



Original research article

Adaptation and psychometric analysis of the Czech version of the Nurse Competence Scale

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Abstract

Aim: The aim of the study was a transcultural adaptation, linguistic validation, and testing of psychometric properties of the Czech version of the Nurse Competence Scale (CZNCS).

Methods: Designed as a cross-sectional observational study. The sample comprised 274 students from third-year bachelor's nursing study programmes at Czech universities. To collect the data, a Czech version of the Nurse Competence Scale was used, containing 73 items grouped into seven subscales. The data was collected between 2018 and 2021. The internal consistency of the scale was assessed using Cronbach's alpha. Content validity was assessed using the Content validity index, while construct validity was tested using Principal Component Analysis. Differences in the assessment of competence were tested using the Mann-Whitney test and Pearson's chi-squared test.

Results: The content validity index average for the Czech version of NCS was 0.95, while the content validity index-universal agreement was 0.75. Cronbach's alpha of the Nurse Competence Scale was 0.981. Factor analysis showed a six-factor solution.

Conclusions: The Czech version of the Nurse Competence Scale showed good levels of content validity and reliability. The Czech version of the NCS may serve as a useful tool for self-assessment of students' competence in the final years of nursing programs.

Keywords: Competence; Nurse Competence Scale; Nursing student; Psychometric properties

Introduction

A comprehensive concept of nurse competence and approaches to its assessment have been the subject of several systematic reviews (Watson et al., 2002; Yanhua and Watson, 2011). Over the past decades, research in the nursing competence assessment (Yanhua and Watson, 2011) has been focused on three important aspects – the development and testing of assessment tools; defining general approaches to assess competence (globalisation and cooperation among institutions); and assessment of factors influencing the development of competencies (using portfolios, objective clinical examination, etc.).

A review of approaches to assess a student's clinical competence by Norman et al. (2002) suggests four levels of methods and tools of assessment: tools to assess clinical competence (minimal standards given on a national level); objective structured clinical examinations; generic and specific self-assessment tools; tools for assessment of students by patients. The most frequently used strategies to assess students' compe-

tence in Europe are structured or non-structured self-assessment scales (Kajander-Unkuri et al., 2013), structured observation, and an inventory of procedures – so-called *checklists* (Oermann and Gaberson, 2014), or using portfolios (McMullan et al., 2003).

The most commonly used scale for assessing the competence of nursing students is the Nurse Competence Scale – NCS (Flinkman et al., 2017; Meretoja et al., 2004). In their review, Flinkman et al. (2017) confirmed that the tool is widely used, but evidence of the psychometric properties of its language versions is often absent. NCS is a generic self-assessment tool designed to assess the competence of nurses from different areas of practice, cultures, and years of experience. However, it is also widely used to evaluate the competence of nursing students. The instrument is based on Benner's conceptual framework *From novice to expert* (Benner, 1984) and its theoretical categories. The tool is based on a holistic approach to the conceptualisation of nurses' competencies, in which competencies are defined as "... adequately and to the required extent integrated knowledge, skills, attitudes and values in the specific

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context of nursing practice situations” (Meretoja et al., 2004). It was developed to bridge the shortcomings of tools for assessing nurses’ competence – the absence of theoretical and methodological basis and rigorous psychometrics (Flinkman et al., 2017; Lejonqvist and Kajander-Unkuri, 2022; Meretoja et al., 2004). The use of valid and reliable scales in the evaluation of clinical practice and competencies is absent in our country. A structured observation of student performance, performance checklists, clinical placement records, and evaluation of documentation of the phases of the nursing process are the most common methods we use in student assessment. The evaluation focuses primarily on the documentation and reporting of nursing care plans, which include assessment and diagnosis of the patient, planning, documentation of implemented activities, and evaluation. Less used in our cultural context are self-assessment scales of the student. Self-assessment scales include assessment of areas related to the student’s personality, such as the student’s response to criticism, the degree of self-reflection, stress management strategies, searching for learning opportunities. In addition, testing the validity and reliability of the assessment scales of students’ competence is an exception in our conditions, rather than a standard practice.

We focused on the transcultural adaptation of the instrument, and linguistic validation, including testing of psychometric properties of the Czech version of the Nurse Competence Scale (Meretoja et al., 2004). The study included testing of structural validity and internal consistency of the Czech version of the NCS.

Materials and methods

Study design

A cross-sectional observational design was used.

Research sample

A total of 274 third-year nursing students from four universities in the Czech Republic took part in the research. Students were selected on a set of inclusion criteria (third year of the bachelor’s study programme in full-time or part-time form, consent to participate in the study), with the guarantee of anonymity.

Research instrument

To collect the data, a questionnaire was used, which contained the items of the NCS. The NCS consists of 73 items grouped into 7 subscales: Helping Role (7 items); Teaching and Coaching (16 items); Diagnostic Functions (7 items); Managing Situations (8 items); Therapeutic Interventions (10 items); Ensuring Quality (6 items); Work Role (19 items). The level of competence in each item is rated on a visual analogue scale (VAS) from 0 (low level) to 100 (very good level). To achieve a more accurate description of competence level, the VAS score is divided into the following areas: a score ≤ 25 marks a low level of competence; a score >25 –50 somewhat low level of competence; a score >50 –75 good level of competence, and score >75 –100 very good level of competence. The relevance of utilising a competence is assessed on a scale from 0 (not relevant) to 3 (used very often). Internal consistency of each subscale of the original NCS measured with Cronbach’s alpha ranged from 0.79 to 0.91 (Meretoja et al., 2004).

Linguistic validation was performed before data collection began. As a first step, a linguistic validation was carried out using the MAPI Research Trust methodology (Acquadro et al., 2012). The linguistic validation of the Czech version according

to the MAPI manual was a condition for the translation and use of the tool acquired from Wiley–Blackwell permission department (Wiley publisher is the right owner). The linguistic validation process took place in several steps, according to the MAPI recommendations. Each step was administered by the validation coordinator, who was also the chief research leader. The Delphi panel ensured communication among the team members who were involved in each phase of the validation. A specific protocol was made for each phase of the validation. Suggestions for translations of the items and phrases, the rationale behind the translation into the target language, and comments on the use and comparisons were noted in the protocols. The steps of the linguistic validation were as follows:

1. English to Czech translation (*forward translation*) and synthesis: experts in nursing from the Czech Republic with experience in translation and good command of the English language completed two independent translations. The coordinator compared the two versions (and their differences) with the original and created a synthesis.
2. *Back translations* into English and their synthesis: two independent back-translations were completed (by a native speaker and a professional translator), with a Finnish expert involved who has experience using the tool.
3. Synthesis: comparison of the back-translations with the original tool by members of the Delphi panel involved in each phase.
4. Piloting of the pre-final version among experts and quantification of the content validity: five evaluators were involved (university experts in the field) who assessed the relevance and representativeness of the items against the content (competence). As an excellent score of content validity, Polit et al. (2007) recommend for each I-CVI item a value of 0.78 and higher. In our assessment, the NCS scale reached the I-CVI 1.00 in 55 items of the scale, and 15 items of the NCS reached I-CVI 0.80. Excellent content validity was not reached in three items, where the I-CVI was 0.60 (items No. 3, No. 50, and 51). To calculate the S-CVI on scales that are evaluated by two or more experts, two approaches may be used: the S-CVI/UA (universal agreement) or S-CVI/Ave (average) (Polit et al., 2007). The S-CVI/Ave in the CZNCS, which is calculated as an average of I-CVI amongst scale items, reached 0.95. Polit et al. (2007) suggest an S-CVI/Ave 0.90 or higher as an excellent value. However, the S-CVI/UA score, which is calculated as the rate of items that reached values 3 and 4 by the experts, did not reach the desired value. In the CZNCS, the S-CVI/UA was 0.75. Polit et al. (2007) suggest 0.80 as the minimum acceptable limit for the S-CVI. Thus, the Czech version of the NCS scale did not reach clear evidence for content validity, and further construction evidence of validity was tested on the sample.

Data collection

Eleven universities were contacted for the study. Data collection took place in the period 2018–2021 in two phases. In the first phase, data collection took place from February 2018 to July 2019 within the project Competence of Nursing Students in Europe – COMPEUnurse (Kajander-Unkuri et al., 2020, 2021) at four universities in the Czech Republic. The response rate was 30% (710 questionnaires were distributed and 213 were handed back). In the second phase, data collection took place from February 2021 to September 2021. During this period, 10 universities were contacted, and only students from three institutions took part in the research. The total number of distributed questionnaires in the second phase cannot be

determined because the data on the number of students who could complete the questionnaire is not known.

Data analysis

Descriptive and inductive statistics were used. Quantitative variables were evaluated using arithmetic average, standard deviation, absolute frequency (N), and relative frequency (%). The normal distribution of quantitative data was verified using the Shapiro–Wilk test. Differences were evaluated using non-parametric (Mann–Whitney test) and Pearson's chi-squared test. To evaluate the factor structure of the CZNCS, a principal component analysis was applied. Mutual correlations of quantitative variables were detected using the Spearman coefficient. The data were processed on a significance level $p = 0.05$. For processing, the IBM SPSS Statistics for Windows, Version 20.0 was used.

Ethical considerations

The research was approved by the Ethical Committee of the Faculty of Medicine at University of Ostrava (No. 14/2017 and No. 16/2020). Informed consent was included in both the online and paper-based versions of the questionnaire. The paper-based version required a signature; the consent in the online version was given by completing and submitting the questionnaire. An informed consent contained a disclaimer that participation is voluntary, anonymous, and may be retracted at any time.

Results

Sample characteristic

The sample consisted of 274 third-year nursing students from four universities in the Czech Republic. Almost all students were female (91.9%), with a mean age of 26.6 years (± 6.9). Sample characteristics are fully reported in Table 1.

Factor structure of the NCS

Factor analysis (factor extraction, rotation, interpretation, and factor labelling) was implemented to identify the dimensionality of the Czech version of NCS. In the first step, the assumptions for the use of factor analysis were verified as a part of the structural validity check. The matrices of Spearman cor-

relation for all 73 items of the Czech version of the NCS were evaluated, a scree plot for graphical verification of the number of monitored factors was created, and the Kaiser–Meyer–Olkin rate and the Bartlett homogeneity test were calculated. Exploratory factor analysis (EFA with Varimax rotation) was used to confirm construct validity. The total Kaiser–Meyer–Olkin measure (KMO) of 0.936 exceeded the recommended value of 0.6. The Bartlett test value was significant ($\chi^2 = 13703.58$; $df = 2628$; $p = 0.000$). Considering the assumptions for factor analysis, all of them were met. Exploratory factor analysis showed a seven-factor solution with eigenvalues above 1, which explained 65.05% of the total variance. The first three factors (41.92%) explained the most % of the total variance. The first factor explained 17.93% of the variability in items, the second factor 13.22%, and the third factor 10.76% of the variability. The seventh factor explained only 2.35% of the total variance, and its individual items were difficult to interpret from a theoretical point of view. For this reason, we opted for a six-factor solution. However, the factor loadings of the items – and thus the affiliation of the individual items to the individual dimensions – often differed significantly from the original version. In the next section, we analyse the seven variables that formed the structure of the original Finnish version and compare them with the results of our factor analysis. The items of the first variable *Helping Role* (items no. 17) in the Czech version do not fall under the common factor. Items no. 1–3 and 6 have high loadings on the sixth factor, items no. 4 on the first factor, and items no. 5 and 7 on the second factor. The items of the second variable *Learning and Coaching* (items 8–23) were also divided into three factors (a maximum of ten items had a high loading in the second factor, one item in the first, and one in the fifth factor, Table 2). Two items (items 15 and 16) had to be excluded because they saturated several factors to the same extent and could not be clearly assigned to any one factor. The items of the third variable *Diagnostic Functions* (items 24–30) are also broken down into three factors. The items of the fourth variable *Managing Situation* (items 31–38) are divided into two factors, with the highest loadings in the first factor (Table 2). The items of the fifth variable *Therapeutic Interventions* (items 39–48) were also divided into two factors, with the highest loadings in the third factor. The items of the sixth variable *Ensuring Quality* (items no. 49–54) break down into two factors (Table 2), and the seventh variable *Work roles* (items no. 55–73) into two factors – with the highest loadings on the fourth factor. EFA factor loadings are listed in the table below (Table 2).

Table 2 shows that in the Czech version, some of the original variables partially merged (e.g., some items from all seven variables in the first factor). We can say that each of the seven variables can be broken down into several factors. In the last step of the EFA (interpretation and naming of factors), we named the individual factors of the Czech version of the NCS as follows:

Factor 1 – *Professional awareness in the process of planning, delivering, and evaluating care* (21 items out of all the 7 original variables).

Factor 2 – *Patient and family education support* (16 items out of 3 original variables).

Factor 3 – *Research utilisation* (12 items out of 2 original variables).

Factor 4 – *Working role and professional development* (11 items out of 1 original variable).

Factor 5 – *Professional leadership* (7 items out of 3 original variables).

Factor 6 – *Helping role and patient-centred care* (4 items out of one original variable).

Table 1. Characteristics of the sample ($n = 274$)

Variable	Descriptive statistic
Age	
Mean	26.6
SD	± 6.9
Min–max	20–48
Gender	
Female	250 (91.9%)
Male	22 (8.1%)
Previous professional qualification in health care	
Yes	184 (68.4%)
No	85 (31.6%)
Work experience before or/and during this education in health care (besides clinical placements)	
Yes	169 (62.6%)
No	101 (37.4%)
Successful supervisory experience	95 (36.3%)

Table 2. Factor structure of the Czech version of the Nurse Competence Scale based on EFA

	Item	NCS Category	Item content	Loading
F1				
<i>Professional awareness in the process of planning, delivering, and evaluating care</i> 21 items	32	MS	Prioritising my activities flexibly according to changing situations	0.818
	37	MS	Keeping nursing care equipment in good condition	0.787
	31	MS	Able to recognise situations that pose a threat to life early	0.775
	33	MS	Acting appropriately in life-threatening situations	0.773
	40	ThI	Making decisions concerning patient care, taking the particular situation into account	0.746
	39	ThI	Planning own activities flexibly according to a clinical situation	0.743
	20	TC	Taking active steps to maintain and improve my professional skills	0.711
	56	WR	Aware of the limits of my own resources	0.708
	55	WR	Able to recognise colleagues' need for support and help	0.695
	59	WR	Familiar with my organisation's policy concerning division of labor and coordination of duties	0.658
	63	WR	Acting autonomously	0.652
	27	DF	Arranging expert help for the patient when needed	0.616
	68	WR	Utilising information technology in my work	0.568
	38	MS	Promoting flexible team co-operation in rapidly changing situations	0.561
	69	WR	Co-ordinating patient's overall care	0.554
	4	HR	Modifying the care plan according to individual needs	0.543
	47	ThI	Incorporating relevant knowledge to provide optimal care	0.510
	52	EQ	Systematically evaluating patients' satisfaction with care	0.507
	58	WR	Acting responsibly in terms of limited financial resources	0.504
	57	WR	Professional identity serves as a resource in nursing	0.463
	36	MS	Planning care consistently with resources available	0.441
F2				
<i>Patient and family education support</i> 16 items	13	TC	Able to recognise family members' needs for guidance	0.762
	12	TC	Co-ordinating patient education	0.718
	9	TC	Finding optimal timing for patient education	0.714
	10	TC	Mastering the content of patient education	0.685
	18	TC	Evaluating patient education outcomes with family	0.676
	8	TC	Mapping out patient education needs carefully	0.661
	14	TC	Acting autonomously in guiding family members	0.652
	26	DF	Able to identify family members' need for emotional support	0.635
	19	TC	Evaluating patient education outcomes with a care team	0.635
	17	TC	Evaluating patient education outcomes together with a patient	0.621
	21	TC	Developing patient education in my unit	0.597
	24	DF	Analysing a patient's well-being from many perspectives	0.596
	25	DF	Able to identify a patient's need for emotional support	0.575
	11	TC	Providing individualised patient education	0.505
	7	HR	Decision-making guided by ethical values	0.502
	5	HR	Utilising nursing research findings in relationships with patients	0.475

Table 2. (continued)

	Item	NCS Category	Item content	Loading
F3				
<i>Research utilisation</i> 12 items	45	ThI	Utilising research findings in nursing interventions	0.742
	43	ThI	Updating written guidelines for care	0.669
	48	ThI	Contributing to the further development of multidisciplinary clinical paths	0.667
	44	ThI	Providing consultation for the care team	0.659
	46	ThI	Systematically evaluating patient care outcomes	0.633
	50	EQ	Able to identify areas in patient care that need further development and research	0.556
	51	EQ	Critically evaluating my unit's care philosophy	0.593
	54	EQ	Making proposals concerning further development and research	0.626
	53	EQ	Utilising research findings in the further development of patient care	0.598
	42	ThI	Coaching the care team in the performance of nursing interventions	0.553
	49	EQ	Committed to my organisation's care philosophy	0.545
	41	ThI	Co-ordinating multidisciplinary team's nursing activities	0.506
F4				
<i>Working role and professional development</i> 11 items	64	WR	Guiding staff members toward duties corresponding to their skill levels	0.716
	65	WR	Incorporating new knowledge to optimise patient care	0.669
	73	WR	Developing the work environment	0.598
	60	WR	Co-ordinating student nurse mentoring in the unit	0.593
	66	WR	Ensuring a smooth flow of care in the unit by delegating tasks	0.588
	72	WR	Developing patient care in multidisciplinary teams	0.578
	71	WR	Giving feedback to colleagues in a constructive way	0.570
	62	WR	Providing expertise for the care team	0.561
	61	WR	Mentoring novices and advanced beginners	0.547
	70	WR	Orchestrating the whole situation when needed	0.499
	67	WR	Taking care of myself in terms of not depleting my mental and physical resources	0.432
F5				
<i>Professional leadership</i> 7 items	35	MS	Coaching other team members in mastering rapidly changing situations	0.673
	23	TC	Coaching others in duties within my responsibility area	0.599
	34	MS	Arranging debriefing sessions for the care team when needed	0.582
	29	DF	Coaching other staff members in the use of diagnostic equipment	0.568
	28	DF	Coaching other staff members in patient observation skills	0.521
	30	DF	Developing documentation of patient care	0.504
	22	TC	Developing orientation programs for new nurses in my unit	0.501
F6				
<i>Helping role and patient-centred care</i> 4 items	1	HR	Planning patient care according to individual needs	0.726
	2	HR	Supporting patients' coping strategies	0.631
	3	PR	Critically evaluating one's own philosophy of nursing	0.326
	6	HR	Developing the treatment culture of my unit	0.493

NCS original categories: HR – Helping role; TC – Teaching-coaching; DF – Diagnostic functions; MS – Managing situations; ThI – Therapeutic interventions; EQ – Ensuring quality; WR – Work role.

Reliability

Internal consistency was evaluated using Cronbach's alpha. The internal consistency for 73 items of the NCS was $\alpha = 0.981$, internal consistency of all seven original variables ranged from

0.840 to 0.951. Internal consistency of new variables identified based on EFA ranged from 0.777 to 0.961 (Table 3). These results suggest a good internal consistency of the Czech version of the NCS.

Table 3. Internal consistency of the original and the Czech version of the NCS

Factors of the original version NCS			
Factor	Mean	SD	Cronbach's alfa
Helping role	57.24	18.23	0.841
Teaching-coaching	59.81	19.94	0.944
Diagnostic functions	61.81	19.80	0.870
Managing situations	67.84	19.25	0.903
Therapeutic interventions	61.32	20.65	0.922
Ensuring quality	54.64	21.62	0.888
Work role	67.19	18.97	0.951
Factor structure of the Czech version			
Professional awareness in the process of planning, delivering, and evaluating care	71.44	18.09	0.961
Patient and family education support	59.05	19.52	0.946
Research utilisation	55.40	21.31	0.939
Working role and professional development	63.45	20.96	0.930
Professional leadership	57.04	22.03	0.896
Helping role and patient-centred care	54.68	19.32	0.777

The aim of the study was transcultural adaptation, linguistic validation, and testing of psychometric properties of the Czech version of the Nurse Competence Scale (CZNCS). In the authors' opinion, evidence obtained from the psychometric analysis is not conclusive. The factor structure was not in line with the original version. Differences in the dimensionality of the tool compared to the original version were found in several language versions (Table 4). Within the validation of individual language versions, differences were found in the applied methods of testing content and design validity and reliability.

Discussion

The original version of the NCS scale (Meretoja et al., 2004) was tested on a sample of 498 registered nurses working in the university's internal medicine and surgical departments. The validation study of the original scale confirmed that the NCS is a suitable tool for the self-assessment of competence of various levels of nurses, from beginners to experienced nurses. Validation studies of selected language versions of the NCS scales were performed on different samples. Registered nurses working at the hospital formed the sample group in Thai (Juntasopeepun et al., 2019) and Turkish studies (Toprak and Aslan, 2020). Norwegian authors (Wangenstein et al., 2015) performed testing of the psychometric properties of NCS on a sample of nursing graduates. Students in the final years of bachelor's programs in nursing were included in this study, as well as in validation studies in Slovakia (Nemcová et al., 2020) and Italy (Notarnicola et al., 2018).

Evidence of content validity was found in only two versions (Juntasopeepun et al., 2019; Toprak and Aslan, 2020). In this study, evaluating content validity CZNCS achieved an

excellent score of 70 items on the scale. The value of excellent content validity was not obtained for three NCS items, these items reached I-CVI 0.60 (items no. 3, no. 50, and 51). The S-CVI / Ave score reached an excellent value of 0.95 for the CZNCS scale. The evaluation of the content validity was also performed in some other language versions being compared. In a Thai study (Juntasopeepun et al., 2019), three experts evaluated content validity. The resulting content validity index for each scale item (I-CVI) was 0.90, while the S-CVI/Ave score reached 0.95. Based on the content validity results of the Thai version of the NCS, no item was excluded before factor analysis (Juntasopeepun et al., 2019). The content validity of the Turkish translation of the NCS scale was evaluated by 14 experts, and the overall content validity index of the scale reached 0.95, based on which no item of the scale was excluded (Toprak and Aslan, 2020).

The factor analysis performed in this study resulted in a six-factor solution of the CZNCS. Confirmatory factor analysis in previous validation studies has not confirmed the original structure of NCS (Notarnicola et al., 2018; Wangenstein et al., 2015). For this reason, in our study, we obtained evidence of validity only through the exploratory factor analysis (EFA). The assignment of individual items to individual factors (dimensions) of the scale in the Czech version differs significantly from the original. For two items (items 15 and 16), it was not possible to clearly assign them to any one factor, and these were excluded. By evaluating the psychometric properties of the CZNCS, 71 items were identified, divided into six factors: *Professional awareness in the process of planning, delivering, and evaluating care* (21 items); *Patient and family education support* (16 items); *Research utilisation* (12 items); *Working role and professional development* (11 items); *Professional leadership* (7 items); *Helping role and patient-centered care* (4 items)

Table 4. Comparison of the factor structure of available language versions

Original version		Czech version	Slovak version	Italian version	Norwegian version	Turkish version	Thai version
Factor structure	7 factors (73 items)	6 factors (71 items)	7 factors (73 items)	7 factors (58 items)	5 factors (46 items)	7 factors (73 items)	6 factors (36 items)
	• Helping role • Teaching-coaching • Diagnostic functions • Managing situations • Therapeutic interventions • Ensuring quality • Work role	• Professional awareness in the process of planning, delivering, and evaluating care • Patient and family education support • Research utilisation • Working role and professional development • Professional leadership • Helping role and patient-centred care	• Professional awareness • Professional leadership • Research utilisation • Helping role • Patient education • Mentoring and coaching • Managing situations	• Using research • Professional awareness • Ethical values • Tutorial functions • Professional leadership • Educational interventions • Management of care processes	• Planning and delivery of care • Teaching interventions • Professional leadership • Research utilisation and nursing values • Professional awareness	• Helping role • Teaching-coaching • Diagnostic functions • Managing situations • Therapeutic intervention • Ensuring quality • Work role	• Research oriented • Work role • Diagnostic functions • Managing situations • Patient education • Mentoring functions
Methods	PCA	PCA Scree plot	Parallel analysis Very Simple Structure – EFA (RMSEA, TLI, SRMR, <i>Chi-squared test</i>) PCA Criterion (BIC) test dimensionality Minimum Average Partial	CFA (CFI, NFI, RMSEA, <i>Chi-squared test</i>) Three EFAs	CFA (CFI, NFI, RMSEA, TLI, <i>Chi-squared test</i>) Parallel analysis Three PCAs, Monte Carlo parallel analysis	CFA (CFI, NNFI, RMSEA, SRMR, TLI, <i>Chi-squared test</i>)	PCA Scree plot
CVI	yes	yes	no	no	no	yes	yes
Sample	593 RNs	274 graduating nursing students	310 graduating nursing students	698 graduating nursing students	593 newly graduated nurses	370 RNs	566 RNs

Notes: EFA – Exploratory factor analysis; CFA – Confirmatory factor analysis; PCA – Principal component analysis; RMSEA – The Root Mean Square Error of Approximation; TLI – The Tucker–Lewis index; SRMR – The Standardised Root Mean Square Residual; CFI – comparative fit index; NNFI – the Non-Normed Fit Index; RNs – Registered nurses.

(Table 3). The six-factor solution is also included in the Thai version of NCS (Juntasopeepun et al., 2019). The authors combined parallel analysis and EFA to evaluate the design validity of the scale. After performing the primary EFA, six factors and 40 items of the scale were identified. After repeating the EFA with 40 items, six factors were confirmed, but four items were discarded (cross-loading ≥ 0.32). The final model of the Thai version of the NCS scale contains 36 items divided into six factors: *research-oriented* (7 items); *work role* (8 items); *diagnostic functions* (6 items); *managing situations* (7 items); *patient education* (5 items); *mentoring functions* (3 items).

The original structure of the NCS scale was not confirmed by the validation of its Slovak version (Nemcová et al., 2020). Although the analyses performed showed that the seven-factor distribution of the original version was satisfactory, the individual items did not structurally correspond to the original version. The names of individual factors of the Slovak version of NCS (SKNCS) came from the content analysis: *professional awareness* (14 items); *professional leadership* (14 items); *research utilisation* (9 items); *helping role* (8 items); *patient education* (8 items); *mentoring and coaching* (9 items); *managing situations* (11 items).

The psychometric properties of the Italian version of NCS – INCS (Notarnicola et al., 2018) were tested using confirmatory factor analysis (CFA), which did not confirm the structure of the original scale. For further analysis, EFA was used, which the researchers repeated three times. This resulted in 58 items that have reached the specified value (factor loading >0.4), divided into seven new factors: *using research* (12 items); *professional awareness* (5 items); *ethical values* (7 items); *tutorial functions* (5 items); *professional leadership* (9 items); *educational interventions* (11 items); *management of care processes* (9 items).

The original structure of NCS was not confirmed in the Norwegian version of NCS – NNCS (Wangenstein et al., 2015) either. CFA was used to test the psychometric properties, the results of which did not confirm the original structure of the NCS. EFA was chosen for further testing of the scale. In its first step, the prerequisites for its use (Bartlett's test, KMO) were verified, and the tests performed confirmed the suitability of use. By performing a parallel analysis, the final NNCS model was obtained, which contains 46 items, divided into five categories: *planning and delivery of care* (11 items); *teaching interventions* (12 items); *professional leadership* (11 items); *research utilisation and nursing values* (9 items); *professional awareness* (3 items). Of the language versions compared in this study, the original version of the NCS tool (Meretoja et al., 2004) was confirmed only by Turkish authors (Toprak and Aslan, 2020). When evaluating the design validity of the Turkish version of the NCS scale, the factor loadings of all items ranged from 0.33 to 0.78. Confirmatory factor analysis confirmed the resulting seven-factor NCS model; no items were excluded from the scale.

The internal consistency of the scale was evaluated using Cronbach's alpha. For the Czech version of NCS, the internal consistency ranged between 0.777 and 0.961, which is considered a good internal consistency. When comparing the reliability of each language version, the values of Cronbach's alpha confirmed good internal consistency. The highest values were reached in Italian NCS. Cronbach alpha for each factor ranged from 0.914 to 0.935, which is deemed excellent (Notarnicola

et al., 2018). Very good levels of internal consistency were achieved in the Thai version of NCS, where the Cronbach alpha for each factor ranged between 0.82 and 0.88 (Juntasopeepun et al., 2019). The Slovak version of NCS reached a Cronbach alpha from 0.88 to 0.94 for each factor (Nemcová et al., 2020). Internal consistency of the Norwegian NCS was between 0.73 and 0.92 for each factor (Wangenstein et al., 2015). The Turkish NCS reached a Cronbach alpha from 0.74 to 0.92 for each factor (Toprak and Aslan, 2020). Cronbach's alpha in the original version of the NCS was between 0.79 and 0.91 (Meretoja et al., 2014).

Limitations

The study has some limitations. The first is the sample size, which is relatively small given the number of items in the tool. The low number of respondents may affect the results of the psychometric analysis to some extent. The second limitation is the data collection took place in two phases, with the second phase affected by the COVID-19 pandemic. The third limitation is the low return rate during the first phase. The low return rate may have been because only a group of motivated students completed the questionnaire. The responses regarding competence may have been – namely in the second phase – affected by the limitations in competencies listed in NCS that students faced during their clinical placement.

Conclusions

The results of this study confirm the importance of psychometric analysis of the tool following linguistic validation. The psychometric testing of the Czech NCS did not confirm the original structure of the scale. The final model of CZNCS contains 71 items broken down into six factors. The reliability assessment shows good internal consistency of the Czech scale. The CZNCS may serve as a useful tool for students to self-assess their competence during the final year of their nursing programmes.

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Ethical considerations

The research study was approved by the Ethics Committee of the Faculty of Medicine of the University of Ostrava (No. 14/2017 and No. 16/2020).

Conflict of interests

The authors have no conflict of interests to declare with respect to the research, authorship, and/or publication of this article.

Author contributions

Concept and design (RZ, EG, SKU), analysis and data interpretation (EG, RP, LŠ, DJ), preparation of the manuscript (EG, RP, RZ, SKU), critical revision of the manuscript (EG, SKU, RZ, DJ), final revision (EG, RP, RZ).

Adaptace a psychometrická analýza české verze Nurse Competence Scale

Souhrn

Cíl: Hlavním cílem studie byla transkulturní adaptace, lingvistická validace a testování psychometrických vlastností české verze Nurse Competence Scale (CZNCS).

Metodika: Design – průřezová observační studie. Soubor tvořilo 274 studentů třetích ročníků bakalářských studijních programů ošetrovatelství na českých univerzitách. Pro sběr dat byla využita česká verze Nurse Competence Scale, obsahující 73 položek seskupených do sedmi subškál. Sběr dat byl realizován v období od roku 2018 do roku 2021. Vnitřní konzistence škály byla zjišťována pomocí Cronbachova koeficientu alfa. Obsahová validita byla hodnocena indexem obsahové validity, konstruktová validita byla testována pomocí Analýzy hlavních komponent. Rozdíly v hodnocení kompetencí byly testovány užitím Mann–Whitneyova testu a Pearsonova chí-kvadrát testu.

Výsledky: Index obsahové validity S-CVI/Ave dosáhl u české verze NCS hodnoty 0,95, index obsahové validity S-CVI/UA dosáhl hodnoty 0,75. Cronbachova alfa české verze Nurse Competence Scale bylo 0,981. Faktorová analýza poukázala na šestifaktorové řešení.

Závěr: Česká verze Nurse Competence Scale prokázala dobrou úroveň obsahové validity a reliability. Česká verze NCS může sloužit jako vhodný nástroj pro sebehodnocení kompetencí studentů závěrečných ročníků studijních programů ošetrovatelství.

Klíčová slova: kompetence; Nurse Competence Scale; psychometrické vlastnosti; student ošetrovatelství

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