



## Development and validation of two brief versions of the Nurse Professional Competence (NPC) Scale: The NPC-6 and NPC-12

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### ARTICLE INFO

#### Keywords:

Competence development  
Instrument development  
Nursing  
Reliability  
Short-form scales  
Self-report measure  
Validity

### ABSTRACT

**Background:** Several instruments for measuring nurse professional competence have been tested in different countries and shown to be both reliable and valid. However, there remains a lack of shorter, validated instruments suitable for use in different countries, in large-scale research settings and for longitudinally tracking trends and educational interventions.

**Aim:** The aim of this study was to develop and validate two shortened versions of the Nurse Professional Competence (NPC) Scale, comprising items across the six established competency factors.

**Design:** A cross-sectional, methodological study design, with two secondary data analyses, was conducted.

**Participants:** Participants with NPC data were 612 Swedish registered nurses and 2135 Chinese registered nurses.

**Methods:** Items were selected from the 35-item scale (NPC-35) based on highest corrected item–total correlations, theoretical considerations, and discussions within the research group. Two versions were developed: a 6-item scale (NPC-6) and a 12-item scale (NPC-12). NPC-6 intended to be used only as a total score and NPC-12 to be used both as a total score and as factor scores. The psychometric properties of the shortened scales were evaluated by examining their associations with NPC-35, as well as their reliability and validity.

**Results:** The Swedish and Chinese NPC-6 and -12 scales contained the same items and showed strong associations with the NPC-35 scale ( $r = 0.925\text{--}0.990$ ), after removing overlapping items. Both versions had high internal consistency, with Cronbach's alpha and McDonald's omega values ranging from 0.86 to 0.98. Principal component analyses, using one factor/total scale, indicated that the Swedish and Chinese NPC-12 scales explained 55% and 81% of the variance, respectively, while the NPC-6 scales explained 60% and 82%, respectively. Tests of known-groups validity showed statistically significantly higher scores, NPC-6 and -12, among specialist nurses than non-specialist nurses. Confirmatory factor analyses of the NPC-12 confirmed the original factor structure with six competency factors.

**Conclusions:** The findings indicate that the NPC-6 is a psychometrically acceptable instrument in both countries and the NPC-12 in China when used among registered nurses. The Swedish NPC-12 explained only 55.3% of the variance in nurse professional competence when used as a total score and needs further testing. However, the six competency factors of the NPC-12 might be used instead, as indicated by factor analyses. NPC-6 is intended for total score use only, whereas NPC-12 can be scored using both total and factor scores. Additional psychometric testing is warranted to confirm structural stability, test-retest reliability, and sensitivity to change in different settings and samples.

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<https://doi.org/10.1016/j.nedt.2026.107141>

Received 5 December 2025; Received in revised form 11 April 2026; Accepted 3 May 2026

Available online 5 May 2026

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## 1. Introduction

Self-assessment instruments have proven useful for guiding lifelong learning and competence development among registered nurses (RNs) (Flodén et al., 2025), and similarly in nursing education for evaluating the impact of educational interventions (Högstedt et al., 2022; Xu et al., 2023) and improving curricula (Høegh-Larsen et al., 2022; Theander et al., 2016). Monitoring the education pipeline in working life as well as in education is therefore vital for effective workforce and education planning and for identifying the investments needed in education and training to meet healthcare system demands (WHO, 2025). There are some instruments that have been tested and found valid in several countries, e.g., the 35-item Nurse Professional Competence Scale (NPC-35) (e.g., Abuadas, 2023; Lee et al., 2023; Lusmilasari et al., 2025; Nilsson et al., 2018; Xu et al., 2021) and the Nurse Competence Scale (Flinkman et al., 2017). However, there is a lack of shorter validated instruments that can be used in different countries to longitudinally follow trends and educational interventions. For this reason, the focus here was on developing, based on the NPC-35 scale, and validating shortened versions in two countries in different parts of the world.

### 1.1. Background

Nursing is a complex, values-driven profession that requires evidence-based practice, which refers to decision-making and practice based on the best available scientific evidence, combined with professional experience and an understanding of the needs and preferences of the patient (White et al., 2025). The ability of nurses to fulfill their diverse roles—ranging from clinical care and health system leadership to advocacy and education—depends fundamentally on their professional competence, which ensures safe and high-quality patient care across all settings (Gareau and Gallani, 2023). The development of nurses' professional competence begins during nursing education and continues throughout their careers in order to provide the best possible outcomes for patients and for nurses better quality of working life. For example, nurse thriving, i.e., learning and vitality, have been found linked to better job performance, less stress symptoms and turnover intentions (Engström et al., 2025) and nurse competence to person-centered care (Xu et al., 2025). For registered nurses lifelong learning is central to competence development. Flodén et al. (2025) found that specialist nurses scored higher on self-assessed competence than did other groups, with factors such as academic qualifications, experience, and occupational self-efficacy contributing positively. Their study introduced the Swedish Enhanced Competence Development Model (vKUM), a strategic framework for lifelong learning and competence planning. Although nurses' professional competence is widely recognized as essential, it remains inconsistently defined. Cowan et al. (2008, 2005) described it as a complex combination of knowledge, performance, skills, and attitude. A wide range of instruments has been developed to assess nursing competence, each grounded in different conceptualizations of what competence entails. Two of the most commonly used are the NPC-35 (e.g., Abuadas, 2023; Lee et al., 2023; Lusmilasari et al., 2025; Nilsson et al., 2018; Xu et al., 2021) and the Nurse Competence Scale (Flinkman et al., 2017). Because the NPC-35 was developed by our research group, we chose to further develop this scale.

### 1.2. The Nurse Professional Competence (NPC) Scale

The 88-item NPC-88 scale was developed and published 2014. The scale was based on international guidelines and formal competence descriptions (Nilsson et al., 2014). Based on requests for a shorter version, the 35-item NPC-35 scale was developed (Nilsson et al., 2018) comprising six factors: Nursing Care, Value-based Nursing Care, Medical and Technical Care, Care Pedagogics, Documentation and Administration of Nursing Care, and Development, Leadership and Organization of

Nursing Care. The interest in using the NPC-35 scale was immense among nursing researchers around the world (van de Mortel et al., 2021), and it was applied to nursing students (Carlsson, 2020; Halabi et al., 2023; Xu et al., 2021) and among registered nurses (Duka et al., 2023; Xu et al., 2025; Zaitoun, 2024), internationally educated nurses (Högstedt et al., 2024), specialist nurses and midwives (Flodén et al., 2025). Its global use also contributes to alignment with universal competency standards and provides a practical basis for tools supporting growth, reflection, and progression.

In large-scale research, especially those using lengthy survey instruments, respondent burden can undermine data quality and participation (Yan and Williams, 2022). Although the NPC-35 scale is comprehensive and widely used, it can be time-consuming and demanding for participants. No shortened versions currently exist that retain the scale's psychometric strength and conceptual foundation. Given this gap, the NPC-35 was deemed as an appropriate foundation for developing shorter forms, as it is grounded in national and international competency frameworks, validated across multiple cultural contexts, and captures a concise yet comprehensive set of competency factors relevant to both students and registered nurses. Against this background, the present study developed two shortened versions of the NPC scale: NPC-6 for rapid uni-factor screening and NPC-12 for both uni-factor assessment and abbreviated multi-factor use. This study adds new evidence by examining overlap-adjusted associations, providing Confirmatory factor analysis (CFA) support for the NPC-12 structure, and assessing known-groups validity in two countries.

### 1.3. Aim

To develop and validate two shortened versions of the 35-item Nurse Professional Competence (NPC) Scale, comprising items across the six established competency factors, with the NPC-6 used as a uni-factor screening instrument providing a total score and the NPC-12 used as an abbreviated multi-factor instrument providing both total and factor scores.

## 2. Methods

A theory and psychometrically guided methodological design, based on the NPC framework (Nilsson et al., 2018), was used to develop the NPC-6 and -12 versions of the scale. Two independent studies conducted in two different countries, Sweden and China, were utilized for scale development, and they are treated separately throughout this paper. The present study involved two secondary data analyses (Flodén et al., 2025; Xu et al., 2025). The use of secondary data was considered appropriate for the initial short-form development and the psychometric evaluation, as both data sets were large and well-characterized. However, as the data had already been collected, it was not possible to assess responsiveness or temporal stability. We drafted the manuscript in accordance with the COSMIN reporting guideline (Gagnier et al., 2025). In particular, we followed the general recommendations from the section "General reporting recommendations relevant for all studies on measurement properties," as well as the specific items of subsections on structural validity, internal consistency and hypotheses testing for construct validity.

### 2.1. Study I

#### 2.1.1. Sample and data collection

All nurses working in the clinical setting at a regional teaching hospital in Sweden were invited to participate ( $N = 1047$ ). Inclusion criteria were registered nurses, specialist nurses, and midwives employed in clinical roles (full-time or part-time) during the data collection period. Exclusion criteria were nurses in purely administrative or educational roles. Of these, 615 RNs responded, resulting in a response rate of 58.7%. Among the respondents, 612 completed all items

on both the NPC-6 and -12. These data were originally collected by Flodén et al. (2025) and are analyzed here as part of a secondary analysis. The majority of participants were female (83.4%). Their professional experience ranged from 0.2 to 45 years, with a mean of 16.4 years. Overall, 81.5% worked between 80% and 100% in patient care. Additionally, 82.4% held a bachelor's degree or higher and 358 (56.4%) were specialist nurses (ibid.).

Questionnaire data were collected including several validated instruments, whereof the NPC-35 scale (Nilsson et al., 2018) was used for the present study. The NPC-35 scale consists of six factors: Nursing Care (5 items), Value-based Nursing Care (5 items), Medical and Technical Care (6 items), Care Pedagogics (5 items), Documentation and Administration of Nursing Care (8 items), and Development, Leadership and Organization of Nursing Care (6 items). All statements/items have 7-point response options from 1 "to a very low degree" to 7 "to a very high degree". All items point in the same direction, and the total value is calculated by the average value for all items included in the scale (NPC-6 and -12) or for each factor (NPC-12). The NPC-35 has shown acceptable construct validity using confirmative factor analysis (CFA) and known-groups validity (Halabi et al., 2021; Nilsson et al., 2014); good reliability measured as internal consistency using Cronbach's Alpha (Flodén et al., 2025; Högstedt et al., 2022; Tanabe et al., 2025); and has proven sensitivity to measure changes over time (Høegh-Larsen et al., 2022). In a recent study (Flodén et al., 2025), Cronbach's Alpha for the factors in the scale has been reported to vary between 0.86 and 0.91, total scale 0.94. The NPC-35 has been translated into several languages and used in different countries to describe registered nurses' and nursing students' professional competence (Gardulf et al., 2019; The NPC Research Group, 2007).

### 2.1.2. Data analysis

Data were analyzed using IBM SPSS statistics version 29. A set of predefined rules guided the item selection process. (1) According to the six core competencies formally identified in international guidelines (Institute of Medicine, 2003; WHO, 2015), which are also reflected in the NPC-35, each short version was required to include at least one item from each of the six competency factors to ensure conceptual coverage. (2) For initial reduction, corrected item-total correlations (CITC) were calculated within each factor, and the three items with the highest CITC values per factor were shortlisted. (3) For the NPC-12, two items per factor were selected; for the NPC-6, one item per factor. (4) Final item selection was based on theoretical grounds and consensus discussions within the research group, which comprised five experts in the field, to determine which items best represented each factor.

Descriptive statistics were used to describe values for the items and total scales. Floor and ceiling effects were evaluated by calculating the proportion of participants with minimum or maximum total scores for the NPC-6 and -12, and discussed in relation to the threshold of 15% as recommended by Terwee et al. (2007). Relationships between the NPC-35, -12, and -6 scales were analyzed using Pearson correlation, coefficient ( $r$ ). Correlations were calculated using an adjusted NPC-35 total scores with overlapping items with NPC-6 or -12 removed. Internal consistency was tested using Cronbach's Alpha ( $\alpha$ ) and McDonald's omega total for the NPC-6 and -12 scales. Furthermore, for the NPC-6 and -12 scales, we describe the corrected item-total correlation and Cronbach's Alpha if item deleted. Given that the purpose of the NPC-6 was to provide an instrument for overall competency assessment rather than factor-specific scoring, a one-factor solution was selected. Principal component analyses (PCA) were performed to describe how much variance one factor, i.e. using the total scale, could explain for the NPC-6 scale. For NPC-12, both a uni-factor solution and a multi-factor-specific solution were tested using PCA and CFA, respectively. CFA was performed using IBM SPSS Amos. In Supplementary file A Fig. 1, we present the underlying construct of the NPC-12. For CFA model fit summary, we used Normed fit index (NFI), Comparative fit index (CFI), Chi-square test, Root mean square error of approximation (RMSEA), and

Standardized root mean square residual (SRMR) (Kline, 2013a). In a large sample, Chi-square is often significant and RMSEA is recommended (Kline, 2005). It is recommended that multiple indexes be presented. Acceptable values reported for CFI and NFI are  $>0.95$  (Kline, 2013a; Kääriäinen et al., 2011), RMSEA  $<0.08$  (Kline, 2013b) with 90% confidence interval (CI) not exceeding 0.10, SRMR  $<0.10$  (Kline, 2013b). Based on the factor loadings from the CFA for the NPC-12, the composite reliability value was calculated for each factor in both the Swedish and Chinese versions (Colwell, 2014). Construct validity was further examined using known-groups validity. It was hypothesized that specialist nurses would have significantly higher total scores on NPC-6 and -12 than non-specialist nurses. Data stability using test-retest reliability was not examined, as both the Swedish and Chinese datasets were collected at a single time point from hospital-based samples within one city in each country.

### 2.1.3. Ethics

The study received ethical approval from the Swedish Ethical Review Authority (Reg. no. 22-03922-01). All participants received written information about the study, including details regarding their voluntary participation. Written informed consent was obtained from the participants.

## 2.2. Study II

### 2.2.1. Sample and data collection

In total, all registered nurses (2650 nurses) working at three hospitals in China were invited. Of these, 2172 RNs responded (response rate 82.0%). Among the respondents, 2133 completed all items on the NPC-12 and 2135 completed all items on the NPC-6. The dataset was analyzed here as a secondary analysis of Xu et al. (2025). Most participants were female (96%), all were employed full-time, and most (92.7%) were not specialist nurses (i.e., nurses certified in a specific field after specialized training, possessing advanced skills and expertise, and with longer clinical experience).

The questionnaire survey included different instruments, including the NPC-35 scale, Chinese version (Xu et al., 2021). The Chinese version has shown good construct validity using CFA, and reliability, internal consistency, with Cronbach's alpha for the factors varying between 0.78 and 0.95.

### 2.2.2. Data analysis

Data were analyzed in a similar way as for Study I.

### 2.2.3. Ethics

The study was approved by Lishui University ethical boards (No 2023YR020). All participants received written study information, information about the procedures and voluntary participation.

## 3. Results

### 3.1. Study I

Table 1 describes the three items with the highest corrected item-total correlation for each factor in the NPC-35. For the NPC-12 scale, the items with the highest corrected item-total correlation were selected in five of the factors. For Factor 1 'Nursing Care', we chose 'cater for the patient's needs regarding specific, physical nursing care' instead of 'cater for the patient's needs regarding basic, physical nursing care' guided by theoretical considerations based on the NPC framework (Nilsson et al., 2018). For NPC-6, the items with the highest corrected item-total correlation were selected for three of the factors, and for the rest, selection involved a theoretical choice and a discussion based on which of the three items selected suited the factors best (Table 1).

Associations between the NPC-35, -12, and -6 scales were  $r$  0.948 (95% CI 0.940; 0.956) for NPC-35 and -12,  $r$  0.925 (95% CI 0.912;

**Table 1**  
The three highest CITC for each factor in the NPC-35 scale, study I (n = 612).

Factors/the three highest items and corresponding number in the 35-item NPC scale	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
<b>Factor 1 Nursing Care</b>						
2. Cater for the patient's needs regarding basic, physical nursing care?	0.732					
3. Cater for the patient's needs regarding specific, physical nursing care?	<b>0.730</b>					
4. Document the patient's physical condition?	<b>0.763</b>					
<b>Factor 2 Value-based Nursing Care</b>						
7. Show concern and respect for the patient's autonomy, integrity and dignity?		<b>0.775</b>				
8. Utilise the knowledge and experience of the patient and/or their next of kin?		<b>0.743</b>				
9. Show openness to and respect for different values and faiths?		0.726				
<b>Factor 3 Medical and Technical Care</b>						
11. Manage drugs adequately, applying knowledge in pharmacology?			<b>0.725</b>			
13. Question unclear instructions/prescriptions?			0.663			
14. Display judgement, knowledge and thoroughness when informing and providing for the patient's security and wellbeing during examinations and treatments?			<b>0.696</b>			
<b>Factor 4 Care Pedagogics</b>						
17. Provide support and guidance to enable optimal participation in care and treatment, in dialogue with				0.782		

**Table 1 (continued)**

Factors/the three highest items and corresponding number in the 35-item NPC scale	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
the patient and next of kin?						
18. Inform and educate patients and next of kin individually, taking into account time, form and content?				<b>0.808</b>		
20. Make sure that the patient and next of kin understand the information provided?				<b>0.790</b>		
<b>Factor 5 Documentation and Administration of Nursing Care</b>						
24. Carry out documentation according to current legislation?					<b>0.753</b>	
25. Comply with existing regulations as well as guidelines and procedures?					<b>0.769</b>	
26. Handle sensitive information correctly and carefully?					0.716	
<b>Factor 6 Development, Leadership and Organization of Nursing Care</b>						
30. Act adequately in case of unprofessional conduct by staff?						0.677
32. Implement new knowledge and thus promote nursing care in accordance with science and evidence-based practice?						<b>0.698</b>
35. Supervise and train co-workers/staff?						<b>0.739</b>

Note: CITC, Corrected item-total correlation; **Bold** text indicates the items used in the NPC-12 scale and **bold italics** items indicates items used in the NPC-6 scale.

0.935) for NPC-35 and -6 (overlapping items, NPC-12 and -6, were deleted in NPC-35), and r 0.973 (95% CI 0.968; 0.977) for NPC-12 and -6, all p-values <0.001.

PCA using one factor/total scale for the Swedish NPC-6 and -12 scales showed that one factor explained 59.6 and 55.3% of the variance in the NPC scales, respectively. From 60% explained variance is considered acceptable (Polit and Beck, 2021). Using CFA for NPC-12 with the same six factors as in the NPC-35, model fit summary revealed NFI 0.96, CFI 0.97, RMSEA 0.07 (90% CI 0.06; 0.08) and SRMR 0.03. The results regarding known-groups validity revealed that the scores on NPC-6 and -12 were significantly higher for specialist nurses

NPC-6, Mean [standard deviations (SDs)] 6.06 (0.70) and NPC-12, 6.03 (0.70) than non-specialist nurses NPC-6, 5.90 (0.73) and NPC-12, 5.87 (0.72) (both *p*-values 0.004). Cohen's *d* was  $-0.231$  for NPC-6 (95% CI  $-0.388$ ;  $-0.073$ ) and  $-0.234$  for NPC-12 (95% CI  $-0.392$ ;  $-0.076$ ).

Internal consistency reliability, measured as  $\alpha$  and McDonald's omega, was 0.856 for the NPC-6 scale and 0.923 for the NPC-12 scale for both tests. For the NPC-6 scale,  $\alpha$  if item deleted varied from 0.821 to 0.841 and corrected item-total correlations varied from 0.598 to 0.722. For the NPC-12 scale,  $\alpha$  if item deleted varied from 0.915 to 0.920 and corrected item-total correlations varied from 0.628 to 0.729. Table 2 presents the corrected item-total correlations and the 'α if item deleted' for the Swedish versions of the NPC-6 and -12.

For NPC-12, internal consistency for the six factors was also examined and inter-item correlation. Cronbach's  $\alpha$  were 0.77 for Nursing Care (2 items, inter-item correlation 0.630), 0.78 for Value-based Nursing Care (2 items, inter-item correlation 0.649), 0.70 for Medical and Technical Care (2 items, inter-item correlation 0.536), 0.83 for Care Pedagogics (2 items, inter-item correlation 0.715), 0.85 for Documentation and Administration of Nursing Care (2 items, inter-item correlation 0.741), and 0.72 for Development, Leadership, and Organization of Nursing Care (2 items, inter-item correlation 0.560). Composite reliability scores were all above 0.70, see Supplementary file A. In

**Table 2**  
Psychometric of NPC-12 and NPC-6 scales, study I.

Scales/items	NPC-12 n = 612		NPC-6 n = 612	
	CITC	α if item deleted	CITC	α if item deleted
1. (1) cater for the patient's needs regarding specific, physical nursing care?	0.663	0.917	0.598	0.841
2. Document the patient's physical condition?	0.666	0.917		
3. (2) show concern and respect for the patient's autonomy, integrity and dignity?	0.671	0.918	0.659	0.833
4. Utilise the knowledge and experience of the patient and/or their next of kin?	0.707	0.916		
5. Manage drugs adequately, applying knowledge in pharmacology?	0.652	0.918		
6. (3) display judgement, knowledge and thoroughness when informing and providing for the patient's security and wellbeing during examinations and treatments?	0.728	0.915	0.722	0.821
7. (4) inform and educate patients and next of kin individually, taking into account time, form and content?	0.723	0.915	0.667	0.828
8. Make sure that the patient and next of kin understand the information provided?	0.714	0.915		
9. Carry out documentation according to current legislation?	0.679	0.917		
10. (5) comply with existing regulations as well as guidelines and procedures?	0.729	0.915	0.658	0.829
11. (6) implement new knowledge and thus promote nursing care in accordance with science and evidence-based practice?	0.656	0.918	0.625	0.838
12. Supervise and train co-workers/ staff?	0.628	0.920		
<b>Cronbach's Alpha</b>	0.923		0.856	
<b>Scale Mean (SD)</b>	5.96 (0.73)		5.98 (0.73)	
<b>Scale Median</b>	6.00		6.00	
<b>Min-Max, n (%)</b>	1 (0.2%)–7 (8.8%)		1 (0.2%)–7 (6.7%)	

Note: (number in the 6-item NPC scale); CITC, Corrected Item-Total Correlation; Cronbach's Alpha if Item Deleted,  $\alpha$  if item deleted; SD, Standardized Deviation; Min, Minimum; Max, Maximum.

Supplementary file A Table 1 we present CFA factor loadings Swedish NPC-12, standardized regression weights and model fits.

Mean scores (SDs) of the NPC-35, -12 and -6 scales were 5.90 (0.71), 5.96 (0.73) and 5.98 (0.73). Minimum and maximum scores for the three scales were 1 and 7 for all versions of the scale (Table 2). Ceiling effects were 6.7% (NPC-12) and 8.8% (NPC-6), while floor effects were 0.2% for both. All values were below the 15% threshold (Terwee et al., 2007), indicating acceptable floor and ceiling effects.

### 3.2. Study II

Using the same principle as in Study I, the three items with the highest corrected item-total correlation for each factor in the NPC-35 were marked (Table 3). For the factor Nursing Care, the three highest in the Chinese version varied between 0.924 and 0.930 and included number 4, i.e., the same as in the Swedish version, while number 3, which we used in the Swedish version, had 0.912. For the factor 'Medical and Technical Care' (all items within this factor had uniformly high values, ranging from 0.845 to 0.945), the three highest in the Chinese version varied between 0.938 and 0.945 and included number 14, while number 11 and 13, which we used in the Swedish version, had corrected item-total correlations 0.845 and 0.934, respectively. Because the differences were not particularly large in the corrected item-total correlation for these two factors, we kept the same items we used in the Swedish NPC-12 version. Thus, the same items as in the Swedish NPC-12 and -6 scales were kept.

Associations between the NPC-35 using adjusted NPC-35 total scores without overlapping items, -12, and -6 scales were 0.990 (95% CI 0.989; 0.991) for NPC-35 and -12, 0.987 (95% CI 0.986; 0.988) for NPC-35 and -6, and 0.994 (95% CI 0.994; 0.995) for NPC-12 and -6), all *p*-values less than 0.001. Principal component analyses using one factor, i.e., total scales showed that the NPC-6 explained 82.0% of the variance in the scale and the NPC-12 81.4%. For CFA (NPC-12), the model fit summary revealed NFI 0.99, CFI 0.99, RMSEA 0.06 (90% CI 0.05; 0.06) and SRMR 0.009. The results of the known-groups validity showed that specialist nurses scored significantly higher than non-specialist nurses on both the NPC-6 (Mean 6.45 [SD 0.62] vs. 6.24 [0.77]) and the NPC-12 (6.45 [0.63] vs. 6.23 [0.77]), with both *p*-values <0.001. Cohen's *d* was 0.284 for NPC-6 (95% CI 0.117; 0.451) and 0.292 for NPC-12 (95% CI 0.125; 0.459).

Table 4 presents the corrected item-total correlations and the 'α if item deleted' for the Chinese versions of the NPC-6 and -12. Corrected item-total correlations for the NPC-6 scale varied between 0.801 and 0.885, and for the NPC-12 between 0.832 and 0.905. Both  $\alpha$  and McDonald's omega were 0.955 for NPC-6 and 0.979 for NPC-12,  $\alpha$  if item deleted for both scales was less than the total value, see Table 4.

Cronbach's Alpha values for the six factors in NPC-12 were Nursing Care 0.93 (2 items, inter-item correlation 0.868), Value-based Nursing Care 0.96 (2 items, inter-item correlation 0.916), Medical and Technical Care 0.90 (2 items, inter-item correlation 0.823), Care Pedagogics 0.92 (2 items, inter-item correlation 0.849), Documentation and Administration of Nursing Care 0.97 (2 items, inter-item correlation 0.934), and Development, Leadership and Organization of Nursing Care 0.94 (2 items, inter-item correlation 0.892). The composite reliability scores for NPC-12 were all above 0.70, see Supplementary file A Table 2. In Supplementary file A Table 2 we present CFA factor loadings Chinese NPC-12, standardized regression weights and model fits.

Mean scores (SDs) of the NPC-12 and -6 scales were 6.24 (0.76) and 6.25 (0.76), respectively. Minimum and maximum scores for the scales were 1 and 7 for both versions of the scale (Table 4). Ceiling effects were 28.3% (NPC-12) and 25.9% (NPC-6), exceeding the 15% threshold (Terwee et al., 2007), while floor effects were 0.1% for both. These results indicate notable ceiling effects in the Chinese NPC-12 and NPC-6.

**Table 3**

The three highest CITC for each factor in the NPC-35 scale, study II (n = 2131–2135).

Factors/the three highest items, corrected item-total correlation, and corresponding number in the NPC-35 scale	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Factor 1 Nursing care. The three highest in the Chinese version varied between 0.924 and 0.930 and included number 4 whereas number 3 as we used in the Swedish version had 0.912. Since the difference was not that big in CITC we kept the same items as in the Swedish 12-item version						
2. Cater for the patient's needs regarding basic, physical nursing care?	0.930					
3. Cater for the patient's needs regarding specific, physical nursing care?	<b>0.912</b>					
4. Document the patient's physical condition?	<b>0.924</b>					
5. Document patient's psychological status?	0.925					
Factor 2 Value-based nursing care. The two selected among the three highest						
7. Show concern and respect for the patient's autonomy, integrity and dignity?		<b>0.944</b>				
8. Utilise the knowledge and experience of the patient and/or their next of kin?		<b>0.939</b>				
9. Show openness to and respect for different values and faiths?		0.931				
Factor 3 Medical and technical care. The three highest (0.938–0.945) in the Chinese version included number 14 whereas number 11 as we used in the Swedish version had 0.845. Since the difference was not that big in CITC we kept the same items as in the Swedish 12-item version						
11. Manage drugs adequately, applying knowledge in pharmacology?			<b>0.845</b>			
13. Question unclear instructions/prescriptions?			0.934			
14. Display judgement, knowledge and thoroughness when informing and providing for the patient's security and wellbeing during			<b>0.945</b>			

**Table 3 (continued)**

Factors/the three highest items, corrected item-total correlation, and corresponding number in the NPC-35 scale	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
examinations and treatments?						
15. Follow up on patient's conditions after examinations and treatments?			0.943			
16. Handle medical/technical equipment according to legislation and safety routines?			0.938			
Factor 4 Care pedagogics. The two selected among the three highest						
17. Provide support and guidance to enable optimal participation in care and treatment, in dialogue with the patient and next of kin?				0.871		
18. Inform and educate patients and next of kin individually, taking into account time, form and content?					<b>0.908</b>	
19. Inform and educate groups of patients and relatives?				0.912		
20. Make sure that the patient and next of kin understand the information provided?					<b>0.920</b>	
Factor 5 Documentation and administration of nursing care. The two selected among the three highest						
24. Carry out documentation according to current legislation?					<b>0.934</b>	
25. Comply with existing regulations as well as guidelines and procedures?					<b>0.943</b>	
26. Handle sensitive information correctly and carefully?					0.944	
Factor 6 Development, leadership and organization of nursing care. The two selected among the three highest						
30. Act adequately in case of						0.924

(continued on next page)

**Table 3** (continued)

Factors/the three highest items, corrected item-total correlation, and corresponding number in the NPC-35 scale	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
unprofessional conduct by staff?						
31. Apply principles of disaster medicine?						0.927
32. Implement new knowledge and thus promote nursing care in accordance with science and evidence-based practice?						<b>0.940</b>
33. Interact with other professionals in care pathways						0.927
35. Supervise and train co-workers/staff?						<b>0.933</b>

Note: CITC, Corrected item-total correlation; **Bold** text indicates the items used in the 12-item NPC scale and **bold italics** items indicates items used in the 6-item NPC scale.

**4. Discussion**

The present study aimed to develop and validate shortened versions of the NPC-35 Scale, comprising items across the six established competency factors. The analysis led to the development of the 6-item NPC-6 and the 12-item NPC-12 scales, each representing the six established factors of professional competence. NPC-6 aimed to be used as a total score and NPC-12 both as a total score and as factor scores based on the previously identified six competency factors, and in our study confirmed using CFA.

The development of the NPC-6 and -12 scales was guided by both theoretical and methodological considerations to ensure scientific rigor. First, item selection in both the Swedish and Chinese versions was closely aligned with the NPC framework (Nilsson et al., 2018) and international guidelines used when the NPC-35 scale was developed (Institute Of Medicine US Committee On The Health Professions Education Summit, 2003; WHO, 2015). The items covered all the competency factors from the previous NPC-35 scale, including information about nursing care, value-based nursing care, medical and technical care, care pedagogics, documentation and administrative care, and development, leadership, and organization of nursing. This ensured that the shortened versions used in the present study preserved the theoretical breadth of the 6 factors in the full 35-item instrument. Furr (2021) argued that using items with the highest item-total correlations ensures the most robust indicators consistent with the total score of the factor/scale (Furr, 2021).

Item selection was further validated through expert discussions with other researchers in the NPC group who were experienced in nurse competence assessment. For the NPC-12 Swedish version, for Factor 1 ‘Nursing Care’, we chose ‘cater for the patient’s needs regarding specific, physical nursing care’ over ‘basic, physical nursing care,’ as it better captures targeted aspects of registered nurses’ nursing care and, thus, is more sensitive to variations in competence. For the Chinese version, Item 11, ‘manage drugs adequately, applying knowledge in pharmacology,’ was retained in the ‘Medical and Technical Care’ factor to

**Table 4**

Psychometric of NPC-12 and NPC-6 scales, study II.

Scales/items	NPC-12 n = 2133		NPC-6 n = 2135	
	CITC	α if item deleted	CITC	α if item deleted
1. (1) cater for the patient's needs regarding specific, physical nursing care?	0.832	0.978	0.801	0.954
2. Document the patient's physical condition?	0.866	0.977		
3. (2) show concern and respect for the patient's autonomy, integrity and dignity?	0.902	0.976	0.882	0.944
4. Utilise the knowledge and experience of the patient and/or their next of kin?	0.905	0.976		
5. Manage drugs adequately, applying knowledge in pharmacology?	0.871	0.977		
6. (3) display judgement, knowledge and thoroughness when informing and providing for the patient's security and wellbeing during examinations and treatments?	0.896	0.977	0.885	0.944
7. (4) inform and educate patients and next of kin individually, taking into account time, form and content?	0.865	0.977	0.848	0.948
8. Make sure that the patient and next of kin understand the information provided?	0.871	0.977		
9. Carry out documentation according to current legislation?	0.905	0.976		
10. (5) comply with existing regulations as well as guidelines and procedures?	0.898	0.977	0.880	0.944
11. (6) implement new knowledge and thus promote nursing care in accordance with science and evidence-based practice?	0.887	0.977	0.870	0.945
12. Supervise and train co-workers/ staff?	0.886	0.977		
<b>Cronbach's Alpha</b>	0.979		0.955	
<b>Scale Mean (SD)</b>	6.24 (0.76)		6.25 (0.76)	
<b>Scale Median</b>	6.17		6.17	
<b>Min–Max, n (%)</b>	1 (0.1%)–7 (28.3%)		1 (0.1%)–7 (25.9%)	

Note: (number in the 6-item NPC scale); CITC, Corrected Item-Total Correlation; Cronbach's Alpha if Item Deleted, α if item deleted; SD, Standardized Deviation; Min, Minimum; Max, Maximum.

maintain consistency with the Swedish version. Although other items showed slightly higher corrected item-total correlations, Item 11 was conceptually integral, reflecting core aspects of nursing competence in medical and technical care. The tests for the Swedish and Chinese versions revealed similar reliability patterns, facilitating use in these two countries (Hawkins et al., 2020); however, future invariance testing is required.

With respect to reliability and validity, the NPC-6 indicated acceptable psychometric properties in Swedish and Chinese contexts. This was also true of NPC-12 in the Chinese context, while the NPC-12 Swedish version had high internal consistency, but the explained variance was 55.3% when used as a uni-factor scale, i.e., below the threshold of 60% (Polit and Beck, 2021). For the Swedish NPC-12 and the Chinese, it can be used as a multi-factor scale representing the six competency factors. Internal consistency was high across all versions, with α coefficients of 0.856 for the Swedish NPC-6, 0.923 for the Swedish NPC-12, 0.955 for the Chinese NPC-6, and 0.979 for the Chinese NPC-12. High values indicate that fewer items could be used. However, as we wanted the shortened versions to be consistent with the six NPC factors, we decided to keep the number of items. Principal component analyses showed that a one-factor solution explained 55% of the variance in the Swedish NPC-12, 60% in the Swedish NPC-6, 81% in the Chinese NPC-12, and 82% in

the Chinese NPC-6. According to different guidelines, from 60% (Polit and Beck, 2021) to over 70% explained variance is considered acceptable (Jolliffe and Cadima, 2016). Both shortened versions showed very strong correlations with NPC-35 (ranging from 0.92 to 0.99). Known-groups validity was examined as a test of construct validity. In both countries specialist nurses scored statistically significantly higher on both NPC-6 and -12 than non-specialist nurses. These findings, i.e., competence related to educational level were hypothesized and are consistent with previous studies (Almarwani and Alzahrani, 2023; Cao et al., 2025) and provide further support for the construct validity of the NPC-6 and -12. When the NPC-12, Swedish and Chinese versions, was tested with CFA for the six-factor structure, the results revealed an acceptable model fit. The fit indices met recommended thresholds, indicating that the six factors can be used for the NPC-12 and internal consistency showed  $\alpha$  values and Composite Reliability of 0.70 or more, thus also meeting the recommended thresholds.

The shortened scales offered advantages in terms of practicality and applicability in research. Evidence from a meta-analysis (Rolstad et al., 2011) demonstrated an association between questionnaire length and response rate, indicating that longer instruments are more likely to reduce participation and completion rates. While the NPC-35 scale is comprehensive and has demonstrated high response rates in previous studies (Nilsson et al., 2018; Nilsson et al., 2014; Xu et al., 2021; Xu et al., 2025), its length may still pose challenges in large-scale surveys and longitudinal research, where participant burden can compromise data quality and follow-up rates. In contrast, the NPC-6 and NPC-12 scales offer more efficient alternatives by substantially reducing respondent burden while retaining coverage of the essential competency factors of nurse professional competence.

The NPC-6 is recommended for fast total-score screening in large surveys, and does not support factor-level interpretation. The NPC-12 is recommended when users need factor scores across the six competence areas. For the Swedish NPC-12, the explained variance in the uni-factor model was below 60%, possibly due to sample characteristics or low response bias, and warrants further testing. Future validation should include larger and more diverse Swedish samples. Although the NPC-12's multi-item structure permits factor-level interpretation, the presence of two-item factors may introduce identification issues and unstable parameter estimates (Kunina-Habenicht et al., 2012); therefore, further structural validity testing is needed. Furthermore, problematic ceiling effects were observed in both the Chinese versions of the NPC-6 and NPC-12, which may limit the instruments' sensitivity to detect improvements in nurses' professional competence in intervention studies. Future scale development could examine whether ceiling effects vary across participant subgroups and explore alternative response formats.

#### 4.1. Implications

The present study resulted in the development of two new shortened versions of the NPC Scale, the goal being to reduce the respondent burden in large-scale research settings while maintaining the scale's core functionality and relevance. The shortened versions of the NPC Scale were developed based on data from large-scale studies involving Swedish- and Chinese-speaking participants. To enhance the scales' generalizability, future research should include participants who speak other languages. Furthermore, the scales must be tested when the NPC-6 and -12 item versions are used. Although nursing students were not included in our study, we believe the new brief versions of the scale would be applicable to this group, given the successful use of the previous version in similar educational contexts. However, this needs to be evaluated in future studies. The intended use for these versions is that the NPC-6 can be used as a rapid total competence screener in large surveys and the NPC-12 when users need factor scores across the six competence areas. However, the NPC-12, while designed as a brief tool, currently requires further validation before it can be confidently used, given the two-item factor structure and the psychometric concerns

identified in the Swedish version when used as a total score. Future structural validity evidence is needed when data are collected with the NPC-12 version.

#### 4.2. Limitations

This study has several limitations. As the datasets were originally collected for other purposes and at a single time point, it was not possible to assess test-retest reliability, or responsiveness to change of the NPC-6 and -12. Future studies are therefore needed to evaluate these psychometric properties. No cross validation was conducted, as the short forms were developed and tested within the same datasets, this means all psychometric estimates (alpha, correlations, factor loadings) are likely overestimates that will shrink in new samples. Furthermore, self-report data may be subject to common method bias, potentially inflating the observed relationships. Some items in the Chinese version were retained despite lower corrected item-total correlations to maintain consistency with the Swedish version, the magnitude of the differences potentially compromising the Chinese version's psychometric integrity. When testing the NPC-12 with CFA, there is a foundational limitation with the two-item factors, which can lead to identification issues and unstable parameter estimates. Furthermore, the high Cronbach's alpha values for the total score of the NPC-12, particularly in the Chinese version, may indicate item redundancy. Lastly, the scales are suitable for within-country use, but cross-country comparisons should be made cautiously, as measurement invariance was not formally tested in this study. Future research should formally test invariance across different countries and linguistic contexts. In the future, also external criterion validity needs to be addressed using objective competence measures, supervisor ratings, or performance outcomes.

#### 5. Conclusions

In conclusion, the NPC-6 demonstrates strong internal consistency and supports a total score in both the Swedish and Chinese samples. The NPC-12 shows an acceptable six-factor CFA fit in both samples and can be used for factor scoring, while the Swedish total score needs cautious interpretation based on the weaker one-factor variance. Given the presence of two-item factors, our proposed six-factor structure of the NPC-12 also warrants caution, and further structural validity testing is needed.

#### CRedit authorship contribution statement

**Maria Engström:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Lijuan Xu:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Jan Nilsson:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Marianne Carlsson:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Anne Flodén:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization.

#### Declaration of Generative AI and AI-assisted technologies in the writing process

During the writing process, no generative AI or AI-assisted technologies were used during the writing process.

#### Funding source

The study was supported by University of Gävle, and grant from Department of Education Research Fund in Zhejiang Province, Grant/Award Number: JGCG2025746.

## Declaration of competing interest

The authors have declared no conflict of interest.

## Acknowledgement

We thank all participating nurses and the participating organizations.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.nedt.2026.107141>.

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