ORIGINAL RESEARCH

Evaluation of Austrian nurses' competence and factors related to it: An exploratory cross-sectional study

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ABSTRACT

Background and objective: The continuous assessment of Registered Nurses' (RNs') competence is important at individual, organizational and systemic levels. Qualifications, the professional working environment as well as experience influence nursing competence. Nursing has significantly changed over the last 25 years in Austria, but RNs' competence has not been evaluated so far. The aim of the study was to assess nursing competence of Austrian RNs, considering relevant influencing factors.
Methods: An exploratory cross-sectional study was conducted. Between October 2021 and February 2022 a total of 841 RNs from 16 Austrian hospitals self-assessed their nursing competencies using the Austrian version of the Nurse Professional Competence Scale Short Form (NPC-SF-AUT). Multiple subgroup analyses with regard to theoretically reasonable influence factors on nursing competence were performed to explore differences in the extent of RNs' competence.
Results: Competencies in scale factors Multi-professional development and cooperation as well as in Health promotion and safeguarding were found as lowest. The overall work experience as well as further education and training had a significant influence on nursing competence, whereas the type of nursing education (vocational vs. higher education), the professional understanding of nursing care and the type of medical discipline did not.
Conclusions: Appropriate structures must be implemented to ensure the development and application of Austrian RNs' basically acquired competencies in practice.

Key Words: Assessment, Austria, Competence, Evaluation, NPC scale, Registered nurses

1. BACKGROUND

Nurses are the largest professional group in the health sector worldwide,[1] and the quality of their professional performance based on high competence influences patient outcomes,[2] health care costs[3] and patient safety[4] and is crucial for reducing patient mortality.[5] In Austria, nurses play a central role in health care too, whereas the largest professional group consists of nurses at the qualification level of registered nurses (RNs).[6] While these nurses are generally engaged in acute and long-term care in various inpatient and outpatient settings, most of these RNs are providing profes-

sional care as an important part of the multi-professional team in general wards.[7]

The profession of RNs in Austria and the responsibilities and tasks associated with it has faced significant changes over the last 25 years. The first amendment of the Austrian Health and Nursing care Act[8] in 1997, which replaced the legal basis for the practice of the nursing profession that had been valid for 36 years[9] until then, redefined the areas of action and responsibilities of RNs, accompanied by a substantive realignment of the nationally standardised curriculum.[10] While training content of RNs up to that time had been

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strongly characterised by medical or pathogenetic elements, the newly developed three-year vocational nursing training followed a salutogenetic understanding of nursing from 1998 onwards and for the first time addressed learning outcomes with regard to health promotion, scientifically based and process-guided nursing practice, as well as professional nursing development, in order to ensure the implementation of the newly legislated competences in practice.[11]

The second amendment of the Austrian Health and Nursing care Act[12] was implemented in 2016. The basis for this regulatory modification of the legally defined competences constitutes the competence framework of the International Council of Nurses,[13] the legally regulated responsibilities and tasks of Austrian RNs in addition to occupational group-specific competences of the nursing assistant professions are strongly in line with the outlined competencies in the ICN framework.[14] The Austrian Health and Nursing care Act now comprises taxatively formulated competencies under the domains of nursing core competences, participation in the context of medical diagnostics and therapy, emergency care, the further use of medical products and cooperation in the multi-professional team.[12]

In the course of the recent legislative reform, nursing education was transferred to the higher education sector, which implied the required adaptation to European standards.[15] This academic type of nursing education, which corresponds to the European Union standards for nursing and midwifery in terms of content and structure,[16] is mainly intended to improve nurses' competencies regarding the implementation of evidence-based nursing knowledge into practice, the strengthening of the awareness of continuous professional development, the promotion of intra- and interdisciplinarity as well as multi-professional cooperation, and the fostering of necessary leadership competencies.[14]

Even if it seems reasonable to increase nursing competence by upgrading nursing education to an academic level[17] and study results indicate that academically trained nurses might have higher competence,[18, 19] formal qualification is only one factor for the initiation and development of competence.[20] In general, competence is a complex construct, which is influenced by the reciprocal interaction of abilities, skills, informal knowledge[21] as well as qualifications, values, norms and rules.[22] The possibility of repeated performance of actions based on particular competences within task-specific contexts promotes the development of competence,[23] whereby competence manifests itself as the potential for action in a stepwise process which, with increasing experience, enables the intuitive mastering[24] of intricate problems in complex situations.[25]

Nursing competence is an ambiguously defined construct,[26] but its definitions are closely related to the general concept of competence.[27, 28] The assessment of nurses' competences can be conducted using different methodological approaches,[29] whereby the use of standardised large-scale instruments for the self-assessment of nursing competence has established internationally.[30] Several original instruments[31, 32] are currently available for the use in European countries,[33–35] which differ with respect to their theoretical constructs and specific competence designations,[30] especially at item level.[36] At dimensional level, these assessment instruments reflect competencies related to direct clinical practice, communication and cooperation, nursing development, scientific knowledge, teaching and coaching, health promotion and ethical practicing; the corresponding competency extents are furthermore related to the influencing factors derived from the theory in several studies.[37, 38] Thus, experience in the nursing profession, competence-based task performance in distinct medical disciplines and nursing settings, non-formal and formal basic and further qualifications as well as attitudes towards professional performance and nursing related values are reported as significant influence factors for the prevalence of nursing competence and its development in European countries.[39]

However, there is no data available for the Austrian nursing context on the development of nursing competencies within the professional group of RNs, nor on possible factors that influence them. This seems problematic, as the continuous assessment of nursing competence identifies development needs on individual, organizational and systemic levels,[40] is crucial for the advancement of individual competencies over the career path,[41] provides information about the prevalent human capital within the health care system[42] and thus contributes to data based strategic health policy decision-making.[40] Furthermore, the continuous evaluation of nursing competence is an explicit demand of European policy-makers to strengthen professional nursing and its development.[43] Considering the previously mentioned changes in Austrian nursing over the last 25 years, it is therefore the aim of this study to initially present the extent of nursing competence among RNs in Austria and to explore the influence of professional experience, different types of nursing education, formal and non-formal further education as well as the influence of different professional disciplines on nursing competence.

2. METHODS

2.1 Study design

An exploratory cross-sectional study was conducted.

2.2 Participants and setting

A convenience sample of RNs from Austrian hospitals was established. Based on a general population of approximately 55.000 RNs[7] in Austrian hospitals, a minimum sample size of n = 382 (95% confidence interval [CI]; error margin α = 5%) was determined.[44] Only graduated nurses who had completed their trainings as RNs in Austria were included. Participants had to be actively working in an inpatient department (surgical, conservative or interdisciplinary) in a public or private hospital at the time of data collection. Any RNs who worked in an outpatient setting or in a setting that required a legally defined advanced training or specialisation to practice (e.g. intensive care units, anaesthesia, operating theatre) were excluded from the study.

2.3 Instrument

The questionnaire comprised two parts. In the first part, besides socio-demographic variables (age in years and gender), further macro-social influence variables were collected in accordance with the theoretical model of competence development. Experience was operationalised based on the time duration (in years) of active practice as an RN in total as well as with reference to the current field of specialisation; in addition, the current professional field of practice was recorded as a separate influencing variable. Qualification-related variables covered the type of training as an RN, any formal nursing-related further training or specializations completed as well as the related educational workloads (training hours or number of designated European Credits Transfer System credits). In addition, the influence variable on non-formal knowledge acquisition was measured by the number of hours of continuing education completed in the last five years.

The Austrian version of the Nurse Professional Competence Scale Short Form (NPC-SF-AUT) was used to estimate nursing competence (part two of the questionnaire). Originally designed in Sweden[32] and translated and culturally adapted for the Austrian nursing context,[45] the NPC-SF-AUT has the potential to adequately assess the professional nursing competencies of RNs in Austria.[36, 46] It is a valid and reliable self-assessment instrument[47] that records the extent of 35 individual nursing competencies (seven-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 items are topically related to five scale factors (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). The interpre-

tation of the ratings is carried out on item level and on factor level based on a relative factor score, respectively. A sample-specific evaluation of the factor-related internal consistency using the Cronbach's alpha (α) approach showed a good to excellent[48] reliability (α = 0.83–0.92) of the NPC-SF-AUT for our study.

2.4 Data collection

Data collection was conducted from October 2021 to February 2022. The nursing directors of those hospitals willing to participate each sent a hospital-specific total number of potential participants to the study authors. The paper-based questionnaires, including the information about the study and the privacy declaration, were then placed in pre-stamped and re-addressed envelopes on the required wards. Completed questionnaires were individually returned to the study authors by postal mail.

2.5 Data analysis

Descriptive data as well as subgroup analyses were performed using IBM SPSS Statistics for Windows, Version 27.0.[49] Socio-demographic and macro-social data were presented as absolute and relative frequencies. The metric variables age, experience, and hours of continuing education were presented as means and standard deviations (SD). For the item-specific levels of the nursing competence and the scale factor scores, the corresponding 95% confidence intervals were also provided. To calculate the scale factor scores, a quotient was calculated from the individual factor-related item ratings (nominator) and the highest possible factor total score (denominator) which was then multiplied by 100.

To analyze the influence of macro-social variables on nursing competence, several subgroups were formed. The metric variables overall work experience and experience in the current discipline were each clustered into six subgroups (duration of experience in years) considering the theory of competence development[24, 50] (subgroup 1: $\leq$ 1 year; subgroup 2: > 1 to $\leq$ 2 years; subgroup 3: > 2 to $\leq$ 5 years; subgroup 4: > 5 to $\leq$ 10 years; subgroup 5: > 10 to $\leq$ 20 years; subgroup 6: > 20 years). The potentially different curriculum-related understanding of nursing care[11] (pathogenetically versus salutogenetically influenced nursing philosophy) comprises two subgroups, which are consisting of RNs with graduation before the year 2001 (subgroup 1) and from the year 2001 (subgroup 2). Continuing education hours completed in the last five years were also grouped into two subgroups based on legal prescription[12] (subgroup 1: $\leq$ 60 hours across last 5 years; subgroup 2: > 60 hours across last 5 years). To avoid biased results, we excluded those RNs from this variable's subgroup analysis who had less than five years of overall

work experience as they potentially were not able to acquire at least the legally defined minimum number of 60 continuing educational hours.

Data were checked for normal distribution using Q-Q plots and Kolmogorov-Smirnov tests. Unpaired *t*-tests were used to compare those variables clustered into only two groups in case of normally distributed data and homogeneity of variances, alternatively Mann-Whitney-U-tests for independent samples were performed. Variables clustered in more than two subgroups were explored for differences on factor-related scores of nursing competence using analysis of variance (ANOVA) tests followed by Tuckey post-hoc tests. Kruskal-Wallis tests and subsequent Dunn-Bonferroni post hoc tests were performed in case of infringement of the test requirements for ANOVA. The significance level was set at $p \leq .05$. For significant post-hoc test results, the effect size of the subgroup difference was calculated using Pearson correlation coefficients.

2.6 Ethical considerations

The study was approved by the university's ethics board after evaluation of the described methodological approach and the planned measures to ensure both research ethics in accordance with the Declaration of Helsinki[51] and privacy principles. In addition, written permission to use the NPC-SF-AUT scale was obtained from the applicable authors.

3. RESULTS

3.1 Sample

A total of 1,961 questionnaires were sent out to fourteen public and two private Austrian hospitals, of which 896 (response rate 45.7%) were returned. A total of 19 participants were excluded due to ineligible professional working settings (RNs working in intensive care units n = 13; RNs working in ambulance n = 6) and five RNs who had not completed nursing education upon Austrian legal regulations. Due to missing responses (response of less than 60% of the NPC-SF-AUT items), further 31 participants were excluded from the study, resulting in 841 participants finally being included.

Most participants were female (n = 730; 86.9%), and the average age of the entire sample was nearly 37 years. About one half of all RNs had an overall work experience of at least 10 years, and one-third have been employed in their current discipline for at least 10 years. Nearly half of RNs completed vocational nursing training between the years 2001 and 2021, about one-third of the RNs were trained on a pathogenetically oriented curriculum. Approximately one-third of respondents reported having completed either a nursing-related specialization or formal further education. Only 556 (66.1%) of all participants provided information about the

legally required number of continuing education hours in the past five years. Table 1 provides a detailed overview of the sample characteristics and lines out the clustered variables for the subsequent subgroup analysis.

3.2 Nursing competence extents across total sample

RNs rated themselves most competent in the context of Inclusive decision making (Factor 4; mean = 90.33, SD = 9.78) and Process-guided nursing care (Factor 3; mean = 89.04, SD = 10.43); competence regarding Rule-governed professional practice (Factor 5) was rated slightly lower (mean = 85.08, SD = 10.83). The two scale factors Health promotion and safeguarding (Factor 1; mean = 84.65, SD = 10.84) and Multi-professional cooperation and development (Factor 2; mean = 81.15, SD = 12.78) showed the lowest factor scores. Furthermore, those items with the lowest extents of the respective nursing competencies can be assigned to those two scale factors. Implementing new, evidence-based knowledge into nursing practice (Factor 2, item 17; mean = 5.34, SD = 1.27) was rated by RNs as the lowest present nursing competency. In addition, comparatively lower competencies emerged with reference to group patient education (Factor 1, item 9; mean = 5.36, SD = 1.40), disaster response (Factor 2, item 16; mean = 5.50, SD = 1.20), medication management (Factor 1, item 1; mean = 5.50, SD = 1.21), and use of information and communication technologies (Factor 1, item 13; mean = 5.64, SD = 1.20). In contrast, RNs rated themselves as particularly competent in basic nursing care (Factor 3, item 22; mean = 6.54, SD = 0.86), in communication (Factor 4, item 26; mean = 6.53, SD = 0.75) and in patient care following ethical principles (Factor 4, item 27; mean = 6.53, SD = 0.74), as well as in handling sensitive data (Factor 5, item 33; mean=6.46, SD = 0.78). Table 2 shows the item- and factor-related extents of nursing competence across the sample in detail.

3.3 Factors influencing nursing competence
3.3.1 *Overall working experience*

The lowest subgroup-related competence scores were consistently found in factor 2 and the highest in factor 4. In factors 1, 2, 3, and 5, the newly graduated nurses (overall work experience ≤ 1 year) had the lowest factor scores, whereas the most experienced RNs (overall work experience > 20 years) showed the highest competence across all factors. Those RNs who had already been in the nursing profession between 10 and 20 years showed slightly lower competency scores across all factors consistently than those with an overall work experience of > 5 to ≤ 10 years (see Figure 1). The subgroups were explored for differences in the extent of factor-related nursing competence using Kruskal-Wallis tests, indicating several statistically significant over-

all work experience-specific subgroup differences regarding Health promotion and safeguarding (χ^2 = 25.096(5), $p <$ .001), Multi-professional cooperation and development (χ^2 = 22.119(5), $p <$ .001), Process-guided nursing care (χ^2 = 26.527(5), $p <$ .001) and Rule-governed professional practice (χ^2 = 23.337(5), $p <$ .001). The strongest effects of overall work experience on nursing competence were seen between the group of newly graduated nurses and RNs with more than 20 years of work experience in the factors Health promotion and safeguarding (mean = 82.2, CI 95% [80.10, 84.33] vs. mean=87.00, CI 95% [85.67, 88.32], Bonferroni adjusted $p <$ .001, r = .23), Multi-professional cooperation and development (mean = 76.77, CI 95% [73.86, 79.69] vs. mean = 82.81 CI 95% [81.11, 84.52], Bonferroni adjusted p = .002, r = .22) as well as Process-guided nursing care (mean = 84.89, CI 95% [82.33, 87.44] vs. mean = 90.17, CI 95% [88.71, 91.63], Bonferroni adjusted $p <$ .001, r = .26).

Table 1. Characteristics of the sample (n = 841)

Background factors	n# (%)	Mean (± SD)
Age in years	837	36.94 ± 10.92
Female	730 (86.9)	35.55 ± 10.88
Male	105 (12.5)	39.79 ± 10.90
Divers	5 (0.6)	34.80 ± 11.95
Hospitals	841	
Public (n=14)	777 (92.4)	
Private (n=2)	64 (7.6)	
Current medical discipline	767	
Surgical	331 (43.2)	
Conservative	356 (46.4)	
Interdisciplinary	80 (10.4)	
Overall work experience (OWE) in years	837	13.84 ± 10.87
OWE group 1 (≤ 1 year)	76 (9.1)	1.0
OWE group 2 (1 to ≤ 2 years)	63 (7.5)	2.0
OWE group 3 (>2 to ≤ 5 years)	131 (15.7)	3.90 ± 0.85
OWE group 4 (>5 to ≤ 10 years)	134 (16.0)	7.77 ± 1.57
OWE group 5 (>10 to ≤ 20 years)	192 (22.9)	15.79 ± 3.10
OWE group 6 (>20 years)	241 (28.8)	28.22 ± 5.28
Experience in current medical discipline (ECD) in years	821	9.49 ± 8.64
ECD group 1 (≤ 1 year)	120 (14.6)	1.0
ECD group 2 (1 to ≤ 2 years)	85 (10.1)	2.0
ECD group 3 (>2 to ≤ 5 years)	156 (19.0)	3.81 ± 0.82
ECD group 4 (>5 to ≤ 10 years)	176 (21.4)	7.76 ± 1.55
ECD group 5 (>10 to ≤ 20 years)	176 (21.4)	14.99 ± 3.00
ECD group 6 (>20 years)	108 (13.2)	26.89 ± 4.57
Legally regulated further qualifications	263 (31.3)	
Specialization (minimum qualification period 800 hours)	58 (6.9)	
Further qualification (qualification period 160 - 799 hours)	187 (22.2)	
Specialization AND further qualification	18 (2.1)	
Legally required non-formal education (in hours)	556	81.36 ± 89.71
Type of nursing education	840	
Vocational nursing training total	717 (85.4)	
†Vocational training (graduation < 2001)	269 (32.0)	
∗Vocational training (graduation 2001 – 2022)	412 (49.0)	
Abbreviated vocational training	36 (4.3)	
Academical nursing education total	123 (14.6)	
¥ Combined academical nursing education	66 (7.9)	
‡ Academical Nursing education	57 (6.8)	
Curriculum-related understanding of nursing care (CUNC)	840	
CUNC group 1 (pathogenetic, graduation before year 2001)	269 (32.0)	
CUNC group 2 (salutogenetic, graduation from year 2001)	571 (68.0)	

all percentages related to valid values for respective background factor; number of missings per background factor = (841) minus (valid value); † duration 3 years; ‡ duration 3 years; ∗ duration 2 years; ¥ combined academical and vocational nursing education at university (duration 3,5 years); ‡ academical nursing education at university of applied sciences (duration 3 years)

In terms of Rule-governed professional practice-related competence, RNs with work experience between one and two years differed most from those with over 20 years of work experience (mean = 84.04, CI 95% [81.31, 86.76] vs. mean = 86.88, CI 95% [85.50, 88.25], Bonferroni adjusted $p < .001$, r = .23), while Inclusive decision-making was not significantly influenced by overall work experience (Kruskal-Wallis test, $\chi^2 = 10.157(5)$, $p = .071$). Detailed results of the subgroup analysis regarding overall work experience and factor-related nursing competence are presented in Appendix 1.

Table 2. Item- and factor-related extents of nursing competence across the sample (n = 841)

Factor Mean ± SD [95% CI]	Item No.	Factor-related items Do you think you have the ability to...	Mean ± SD[‡]	95% CI
Factor 1 Health promotion and safeguarding 84.65 ± 10.84 [83.91; 85.39]	1	Manage drugs adequately, applying knowledge in pharmacology?	5.50 ± 1.21	5.42; 5.59
	2	Independently administer prescriptions?	5.88 ± 1.30	5.80; 5.97
	3	Question unclear instructions/prescriptions?	6.24 ± 0.92	6.17; 6.30
	4	Display judgement, knowledge and thoroughness when informing and providing for the patient's security and wellbeing during examinations and treatments?	6.22 ± 0.84	6.17; 6.28
	5	Follow up the patient's condition after examinations and treatments?	6.39 ± 0.80	6.34; 6.45
	6	Handle medical products on the basis of existing regulations and safety routines?	5.90 ± 0.99	5.84; 5.97
	7	Provide support and guidance to enable optimal participation in care and treatment, in dialogue with the patient and next of kin?	5.90 ± 1.07	5.82; 5.97
	8	Inform and educate patients and next of kin individually, taking into account time, form and content?	5.78 ± 1.13	5.70; 5.85
	9	Inform and educate patients and next of kin in a group, taking into account time, form and content?	5.36 ± 1.40 [†]	5.26; 5.45
	10	Make sure that the patient and next of kin understand the information provided?	5.95 ± 1.06	5.87; 6.02
	11	In dialogue motivate the patient to comply with treatments?	6.11 ± 0.91	6.05; 6.18
	12	Make use of relevant patient records?	6.16 ± 0.91	6.10; 6.22
	13	Use information and communication technology (ICT) to support nursing care?	5.64 ± 1.20	5.55; 5.72
Factor 2 Multi-professional cooperation and development 81.15 ± 12.78 [80.28; 82.02] [‡]	14	Continuously engage in your own personal and professional competence development?	5.85 ± 1.03	5.78; 5.92
	15	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?	5.91 ± 1.07	5.83; 5.98
	16	In case of a serious incident within or outside the care institution, apply emergency medical principles?	5.50 ± 1.20	5.42; 5.58
	17	Implement new knowledge and thus promote nursing care in accordance with science and evidence-based practice?	5.34 ± 1.27 [†]	5.26; 5.43
	18	Plan, consult, inform and cooperate with other actors in the chain of care?	5.77 ± 1.12	5.69; 5.84
	19	Teach, supervise and assess students?	5.69 ± 1.25	5.60; 5.77
	20	Supervise and train co-workers/staff?	5.71 ± 1.29	5.63; 5.80
Factor 3 Process-guided nursing care 89.04 ± 10.43 [88.34; 89.75]	21	Independently apply the following stages in the nursing process: observation and assessment?	6.27 ± 0.93	6.20; 6.33
	22	Cater for the patient's needs regarding basic, physical nursing care?	6.54 ± 0.86	6.48; 6.60
	23	Cater for the patient's needs regarding specific, physical nursing care?	6.15 ± 0.97	6.09; 6.22
	24	Document the patient's physical condition?	6.37 ± 0.83	6.31; 6.43
	25	Document the patient's psychological condition?	5.84 ± 1.08 [†]	5.76; 5.91
Factor 4 Inclusive decision-making 90.33 ± 9.78 [89.67; 90.10]	26	Communicate with patients, next of kin and staff respectfully, sensitively and empathetically?	6.53 ± 0.75	6.48; 6.58
	27	Show concern and respect for the patient's autonomy, integrity and dignity?	6.53 ± 0.74	6.48; 6.58
	28	Utilize the knowledge and experience of the patient and/or their next of kin?	6.03 ± 0.99 [†]	5.96; 6.10
	29	Show openness to and respect for different values and faiths?	6.17 ± 1.02	6.10; 6.24
	30	Utilize the knowledge and experience of the team and others, and through team collaboration contribute to a holistic view of the patient?	6.35 ± 0.86	6.29; 6.41
Factor 5 Rule-governed professional practice 85.08 ± 10.83 [84.34; 85.81]	31	Carry out documentation according to current legislation?	5.71 ± 1.10	5.63; 5.78
	32	Comply with existing regulations as well as guidelines and procedures?	5.82 ± 1.03	5.75; 5.89
	33	Handle sensitive information correctly and carefully?	6.46 ± 0.78	6.41; 6.51
	34	Pay attention to work-related risks and actively prevent these?	6.12 ± 0.89	6.06; 6.18
	35	Act adequately in case of unprofessional conduct by staff?	5.67 ± 1.09 [†]	5.60; 5.75

[‡] Lowest rated scale factor; [†] Item with lowest extent in respective scale factor; Item is among the five lowest rated items across the total scale; [‡] 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; CI = confidence interval
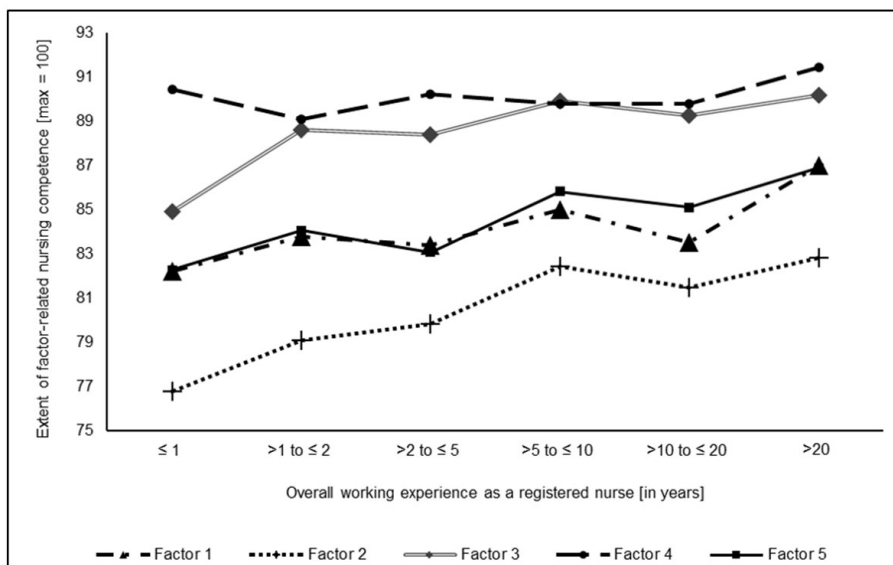
Figure 1. Factor-specific extents of nursing competence among sub-grouped RNs' overall work experience in years

3.3.2 Experience in current medical discipline

Depending on the experience in the current medical discipline, the factor-related nursing competence was rated lowest across all subgroups regarding Multi-professional cooperation and development, while Inclusive decision-making showed the highest scores. Nursing competence continually increased in each factor with growing experience in the current medical discipline except in factor 4; subgroup comparisons using Kruskal-Wallis tests confirmed significant differences across each factor ($p < .05$). The largest effects were observed when comparing RNs who have been working in the respective medical discipline for up to one year and those RNs who have the highest discipline-related experience (> 20 years) (see Appendix 2).

3.3.3 Professional working environment

Regardless of the professional working environment (surgical, conservative, interdisciplinary), the nursing competencies regarding Multi-professional cooperation and development were rated lowest and those regarding Inclusive decision-making highest. There were no differences found between working environment-related subgroups in any of the factors (Kruskal-Wallis-tests, $p > .05$) (see Appendix 3).

3.3.4 Formal and non-formal qualifications

There were no differences in the extent of nursing competence depending on the type of nursing education across all factors (Kruskal-Wallis-tests, $p > .05$). Those RNs with graduation before 2001 scored highest in all factors, while RNs with one of the two types of academic education rated their competence lower than each other subgroups in factors 2, 3 and 5 (see Appendix 4).

Factor-related Kruskal-Wallis-tests indicated significant differences between nurses without formal further qualifications and those with corresponding qualifications for factor 2 ($\chi^2 = 36.153(3)$, $p < .001$), factor 3 ($\chi^2 = 11.203(3)$, $p = .011$) and factor 5 ($\chi^2 = 11.680(3)$, $p = .009$). Dunn-Bonferroni post hoc tests suggested that nurses with advanced qualifications ranging from 160 - 799 training hours had higher competencies in terms of Multi-professional cooperation and development, Process-guided nursing care and Rule-governed professional practice. RNs with a specialization (at least 800 training hours) have only significantly higher competencies in factor 2 than their colleagues without any formal further qualification.

RNs with at least 60 hours of legally required non-formal continuing education across the last five years rated themselves significantly more competent in terms of Multi-professional cooperation and development, Process-guided nursing care, Inclusive decision-making and Rule-governed professional practice.

Nurses who completed their nursing training based on a more pathogenetically oriented curriculum showed higher competency levels in all five factors than nurses whose curriculum had salutogenic content, with significant differences in the competencies of Health promotion and safeguarding and Inclusive decision-making (see Table 3). Detailed results of the subgroup analysis regarding types of nursing education, formal and non-formal education as well as curriculum-related understanding of nursing and factor-related nursing competence are presented in Appendixes 5-7.

Table 3. Differences in extents of nursing competence regarding non-formal and formal qualifications

[†] Variables	Factor 1		Factor 2		Factor 3		Factor 4		Factor 5	
	p	[¥]*r*	[‡]*p*	[¥]*r*	[‡]*p*	[¥]*r*	*p*	[¥]*r*	*p*	[¥]*r*
Legally regulated further qualifications										
[#]No further qualification *vs* Further qualification			.001	.19	.013	.11			.015	.11
No further qualification *vs* Specialization			.010	.13						
[#]No further qualification *vs* Specialization AND further qualification										
[‡]Legally required non-formal qualifications										
Group 1 (< 60 hours across last 5 years) *vs* Group 2 (≥ 60 hours across last 5 years)	.007	.11	.001	.16	.001	.17	.004	.12	.006	.12
[‡]Understanding of nursing care										
Group 1 (pathogenetic, graduation < 2001) *vs* Group 2 (salutogenetic, graduation 2001 – 2022)	.004	.10					.012	.09		

[†] Descriptive data (means, confidence intervals) and test statistics are presented in detail in Appendixes 5,6,7

[#] Dunn-Bonferroni post hoc test (Bonferroni corrected *p*-values)

[‡] Mann-Whitney-U-test for independent samples (significance level at $p \leq .05$)

[¥] Pearson correlation coefficient

4. DISCUSSION

The aim of the study was to present the prevalence of nursing competence among Austrian RNs and to explore differences in the extent of nursing competence depending on macro-social factors. Self-assessed competence with reference to the five scale factors varied partially strong. Furthermore, competence appeared to be dependent on professional experience and completion of formal and non-formal further education, whereas neither the professional working environment nor the type of nursing education influenced nursing competence. Competencies relating to Multi-professional development and cooperation (Factor 2) and Health promotion and safeguarding (Factor 1) were rated lowest across the entire sample and within all subgroups. Within these scale factors, the item-specific competencies with the lowest scores were also found.

The implementation of new knowledge based on scientific findings in nursing practice (related to Factor 2) was the lowest rated nursing competence in our study. As early as 1997, a curriculum for nursing education was introduced in Austria that focused on scientific training content;[8,52] and since 2016, the transfer of Austrian nursing education to the academic education sector has addressed the relevant competencies even more strongly.[12] Despite these measures, the theoretically available competencies do not seem to be transferred effectively into nursing practice. An explanation for this result could be provided by a corresponding study in the Austrian nursing context,[53] which showed that a lack of structural prerequisites in particular inhibits the implementation of evidence-based practice, a problem that is also reflected in several international studies.[54–57] Consequently, a sustainable organizational culture must be created by adapting structural conditions in order to use and further develop

this competence acquired during nursing education also in practice.[58]

Providing target-oriented information, counselling and instruction is a core competence of Austrian RNs and should contribute essentially to prevention, treatment and rehabilitation[59] as well as to the improvement of specific population's health literacy,[60] but the corresponding competencies (related to Factor 1) were found to be comparatively low. International studies point out lack of time resources and lack of differentiation of educational interventions from routine care tasks[61,62] as negative influencing factors on the possibility of competence development in the context of patient education, which could also be a plausible explanation for the low respective competence assessment of Austrian nursing practice. Furthermore, the low level of educational competence appears to be problematic as the specific professional field of community nursing is currently being implemented in Austria. No further qualification than generalist nursing training is required for working as a community nurse, but one of the central tasks is to educate different people and, above all, groups about health-related topics. Due to the lack of corresponding educational competence, high-quality performance of the designated tasks is questionable[63,64] and supports the demand for education-specific further qualification[64] for these RNs.

The results of the subgroup analyses showed that experience in the nursing profession has some relatively high[65] effects on the development of nursing competence. In general, nursing competence increased continuously in relation to the number of years in the nursing profession, which is also reflected in several international studies.[19,66–73] The lowest levels of competence in four of the five scale factors were found in the group of newly graduated nurses with less than

one year of professional experience. Although competence subsequently increased, the subgroup-specific differences within the first five years of professional experience were not significant in any of the scale factors. A similar result was obtained by Numminen et al.,[74] who described the competence development of newly graduated nurses in a co-hort study and found no significant differences between the competence levels within the first three years of professional practice. Dreyfus and Dreyfus[24] described the development of competence as a staged process. Newly graduated nurses are at the level of advanced beginners and develop into competent nurses within the first two years of professional practice. Until the completion of this competence development, the actions of these RNs are characterised by hierarchical prioritising of actions in unpredictable situations, the self-confidence in one's own ability to perform is not yet highly developed and one's own competence is often doubted.[50,75] In this study, this could be a plausible explanation for the relatively low competence self-assessment and the comparatively slow progression of competence extents among those nurses who have been in the nursing profession for less than five years.

While nursing competence largely increased in the first ten years of professional experience, a decrease in competence in all five scale factors in the subgroup with 10 to 20 years of professional experience was observed in this study. This reduction could be due to the specific socio-demographic characteristics within the nursing profession. Considering the high proportion of female (> 85%) nurses,[76] a fertility rate of 1.48 per woman in Austria, an average gestational age of 31 years,[77] and taking into account the graduation of RNs in their early twenties, it is obvious that many RNs in the subgroup with 10 to 20 years of work experience were returning to work after a corresponding period of maternity leave. Returning to work is often accompanied by a change from full-time to part-time employment[78] with a corresponding change in the personal value system regarding one's own work as a nurse as well as a negatively connoted perception of professional performance by colleagues. This leads to difficulties in adapting to new professional demands and redefining one's role within nursing teams.[79,80] Potential negative experiences of one's own professional performance, reduced expectations of one's own quality of care and a low level of empowerment can lead to reduced nursing competence.[18,74] Internationally, career break programmes and retraining programmes have been established to reintegrate inactive RNs into practice as effectively as possible.[81] It seems advisable to introduce such measures in Austria as well to lower the observed loss of competence to a minimum.

Comparing the competencies between RNs in conservative,

surgical and interdisciplinary medical disciplines, no differences were found, which contrasts with corresponding results of international studies. For example, Numminen et al.[72] showed significantly higher levels of competence among RNs in conservative medical disciplines than among RNs in surgical wards. This difference could be explained by the different instruments used to assess nursing competence. The Nurse Competence Scale[82] used by Numminen et al.[72] records nursing competencies much more comprehensively due to the scale's higher number of items compared to the NPC-AUT-SF[32] (7 factors, 73 items vs. 5 factors, 35 items). In addition, some of the competences depicted in this instrument are not relevant in the Austrian nursing context,[36] which severely limits the comparability of the results of the studies. Positively interpreted, the lack of difference in competencies between RNs of different disciplines observed in our study increases discipline-independent flexibility in workplace selection for RNs as well as for their employers and might support the decision of Austrian policy makers towards the establishment of generalist nursing education.[59]

The results on the effects of the type of nursing education on the competence of graduated RNs are internationally heterogeneous. Some studies describe higher competencies of academically trained nurses,[19,83] but this is contrasted by corresponding study results in the Finnish[71,84] and Italian[68] nursing context as well as by the results of our study. There were no differences between the different types of nursing education (different types of vocational training and academic education, respectively) and likewise weak differences between those RNs with an education before the introduction of a salutogenetically shaped curriculum (graduation until 2001) and those whose education should enable a salutogenetically characterised understanding of nursing with corresponding competencies. This seems problematic, as the study results indicated that the expected effects[85] of the two major amendments of the Austrian Health and Nursing care Act in the last 25 years did hardly manifest themselves. Especially the lowest scores in the NPC-AUT-SFs' factors 1 and 2 (Health promotion and safeguarding and Multi-professional cooperation and development, respectively) among the subgroups of academically trained RNs contradicted the intention of the policy makers to decisively increase the competencies regarding multi-professional cooperation, leadership and development of the professional nursing practice by particularly integrating these corresponding learning contents into the curricula. This result may be due to the comparatively smaller number of academically trained RNs in the sample; however, the ratio of academic to vocationally trained nurses (about 1:7) in our study was much higher than the corresponding ratio in the general nursing population (about 1:50[86]). Fur-

thermore, Olbrich[87] argues that nursing competencies only develop when theoretically acquired competencies can be applied as performance, which is also confirmed by the results of several studies.[18, 67, 70, 74, 84] Additionally, academically trained nurses report a discrepancy between the competences attained during their education on the one hand and the actual application possibilities in practice on the other.[88] The consequences of such discrepancies are reflected, for instance, in low job satisfaction.[89] Istomia et al.[18] describe a negative correlation between the individually experienced satisfaction with the quality of the work performed and the level of nursing competence among nurses; such a correlation could therefore also have influenced the self-assessment of nursing competence of academically qualified nurses in our study.

It is hardly surprising that those RNs with formal further qualifications partially demonstrated higher competencies in the individual scale factors than their colleagues without such further training. Even if the formal further qualifications and specialisations in the sample varied strongly in subject-related terms, the results support the conclusions of previous studies that further educational programmes seem to be crucial in initiating required competencies[19] with regard to multi-professional cooperation and professional development,[90] irrespective of the discipline-specific focus of the further qualifications obtained. Formally further educated RNs could thus take an exposed role in multi-professional care and serve as role models for their colleagues[91] in the development of their own professional competencies as well as the nursing profession in general.[92]

In addition to formal training, some evidence for the importance of continuous non-formal learning to develop one's competencies were found. Those RNs who completed at least the legally indicated number of 60 continuing education hours per five years[93] were significantly more competent in all factors than those RNs without corresponding continuing education hours. What was striking in our study, however, was the relatively low number of RNs who provided any information at all on the extent of non-formal further training they had received, as only just two thirds of all RNs provided information on this question. This raises the issue if the lack of a corresponding response means a general absence of further education hours or if the required information was not specifically available and subsequently could not be addressed. Furthermore, the identified effects of continuing competence measures are weak[65] at best. This raises the question of whether the currently prescribed number of training hours[59] is too low or whether the relatively low standardization[94] regarding content quality and provable relevance of the training formats offered detract from learning outcomes. Internationally, the extent as well as the control of

the quality of continuing competence measures[51] are regulated by the authorities and regularly audited.[95] In 2018, the registration law for health care professions was introduced in Austria, which, however, does not provide for a corresponding obligatory recording of continuing education.[96] An adaptation to international standards could potentially increase the effectiveness of corresponding continuing education measures in Austria and at the same time reduce the potential lack of transparency regarding professional development both on an individual and on a systemic level. Given the significant influence of non-formal continuing education on nursing competence[18] this could subsequently provide nurses a comprehensible overview of their acquired professional competence and enable policy makers to tailor continuing education measures under the aspects of strategic necessity and assured quality.

Limitations

A cross-sectional study was conducted, therefore explored relations can only be discussed in the context of theoretical considerations and causalities cannot be derived.[97] However, this methodological approach was suitable to provide an initial description of the competencies of RNs in Austria based on valid data and thus offers a starting point for subsequent studies exploring the findings more specifically.

Study participants were selected by drawing a convenience sample, which precludes the representativeness of the results to the general population.[98] The calculated sample size might basically enable conclusions regarding the general population of RNs working in inpatient general wards, and the characteristics of our sample concerning the distribution of age, gender and experience in the profession adequately reflect the target population.[7] Nevertheless, nurses with formal further qualifications and specializations were overrepresented,[86] which could explain a potential influence on the relatively high ratings[73] on individual items in the total sample, especially as the respective subgroups showed a partly significantly higher competence; the actual ratings in the general population of RNs might hence be lower.

Another limitation is the assessment method of the variable nursing competence. Although the NPC-AUT-SF is a valid and reliable instrument, self-assessments of professional competencies are potentially biased.[99] It can be speculated that one's competencies were overestimated due to social desirability[100–102] as well as personal interest in a more positive display of professional competence with respect to further healthcare professionals.[103, 104]

The data collection was conducted during one of the strongest peaks of the COVID-19 pandemic in Austria. On the one

hand side, the high response rate despite the difficult circumstances must be appreciated even more and can be interpreted as a signal that RNs are highly interested in reflecting on their own competence.[105] On the other hand side, many nursing care activities, especially in the context of patient education and counselling, could only be carried out sporadically or not at all since the beginning of the COVID-19 pandemic due to staff shortages, restrictive hygiene measures and reduced in-person clinical care.[106] The assessments regarding nursing competencies might have been partly affected by recall bias,[107] as some ratings might have been based on activities being relatively rarely performed in actual nursing practice[108] within a period of approximately two years. It is therefore strongly recommended to interpret these ratings under the consideration of the extraordinary circumstances and ideally repeat the competence assessment under more regularly conditions in the healthcare sector.

5. CONCLUSIONS AND RECOMMENDATIONS

This study provides valuable insights on Austrian RNs' competence. Overall, competence is relatively high, but competencies regarding the implementation of scientific knowledge, nursing development as well as health promotion and education are comparatively low. It is recommended to explore concrete causes for this deficit based on further studies to derive corresponding competence-promoting measures. At the same time, this result is a demand for organizational nursing management to establish structures that support the development and application of these competences.

Professional experience showed the most significant influence on the development of competence. This result supports the already formulated demands of Austrian policy-makers[109] to improve working conditions in the nursing sector urgently, especially to reduce the already high turnover rates in this occupational group and thus ensure that highly competent RNs remain in the profession.

The type of qualification to become an RN does not seem to have a significant impact on competence, at least not yet. However, given the still short time span since the introduction of academic education in Austria, nursing practice seems to be in a time of transformation. Therefore, it is advisable to continuously monitor the development of nursing competence, especially of academically educated RNs, and to evaluate whether the competencies acquired during education are actually implemented in practice.

Continuous professional development has proven to promote competence, but the effects are weak when the minimum legal requirements are taken into account. It seems advisable to evaluate the current legislation on individual continuing competence and, if necessary, to adapt the actual regulation to internationally established models.

CONFLICTS OF INTEREST DISCLOSURE
We have no conflict of interest to disclose.

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