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RESEARCH ARTICLE

Translation and Validation of the Persian Version of the Nurses Clinical Reasoning Scale (NCRS): A Psychometric Analysis

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Abstract:

Purpose:

Nurses need strong clinical reasoning competency because they provide specialized and important care to patients. It is hence necessary to measure nurses' clinical reasoning by using a valid and reliable tool.

Objective:

This study aimed to translate and determine the psychometric test of Persian version of the nurses clinical reasoning scale.

Methodology:

This study was a cross-sectional study. In the first step of this methodological study, the English version of Nurses Clinical Reasoning Scale (NCRS) was translated and back-translated. Then the content validity index (CVI) of the items was assessed based on expert views, and its face validity was examined by studying the views of the target group and experts. In the next step, 170 nurses working in hospitals affiliated with Tabriz University of Medical Sciences were asked to complete the instrument. Finally, the construct validity and reliability of this scale were measured using exploratory factor analysis (EFA) and internal consistency (Cronbach's alpha), respectively.

Results:

The findings showed that the CVI values of all the items were greater than .8. The wording of some items was changed based on the suggestions received regarding face validity, whereas the results of content and face validity did not necessitate the elimination of any of the items. The EFA results also suggested that the Persian version of the NCRS had a two-factor structure with the titles of nursing diagnosis and care knowledge. The Cronbach's alpha for this scale was 0.91, which confirmed its internal consistency.

Conclusion:

This instrument is valid and reliable enough to assess Iranian nurses' clinical reasoning in the dimensions of nursing diagnosis and care knowledge. The research limitations and further recommendations will be discussed later in this paper.

Keywords: Psychometrics, Clinical reasoning, Nurses, Scale, Nursing diagnosis, Care knowledge.

1. INTRODUCTION

Clinical reasoning is a multifaceted and complex process that begins as soon as the health professionals meet the patients [1], during which they identify the signs and symptoms, process the information, gain a correct understanding of the patients' problems, plan and implement interventions, evaluate outcomes, and reflect on the workflow and learn [2, 3]. Clinical reasoning in nursing includes examining the patients, collecting and reviewing key information, relating the pieces of information to each other, interpreting the information, distinguishing between relevant and irrelevant information, matching, predicting and combining the pieces of information for making a diagnosis, identifying the difficulties or problems, setting goals, planning and selecting the methodology, implementing interventions, evaluating outcomes, and utilizing the results of the evaluation [4].

Evidence suggests that clinical reasoning is a vital

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competency for improving patient outcomes and increasing the effectiveness of nursing practice [5]. Nurses with poor clinical reasoning are less likely to succeed in understanding the patients, diagnosing their conditions, and saving their lives [6]. Leoni-Scheiber *et al.* argued that enhancing nurses' clinical reasoning can improve their job performance [7]. There is an important relationship between clinical reasoning competency and patient outcomes. Nevertheless, nurses' competency in clinical reasoning is rarely evaluated in nursing schools and even less in clinical settings [8].

To the best of our knowledge, there are a limited number of tools for measuring nurses' clinical reasoning, most of which are not valid and reliable or have been developed for physicians. For example, Carrière *et al.* employed it for measuring the clinical reasoning of the medical staff working in pediatric emergency departments [9]. Although that tool was specialized for physicians, it was also used by Dawson *et al.* to evaluate the clinical reasoning competency of nursing students [10]. It seems that these scales could be suitable in the medical field. In a recent review article, it was found that most of the included articles reported on the Script Concordance Test or Lasater Clinical Judgement Rubric to measure clinical reasoning [11].

Various tools were used to evaluate clinical reasoning and related constructs in placements and simulation in health professional education, but many of these evaluation tools were described as rubrics, examinations, and objective structured clinical examinations (OSCEs), and the authors did not clearly define the construct being assessed as one of critical thinking, clinical judgment, clinical decision making, or clinical reasoning [11]. There may be semantic differences between these concepts, however, if they are developed based on the clinical reasoning model, they can be considered clinical reasoning scales.

Liou *et al.* developed the Nurses Clinical Reasoning Scale (NCRS) and evaluated its psychometric properties [12]. Its items were (i) based on a specific model of clinical reasoning, and (ii) noted by the original authors to be "perceived" clinical reasoning competencies. In this model, clinical reasoning was described as 'a logical process by which nurses collect cues, process the information, come to an understanding of a patient problem or situation, plan and implement interventions, evaluate outcomes and reflect on and learn from the process' [12]. The NCRS was psychometrically tested in Chinese and translated into English. The results of this psychometric study supported the validity and reliability of the developed scale. Construct validity of the NCRS was based on factor analysis where the emerged one factor explained 50.7% of the variance of clinical reasoning competence. The Cronbach's alpha for the NCRS was good ($\alpha = 0.90$), and the test-retest reliability was evidenced by high intraclass correlation (ICC = 0.87). It was translated and validated by Jung and Han [13] for use in a Korean context and was also used to measure nursing students' clinical reasoning ability by Hong *et al*. [14]. It seems that, this scale has good reliability in other cultures, for example, in Korea, Italy and Dutch [13, 15, 16]. Due to the described properties, the NCRS seemed well-suited to assess clinical reasoning in Iranian clinical nurses [12]. This study aimed to translate and determine the psychometric test of the Persian version of the nurses clinical reasoning scale.

2. METHODOLOGY

2.1. Nurses Clinical Reasoning Scale

The Nurses Clinical Reasoning Scale (NCRS) was developed and validated for nurses by Liou *et al*. in a study in Taiwan [12]. Initially, a 24-item pool was generated and subsequently reduced to 15 items after being reviewed by experts. The items are scored on a 5-point Likert scale [Never: 1, rarely: 2, sometimes: 3, often: 4, always: 5). The total score on this scale ranges between 15 and 75, and higher scores indicate higher levels of clinical reasoning [12].

2.2. Translation- Back-translation

When permission to use and modify the tool was obtained, the original NCRS was first translated from English to Farsi by two translators fluent in both languages. The two translated versions were then merged into a single one. In the next step, the translated version was back-translated to English by a translator fluent in both languages, which was not involved in the translation of the original version to Farsi. Finally, the back-translated version was reviewed by all translators in the previous steps and the research team. Since the translated version highly matched the original NCRS, the Farsi version of this tool was approved.

2.3. Content Validity

According to the theoretical framework for scale validation, based on Polit & Yang [17], the Content Validity Index (CVI) was used to examine the relevance of the items. The views of 15 experts in nursing and instrumentation, selected purposefully, were used in calculating the CVI [18]. The experts evaluated the "relevance" of each item using a 4-point Likert scale (from 1: not very relevant to 4: very relevant). Item-CVI (I-CVI) was calculated based on the number of experts giving a score of 3 or 4 to each item divided by the total number of experts. An I-CVI$\geq$0.78 indicated good content validity [17]. In addition, the mean CVI for the whole scale was calculated by dividing the sum of all I-CVIs by the number of items.

2.4. Face Validity

To examine the face validity of the instrument, 10 nurses and 15 faculty members (8 of them were participated in determining CVI), were purposefully selected, and asked to review the scale and express their opinions about the wording, simplicity and comprehensibility of the items. They were also asked to express their views and suggestions about improving each item and concerning the face validity of each one.

2.5. Exploratory Factor Analysis

The subscales of the instrument in the setting were studied using Exploratory Factor Analysis (EFA). To identify the important factors, EFA was employed in IBM-SPSS 21 using the Principal Axis factoring (PAF) extraction method and considering eigenvalues greater than 1. These factors were

identified using the rotation method of Oblimin with Kaiser Normalization. The strongest positive loading for each item determined the related factor [17].

2.6. Reliability (Internal Consistency)

Cronbach alpha coefficients of the items were calculated to determine the internal consistency (reliability) of the tool. A coefficient above 0.8 indicates a good richness in the levels of the structure [19].

2.7. Sociodemographic Characteristics

The demographic variables of the samples were also measured. Variables that seemed related or confounding, such as participation in related courses, were also added to the demographic questionnaire. Independent t-test, analysis of variance and Pearson correlation were used to examine the relationship between clinical reasoning and individual and social variables.

2.8. Participants and Study Settings

This study was conducted in the East Azerbaijan Province of Iran, where there are 10 hospitals affiliated with the Tabriz University of Medical Sciences. The study settings were the emergency departments of the hospitals in which 290 nurses worked during the sampling. Ten participants per item were needed to do EFA. We considered a 20% attrition rate; therefore, the questionnaires were distributed to 180 eligible nurses. The respondents were selected based on cluster random sampling. After calculating the ratio of the number of qualified nurses in each hospital to the total sample size, random numbers were extracted from Randomizer-11 to represent the number of nurses on the hospital list. Then the paper form of the instrument was distributed among the nurses working in the morning, evening, and night shifts to be completed. Questionnaires were delivered at the beginning and received at the end of the shift.

2.9. Ethical Considerations

This research project was conducted after obtaining permission from the NCRS developers for translation and psychometric evaluation, the Regional Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.

1400.607), and the officials of the hospitals. The respondents were required to fill out an informed consent form before completing the instrument. They were also provided with an email address to send their possible suggestions regarding the tool to the authors.

3. RESULTS

A total of 170 nurses completed the NCRS (response rate: 94.44%). The data showed that the mean and standard deviation of age and work experience of the respondents were 34.54 ± 6.97 and 9.91 ± 6.41 years, respectively. The demographic information of the respondents is presented in Table **1**. The mean and standard deviation of nurses clinical reasoning score was 60.91 ± 7.079 (Range: 34 to 75, CI 95%, 59.84 to 61.98).

3.1. Content and Face Validity

The mean CVI value for the overall scale was excellent (CVI>0.92), and the I-CVI values were also higher than .8. The respondents' suggestions regarding face validity led to making changes in the wording of some items, whereas the results of content and face validity did not necessitate the elimination of any item.

3.2. EFA

The EFA was performed to assess the construct validity of the tool. The value obtained for the Kaiser-Meyer-Olkin (KMO) test was 0.90, which indicated the adequacy of the sample size for this analysis. The results of Bartlett's test (p-value<0.0001) also showed the data structure was appropriate, and there was a considerable correlation between them for EFA. The results indicated that two factors with eigenvalues greater than 1 predicted 52.65% of the total variance. The results of this test, along with the factor loadings, are presented in Table **2**.

The first factor was mainly about data collection to diagnose (*e.g.*, Item 2: I can apply proper examination and assessment skills to collect information related to the patients' current condition) and nursing diagnosis explanation (*e.g.*, Item 5: I can recognize early signs and symptoms of a possible worsening of the patients' health status). Therefore, this factor is called "*nursing diagnosis*".

Table 1. Demographic information of respondents (N=170).

Variable	Description	Frequency	Percentage
Gender	Female	96	56.5
	Male	74	43.5
Marital status	Married	118	69.4
	Single	51	30
	Divorced, widowed	1	0.6
Employment status	Permanent	96	56.5
	Fixed-term	36	21.2
	Corporation	24	14.1
	Contractual	14	8.2
Educational attainment	Bachelor's degree	158	92.9
	Master's degree	12	7.1

(Table 1) contd.....

Variable	Description	Frequency	Percentage
Work shift	Morning (fixed)	9	5.3
	Rotating	161	94.7
Have you ever taken a class or course on creativity or patenting?	Yes	15	8.8
	No	155	91.2
Have you ever taken a class or course on critical thinking or clinical reasoning?	Yes	34	20
	No	136	80

Table 2. EFA results along with factor loading.

Data	Factor	
	1	**2**
I can explain the mechanism and development associated with the early signs or symptoms when a patient's health deteriorates.	**.732**	-.029
I can identify a patient's health problems from the abnormal information collected.	**.699**	-.057
I can accurately prioritize and manage any identifiable patient problems.	**.676**	.074
I can apply proper assessment skills to collect a patient's current health information.	**.671**	-.046
I can recognize possible early signs or symptoms when a patient's health deteriorates.	**.652**	.074
I can correctly explain the mechanism behind a patient's problems.	**.636**	.088
I can identify abnormalities from the collected patient information.	**.614**	-.001
I know how to collect an admitted patient's health information quickly.	**.539**	.028
I can anticipate the prescription ordered by the doctor according to the patient information provided.	-.123	**.738**
I am knowledgeable of each nursing intervention provided.	.105	**.679**
I can identify and communicate vital information clearly to the doctors based on the patient's current condition.	.037	**.671**
I can accurately evaluate and identify whether a patient's condition is improved.	.026	**.570**
I can set nursing goals properly for the identified patient problems.	.380	**.446**
I can provide appropriate nursing intervention for the identified patient problems.	.388	**.402**
I know the follow-up steps to take if the patient's condition does not improve.	.177	**.401**

The second factor mainly focused on nursing interventions (*e.g.*, Item 10: I can select the appropriate nursing intervention for the identified patient problems of the patients) and nursing knowledge (*e.g.*, Item 11: I have sufficient knowledge of the nursing care that I provide). This factor is hence called "*care knowledge*".

3.3. Reliability (Cronbach's Alpha):

Cronbach's alpha for the overall instrument was 0.9, which was an acceptable value for internal consistency. Cronbach alpha coefficients for the first and second sub-scales were 0.88 and 0.87, respectively.

3.4. Sociodemographic characteristics:

According to the findings, only Participation in clinical reasoning courses had a positive and significant statistical relationship with the clinical reasoning score (Table **3**).

4. DISCUSSION

This study aimed to translate and determine the psychometric test of the Persian version of the nurses' clinical reasoning scale. The results showed that the CVI of this tool was acceptable, and no significant change was made in face validity.

The results of the KMO test and Bartlett's test indicated the adequacy of the sample size for this analysis. Based on EFA results, there were two factors with eigenvalues greater than 1 that predicted 52.65% of the total variance.

The first factor, *nursing diagnosis*, was mainly about data collection to diagnose and nursing diagnosis Nurses with poor clinical reasoning competency often cannot diagnose the worsening conditions of a patient; this may result in making wrong decisions and, thereby, inefficient patient care and increases patients' suffering [20]. The second factor, care *knowledge*, was mainly focused on nursing interventions and nursing knowledge. Regarding the promotion of patient safety when performing routine nursing interventions, nurses need to acquire clinical knowledge, skills, and expertise through clinical reasoning. In fact, clinical reasoning can correctly guide nurses to achieve optimistic outcomes and prevent unpleasant injuries to patients [7].

Table 3. The relationship between clinical reasoning and sociodemographic variables.

Parameter		N	Mean	Std. Deviation	f/t	P value
Gender	Female	74	60.71	7.162	.106	.746
	Male	96	21.77	6.38		

(Table) contd.....

Parameter		N	Mean	Std. Deviation	f/t	P value
Marital status	Married	51	59.62	5.96		
	Single	118	61.57	7.4	2.75	.099
	Divorced, widowed	1	49	0		
Employment status	Permanent	96	61.5	7.49		
	Fixed-term	36	61.02	6.51	1.15	.328
	Corporation	24	58.5	6.31		
	Contractual	14	60.78	6.58		
Educational attainment	Bachelor's degree	158	60.97	7.14	.145	.704
	Master's degree	12	60.16	6.35		
Work shift	Morning (fixed)	9	65.11	6.71	3.38	.068
	Rotating	161	60.68	7.04		
Have you ever taken a class or course on creativity or patenting?	Yes	15	62.86	5.95	1.24	.265
	No	155	60.72	7.16		
Have you ever taken a class or course on critical thinking or clinical reasoning?	Yes	34	63.29	7.69	4.89	.028
	No	136	60.32	6.81		

These two factors extracted from the instrument (*nursing diagnosis* and *care knowledge*) can largely represent the nursing process. Leoni-Scheiber *et al.* stated that clinical reasoning is a method for achieving an advanced nursing process [7]. Bruylands *et al.* and Müller-Staub *et al.* also believe that a high level of clinical reasoning can effectively help nurses to improve nursing evaluation, diagnosis, and interventions [21, 22].

However, Guerrero *et al.* believed that clinical reasoning manifests itself through the nursing process [20]. The nursing process involves assessment, diagnosis, planning, implementation and evaluation, which form the basis of clinical reasoning. Clinical reasoning is practically an organizing framework that underpins all models of care and hence must be the center of attention [23]. Considering that both clinical reasoning and the nursing process may be rooted in problem-solving [24], it is possible to point out the connection of clinical reasoning with the nursing process and problem-solving. Problem-solving is one of the main uses of critical thinking, and critical thinking is the main tool for problem-solving [25]. On the other hand, Clinical reasoning is based on the principles of the nursing process, problem-solving, and the scientific method, and requires opinion and decision-making based on evidence [24].

The EFA reported on one factor in the study of Liou *et al.* They discussed although the clinical reasoning model used to construct the NCRS presents an eight-step circular diagram, the distinction between the stages is not clearly defined, providing a one-dimensional conceptual model of clinical reasoning [12].

In our research, Cronbach's alpha for the overall instrument was 0.9, which was an acceptable value for internal consistency. Italian, Dutch and Korean versions have also reported good reliability [13 - 15]. Italian version has been reported as reliable, both showing a good internal consistency (Cronbach's Alpha = 0.90], and good stability (ICC = 0.90; CI = 0.87-0.92) [16], in the Dutch version, Cronbach's alpha was 0.94 [15], and in Korean version, Cronbach's Alpha was 0.93 [13].

Given the fact that this is the first study testing these psychometric properties of a translated version of the NCRS, we are not able to compare our results to equal studies in Iran. Considering more than a one-factor model may be meaningful in future studies for this population to improve model fit. In the liou study, one factor was revealed in the factor analysis [12], but in the Dutch version, CFA, did not provide the hypothesized one-factor structure too. In the Dutch version, EFA showed a two-factor structure, and this result is similar to our study results [15].

5. RESEARCH LIMITATIONS

The findings of the current study should be interpreted with caution as a result of the following limitations. First, this study was conducted on all nurses working in emergency departments of hospitals affiliated with Tabriz University of Medical Sciences. Therefore, the findings should be cautiously generalized to other populations like students and other departments. Second, the Scale is a self-report measure; hence the results of the current study might be due to self-assessment bias. In addition, the design of the study to investigate the items present in the NCRS without explicitly investigating extended content validity is a limitation, as is the necessity of not investigating further evidence of reliability (*e.g.*, test-retest) or validity (*e.g.*, against known outcomes or at least between known groups).

CONCLUSION

This study aimed to determine the psychometric properties of a model-based tool for assessing nurses' clinical reasoning from the perspective of nurses working in Iranian public hospitals. The results showed that the NCRS was a valid and reliable instrument that could be applied to future surveys on the clinical reasoning of Iranian nurses. The Iranian version is a short and easily administrable questionnaire with good overall psychometric properties. Therefore, the scale could be a useful tool for Iranian nurses.

APPLICATION IN THE NURSING PROFESSION

The findings of this study provide a suitable tool for nurses, officials and researchers so that by accurately

measuring the clinical reasoning of nurses, they can take appropriate measures to improve the conditions, or they can measure the effect of interventions related with clinical reasoning. Also, future researchers can use advanced methods to test psychometric of the instruments by removing the limitations of the study. We thank all nurses for their sincere cooperation despite demanding workloads.

AUTHORS' CONTRIBUTIONS

Study design: EA

Data collection: AS

Data analysis: PS

Study supervision: FJ

Manuscript writing: EA, AS, FJ

LIST OF ABBREVIATIONS

NCRS	=	Nurses Clinical Reasoning Scale
CVI	=	Content Validity Index
EFA	=	Exploratory Factor Analysis
OSCEs	=	Objective Structured Clinical Examinations

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research project was conducted after obtaining permission from the NCRS developers for translation and psychometric evaluation, the Regional Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1400.607), and the officials of the hospitals.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committees and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available on request from the corresponding author [E.A].

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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