

Original Article

Turkish Adaptation of the Medication Safety Competence Scale for Nurses: Validity and Reliability Study

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Abstract

Aim: This study was conducted to establish the Turkish validity and reliability of the Medication Safety Competence Scale for Nurses.

Methods: The study group of this methodological research consisted of 369 nurses working in a province in Turkey. The translation-back translation procedures was used in adapting the scale to Turkish. Content Validity Index was calculated. Exploratory and Confirmatory Factor Analysis were done for construct validity. Cronbach's α , split-half reliability, t-test and Intraclass Correlation Coefficient were used in the reliability analysis of the scale.

Results: A six-factors structure explained 77.5% of the total variance. The Cronbach's α coefficient value for the whole scale was 0.953 ranging between 0.856 and 0.972 for the subscales. It was determined that the split-half reliability coefficient was 0.709 and the Intra-Class Correlation Coefficient value for the total scale was 0.981 ($p < 0.001$). All model fit indices were in the acceptable range.

Conclusions: The results revealed that Medication Safety Competence Scale for Nurses is a valid and reliable instrument and can be used to evaluate the competence of medication safety in Turkish nurses.

Keywords: Medication Errors, Medication Safety Competence, Nurses, Realibility, Validity

Introduction

Patient safety is an important part of quality in healthcare (Lee et al., 2019). Medication errors, one of the most common medical errors that threaten patient safety, are of utmost importance as they are related to life (Dehvan et al., 2021). These mistakes prolong the hospital stay of the patients, increase the morbidity and mortality rates, and may cause additional financial expenses as a result of the complications (Assiri et al., 2018; Khalil et al., 2017). In addition, the emergence of these errors affects the motivation and self-confidence of health professionals. As a result, dissatisfaction with health services develops in society (Isik et al., 2012). It is stated that medication errors are among the most frequently reported sentinel events to the Joint Commission by accredited or voluntary

organizations in 2021 (The Joint Commission, 2021). The World Health Organization draws attention to the fact that medication errors are a global problem. To reduce medication errors and improve patient safety, it encourages governments around the world, to develop new strategies and guidelines to improve medication safety (WHO, 2016). Many countries around the world have established national patient safety systems and implemented policies in this regard (NHS Improvement, 2018; Ha et al., 2020). Because more than half of medication errors are said to be preventable (Sulosaari et al., 2011; WHO, 2016). Medical errors are an important issue for all healthcare professionals (Rodziewicz et al., 2021). Medication errors usually occur from mistakes made by pharmacists, physicians,

and nurses (Abdel-Latif, 2016). It is a worldwide accepted fact that nurses have an important role in medication safety (Khan & Tidman, 2022; Rohde & Domm, 2018). Because nurses devote a large part of their working time to medication administration and medication errors are the first among the medical errors faced by nurses (Cirpi et al., 2009; Karavasiliadou & Athanasakis, 2014). Nurses are responsible for obtaining physician order, preparation-practice of medication, recording the application, monitoring of the medication's effects on the patient, and providing education to the patient about medications. Nurses, who are involved in many stages of the medication administration process, have an important role in reducing and preventing medication errors, as they are at the most critical point where the medication is administered and the error reaches the patient (Potter et al., 2021). For this reason, the competence of nurses in medication safety is of great importance (Gaffney et al., 2016). Therefore, this study was conducted to evaluate the Turkish validity and reliability study of the Medication Safety Competence Scale (MSCS) for nurses developed by Park and Seomun (2020).

Method

Study Design: This research is methodological type.

Participants: The study group of this research consisted of nurses working in tertiary care hospitals of a province between May 2021 and September 2021. In scale adaptation studies, it is recommended that the number of subjects to be sampled should be approximately 5-10 times the number of items in the scale, for reliability and to ensure the accuracy of factor analysis (DeVellis, 2017; Alpar, 2018). Considering this recommendation for the sample size of the validity and reliability study, it was planned to reach at least 180 nurses. The study was completed with 369 nurses.

Data Collection Tools: Introductory characteristics questionnaire and MSCS for nurses were used to collect research data.

Introductory Characteristics Questionnaire: It consists of questions including gender, age, professional experience and educational status of the participants.

Medication Safety Competence Scale for Nurses: The validity and reliability of the scale developed by Park and Seomun (2020) was made with nurses. The scale, which is a five-point Likert type, consists of a total of 6 factors and 36 items: "patient-centered medication management", "improvement of safety problems", "management of effecting factors", "safety risk management", "multidisciplinary collaboration" and "responsibility in the nursing profession". It was stated that the Cronbach's α value of the scale was 0.96 and the Cronbach's α value of each factor ranged between 0.77 and 0.91.

Validity and Reliability Procedures of the Scale: The process of determining the validity and reliability of the scale was carried out in five stages: language validity, content validity, pilot study, applying forms and psychometric analysis.

Language Validity: Firstly, written permission was obtained via e-mail from JinKyung Park and GyeongAe Seomun for scale. The translation-back translation procedures was used for language validity in adapting the scale from its original language to Turkish. The translation from English to Turkish was made by three experts, and the resulting Turkish form was evaluated by the researchers. After this stage, the Turkish scale was translated back into English by three different experts. The items in the original scale and the back-translated scale were compared by the researchers. It was determined that the translation of the scale did not differ significantly from the original scale.

Content Validity: For this purpose, expert opinions of 9 academicians who are experts in their fields and 4 clinical nurses with at least 10 years of clinical experience were taken. Both Turkish and English versions of the scale were sent to the experts. Experts evaluated each item by scoring between 1-4. Content Validity Index (CVI) was calculated with the scores obtained from the experts (Davis, 1992). An item-based CVI (I-CVI) was evaluated for each item in the scale. This calculation was obtained by dividing the number of experts who gave 3 and 4 points to the items in the expert opinion by the total number of experts. The CVI of the scale (S-CVI) was calculated by taking the average of the I-CVI for all items in the scale. A CVI of more than 0.80 was interpreted as an indicator of high content validity (Davis, 1992).

Pilot Study: A pilot study was recommended to evaluate the intelligibility of the scale items (Capik et al., 2018; WHO, 2017). A pilot study was conducted with 20 nurses who matched the sample characteristics. As a result of the pilot study, the participants stated that the scale items were understandable, and no changes were made in the scale.

Application of Data Collection Tools: The forms were applied between May and September 2021 via an electronic questionnaire where, first of all, the participants were informed and then they were asked to fill in the questionnaire form. It has been stated that these collected data will only be read by the researchers, and the hospital management or other persons will not be informed about them.

Test-Retest: This step is done to show that the scale can measure without errors and that it is a repeatable scale (Noblea et al., 2019). In the literature, it is stated that it is appropriate to repeat the test between two and four weeks (Secer, 2018). For this purpose, three weeks after the forms were applied, the forms were re-applied to the nurses who wanted to participate in the test-retest phase. Responses were received from 55 nurses.

Psychometric Analysis of the Scale

Construct Validity of the Scale: The Kaiser-Meyer-Olkin (KMO) coefficient was calculated and Bartlett's Test of Sphericity analysis was performed. In order to define the suitability of the data for factor analysis, it was taken into account that the KMO value was 0.70 and above, and the Bartlett's test was $p < 0.05$ (Secer, 2018). Then, Exploratory Factor Analysis (EFA) was carried out in order to reveal the factor structure of the scale. The varimax rotation was used to determine the ideal factor structure in EFA. While determining the number of factors in the scale, the rule that both the eigenvalue should be above 1 and the explained variance value should be above 5% was followed (Secer, 2018). At the same time, it was taken into account that the factor load of each item in the scale should be 0.30 and above (Secer, 2018). Confirmatory Factor Analysis (CFA) was conducted to test the suitability of the factor structure obtained after EFA with the model. In order to examine the model fit of the structure obtained by CFA, certain fit indices such as Chi-Square Goodness, Root Means Square Error of Approximation (RMSEA),

Non-Normed Fit Index (NNFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), Goodness Fit Index (GFI) ve Comparative Fit Index (CFI) were examined.

Reliability of the Scale: Cronbach's α , split-half reliability, t-test and Intraclass Correlation Coefficient (ICC) were used. The internal consistency reliability of the scale was evaluated by calculating the Cronbach's α coefficients and dimensions of the scale. The split-half reliability was calculated. Three weeks later, the scale was used to determine its stability among 55 nurses. Test-retest correlation analysis was made to determine the consistency and stability of the scale across. ICC was calculated to determine intra- and interrater reliability of the scale.

Data Analysis: Data were analyzed with IBM SPSS Statistics 22 and Lisrel 8.71 programs. EFA and then CFA were performed for construct validity analyzes of the scale. The suitability of the data for factor analysis was examined with the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's Test of Sphericity. In the reliability analysis, both internal and external reliability were tested. The Cronbach's α reliability method was used for the internal reliability analysis, and the Cronbach's α coefficient was calculated for the factors and the whole scale. For external reliability, the test-retest technique was used. In the analysis of the data obtained from the test-retest, Paired Samples T-Test and Pearson Correlation analysis were used in dependent groups.

Ethical Consideration: Permission to use the scale was obtained from the authors who developed the original scale in order to conduct a Turkish validity and reliability study. Ethical approval was obtained from the University Clinical Research Ethics Committee (148/2021) and permission from the hospital where the data were collected. In addition, the purpose of the study was explained to the nurses participating in the study, and information was given about the study and their consent was obtained.

Results

Descriptive Statistics

A 84.0% of the nurses were female, 91.9% had a undergraduate education and 29.8% had a professional experience of 6-10 years. The

mean age of the participants was 34.3 ± 6.83 (Table 1).

Validity Analysis

Thirteen experts were consulted to evaluate the content validity of the scale. Expert opinions were evaluated using the Davis technique and the CVI of each item was calculated. According to the scoring results between 1 and 4 points made by each expert for each item of the scale; it was determined that the I-CVI varied between 0.84 and 1.00, and the S-CVI was 0.98. Then, EFA and CFA were used to test the construct validity of the scale. In the KMO coefficient calculation and Bartlett's Test of Sphericity analysis to determine the suitability of the sample for factor analysis; The KMO validity coefficient was found to be 0.918 and the sample size was found to be suitable for factor analysis ($\chi^2=14638.648$; $df=630$; $p<0.001$). According to the result of EFA with Varimax rotation; EFA revealed six factors explained 77.5% of the total variance in MSCS-Turkish version: 18.93% for "patient-centered medication management", 18.82% for "improvement of safety problems", 13.08% for "management of effecting factors", 11.64% for "safety risk management", 9.17% for "multidisciplinary collaboration", and 5.85% for "responsibility in the nursing profession". When the factor loads of the scale are examined; the first factor loading values are between 0.661 and 0.864, the second factor loading values are between

0.900 and 0.929, the third factor loading values are between 0.666 and 0.823, the fourth factor loading values are between 0.490 and 0.863, the fifth factor loading values are between 0.691 and 0.738, and the sixth factor loading values are between 0.531 and 0.839 (Table 2).

Based on the results of EFA on 36-item MSCS-Turkish version, CFA was performed to provide an appropriate model fit ($\chi^2/df=3.31$; $RMSEA=0.079$; $CFI=0.97$; $GFI=0.91$; $AGFI=0.94$; $NFI=0.96$; $NNFI=0.97$, $IFI=0.95$) (Table 3).

Reliability analysis

In the test-retest analysis performed to determine the external reliability of the scale, it was determined that the mean score of the scale and subscales of the participants did not change statistically significantly over time ($p>0.05$). The ICC for the total scale was 0.981 between the initial test and the retest ($p<0.001$) (Table 4).

The Cronbach's α coefficient was calculated to define the internal consistency. The Cronbach's α coefficient for the whole scale was 0.953. The Cronbach's α coefficients of the subscales of the scale were 0.941, 0.972, 0.922, 0.926, 0.940 and 0.856, respectively. The split-half reliability was 0.709 (Table 5). The scores of each item were positively correlated with the total score ($r = 0.434$ to 0.722 , $p < 0.001$), this showed that each item was moderately correlated with the scale.

Table 1. Demographic characteristics of participants

Characteristics	
Age (Mean \pm SD)	34.3 \pm 6.83
	n(%)
Gender	
Female	310 (84.0)
Male	59 (16.0)
Education level	
Associate degree	4(1.1)
Undergraduate education	339(91.9)
Postgraduate education	26(7.0)

Professional experience (year)

<1 year	14(3.8)
1-5 year	80(21.7)
6-10 year	110(29.8)
11-15 year	87(23.6)
16-20 year	29(7.9)
21 year and above	49(13.3)

Table 2. Factor loadings of exploratory factor analysis for the Medication Safety Competence Scale

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1	.781					
2	.778					
3	.864					
4	.741					
5	.736					
6	.834					
7	.666					
8	.748					
9	.661					
10		.900				
11		.917				
12		.918				
13		.929				
14		.929				
15		.909				
16		.900				
17		.910				
18			.804			
19			.759			
20			.791			
21			.823			
22			.751			
23			.666			
24				.787		
25				.836		
26				.863		
27				.858		
28				.490		
29				.575		
30					.738	
31					.735	
32					.721	
33					.691	
34						.823
35						.839
36						.531
Eigenvalue	6.185	6.775	4.712	4.191	3.303	2.107
Variance explained (%)	18.930	18.821	13.089	11.642	9.175	5.853

Cumulative variance explained (%)	18.930	37.751	50.840	62.481	71.656	77.510
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Table 3. The Fit Indices Turkish version of the Medication Safety Competence Scale in the Confirmatory Factor Analysis

	χ^2 / df	RMSEA	CFI	GFI	AGFI	NFI	NNFI	IFI
MSCS	3.31	0.079	0.97	0.91	0.94	0.96	0.97	0.95

MSCS= Medication Safety Competence Scale ; χ^2 / df =Chi-squared/degrees of Freedom; RMSEA= Root Mean Square Error of Approximation; CFI= Comparative Fit Index; GFI= Goodness of Fit Index; AGFI= Adjusted Goodness of Fit Index; NFI= Normed Fit Index; NNFI= Non-Normed Fit Index; IFI= Incremental Fit Index

Table 4. Test-Retest Analysis Results of the Medication Safety Competence Scale

Subscales and scales	Test	Re-test	Intra-Class Correlation Coefficient Analysis			
			Mean(SD)	Mean(SD)	t	p
Patient-Centered Medication Management	40.0(4.46)	40.1(4.53)	-0.683	0.497	.976	<0.001
Improvement of Safety Problems	33.8(4.37)	33.9(4.34)	-0.876	0.385	.950	<0.001
Management of Effecting Factors	25.7(3.05)	25.7(3.19)	-0.574	0.568	.976	<0.001
Safety Risk Management	24.5(4.24)	24.6(4.26)	-0.814	0.419	.988	<0.001
Multidisciplinary Collaboration	17.1(2.11)	17.1(2.22)	-0.504	0.617	.933	<0.001
Responsibility in the Nursing Profession	12.6(1.67)	12.6(1.65)	-0.685	0.496	.937	<0.001
Medication Safety Competence Scale	153.9(17.22)	154.4 (17.51)	-1.075	0.287	.981	<0.001

Table 5. Reliability analysis for Turkish version of the Medication Safety Competence Scale

The scale and its dimension	Score (SD)	Cronbach's Alpha	Split-half
Medication Safety Competence Scale	152.4(14.25)	0.953	0.709
Patient-Centered Medication Management	40.6(4.02)	0.941	
Improvement of Safety Problems	29.5(5.05)	0.972	
Management of Effecting Factors	26.8(3.07)	0.922	
Safety Risk Management	25.4(3.64)	0.926	
Multidisciplinary Collaboration	17.2(2.27)	0.940	
Responsibility in the Nursing Profession	12.6(1.98)	0.856	

Discussion

This study was carried out to adapt the MSCS for nurses into Turkish and to identify its validity and reliability. The validity and reliability analyzes of the scale were discussed in parallel with the findings.

The first step of adapting a scale to another society is to translate the scale into the target language. At this stage, the translation-back translation method was used and experts other than researchers were used. Language validity was completed when the text obtained from the back-translation of the scale into English showed high similarity with the original scale and the participants found the scale items understandable in the pilot study and did not suggest any changes.

Content validity is the degree to which the components of a measurement tool are relevant to the targeted construct for a certain assessment purpose. The minimum value of CVI is accepted as 0.80 (Yusoff, 2019). In this study, I-CVI was found to range between 0.84 and 1.00, and S-CVI was 0.98. The CVI of the scale was at a good level, no items were removed. It was determined that the scale provided a high level of content validity, the language was understandable and the content was appropriate.

In this study, EFA was performed to evaluate the compatibility of the original scale with the scale adapted into Turkish before performing CFA. In order to determine the suitability of the sample for factor analysis, it is recommended that the KMO value be 0.70 and above, and the Barlett's test should be $p < 0.05$ (Secer, 2018). In this study, the KMO validity coefficient was found to be 0.918 and the Barlett's test result as $p < 0.001$ ($\chi^2=14638.648$; $df=630$; $p=0.001$). According to this result, it was determined that the sample size was suitable for factor analysis.

In order to determine the factorial structure of the scale in EFA, the percentage of variance explained, the number of eigenvalues greater than 1, and the scree plot were examined (Secer, 2018; DeVellis, 2017). The fact that the explained variance exceeds 50% of the total variance is an important criterion of factor analysis (Yaslioglu, 2017). In this study, six factors of the scale explained 77.5% of the total variance (Table 2). In the original

version of the scale, the six-factor structure explained 63.205% of the total variance (Park & Seomun, 2020), and in the Chinese adaptation study of the scale, it was seen that 71.485% of the total variance was explained (Yang et al., 2021). In this study, when the load values related to the six factors of the scale are examined; load values were determined to vary between 0.490 and 0.929 (Table 2). Findings from the EFA results reveal that the scale is a valid measurement tool with a six-factor structure.

Fit indices, which give information about whether the model and theory are compatible or not, were calculated with CFA. According to CFA, the χ^2/df value was found to be 3.31 (Table 3). According to the literature, this value being less than 5 is an acceptable value (Erkorkmaz et al., 2013; Karagoz, 2018). The RMSEA was found to be 0.079. $RMSEA \leq 0.08$ indicates that the fit is at an acceptable level (Xia & Yang, 2018). The fit indices were calculated as CFI=0.97, NFI=0.96 and GFI=0.91 (Table 3). The fact that these values are above 0.90 indicates that the scale has an acceptable fit (Skinner, 2018). The fit indices obtained from the CFA results show that the Turkish version of the scale can validly measure the construct it aims to measure.

Test-retest method was used to identify the reliability of the study and internal consistency reliability coefficients were calculated. In order to test the reliability of the scale, the scales were reapplied to 55 nurses at 3-week intervals. In current study, it was concluded that there was no significant difference between the two test scores, indicating that the measurements are repeatable ($t = -1.075$, $p = 0.287$). In addition, ICCs were calculated for each subscale and for the total scale. The ICC was calculated as 0.981 ($p < 0.001$) (Table 4). ICC values were commented according to guidelines from Fleiss et al. (2003) (below 0.40 = poor, 0.40 to 0.59 = fair, 0.69 to 0.74 = good, and 0.75 to 1.00 = excellent). According to this calculation, there is an acceptable relationship between the two measurement, that is, the scale gives similar results in both measurements. According to the test-retest analysis results, it was determined that the scale is a very reliable measurement tool.

Chronbach's α coefficient was used to calculate the internal consistency of the scale. The Cronbach α coefficient is a measure of the internal consistency of the scale items and is an indicator of whether the scale items form a whole (Raykov & Marcoulides, 2019). Cronbach's α value was found to be 0.96 in the original form of the scale, Yang et al. (2021), in the Chinese validity and reliability study, Cronbach's α was found to be 0.94. In this study, the Cronbach's α value of the scale was found to be 0.953 (Table 5). If the Cronbach's α value of a measurement tool is between 0.60 and 0.79, the measurement tool is considered relatively reliable, while if it is between 0.80 and 1, it is considered highly reliable (Bujang et al., 2018). Accordingly, the Turkish version of the MSCS is considered to be highly reliable in terms of internal consistency.

Conclusion: It has been determined that the MSCS for nurses, developed by Park and Seomun (2020), is a valid and reliable measurement tool for Turkish culture. It is recommended that the scale be used in studies to evaluate the competencies of nurses for medication safety.

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