ORIGINAL RESEARCH

Psychometric evaluation of the Austrian version of the Nurse Professional Competence Scale Short Form (NPC–SF–AUT)

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ABSTRACT

Background and objective: The continuous assessment of nursing competence is internationally established and an important task in the further development of professional nursing. The Nurse Professional Competence Scale Short Form is a potentially appropriate instrument to assess the competence of Austrian Registered Nurses (RN). However, the translated and Austrian-specific culturally adapted version of the scale has not yet been sufficiently psychometrically tested. The aim of this study was to test the validity and internal consistency of the Austrian version of the Nurse Professional Competence Scale Short Form.
Methods: We conducted an exploratory cross-sectional study. Between October 2021 and January 2022, Registered Nurses from a total of 16 hospitals were invited to assess their competencies using the Austrian version of the Nurse Professional Competence Scale Short Form. Principal axis factor analysis with Promax rotation was performed to test construct validity. Both Cronbach's Alpha and McDonald's Omega coefficients were used to evaluate internal consistency.
Results: Data from a total of 576 Registered Nurses were included in the psychometric evaluation. Both the Kaiser-Meyer-Olkin coefficient (KMO = 0.958) and the significant Bartlett test (χ^2 = 12430.988; df = 595; $p < .001$) indicated appropriate fit of the data for factor analysis. Using principal axis factor analysis with Promax rotation, five factors were extracted, explaining a total of 60.5% of the variances. The Nurse Professional Competence Scale Short Form German Austrian language version (NPC–SF–AUT) thus comprises 35 items representing the five factors "Health promotion and safeguarding" (13 items), "Multi-professional cooperation and development" (7 items), "Process-guided nursing care" (5 items), "Inclusive decision-making" (5 items) and "Rule-governed professional practice" (5 items). Both the factor-specific Cronbach's Alpha and McDonald's Omega coefficients confirmed good to excellent (α = 0.83-0.92; ω = 0.83-0.92) internal consistency of the NPC-SF-AUT.
Conclusions: The NPC–SF–AUT is a valid and internal consistent instrument for the self-assessment of RNs' competence in Austria. The instrument can be used for the continuous assessment of nursing competence and thus contribute to the advancement of the nursing profession.

Key Words: Assessment, Austria, Nursing competence, Professional nursing development

1. BACKGROUND

Almost 97,000 nursing professionals work in Austria, of whom about 60% are employed as registered nurses (RNs) in the higher service for health care and nursing.[1] Nurses have to ensure high-quality health care[2] and to promote transformative change regarding patient-centered care as an

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important part of interprofessional teams.[3] Highly qualified nurses increase patient safety, reduce mortality, improve quality of care, and help reduce the cost of care.[4–7]

As part of the reform of the Austrian Health and Nursing care Act[8] the competencies of the individual nursing professions were redefined[9] on the basis of the competency model of the International Council of Nurses (ICN)[10] as well as the World Health Organization's[11] global standards for the initial education of professional nurses and midwifes, comprising competencies with regard to evidence-based practice, critical thinking, community oriented and culturally competent practising within the crountry-specific regulations and care systems, effective, safe and multi-professional working in line with ethical principles as well as leadership and continuing professional development. Eventually, this legal reform resulted in the transfer of nursing education for registered nurses (RNs) from the vocational to the higher education level, accompanied by a curricular adaptation of the learning content and addressing the intended competencies suggested for European Union countries[12] to be acquired within nursing educational programs and eventually being performed in nursing practice. Thus, Austrian RNs are responsible for promoting and maintaining the health of people of all age groups, families and populations in every care setting. This requires nursing practice based on scientific evidence and with reference to health-promoting, preventive, curative, rehabilitative, and palliative competencies. In addition, the development of professional competencies based on continuing further qualifications is mandatory for Austrian RNs.[8]

Nursing competencies are generally defined as a conglomerate of knowledge, skills, qualifications, norms, values, and rules,[13–15] and they develop stepwise with experience under context-dependent requirements.[16–18] Several European studies have identified the influence of the type of nursing education and RNs' experience in different nursing settings as critical for the extent of individual nurses' competencies.[19] The assessment of competencies can be carried out methodically in various ways, so that both qualitative examinations (e.g. interviews) as well as objective and subjective quantitative assessments are described as purposeful.[20] In order to evaluate the development of profession-specific competencies continuously and comprehensively, the use of standardized self-assessment instruments has become established internationally.[21,22] However, such instruments often have to be adapted for the respective national nursing contexts.[23]

For European countries, a total of five different valid and reliable large-scale self-assessment instruments have been developed, which evaluate nursing competence based on different theoretical constructs. A content-analytic exploration of these instruments at item level revealed the Nurse Professional Competence (NPC) Scale[24] as potentially appropriate for assessing nursing competencies in the Austrian nursing context.[25]

The theoretical construct of the NPC Scale was developed in Sweden and is based on both the competencies defined in Swedish national nursing legislation and the competencies defined in the European Union standards for nursing and midwifery.[26] The original Swedish 88 items version of the NPC Scale has been evaluated among nursing students at their point of graduation on construct validity and reliability.[24] It was subsequently translated into English[27] and German[28] and thus culturally adapted for Austria and German-speaking Switzerland.[29] In a first test-theoretical step, the 88 items version of the NPC Scale was content-validated in both Austria[30] and Switzerland.[31] Due to the high number of items and associated low practicability and acceptance in the target group, a short form of the instrument was developed by the original authors. For the NPC Scale Short Form,[32] 35 items of the original instrument were extracted, and these were assigned to six scale dimensions (nursing care; value-based nursing care; medical-technical treatment nursing care; nursing-related pedagogy; documentation and nursing-related administration; nursing development, leadership and organization of nursing care), although during this reduction process no modifications were conducted to the individual items in terms of wording or content.[33] This scale version is recommended by the authors for use with both nursing students and graduated RNs to assess their extent of nursing competence.[32] The NPC Scale Short Form has so far been tested for its psychometric properties in several countries worldwide. The original six-factor structure of the original instrument was confirmed after factor analysis in three studies,[34–36] while Prosen et al.[37] revealed a four-factor structure after confirmatory factor analysis and Lee et al.[?] extracted five factors based on principal component analysis. The reliability of the country-specific NPC Scale Short Form versions revealed consistent good to excellent homogeneity of the items at factor level after checking internal consistency using Cronbach's Alpha.[34–39] A revision of the item-specific results of a previous psychometric evaluation of the Austrian version of NPC Scale[30] indicated a good to excellent relevance of the respective items which are represented in the NPC Scale Short Form, with item content validity indexes (I-CVIs) ranging from 0.83 to 1.00.

Despite the internationally widely established evaluation of nurses' competencies[19] and its addressing in the European development plan for nursing professions,[40] there is no respective scientific evidence available so far for German-

speaking countries.[41] The lack of psychometrically validated instruments hampers the required continuous evaluation of developed competencies across nursing careers[42] and means widespread uncertainty regarding development needs at individual, organizational, and systemic levels.[43,44] The German-Austrian-language version of the NPC Scale Short Form could be used in both research and nursing practice. However, the use of a translated instrument requires that it has been evaluated prior at least with regard to the classical test theory quality criteria of reliability and validity to ensure the confidence of data collected based on the instrument.[45]

Therefore, the aim of this study was to examine the Austrian version of the NPC Scale Short Form with regard to its construct validity as well as its internal consistency in order to subsequently provide a psychometrically tested instrument for the assessment of nursing competence of Austrian RNs.

2. METHODS

2.1 Study design

We conducted an exploratory cross-sectional study.

2.2 Sampling

The sampling of participants corresponded to a non-probabilistic convenience sample.[46] For the testing of construct validity by exploratory factor analysis, a minimum size of 500 participants is defined as appropriate, considering the number of items of the instrument and considering potentially low communalities and low factor loadings, respectively.[45] We included RNs in public and private hospitals in Austria. Prerequisites for participation were active employment in a conservative, surgical, or interdisciplinary inpatient medical discipline. Additionally, professional certification must have been acquired through training in accordance with the respective training regulations in the Austrian Health and Nursing care Act. Nurses with legally defined specialized education and further qualifications were excluded to increase the homogeneity of the sample and to prevent potential bias due to additional acquisition of competencies based on formal additional qualifications. Finally, we defined to exclude all those RNs who had not completed the entire nursing competence-related assessment items (part two of the survey instrument).

2.3 Instrument

The survey instrument consisted of two parts. Part one covered relevant background variables to describe the sample (age, gender, work experience, type of hospital, type of qualification as RN, formal qualifications, current work area), part two represented the items of the Austrian version of the Nurse Professional Competence Scale Short Form (NPC-SF). The NPC–SF consists of a total of 35 items, which are assigned to six scale dimensions (nursing care, 5 items; value-based nursing care, 5 items; medical-technical treatment nursing care, 6 items; nursing-related pedagogy, 5 items; documentation and nursing-related administration, 8 items; nursing development, leadership and organization of nursing care, 6 items). The individual items are answered by self-assessing the corresponding nursing competencies using a 7-point Likert scale (1 = to a very low degree; 2 = to a low degree; 3 = to a fairly low degree; 4 = neither high or low degree; 5 = to a fairly high degree; 6 = to a high degree; 7 = to a very high degree). The extent of nursing competence at item level can be interpreted directly based on Likert-scaled scores. Dimension-specific scale scores are calculated by summing up the self-estimated item scores per scale dimension divided by the maximum achievable total score for the respective scale dimension. This calculated value is finally multiplied by 100, so scale dimension scores can range from 0-100. No cut-off value is specified for the instrument; the closer the score is to 100, the higher the level of dimension-related nursing competence.[33]

2.4 Data collection

A paper-based data collection was conducted from October 2021 to January 2022. To recruit study participants, nursing directors in Austrian health care facilities were initially contacted and informed about the study. In case of a respective healthcare facility's agreement for participation, the prepaid and readdressed questionnaires, including the information letters, were placed in envelopes in those departments in which RNs were employed. In the enclosed information letters, explicit reference was made to voluntary participation, anonymity, data storage and publication of the results in anonymized way, as well as the possibility of contacting the study authors in case of questions regarding the study. Returning the completed questionnaires was consent to study participation.

2.5 Data analysis

Exploratory factor analysis and internal consistency testing, as well as descriptive analyses were performed using IBM SPSS Statistics for Windows, Version 27.0.[47]

2.5.1 *Descriptive data*

The background variables of the sample were described using absolute and relative frequency distributions, and the mean values and standard deviations were calculated for the background variables age and experience as well as the values of the item-specific nursing competence estimations. The normal distribution of the item-specific ratings was analysed using histograms and Kolmogorov-Smirnov tests.

2.5.2 *Estimating construct validity*

The construct validity of the German-Austrian-language version of the NPC Scale Short Form was tested by conducting exploratory factor analysis (EFA). Since the data were not expected to be free of measurement error, EFA using the maximum likelihood method was intended under the prerequisite of normally distributed data. If normal distribution is lacking, principal axis factor analysis is considered a more appropriate method[48] to explain correlations among items by a smaller number of homogeneous factors.[45] Data were tested for distribution using histograms and Kolmogorov-Smirnov test for normality, a Kaiser-Meyer-Olkin coefficient of > 0.5 was considered as a minimum requirement for the conductibility of the factor analysis as well as a significant result of testing for Bartlett sphericity.[49] Item communalities between $h^2 = 0.2$ and $h^2 = 0.4$ in relation to the established sample size[45] were defined as the minimum requirement for further inclusion of the corresponding items in the EFA. Initially, oblique Promax factor rotation was performed due to potential factor intercorrelations, whereby extracted factors had to have an eigenvalue of $\lambda > 1$.[45] A correlation between factors of < 0.32[50] was established as a criterion for possible further orthogonal rotation.

2.5.3 *Estimating reliability*

The reliability of the instrument was evaluated by testing the internal consistency using the Cronbach's alpha coefficient.[51] The mean-inter-item correlation (MIC) as an index of homogeneity was determined to be $r > 0.3$ according to Cristobal et al.,[52] and the corrected item total correlation as an expression of the discriminatory power of the items had to show solely positive correlation coefficients of $r > 0.38$.[53] Additionally, the internal consistency was calculated using McDonald's Omega,[54] since Cronbach's Alpha values can lead to an overestimation of the internal consistency due to potential tau-equivalence violating factors that remain disregarded.[55] Reliability coefficients ≥ 0.7[56] were considered acceptable confirmation of internal consistency.

2.6 Ethical considerations

The detailed study plan was submitted to the university ethics board. The described methodological procedure and the measures to ensure both research ethics according to the declaration of Helsinki[57] and data protection principles were voted as appropriate and the study was given approval. Additionally, written permission to use and psychometrically evaluate the German-Austrian-language version of the NPC Scale Short Form was obtained from the developer of the original instrument.

3. RESULTS

3.1 Description of the sample

A total of 868 of the 1,961 questionnaires sent out were returned, thus resulting in a response rate of 44.3%. In a first selection step, a total of 263 participants were excluded due to lack of inclusion criteria, and in a second selection step, a further 29 participants were excluded due to missing information in the questionnaires with regard to the assessment of item-specific nursing competencies. Consequently, data from 576 RNs from 16 Austrian hospitals (14 public hospitals, 2 private hospitals) could be included for psychometric testing of the German-Austrian-language version of the NPC Scale Short Form (see Figure 1). Participants were working in different medical disciplines (conservative, surgical, and interdisciplinary) in inpatient care at the time of data collection. Table 1 provides a detailed overview of the participants' background variables.

3.2 Construct validity

The analysis of the data by histograms showed left-skewed distributions for all 35 items, the subsequent Kolmogorov-Smirnov tests were significant for all items ($p < .001$). The Kaiser-Meyer-Olkin coefficient showed a very good (KMO = 0.958) fit of the data for factorization, and the Bartlett-test was significant ($\chi^2 = 12430.988$; df = 595; $p < .001$). Due to lack of normal distribution, the use of maximum liklihood method was rejected and several principal axis factor analysis procedures were performed. Besides factorizations based on the retention criterion of eigenvalue > 1, it was tested whether the original instrument's six-factor structure would be appropriate for explaining the variances in our sample. In the course of each analysis procedure, the accuracy of the extracted factor solutions and their corresponding item loadings was reviewed by taking both methodological determinants and content relevance into account. With regard to the best fitting factorial solution presented in the following, three items (items 11, 12,13) had low communalities ($h^2 < 0.4$), the remaining items' communalities ranged between medium and high. Thus, all 35 items were included in the further analysis. By initially applying oblique factor rotation using Promax method, five factors with eigenvalues > 1 were extracted; due to high correlations ($r > 0.32$) among the extracted factors, subsequent orthogonal rotation was omitted. This model explained a total of 60.5% of the variances with factor loadings ranging from $\lambda = 0.27$ (item 30) to $\lambda = 0.93$ (item 20); five items showed cross loadings on two factors each (items 8, 22, 26, 28, 30). After content revision of these cross-loaded items and considering both the high item-specific content validity indexes (I-CVIs 0.89-0.98[30]) as well as the items' substantive theoretical relevance for the construct of nursing competence of Austrian RNs we

decided to remain them in the scale. The five factors were designated according to theoretically reasonable interpretations of factor-related meanings and the final model (see Table 2) of the Nurse Professional Competence Scale Short Form German AUT language version (NPC–SF–AUT) was established as following: Factor 1: Health promotion and safeguarding (13 items); Factor 2: Multi-professional cooperation and development (7 items); Factor 3: Process-guided nursing care (5 items); Factor 4: Inclusive decision-making (5 items); Factor 5: Rule-governed professional practice (5 items).

3.3 Reliability

The testing of the five-factor-model of the NPC–SF–AUT by using both Cronbach's Alpha and McDonald's Omega approaches indicated good to excellent[59] internal consistency of the scale. The mean-inter-item correlations (MIC) were above 0.30 indicating sufficient homogeneity of the factor-specific items, and corrected item-total correlations > 0.38 showed adequate discriminatory power of the respective items (see Table 3).

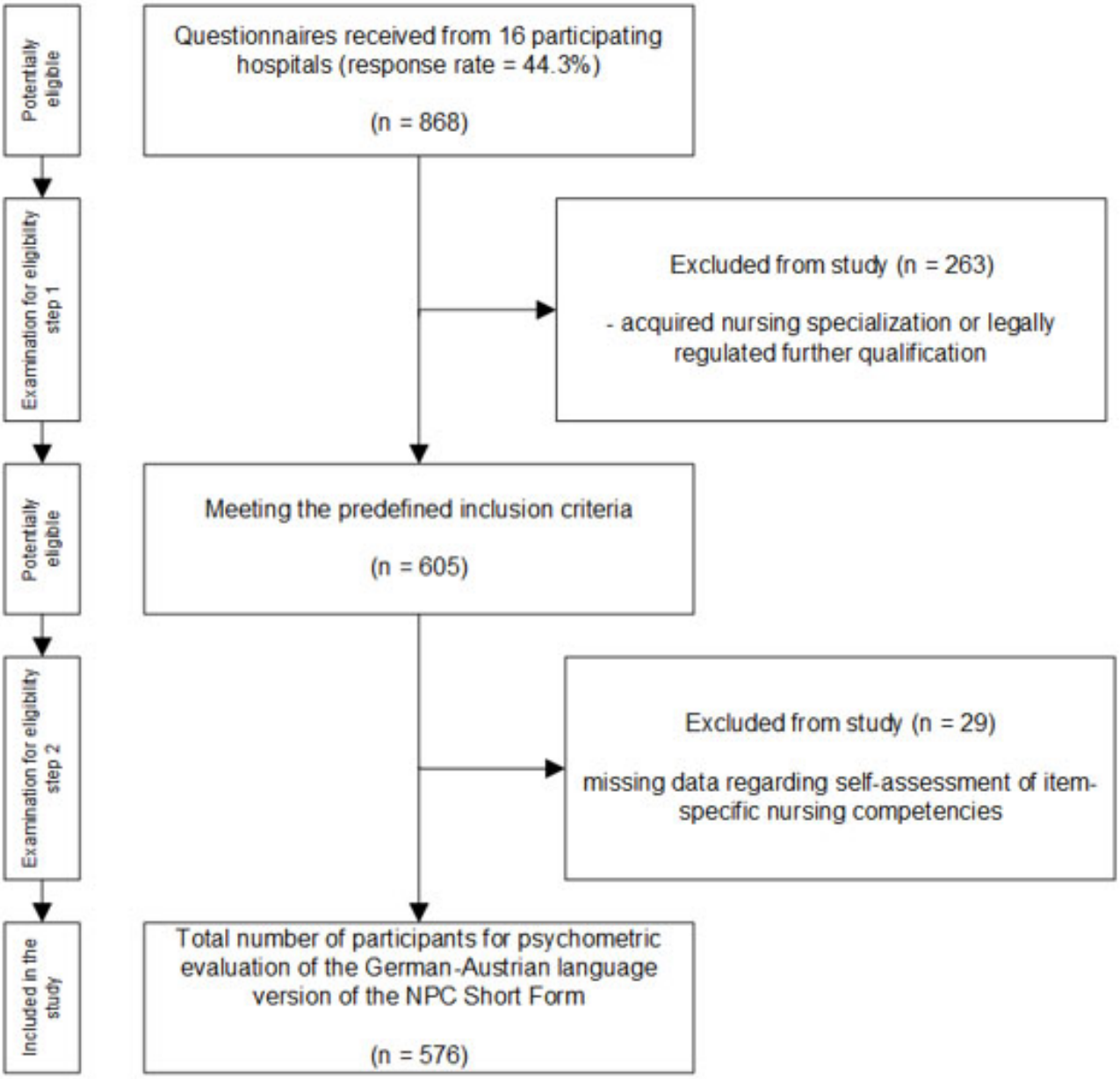

Figure 1. Flow diagram of the sample selection process (adapted from von Elm et al.; STROBE Initiative[58])

4. Discussion

The aim of the study was to evaluate the psychometric properties of the NPC Scale Short Form in the Austrian nursing context. The five-factor structure of the final NPC–SF–AUT demonstrates solid construct validity, and the internal consistency ranges from good to excellent in terms of the five subscales.

Table 1. Characteristics of the sample (n = 576)

Background variable	n (%)	Mean ± SD
Age in years	573#	35.28 ± 10.65
Female	517 (89.9)	35.14 ± 10.68
Male	55 (9.5)	37.02 ± 10.36
Divers	3 (0.5)	28.67 ± 5.17
Hospitals	576	
Public	527 (91.5)	
Private	49 (8.5)	
Current medical discipline	531#	
Conservative	222 (41.8)	
Internal medicine	146 (65.8)	
Neurology	28 (12.6)	
Psychiatry	28 (12.6)	
Oncology	28 (12.6)	
Palliative care	3 (1.4)	
Surgical	247 (46.5)	
General & visceral surgery	140 (56.7)	
Orthopaedics	78 (31.6)	
Gynaecology	20 (8.1)	
Urology	4 (1.6)	
Ophthalmology	3 (1.2)	
ENT	1 (0.4)	
Neurosurgery	1 (0.4)	
Interdisciplinary	62 (11.7)	
Overall work experience in years	573#	12.16 ± 10.56
Experience in current discipline in years	559#	8.46 ± 8.41
Registered nurses' type of professional education	575#	
†VTa	153 (26.6)	
⁑ VTb	292 (50.8)	
□VTc	31 (5.4)	
¥ATa	51 (8.9)	
‡ATb	48 (8.3)	

all percentages related to valid values for background factor; number of missings per background factor = (576) minus (valid value)
† vocational training (duration 3 years; graduation before year 2001)
⁑ vocational training (duration 3 years; graduation between years 2001 – 2022)
□ abbreviated vocational training (duration 2 years)
¥ combined academical and vocational nursing education at university (duration 3,5 years)
‡ academical nursing education at university of applied sciences

Both the potential consistency of the item content of the Nurse professional Competence Scale[26] with the legally defined competences for Austrian RNs described by Kellerer et al.[25] as well as the previously published results of experts' assessments outlining high content relevance for the NPC Short Form's scale items for the Austrian nursing context[30]could be confirmed by the explorative factor analysis. Nevertheless, the factor structure of the NPC–SF–AUT differs strongly from that of the original scale. The original scale version as well as the country-specifically adapted NPC Scale Short Form versions in Saudi-Arabia,[34] China[36] and Croatioa[35] comprise item-specific nursing competencies under a total of six factors.[33] However, Lee et al.[38] and Prosen et al.[37] demonstrated altered scale structures after testing for construct validity, which was also revealed in our principal axis factor analysis results.

One reason for this difference might relate to different sample characteristics. Nilsson et al.[33] as well as Xu et al.[36] included exclusively nursing students at the time of their graduation when psychometrically testing the scale. This implies that the assessment of item-related competencies only referred to individual practical experiences gained from the perspective of trainees. The extents of the self-assessed nursing competencies are relatively high in our study, which is reflected by the item-specific mean values as well as the strongly left-skewed distribution of the data. One explanation may be that the scale-specific items represent nursing competencies that are frequently applied in the context of nursing practice and are therefore particularly high in experienced RNs, as in our sample; similar high ratings are also found in those other studies that conducted the psychometric evaluations of the country-specific adapted scale versions of the NPC Scale Short Form with graduated RNs.[34,37] Moreover, several studies show that nursing competence in the context of professional practising is strongly influenced by the number of years working in the nursing profession[60–64] and the experience in the respective nursing discipline,[61,65,66] respectively. The participants in our study showed a broad distribution with regard to those influencing factors, which might have influenced the individual assessments of the individual competencies. When interpreting these high ratings, it must be critically noted that self-assessments of task-related competencies, which are mastered routinely due to broad experience, per se often lead to an overestimation of one's own abilities[67] and may not be sufficiently consistent with actual performance in practical health care work.[68] Results of self-assessments conducted on the basis of large-scale studies with generic instruments such as the NPC–SF–AUT might therefore rather provide an initial overview of the distribution of the task-related competences of interest;[69] However, item-specific individual competencies should subsequently be examined in more depth using more specific methods or, if necessary, validated through complementary data collection using objective assessment methods.[70]

Table 2. Factorial structure of the NPC–SF–AUT

	Item No.[†]	Item Do you think you have the ability to…	Mean (± SD)[‡]	Communalities	Factor loading
Factor 1 Health promotion and safeguarding	11	Manage drugs adequately, applying knowledge in pharmacology?	5.46 (1.19)	0.37	0.39
	12	Independently administer prescriptions?	5.88 (1.25)	0.37	0.41
	13	Question unclear instructions/prescriptions?	6.21 (0.92)	0.31	0.32
	14	Display judgement, knowledge and thoroughness when informing and providing for the patient's security and wellbeing during examinations and treatments?	6.21 (0.85)	0.52	0.55
	15	Follow up the patient's condition after examinations and treatments?	6.40 (0.78)	0.48	0.44
	16	Handle medical products on the basis of existing regulations and safety routines?	5.84 (1.00)	0.46	0.40
	17	Provide support and guidance to enable optimal participation in care and treatment, in dialogue with the patient and next of kin?	5.86 (1.05)	0.68	0.91
	18	Inform and educate patients and next of kin individually, taking into account time, form and content?	5.71 (1.12)	0.70	0.91
	19	Inform and educate patients and next of kin in a group, taking into account time, form and content?	5.32 (1.36)	0.64	0.84
	20	Make sure that the patient and next of kin understand the information provided?	5.93 (1.04)	0.66	0.93
	21	IN dialogue motivate the patient to comply with treatments?	6.10 (0.90)	0.58	0.50
	22	Make use of relevant patient records?	6.11 (0.92)	0.55	0.28
	23	use information and communication technology (ICT) to support nursing care?	5.59 (1.20)	0.49	0.47
Factor 2 Multi-professional cooperation and development	28	Continuously engage in your own personal and professional competence development?	5.76 (1.04)	0.56	0.46
	29	Systematically lead, prioritize, delegate and coordinate nursing care within the team, based on the patient's needs and the different competencies of co-workers/staff?	5.81 (1.08)	0.53	0.55
	31	In case of a serious incident within or outside the care institution, apply emergency medical principles?	5.39 (1.23)	0.48	0.54
	32	Implement new knowledge and thus promote nursing care in accordance with science and evidence-based practice?	5.26 (1.24)	0.61	0.73
	33	Plan, consult, inform and cooperate with other actors in the chain of care?	5.68 (1.10)	0.56	0.60
	34	Teach, supervise and assess students?	5.55 (1.26)	0.54	0.76
	35	Supervise and train co-workers/staff?	5.53 (1.28)	0.62	0.82
Factor 3 Process-guided nursing care	1	Independently apply the following stages in the nursing process: observation and assessment?	6.22 (0.94)	0.54	0.77
	2	Cater for the patient's needs regarding basic, physical nursing care?	6.52 (0.86)	0.65	0.87
	3	Cater for the patient's needs regarding specific, physical nursing care?	6.10 (0.97)	0.61	0.77
	4	Document the patient's physical condition?	6.33 (0.84)	0.53	0.66
	5	Document the patient's psychological condition?	5.80 (1.06)	0.42	0.29
Factor 4 Inclusive decision-making	6	Communicate with patients, next of kin and staff respectfully, sensitively and empathetically?	6.49 (0.78)	0.59	0.70
	7	Show concern and respect for the patient's autonomy, integrity and dignity?	6.51 (0.75)	0.72	0.87
	8	UTilize the knowledge and experience of the patient and/or their next of kin?	5.99 (1.02)	0.51	0.49
	9	Show openness to and respect for different values and faiths?	6.11 (1.06)	0.44	0.64
	10	Utilize the knowledge and experience of the team and others, and through team collaboration contribute to a holistic view of the patient?	6.33 (0.88)	0.49	0.38
Factor 5 Rule-governed professional practice	24	Carry out documentation according to current legislation?	5.63 (1.11)	0.65	0.78
	25	Comply with existing regulations as well as guidelines and procedures?	5.76 (1.05)	0.68	0.86
	26	Handle sensitive information correctly and carefully?	6.44 (0.79)	0.45	0.50
	27	Pay attention to work-related risks and actively prevent these?	6.05 (0.92)	0.54	0.37
	30	Act adequately in case of unprofessional conduct by staff?	5.61 (1.08)	0.52	0.27

[†] Item numbering corresponding to the original NPC Scale Short Form; [‡] 7-point Likert scale (1 = to a very low degree; 2 = to a low degree; 3 = to a fairly low degree; 4 = neither high or low degree; 5 = to a fairly high degree; 6 = to a high degree; 7 = to a very high degree); SD = standard deviation;

Table 3. Reliability values of the NPC–SF–AUT

Factor	MIC† (min¥; max‡)	Corrected item-total correlations min; max	Cronbach's α	McDonald's ω [CI 95%]
Factor 1 Health promotion and safeguarding	0.48 (0.33; 0.76)	0.52; 0.77	0.92	0.92 [0.91, 0.93]
Factor 2 Multi-professional cooperation and development	0.53 (0.40; 0.75)	0.61; 0.71	0.88	0.88 [0.86, 0.90]
Factor 3 Process-guided nursing care	0.52 (0.37; 0.63)	0.55; 0.71	0.84	0.83 [0.80, 0.86]
Factor 4 Inclusive decision-making	0.52 (0.22; 0.56)	0.60; 0.73	0.84	0.84 [0.81, 0.87]
Factor 5 Rule-governed professional practice	0.50 (0.37; 0.74)	0.55; 0.74	0.83	0.84 [0.81, 0.86]

†Mean inter-item correlation; ¥min = lowest correlation; ‡max = highest correlation; α = Alpha; ω = Omega; CI = confidence interval

An additional influence on the extent of nursing competence is the type of RN qualification.[60, 63, 71] In Austria, all RNs currently work on the basis of the legally defined professional profile,[8] although their training was based in two different educational sectors (vocational and higher education) and whose theoretical and practical qualification and training pathways differ strongly.[72] The majority of nurses actually practicing were qualified by a three-year vocational training. Indeed, the vocational nursing training had changed by the end of the nineties from a highly pathogenetically towards a more salutogenetically oriented curriculum.[73] Consequently, vocationally trained nurses graduating from the millennium acquired different competences as their predecessors. Above all, RNs with academic nursing education also practice on the same legal basis, although their competencies may differ from those of vocationally trained nurses due to different learning modalities and curricula. One consequence of this development is a presumed heterogeneity in the prevalence of particular nursing competencies in current Austrian nursing practice. This specific education-related heterogeneity is also reflected in the sample of our study and therefore might explain the prevalent differences towards item-specific competence estimations between the evaluated study samples in other European[32, 35, 37] and Asian[34, 36, 38] countries and our study cohort and, eventually, the subsequent change of the instruemnts' factorial structure.

The modification of the six-factor structure of the original scale[33] towards the Austrian scale version comprising five factors may also result from the different methods used for testing construct validity.[50] Exploratory factor analysis of the original scale was conducted using principal component analysis. This type of factor analysis presupposes that data are free of measurement error.[45] However, in our study, it was assumed that absence of measurement error would not prevail in the self-assessment of complex nursing competencies because of the generally dynamic development of competence of postgraduate and, in many cases, highly experienced nurses. Thus, principal axis analysis was chosen as the analytical method that would adequately account for measurement error.[45] Furthermore, orthogonal factor rotations were performed by Nilsson et al.[33] using Varimax method. Brown[74] points out that orthogonal rotation procedures assume uncorrelated factors and should only be used when, from a theoretical point of view, no general higher order factor has to be suspected. In our study, according to the respective recommendations, Promax rotation was initially used as an oblique rotation method, whereas any subsequent orthogonal rotation was omitted due to predominant factor correlations. The differences in factorial structures between the original scale and the NPC–SF–AUT may thus be related to these different factor analysis and rotation methods.

The denominations of the five individual scale factors of the NPC–SF–AUT are based on the concise meanings of the factor-related item contents and both strongly in line with internationally established[10, 11] and nationally derived competence domains[8] for RNs. The items of factor 1 "Health promotion and safeguarding" represent nursing competencies concerning safe, multi-perspective, interprofessional and participative patient care as well as competencies relating to patient education. In the original scale,[33] this factor is not represented in a similar content structure; the corresponding items are thus distributed between two separate subscales (medical and technical care and care pedagogics, respectively). Patient education basically depicts a specific nursing area of responsibility and should be characterized by structured and goal-oriented pedagogical activities.[75] In our study, items related to medical nursing care and treatment correlated significantly with patient education-specific items. A possible explanation might be that patient education might rarely be experienced as a specific, clearly distinct activity in

routine nursing care, but is rather provided in an unstructured way and in the course of medical and nursing care measures due to a lack of time resources and too high a workload of the nurses.[76,77] The factor "Multi-professional cooperation and development" covers those competencies which are intended to ensure high-quality patient care both intra-professionally and across professions. The high relevance of these competencies is evident from the corresponding definition of the professional profile provided by the Austrian Health and Nursing care Act[8] and is explicitly pointed out in the respective WHO's nursing competence domain[11] and the derived curriculum[78] for nursing education in Austria. "Process-guided nursing care" (factor 3) reflects nurses' core competencies in objective-oriented direct patient care with respect to the steps of the nursing process. This item-specific factor structure is identical to the corresponding subscale of the original instrument.[33] Decision-making in the context of nursing care must focus on the individuality and integrity of the patient's preferences, in accordance with an ethical and participatory understanding of nursing care.[79] The items representing the factor "Inclusive Decision-making" (factor 4) cover self-assessments of respective relevant[16] competencies. Finally, competencies for regulation-based professional practice represent the items of factor 5 ("Rule-governed professional practice"). The relevance of these competencies is explicitly emphasised by the defined educational standards for nurses[11] and their respective integration in the Austrian nursing education regulations.[78]

Limitations

We included the self-assessed data of a total of 576 RNs. Due to the recruitment method using a convenience sample strategy, a corresponding selection bias cannot be ruled out,[46] and the representativeness of the sample for the population of Austrian RNs is not ensured. However, in terms of the distribution of socio-demographic and macro-social characteristics, the composition of the sample shows an adequate representation of the Austrian nursing profession at the qualification level of RNs. The nationwide inclusion of nurses from 16 different hospitals as well as the vast variety of medical disciplines had the potential to realistically represent the actual nursing practice and to provide appropriate data for the psychometric testing of the scale. Since further qualifications in particular can significantly influence the characteristics of nursing competences,[71] all nurses who had completed legally scheduled further qualifications or specialisations in addition to their regular nursing education were excluded from the study. This measure further increased the homogeneity of the sample, thus limiting qualification-specific bias.

Nevertheless, it must be critically mentioned that in this study only competences of RNs working in acute inpatient wards were evaluated. The item loadings and subsequently the exploratively extracted factor structure are merely based on the self-assessments of the RNs working in these nursing areas; consequently, the external validity is limited, and a valid assessment of the competences of RNs working in further acute care (e.g. outpatient clinics, intensive care units) or long-term care settings cannot be ensured on the basis of the present instrument.

The data collection was carried out in a period marked by the highest incidence of the COVID – 19 pandemic in Austria since its beginning.[80] Many care-related tasks and activities, which are usually performed under regular working conditions, could only be partially or not at all executed at this time.[81,82] In many cases, the main focus was on managing basic care and preventing the spread of infection within health facilities, which limited the scope of nursing activities and consequently the application of individual competencies such as those related to patient education and genuine multidimensional caring.[83] Consequently, the assessments of the extent of those competencies at the time of the study were potentially based on experiences from the time before the COVID – 19 pandemic, which might have caused recall biased[46] self-assessments.

5. Conclusions

The NPC–SF–AUT is a valid and internal consistent instrument for the self-assessment of Austrian RNs. Thus, an assessment instrument is available that enables both nursing practice and nursing research to continuously assess the competence development of RNs working in acute care settings on general wards. Further studies should evaluate the validity of the present NPC-SF-AUT scale's construct by using confirmatory factor analysis methods, in particular to evaluate the validity of the present factor structure for RNs in specialized, outpatient and long-term care settings. Eventually, since the NPC–SF–AUT is a self-assessment instrument, we recommend further psychometrical testings with regard to concurrent validity through objective competence assessment methods.

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CONFLICTS OF INTEREST DISCLOSURE

We have no conflict of interest to disclose.

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