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Validity and Reliability of the Turkish Nursing Students' Self-Perceptions about Safe Medication Management

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Abstract

Background: Safe medication management is central to nursing education and patient safety. To the best of our knowledge, there is currently no validated Turkish instrument specifically designed to assess nursing students' self-perceptions regarding safe medication management. This study aimed to evaluate the validity and reliability of the Turkish version of the Nursing Students' Self-Perceptions about Safe Medication Management (NURSPeM).

Methods: This methodological study was conducted at a single university using convenience sampling. Data were collected from a sample of 400 nursing students using the NURSPeM. Construct validity was examined with confirmatory factor analysis (CFA). Internal consistency was evaluated using Cronbach's alpha, and test-retest reliability using intraclass correlation coefficients (ICCs).

Results: Questionnaire 1 showed adequate fit (CMIN/df = 1.67, RMSEA = 0.041, CFI = 0.912). Questionnaire 2 demonstrated acceptable fit (CMIN/df = 3.02, RMSEA = 0.071, CFI = 0.905). The Cronbach alpha values ranged from 0.815 to 0.918, and ICC from 0.830 to 0.854.

Conclusions: The Turkish NURSPeM is a valid and reliable tool for assessing nursing students' self-perceptions of safe medication management in nursing education.

Keywords: drug administration, medication errors, nursing students, psychometrics

INTRODUCTION

Nursing not only entails treatment and care services, but also plays a critical role in ensuring patient safety.¹ In this context, it is vital for nurses to ensure that drugs are administered at the right dose, at the right time, and to the right patient.² However, errors in the drug administration process are one of the most common problems that threaten patient safety.³ If newly graduated nurses have not been able to develop adequate skills in drug administration during the education process, the risk of making errors in the clinic after graduation is greatly increased.^{3,4}

To prevent medication errors, the World Health Organization launched the Global Patient Safety Challenge on Medication Safety in 2017.⁵ This initiative aimed to provide nursing students with drug safety education and clinical practice skills more effectively.^{6,7} Inadequacies in education may lead to serious consequences, especially in sensitive issues such as dose calculations,^{8,9} and intravenous drug administration.^{10,11}

Various studies in the literature have evaluated nursing students' knowledge, skills, and self-perceptions about medication management.^{12–17} In Türkiye, medication management is a critical component of nursing education, as nursing students are actively involved in preparing and administering medications during their clinical training. Several studies conducted in Türkiye have reported that nursing students experience difficulties, particularly in drug-dose calculations, intravenous medication administration, and adherence to medication safety principles, which may increase the risk of medication errors in clinical settings. Although national-level medication error reporting systems are limited, available evidence suggests that medication errors remain an important patient safety concern in Turkish healthcare institutions. Therefore, evaluation of nursing students' medication management competencies and self-perceptions within the Turkish context is essential to support safe clinical practice and improve nursing education outcomes. Self-perceptions of safe medication administration and experience of drug dosage calculation are also important for Turkish nursing students. As drug safety and dosage calculation are competencies expected of nursing students during clinical practice, evaluating these skills can help identify gaps in education and thereby support patient safety. The evaluation of students' self-perceptions in this process is of importance not only at the cognitive level but also in affective and behavioral aspects. The Nursing Students'

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Perceptions about Safe Medication Management (NURSPeM) questionnaire is one of the original scales developed to measure students' self-perceptions of medication management.¹⁸ Although the NURSPeM has been used in various populations and settings, to the best of our knowledge, a valid Turkish version of this scale has not yet been published. Given nurses' role in medication administration and the importance of adherence to safe medication management guidelines, identifying and evaluating this competency during their student years can be valuable. Thus, students' self-efficacy in this regard is important for adapting and validating the NURSPeM tool for Turkish nursing students, enabling its use in the Turkish educational context, and facilitating cross-cultural comparisons.

To ensure that treatment is applied as intended and desired, it is essential to assess nursing students' self-perceptions regarding medication management. Meeting this requirement will enable nursing students to identify their current level of medication management, thereby improving their skills and minimizing medication errors.^{18,19} The aim of this study was to adapt the Nursing Students' Self-Perceptions about Safe Medication Management (NURSPeM) scale into Turkish and to evaluate its validity and reliability among nursing students, thereby contributing to the quality of nursing education programs and to patient safety in future clinical practice.

METHODS

The study was conducted and reported in accordance with COSMIN recommendations for psychometric and cross-cultural adaptation studies. This methodological study was conducted with students in the Faculty of Nursing at Atatürk University, Türkiye, during the spring term of the 2024–2025 academic year. The study universe consisted of 1230 students. Previous scale validity and reliability studies have found that sample size should be 5–10 times the number of scale items,^{20,21} so the minimum sample size for this study was calculated to be 370 as the scale included 37 items. The phrase 'students with clinical practice' used in this study refers to nursing students who had commenced clinical training. At the institution where the study was conducted, nursing students begin clinical practice in the second semester of the first academic year. Therefore, students from the first year (second semester), second year, third year, and fourth year were eligible for inclusion. All students with clinical practice experience who voluntarily agreed to participate in the study were included. A total of 1230 nursing students were enrolled during the specified academic year, of which 400 students met the study inclusion criteria. Due to ease of application, rapid data collection, and easy access to participants, the convenience sampling method was used to reach the individuals in the sample.

The study inclusion criteria were: (1) being enrolled as a nursing student in the Faculty of Nursing during the 2024–2025 academic year, (2) having commenced clinical practice, and (3) voluntarily agreeing to participate in the study. The exclusion criteria were: (1) not having any clinical practice experience, (2) being on academic leave or medical leave during the data collection period, and (3) incomplete or missing questionnaire data. After obtaining institutional permission for the research, the academics teaching the courses were informed about the research; students were visited in their classrooms; the purpose of the research was explained; it was stated that participation was voluntary; and forms were distributed.

The research data were collected using a student information form containing three questions to elicit age, gender, and year of study, and the NURSPeM questionnaire to assess nursing students' self-perceptions of safe medication management. The student information form was intentionally kept brief, as the study's primary aim was to evaluate the psychometric properties of the NURSPeM tool rather than examine factors associated with medication management experiences.

The NURSPeM tool was originally developed by Fusterö-Linares *et al.* in Spain in 2022 to assess nursing students' self-perceptions of safe medication management.¹⁸ The scale includes a total of 37 items in the form of two questionnaires: self-perceptions about safe medication management (questionnaire-1) and frequency and learning of drug dose calculation (questionnaire-2). Questionnaire-1 consists of 24 items in seven sub-dimensions: safety in drug prescription, familiarity with pharmacological concepts, relevance for professional practice, factors associated with risk of error, importance of administering medication as prescribed, verifications prior to drug administration, and the thinking process in relation to medication management. Questionnaire-2 consists of 13 main items and two sub-dimensions: frequency of drug dose calculation and learning drug dose calculation. As some items include multiple sub-questions, the total number of analyzed items exceeds the number of main items. The scale is scored on a five-point Likert scale; 0 = never, 1 = sometimes, 2 = often, 3 = most of the time, and 4 = always. The original scale has been reported to be a valid and reliable measurement tool with Cronbach alpha coefficients of 0.894 and 0.846.¹⁸

Linguistic validity was ensured through the translation-back-translation method. The original language of the scale is Spanish. In this process, three Spanish-Turkish-speaking experts independently translated the scale from Spanish into Turkish. The three resulting translations were compared and merged for semantic integrity and linguistic appropriateness, yielding a Turkish form. This Turkish form was reviewed by a Turkish language expert for grammar and conceptual clarity. Then, the Turkish form was translated back into Spanish by three different Spanish

experts. The back-translation forms were compared, and the semantic compatibility with the original text was evaluated. Finally, the scale developer was contacted to obtain approval for the conceptual equivalence and semantic accuracy of the items. After the necessary corrections, the Turkish version of the scale was finalized. Examples of amendments made during the adaptation process, their justifications, and the results of expert and developer evaluations are shown in Table 1.

The Davis technique was used to determine the content validity of the scale, which evaluates the extent to which the scale items adequately represent the construct being measured. Therefore, after ensuring the linguistic validity of the scale, 11 specialists from the fields of Internal Medicine Nursing, Fundamentals of Nursing, and Public Health Nursing were consulted. Feedback was received from seven experts, including one associate professor in Public Health Nursing, one assistant professor in Fundamentals of Nursing, one professor in Internal Medicine, and four assistant professors in Internal Medicine Nursing. All these experts had experience in nursing education and clinical practice. Previous studies have reported that 3–20 expert opinions are sufficient to determine the content validity of a scale.²² The expert opinions were noted then the Content Validity Index (CVI) was calculated using the Davis technique. The experts were asked to score each item on a scale from 1 (not appropriate) to 4 (completely appropriate). The item-level content validity index (I-CVI) was calculated for each item using expert ratings. The I-CVI values ranged from 0.71 to 1.00. Although two items yielded I-CVI values below the recommended threshold of 0.78, the expert feedback mainly focused on improving linguistic clarity and conceptual comprehensibility rather than changing item content. Therefore, minor wording revisions were made before finalizing the Turkish version of the scale. Following the revisions, all items were deemed suitable for inclusion in the final version of the scale. The overall content validity level of the scale was determined using the scale level content validity index (S-CVI/Ave), calculated as the average of all I-CVI values. The S-CVI/Ave value was 0.94, indicating a high level of content validity for the scale.

After completion of the linguistic validity process, the scale was first administered to 40 students to evaluate its comprehensibility and applicability to the target group. No item comprehensibility problems were reported, and the preliminary application results indicated that the scale was clear and understandable to the target group. The data from the pre-application were used for preliminary evaluation purposes only and were not included in the final validity and reliability analyses. During data collection, the lecturers responsible for the relevant courses at each grade level were interviewed in advance, and the necessary permissions were obtained. The students were then informed about the purpose of the study and asked to participate voluntarily.

Between 23 May and 6 June 2025, the data collection forms were applied face-to-face to the students who agreed to participate, with each taking an average of 15–20 minutes to complete. The data collection process was conducted with institutional permission and in accordance with ethical principles. To evaluate the test-retest reliability of the NURSPeM tool, the data collection forms were re-administered to 50 students randomly selected from the sample, 2 weeks after the initial data collection.

Data analysis was performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA), and Mplus, Version 7. Descriptive statistics were stated as mean $\pm$ standard deviation (SD) values for continuous variables and as number (N) and percentage (%) for categorical variables. Confirmatory factor analysis (CFA) was applied to evaluate construct validity. The two questionnaires constituting the scale to be validated were evaluated independently. Therefore, all analyses were performed separately for questionnaires 1 and 2. The first questionnaire of the scale consists of 24 items and 7 sub-dimensions, while the second questionnaire consists of 13 items and 2 sub-dimensions. For each questionnaire, single outliers were checked first, then Mahalanobis distances were checked for multiple outliers. In this way, all data were included in the analysis. CFA was performed using Mplus Version 7 to test the scale's original factor structure, and structural equation modeling was used in the analyses. The maximum likelihood estimation method was used in the CFA analyses. Model fit was assessed using CMIN/df, RMSEA, CFI, TLI, and SRMR. A CMIN/df value ≤ 3.0 , an RMSEA < 0.08 , a CFI ≥ 0.90 , TLI values close to 0.90, and an SRMR < 0.08 were considered indicators of acceptable model fit.²³ In addition, AVE (≥ 0.50) and CR (≥ 0.70) values were calculated to support the construct validity of the factors.^{24,25} The CFA findings are presented in the related section. Within the scope of reliability analyses, the scale's internal consistency was evaluated using Cronbach's alpha. For test-retest reliability, the scale was administered twice to 50 of the same participants at a two-week interval, and the consistency between the two measurements was assessed using intraclass correlation coefficients (ICCs). The Paired Samples t-test was used to evaluate the difference between the mean scores of the measurements. The level of statistical significance was accepted as $p < 0.05$ in all analyses.

Prior to commencement, approval for the study was granted by the Scientific Publications and Ethics Committee of Ardahan University (Approval date: 18 March 2025; Approval number: E-67796128-819-2500009 793). Institutional approval was obtained from the Dean's Office of the Faculty of Nursing at Atatürk University (Approval date: 23 May 2025; Approval number: E-80131 151-100-2500167166). Written and verbal informed consent was obtained from all participants prior to data collection. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

TABLE 1. Examples of item adaptation during the Turkish translation and cross-cultural adaptation process of the NURSPeM

Original wording	Turkish adaptation issue	Reason for modification	Outcome after expert/developer review
"Medication administration as prescribed"	Literal translation was considered overly formal in Turkish	To improve conceptual clarity and linguistic fluency	Revised wording approved and retained
"Drug-dose calculation"	Hyphenated wording is not commonly used in Turkish nursing terminology	To improve readability and consistency with nursing education terminology	Adapted expression accepted
"Verifications prior to drug administration"	Direct translation created ambiguity regarding clinical verification procedures	To ensure conceptual comprehensibility for nursing students	Final wording revised according to expert feedback
"Thinking process in relation to medication management"	Literal translation was difficult to understand conceptually	To preserve semantic meaning and cultural appropriateness	Conceptual equivalence confirmed by scale developers

RESULTS

A total of 400 nursing students participated in the study, comprising 261 females (65.3%) and 139 (34.8%) males. Nearly half of the students were in their second year (48.0%, $N = 192$), followed by those in the third year (31.0%, $N = 124$), the first year (13.5%, $N = 54$), and the fourth year (7.5%, $N = 30$). The mean age of the participants was 21.14 years ($SD = 1.95$), indicating a relatively homogeneous sample of young adults typical of undergraduate nursing education (Table 2).

Direct CFA was conducted in this study as the scale had already been developed with a determined factor structure. Exploratory factor analysis (EFA) was not applied because the original factor structure of the NURSPeM instrument had already been established in previous studies. In cross-cultural adaptation studies, CFA is usually preferred to test whether the scale's existing theoretical structure is supported in a new cultural context. Therefore, CFA was considered appropriate for evaluating the construct validity of the Turkish version of the NURSPeM. Both questionnaires were first subjected to the Kaiser-Meyer-Olkin (KMO) sampling adequacy test and Bartlett's test of sphericity to assess the suitability of the scale for factor analysis. The KMO value for Questionnaire-1 was 0.885, indicating that the sample was suitable for factor analysis. The chi-square value obtained from Bartlett's test was 6862.615, with 378 degrees of freedom and a p -value < 0.001 , indicating a significant correlation among the items and, therefore, that factor analysis is feasible. The KMO value for Questionnaire 2 was 0.929, indicating that the sample was perfectly adequate for factor analysis ($KMO > 0.90$). Bartlett's test was significant ($p < 0.001$), indicating significant correlations among the variables and therefore that the data were suitable for factor analysis.

Questionnaire-1 consists of seven factors and 24 items, of which the ninth item also has sub-items. When the model fit indices were examined, the values were determined to

be $CMIN\ 549.306$, $df\ 329$, $CMIN/df\ 1.669$, $RMSEA\ 0.041$, $CFI\ 0.912$, $TLI\ 0.899$, and $SRMR\ 0.060$. These values indicate that the model provides an acceptable fit overall. Although some indices (particularly TLI and SRMR in Questionnaire-2) were slightly below the recommended thresholds, the overall pattern of fit indices supported the adequacy of the proposed factor structure. The path diagram of the model is shown in Figure 1. Questionnaire-2, evaluating the frequency and learning of drug-dose calculation, has two factors and 13 items. The analysis results showed values of $CMIN\ 299.211$, $df\ 99$, $CMIN/df\ 3.022$, $RMSEA\ 0.071$, $CFI\ 0.905$, $TLI\ 0.885$, and $SRMR\ 0.087$, demonstrating that the model provides an acceptable fit in general (Table 3). The path diagram of the model is shown in Figure 2.

The values in Table 4 show the standardized factor loadings of each item for the relevant factor, item-total correlations, and the mean and variance changes in the scale score when the item is removed. Factor loadings of 0.30 and above are generally considered acceptable in preliminary validation and cross-cultural adaptation studies, indicating that the items are compatible with the scale structure.

When the findings regarding the construct validity and internal consistency reliability of the NURSPeM tool were analyzed, it was seen that the AVE values of most factors in both questionnaires were above 0.50, and the CR values were above 0.70. Although the AVE value for one factor was slightly below the recommended threshold of 0.50, it was very close to the acceptable limit, and the composite reliability (CR) and Cronbach's alpha coefficients for this factor exceeded the recommended levels. According to previous methodological recommendations, when AVE values are close to the threshold, and CR values are satisfactory, convergent validity can still be considered acceptable. Therefore, the construct validity of the relevant factor was deemed sufficient in this study. When the internal consistency coefficients were analyzed, they ranged from 0.815 to 0.918 (Table 5).

The test-retest results for the questionnaires are presented in Table 6. Despite minor differences between pretest and retest mean scores, high pretest-retest correlations (0.710–0.793) and high ICC values (0.830–0.854) indicate strong test-retest reliability and temporal stability.

TABLE 2. Demographic characteristics of the study participants (N = 400)

Variable	N	%
Gender		
Female	261	65.3
Male	139	34.8
Academic year		
First year	54	13.5
Second year	192	48.0
Third year	124	31.0
Fourth year	30	7.5

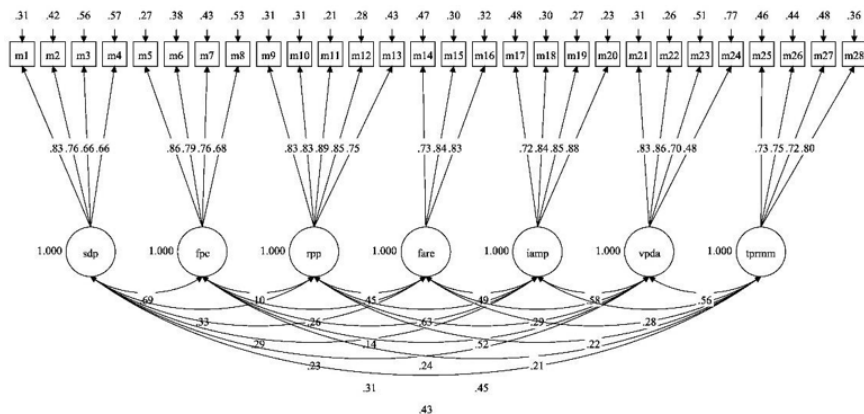


FIGURE 1. Self-perceptions about safe medication management (Questionnaire 1) path diagram

TABLE 3. Confirmatory factor analysis and agreement indices for NURSPeM Questionnaire 1 and Questionnaire 2

Model fit indices	Questionnaire 1	Questionnaire 2
	Fit index values of the scale	
CMIN	549.306	299.211
DF	329	99
χ^2/df	1.669	3.022
RMSEA	0.041	0.071
CFI	0.912	0.905
TLI	0.899	0.885
SRMR	0.060	0.087

Questionnaire 1: Self-perceptions about safe medication management; Questionnaire 2: The frequency and learning of drug-dose calculation; CMIN: Chi-square value; RMSEA: Root Mean Square Error of Approximation; CFI: Comparative Fit Index; TLI = Tucker-Lewis coefficient; SRMR: Standardized Root Mean Squared Residual

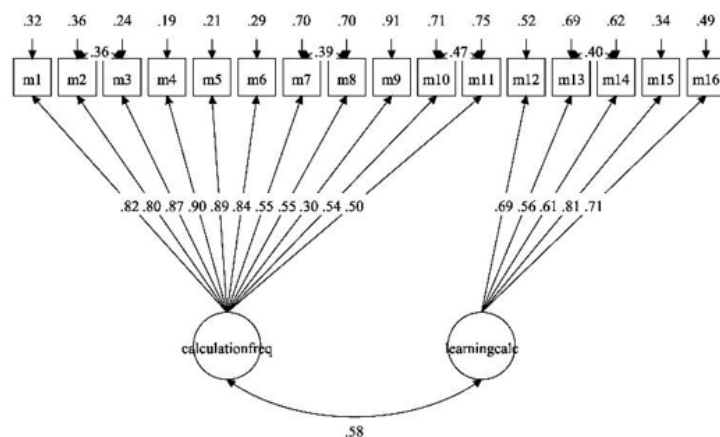


FIGURE 2. The frequency and learning of drug-dose calculation (Questionnaire 2) path diagram

TABLE 4. Standardized factor loadings and item-level statistics for the NURSPeM Questionnaire 1 and Questionnaire 2

Item Label	Standardized Factor Loading	Scale Mean if Item was Deleted	Scale Variance if Item was Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item was Deleted
Questionnaire 1						
Safety in drug prescription						
m1	0.83	74.335	187.697	0.531	0.619	0.908
m2	0.76	74.035	189.954	0.482	0.572	0.909
m3	0.66	73.690	188.821	0.505	0.491	0.908
m4	0.66	74.203	191.129	0.359	0.466	0.911
Familiarity with pharmacological concepts						
m5	0.86	74.665	190.048	0.464	0.648	0.909
m6	0.79	74.592	189.149	0.459	0.606	0.909
m7	0.76	74.600	190.185	0.415	0.566	0.910
m8	0.68	74.615	190.683	0.364	0.478	0.911
Relevance for professional practice						
m9	0.83	73.345	187.600	0.548	0.692	0.908
m10	0.83	73.225	186.085	0.583	0.697	0.907
m11	0.89	73.115	187.696	0.578	0.760	0.907
m12	0.85	73.167	188.175	0.539	0.727	0.908
m13	0.75	73.232	188.660	0.516	0.581	0.908
Factors associated with risk of error						
m14	0.73	73.885	189.496	0.406	0.521	0.910
m15	0.84	73.730	189.526	0.452	0.587	0.909
m16	0.83	73.667	185.635	0.566	0.558	0.909
Verifications prior to drug administration						
m21	0.83	73.140	187.148	0.558	0.674	0.907
m22	0.86	73.220	187.320	0.565	0.649	0.907
m23	0.70	73.522	186.701	0.522	0.536	0.908
Thinking process in relation to medication management						
m24	0.48	73.952	189.253	0.474	0.494	0.909
m25	0.73	73.980	188.305	0.509	0.587	0.908
m26	0.75	73.765	188.822	0.499	0.523	0.908
m27	0.72	74.010	190.251	0.381	0.515	0.911
m28	0.80	73.960	188.515	0.480	0.573	0.909
Questionnaire 2						
Frequency of drug dose calculation						
m1	0.82	34.09	128.32	0.726	0.705	0.925
m2	0.80	34.04	128.90	0.745	0.746	0.924
m3	0.87	34.01	128.41	0.796	0.811	0.923
m4	0.90	34.09	128.01	0.771	0.794	0.924
m5	0.89	34.08	127.91	0.766	0.812	0.924
m6	0.84	34.21	127.84	0.735	0.738	0.924
m7	0.55	33.81	132.12	0.635	0.512	0.927
m8	0.55	33.59	131.42	0.696	0.601	0.926
m9	0.30	33.80	139.08	0.415	0.279	0.932
m10	0.54	33.95	132.39	0.641	0.528	0.927
m11	0.50	34.02	132.45	0.628	0.528	0.927
Learning drug dose calculation						
m12	0.69	33.75	132.71	0.643	0.480	0.927
m13	0.56	33.71	134.59	0.561	0.530	0.929
m14	0.61	33.85	134.57	0.539	0.537	0.930
m15	0.81	33.84	132.43	0.623	0.547	0.927
m16	0.71	33.96	134.63	0.486	0.449	0.931

Questionnaire 1 = Self-perceptions about safe medication management; Questionnaire 2 = The frequency and learning of drug-dose calculation

TABLE 5. Construct validity, composite reliability, and internal consistency indices for the NURSPeM subscale factors

Factor	Number of items	AVE	CR	Cronbach's alpha
Questionnaire 1				
Safety in drug prescription	4	0.536	0.821	0.815
Familiarity with pharmacological concepts	4	0.598	0.856	0.854
Relevance for professional practice	1*	0.693	0.918	0.917
Factors associated with risk of error	3	0.639	0.841	0.836
Importance of administering medication as prescribed	4	0.680	0.894	0.891
Verifications prior to drug administration	3	0.647	0.845	0.832
Thinking process in relation to medication management	5	0.536	0.852	0.850
Questionnaire 2				
Frequency of drug dose calculation	11	0.515	0.915	0.918
Learning drug dose calculation	2**	0.495	0.830	0.828

*The item in this dimension is subdivided into five questions; ** One of the items in this dimension includes multiple sub-questions, in accordance with the structure of the original scale; Questionnaire 1: Self-perceptions about safe medication management; Questionnaire 2: The frequency and learning of drug-dose calculation; AVE: Average Variance Extracted; CR: Composite Reliability; AVE values close to 0.50 were interpreted as acceptable when supported by adequate composite reliability values.

TABLE 6. Retest analysis results of the NURSPeM measurement tool

Factor	Pretest (N = 50)	Retest (N = 50)	<i>p</i>	<i>r</i>	ICC (95% CI)
Questionnaire 1	97.08 ± 5.47	95.48 ± 7.80	0.023	0.793**	0.854 (0.743 – 0.917)
Questionnaire 2	47.48 ± 10.49	44.82 ± 9.97	0.020	0.710**	0.830 (0.700 – 0.903)

**Correlation is significant at the 0.01 level (2-tailed); Questionnaire 1: Self-perceptions about safe medication management; Questionnaire 2: The frequency and learning of drug-dose calculation.

DISCUSSION

This study provides the first Turkish adaptation and psychometric evaluation of the NURSPeM tool. One of the strengths of the study is that it provides the first comprehensive psychometric evaluation of the Turkish version of the NURSPeM among nursing students. The findings demonstrate that the Turkish version exhibits satisfactory content validity, construct validity, internal consistency, and test-retest reliability, supporting its use for assessing nursing students' self-perceptions of safe medication management.

When determining the content validity of the scale, the opinions of seven different experts were considered, and the content validity index (CVI) was calculated with the Davis technique. As the CVI value was determined to be high, this indicated satisfactory content validity of the scale. Confirmatory Factor Analysis was performed to determine the construct validity of the scale, and the results showed that the fit indices were within acceptable limits. These results demonstrated that the original factor structure of the scale was preserved and factorial validity was supported.

The KMO test results for sample adequacy in this study ranged from 0.885 to 0.929, indicating that the sample size was sufficient for the analyses. Similarly, in the development study of the scale, the KMO value was reported to be 0.872–0.876, and the sample size was sufficient.¹⁸ The Cronbach alpha value obtained as a result of the internal consistency analysis of the scale was between 0.815 and 0.918, showing a high level of internal

consistency of the scale. In the ICC analysis applied to determine the test-retest reliability, a comparison was made with the values two weeks after the first measurements, and the scale was seen to demonstrate satisfactory test-retest reliability over time. Reliability analyses conducted on the original form of the scale showed that the Cronbach alpha coefficient was high, similar to that of this study. However, in contrast to this study, the original study reported that the Cronbach's alpha coefficient for the "Importance of administering medication as prescribed" sub-dimension was slightly below the accepted limit of 0.649. In the test-retest analysis of the same scale, the ICC values for both questionnaires ranged from 0.846 to 0.894, indicating that the scale shows a high level of stability over time, similar to the current study.¹⁸

In the original study of the scale, only exploratory factor analysis was performed, and the results of that analysis were included, but confirmatory factor analysis and fit indices were not included. In the current study, confirmatory factor analysis was performed for the Turkish adaptation of the scale, and the construct validity was tested comprehensively by calculating the model fit indices (Questionnaire 1 CFI 0.912, RMSEA 0.041, Questionnaire 2 CFI 0.905, RMSEA 0.071). The fit index values obtained generally support the validity and reliability of the scale. It should be noted that in Questionnaire-2, some fit indices (TLI and SRMR) were slightly outside the recommended threshold values. However, considering the overall pattern of fit indices, the proposed factor structure was considered acceptable. As most of the fit indices in this study, including CMIN/df,

RMSEA, and CFI, fall within acceptable limits, the adequacy of the proposed factor structure is supported. In addition, the factor loadings are generally satisfactory, and the composite reliability values exceed the recommended threshold, indicating acceptable internal consistency of the factors. Therefore, considering the combined evidence from multiple fit indices, the factor structure of the Turkish version of the NURSPeM has been retained. This may be related to the relatively small number of factors and the heterogeneity of items that address both the frequency and learning aspects of drug-dose calculation. However, given that the majority of fit indices indicated an acceptable model fit and all factor loadings met the minimum acceptable criterion, the original factor structure can be considered retained. Although one item exhibited a factor loading at the lower limit of acceptability, it was retained in the model because its loading met the proposed minimum threshold and the item was conceptually consistent with the theoretical structure of the original scale. Retaining this item also contributed to preserving the integrity of the original instrument during the cultural adaptation process. Future studies may further refine the model by testing alternative structures or removing weaker items. Although the TLI and SRMR values for Questionnaire-2 were slightly outside the recommended thresholds, they remained close to acceptable limits. When interpreted together, the other fit indices, including CFI, RMSEA, and CMIN/df, indicated acceptable model fit. The other fit indices, such as CFI, RMSEA, and CMIN/df, used in this study, indicated acceptable model fit, supporting the adequacy of the proposed factor structure. Therefore, when interpreted collectively, the fit indices demonstrate that the model exhibits an acceptable level of fit despite minor deviations in specific indices.

In the present study, one of the sub-dimensions consisted of a single item. Although multi-item factors are generally preferred, single-indicator factors may be acceptable under appropriate theoretical and methodological conditions. In this study, the single-item factor was retained to maintain²⁶ consistency with the original structure of the NURSPeM instrument. As previous studies have also suggested that maintaining equivalence with the original scale is important during cultural adaptation processes, the original factor structure was maintained without modification.^{21,27}

This study can be considered of great value as no other studies on the cultural adaptation of the NURSPeM measurement tool could be found in the literature. In a descriptive study using the NURSPeM measurement tool, the scale was applied to Iranian nursing students and similar to the current study findings, the Cronbach alpha (0.909) and ICC values (0.898) were reported to be high.²⁸ Although paired-sample comparisons showed minor mean differences over time, the ICC values demonstrated strong agreement, indicating that the scale provides

stable measurements rather than exact score equivalence. These subtle differences can be attributed to changes in students' clinical experiences, learning processes, and perceptions over the two-week period. Overall, the findings of this study provide evidence that the Turkish version of the NURSPeM is a psychometrically sound instrument and may help identify nursing students' strengths and areas for improvement in safe medication management throughout their education.

From a practical perspective, the Turkish version of the NURSPeM tool may be used in nursing education to systematically assess students' self-perceptions related to safe medication management. The scale can help educators identify specific areas where students feel less confident, such as drug dose calculation or medication administration, and guide targeted educational interventions. In addition, repeated use of the scale throughout nursing education would enable monitoring of changes in students' perceptions over time and evaluation of the effectiveness of medication safety training programs.^{13,21}

The Turkish version of the NURSPeM provides nurse educators with a practical, psychometrically sound instrument for evaluating students' self-perceptions of safe medication management. The tool can be integrated into undergraduate curricula to identify areas where students feel less confident, such as dose calculation or medication verification. By using the NURSPeM longitudinally, educators may monitor changes in students' perceptions over time and evaluate the effectiveness of educational interventions aimed at improving medication safety competencies. These findings are consistent with previous research in nursing education, which highlights the importance of understanding students' perceptions of safety in order to strengthen educational strategies.¹⁴ Although exploratory factor analysis was not conducted in this study, confirmatory factor analysis was used to assess the validity of the current factor structure based on the theoretical assumptions derived from the original scale. Future studies may consider applying both exploratory and confirmatory factor analyses to examine the dimensional structure of the scale in greater detail across different samples.

This study had some limitations to be considered. As the study was conducted with nursing students at a single university, it may not generalize to nursing students nationwide. The scale is a self-report scale, which bears an inherent risk of social appreciation bias, or the responses may not fully reflect reality. The test-retest was performed two weeks apart, so long-term stability could not be measured. In addition, variables such as medication administration experience, internship duration, and prior medication error experience were not included, which may limit the interpretation of factors influencing

students' self-perceptions. The lack of exploratory factor analysis and the somewhat low fit indices in Questionnaire 2 are among the additional limitations of the study. Finally, the use of convenience sampling may have limited the sample's representativeness and reduced the generalizability of the findings. Future multicenter, longitudinal studies are recommended to further evaluate the psychometric properties of the scale.

The analyses conducted in this study demonstrated that the Turkish version of the NURSPeM tool for assessing nursing students' self-perceptions of safe medication management is valid and reliable. The robust psychometric properties of the scale indicate that this tool is important for educational institutions and researchers to evaluate awareness and skill levels in safe medication practices. Thus, it is important that the NURSPeM is adapted to different cultures for use in both testing its validity across cultural diversity and conducting international comparative studies. It is also recommended that this scale, which addresses drug safety as a very important issue for nurses, be used in descriptive and randomized controlled studies.

CONCLUSIONS

Based on the findings of this study, the NURSPeM tool can be used by nursing educators to assess students' self-perceptions related to safe medication management and to guide educational interventions. The scale may help identify areas requiring additional training, particularly in drug-dose calculation and medication administration processes. Furthermore, the use of this tool in different educational settings may support curriculum development and contribute to improving patient safety practices in clinical settings in the future.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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DATA AVAILABILITY

Data are available from the corresponding author upon reasonable request.

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