injury prevention		0.334*
Comprehensive nursing care		0.416**
Interpersonal relationships		0.348*
Manage technical equipment		0.419**
Critical thinking / research utilization		0.205
Teaching /Coaching		0.509**
Work management		0.438**
Tool 2 (standardized) components		
Helping role	0.725**	
Teaching-coaching	0.372**	
Diagnostic role	0.204	
Managing situations	0.221	
Therapeutic interventions	0.376**	
Ensuring quality	0.293*	
Work role	0.350*	

(*) Statistically significant at $p < 0.05$

(**) statistically significant at $p < 0.01$

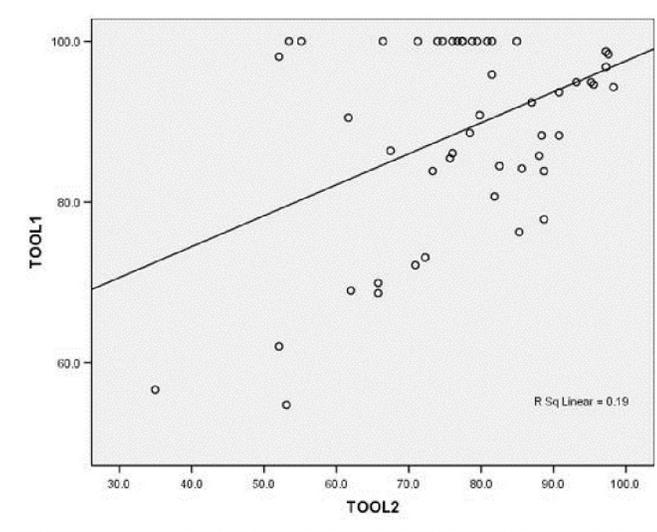


Figure 1. Correlation between the scores of newly developed and standard tools
Correlation coefficient: $r = 0.44$ ($p < 0.01$)

The process of development of the new tool started with compilation of items based on literature review and the opinions of those involved in the job, followed by categorization of these items into related components or dimensions. These components or dimensions were based on different sources including recommendations and guidelines as well as similar assessment tools. The guidelines included the competency profile for critical care nurse duties and tasks (Coombs and Chaboyer, 2007), and the six-component competency framework for critical care nurses developed by the American Association of Critical-Care Nurses (AACN, 2005).

The newly developed tool has also added to the components of previous similar tools. For instance, the tool of the Australian College of Critical Care Nurses (ACCCN, 2002) included only five domains, namely enabling, problem solving, professional practice, reflective practice, teamwork and leadership. Similarly, the tool developed by Hanley and Higgins (2005) had five domains of competency: professional and ethical practice, interpersonal skills, practical and technical skills, critical thinking and clinical decision making, and organization and management of care. More recently, Liu *et al.* (2007) developed and tested a competency with 58 items and seven dimensions: leadership, clinical care, interpersonal relationships, legal/ethical practice, teaching-coaching, professional development, critical thinking and research aptitude. Therefore, our newly developed tool encompassed a wider scope of critical care nursing competencies.

The new tool content validity was assessed through judging the degree to which the items of the instrument adequately represent the universe of the content. This was tested by experts in the area, and then by a jury group. This type of validity evaluation is seen as the most important as it ensures a match between the target to be assessed and the tool (Burns & Grove, 2001). The information obtained from the experts group was used to delete or add items as recommended by Strickland (2000). The experts group had no problems in defining the scope of competency of nursing practice in critical care units, although in the early phases of indicators identification some overlap was detected between some of the categories. The deletion of overlapping items may have resulted in low correlations between certain items. Therefore, the factor analysis method was not very useful in the instrument development, and it was decided to resort to the concurrent validity method of assessment.

The tool selected for concurrent validation of our new tool is a self-assessment validated nurse competency scale composed of 73-item instrument distributed in seven competency categories (Meretoja

et al., 2004). It was chosen because it measures the same construct using a similar method, i.e. self-assessment. Moreover, it is one of the most tested scales internationally (Dellai *et al.*, 2009). Cross-cultural validation of the instrument was also carried out in Australia, Italy, and Finland (Dellai *et al.*, 2009). Furthermore, the tool was tested by concurrent validity against a six-dimension scale developed by Schwirian (1978).

According to the current study findings, moderate to strong statistically significant intra-class correlation coefficients were revealed in the new tool. This adds to its content validity. Moreover, concurrent validity revealed ranges of total-to-items correlations that were between 0.2 and 0.7, which is close to those reported by Bekhet and Zauszniewski (2010) in their concurrent validation of the Arabic version of the Depressive Cognition Scale in first-year adolescent Egyptian nursing students; the corresponding range was 0.3-0.7. Additionally, the total score convergence correlation in the present study (0.44) was close to theirs (0.51). These figures are lower than previously reported in concurrent validity studies such as the study Cowan *et al.* (2008) who tested the convergent validity of two competency measures and reported a correlation of 0.75.

Meanwhile, Suleiman and Yates (2011) assessing the translation of the insomnia severity index into Arabic, found that the total tool score had a strong positive correlation with the Pittsburgh Sleep Quality Index global score ($r= 0.76$). However, the same study reported a moderate correlation with the vitality tool ($r= -0.38$), which is even lower than our figure.

The relatively low value of the convergent validity coefficient of the present study might be explained by the newly added dimensions, which were not covered by the standardized tool. This was evident from the total-to-dimensions correlations, which were insignificant for some dimensions of both tools. Nevertheless, the total correlation is close to the lower limit of acceptable coefficients as recommended by Carlson and Herdman (2010). However, these authors encouraged researchers to develop and report convergent validity data.

The second aspect of psychometric evaluation of the tool developed in the current study was the assessment of its reliability, which was ascertained through the internal consistency approach. The results indicated very high reliability coefficients of both the tool dimensions and its total score, mostly exceeding 0.8. The reliability measures of the new tool were similar or even better, compared to the standardized tool. The very high coefficients indicate a high level of reliability as indicated by Polit and

Hungler (2009). The total reliability coefficient of the present study (0.98) is higher than that reported in a similar study (Suleiman and Yates, 2011), which was 0.84.

Conclusion and recommendations

To conclude, a self-assessment competence tool for nurses working in critical care units was developed with a high level of reliability; its content validity was demonstrated, but concurrent validity was borderline acceptable. The main study limitation is related to representativeness of the sample, which was purposive; therefore, the findings must be interpreted taking this limitation into consideration.

Further improvement of the developed tool is recommended through including a variety of participants, both as experts and novices, and taking a more representative sample. Also, application of the tool in a variety of similar settings would offer data that can help in improving its psychometric characteristics. Moreover, periodic evaluation of nurses' competency can provide longitudinal data that may help in assessing the new tool's predictive validity.

Practical implications

The development of valid and reliable self-assessment tools to measure nurses' competence is the means for developing nurses' evaluation skills along with increasing their assertiveness and empowerment. These tools also are the way for evidence-based management to guarantee efficient clinical nursing practice as competency recognition helps to develop workforce planning and career opportunities of practicing nurses.

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