The European Research Journal 2025;11(2):234-243 Original Article

DOI: https://doi.org/10.18621/eurj.1613952 *Nursing and Emergency Medicine*

# Japanese disaster nursing readiness evaluation index: Turkish adaptation validity and reliability study

**Hatice Azizoğlu[1], Evin Korkmaz[2], Dilay Hacıdursunoğlu Erbaş[3], Betül İlbey Koç[4], Fatma Eti Aslan[2]**

*[1]Department of Nursing, Van Yüzüncü Yıl University, Faculty of Health Sciences, Van, Türkiye; [2]Department of Nursing, Bahçeşehir University, Faculty of Health Sciences, İstanbul, Türkiye; [3]Department of Nursing, Sakarya University of Applied Sciences, Faculty of Health Sciences, Sakarya, Türkiye; [4]Department of Nursing, Bahçeşehir University, Institute of Health Sciences, İstanbul, Türkiye*

## ABSTRACT

**Objectives:** Disaster is a global problem all over the world, and it is essential to measure the readiness of nurses, who play a major role in disaster response, with a valid and reliable tool. This study was conducted to adapt the Japanese Disaster Nursing Readiness Evaluation Index into Turkish and to analyze its validity and reliability.

**Methods:** A total of 202 nurses were reached in this methodological study. The reliability parameters of the scale were examined with Cronbach Alpha and split-half. In addition, Confirmatory Factor Analysis was performed for the construct validity of the scale and 27% sub-item analysis was performed for item discrimination.

**Result:** According to Confirmatory Factor Analysis, the structural equation model, indicating its associated with 31 items and the six-factor structure of the scale. The factor loading values of all items were between 0.450 and 0.920. The alpha values obtained from the subscsles of the scala ranged between 0.771 and 0.883, and the overall alpha value was calculated as 0.905.

**Conclusions:** Based on the findings of the study, it was concluded that the Japanese Disaster Nursing Preparedness Assessment Index is valid and reliable for the Turkish society.

**Keywords:** Disaster management, disaster nursing, Japanese disaster nursing readiness evaluation index, self-assessment scale, Turkey

Natural disasters are natural phenomena that disrupt the normal life order in a society [1]. As a country, we witness many devastating effects of earthquakes, a natural disaster we frequently experience. Most recently, on February 6, 2023, two devastating earthquakes occurred on the Eastern Anatolian Fault in Turkey, nine hours apart. The first earthquake had a magnitude of 7.7 at 04:17, and the second, at 13:24 local time, had a magnitude of 7.6. The earthquakes severely affected a total of 11 provinces in the country, including Hatay, Kahramanmaraş, Adıyaman, Malatya, Gaziantep, Elazığ, Osmaniye, Şanlıurfa, Diyarbakır, Kilis, and Adana, leading to damage and destruction in these provinces. According to official records, 50 thousand 96 people died in these earthquakes as of 02.04.2023. Unfortunately, earthquakes

**Corresponding author:** Hatice Azizoğlu, PhD., Assist. Prof., Phone: +90 432 225 11 80, E-mail: haticeazizoglu@yyu.edu.tr

**How to cite this article:** Azizoğlu H, Korkmaz E, Hacıdursunoğlu Erbaş D, İlbey Koç B, Eti Aslan F. Japanese disaster nursing readiness evaluation index: Turkish adaptation validity and reliability study. Eur Res J. 2025;11(2):234-243. doi: 10.18621/eurj.1613952

**Received:** January 5, 2025
**Accepted:** January 23, 2025
**Published Online:** February 11, 2025

affect many areas and adversely impact human life and health [2]. Besides causing high mortality rates due to the traumas they induce, earthquakes also lead to situations requiring emergency intervention [3]. In the face of such situations, it is crucial for the first healthcare professionals arriving at the scene to be effective and competent in disaster situation assessment, communication, management, and intervention [3, 4]. As healthcare professionals, nurses play a critical role in providing access to health services for the affected population, treating traumas and wounds, and managing cases, including protocols, medications, and materials [1, 4].

During the response phase of a disaster, nurses have clinical nursing roles that include general and advanced practices, including triage, perioperative care, emergency and critical care, infection control, public health, supportive and palliative care [4, 5]. Their experience in disaster response significantly influences their perception of disaster preparedness [6]. Nurses must be ready for disaster when assigned to a disaster area [7, 8, 9].

Due to the earthquakes we experience in our country, nurses' preparedness for disasters plays a crucial role in disaster management. The Japanese Disaster Nursing Readiness Evaluation Index (JDNREI), developed by Maeda *et al*. in Japan in 2018, is an important measurement tool to determine whether nurses are ready for disaster situations [10]. The aim of this study was to adapt the JDNREI to the Turkish population and to assess its Turkish validity and reliability through the nurses who participated in our study.

## METHODS

### Purpose

This research was conducted to adapt JDNREI, developed by Maeda and colleagues in Japan in 2018, to Turkish to determine nurses' readiness for disaster situations and perform validity and reliability analyses.

### Study Population and Sample

The study population consisted of nurses working at an education and research hospital in Istanbul during the dates when the research was conducted. This methodological research was carried out between October and December 2023. The literature suggests that a sample size of five to ten times the number of items on a scale should be sufficient [11]. We planned to use a sample of between 185 and 370 health professionals, 5 to 10 times the number of items in the 37-item scale. The study included 202 nurses who met the specified criteria.

### Data Collection Tools and Data Collection

The research data were collected through face-to-face interviews using data collection forms. Data was collected between October and December 2023. The Nurse Introduction Form and JDNREI, prepared by the research team in accordance with the literature, were used for data collection.

#### *Nurse Introduction Form*

This form includes six questions related to participants' gender, age, working unit, years of experience in the profession, experience in disasters, and assignment to disaster-stricken areas.

#### *Japanese Disaster Nursing Readiness Evaluation Index*

This scale consists of 37 items with six subthemes that assess nurses' self-evaluations regarding their readiness and preparedness to provide medical care in disaster areas. The sub-themes include (I) emergency nursing skills, (II) practical skills in disaster response, (III) communication skills in teamwork, (IV) effective coping with daily stress, (V) collaboration skills, and (VI) adaptation to stressful situations in disaster areas. The scale is designed for self-assessment and preparedness measurement by nurses assigned to disaster areas. Additionally, nurse managers can use this scale to select nurses for disaster response, and it can contribute to preparedness practices before sending nurses to disaster areas. Individual disaster preparedness should be evaluated using the overall score of the JDNREI, not each subscale. As the total score on the scale increases, nurses' disaster preparedness increases.

### Linguistic Equivalence

During the scale adaptation, linguistic equivalence studies were conducted initially, followed by item analyses for structural validity and reliability. To en-

sure linguistic equivalence of the scale, JDNREI was first translated from Japanese to Turkish. The created form was translated back into Japanese. Finally, the items in the Japanese-translated form and the original scale items were reviewed by seven experts for grammar, semantics, and vocabulary. A consensus was reached on the similarity of both forms, and the final version of the scale was established. After the translation process was completed, the application phase was initiated to determine the linguistic equivalence statistically. During the pilot application phase, 29 nurses working in a public hospital were interviewed. In the analysis, the Cronbach's Alpha value for the overall scale was calculated as 0.893, while the alpha value for its subscales was calculated between 0.738-0.896. A Cronbach's Alpha value greater than 0.60 indicates that the scale is reliable [12]. Upon examination of the results, it was seen that the internal consistency of the measurement tool and its subscales used in the study was as desired. Following the pilot application, the main data collection process was initiated without the need to eliminate any item from JDNREI. The pilot application group was not included in the sample.

## Ethical Aspect of Research

Written approvals were obtained from Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Scientific Research Ethics Committee in İstanbul (Ethics No/Date: 43/08.03.2023) and Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Chief Physician in İstanbul to conduct the study. After stating that participation in the study is voluntary, written consent was obtained from the participants. The research was carried out in accordance with the Principles of the Declaration of Helsinki. Necessary permission was obtained from the scale owner.

## Statistical Analysis

The data obtained in the study were analyzed

**Table 1. Demographic characteristics of participants**

| | | n | % |
|---|---|---|---|
| **Gender** | Female | 112 | 55.4 |
| | Male | 90 | 44.6 |
| **Age (years) (mean±SD)(min-max) 34.31±6.02 (22.0-50.0)** | 30 years and under | 63 | 31.2 |
| | 31-40 years | 103 | 51.0 |
| | 41 years and above | 36 | 17.8 |
| **Worked unit** | Intensive care units | 49 | 24.6 |
| | Inpatient treatment settings | 96 | 47.1 |
| | Outpatient treatment settings | 57 | 28.3 |
| **Years of work experience** | 5 years and below | 35 | 17.3 |
| | 6-10 years | 54 | 26.7 |
| | 11-15 years | 58 | 28.8 |
| | 16 years and above | 55 | 27.2 |
| **Previous disaster experience** | Yes | 144 | 71.3 |
| | No | 58 | 28.7 |
| **Number of disaster assignments** | None | 88 | 43.6 |
| | 1 assignment | 55 | 27.1 |
| | 2 assignments | 29 | 14.4 |
| | 3 or more assignments | 30 | 14.9 |

SD=standard deviation

using SPSS (Statistical Package for Social Sciences) for Windows 25 and AMOS 21 software. Descriptive statistical methods (number, percentage, mean, standard deviation) were used when evaluating the data. Reliability parameters of the scale were examined by Cronbach Alpha, split-half. Additionally, Confirmatory Factor Analysis was performed for the scale's construct validity, and 27% sub-item analysis was performed for item discrimination.

## RESULTS

### *Findings Regarding Participants' Individual Characteristics*

The participants' ages ranged from 22 to 50 years, and the average age was calculated as 34.31±6.02 years. Among the participants, 55.4% were female, 28.7% had 11-15 years of work experience, 71.3% had experienced a disaster before, and 43.6% had not previously served in a disaster (Table 1).

### *Findings on the Japanese Disaster Nursing Readiness Evaluation Index*

When the lowest and highest scores obtained from the scale items, as well as the mean scores and standard deviations of the items, were examined, it was seen that the lowest score was one and the highest score was five, with no reverse items in the scale sections. JDNREI has 37 items in total. The internal consistency of the adapted scale was examined using the Cronbach Alpha method. When JNDREI item score distributions are analyzed, it is seen that item 24 received the lowest score (2.59±1.58), while item 16 received the highest score (4.81±0.59). Upon evaluating the relevant results, it was observed that all items could be included in the factor analysis of the adapted scale. Since removing an item from the measurement tool does not cause a significant increase in alpha value, it was decided not to exclude any items, and the analysis proceeded to the confirmatory factor analysis stage.

### *Construct Validity*

According to the first-level multifactor confirmatory factor analysis results, the scale's goodness of fit indices showed an acceptable fit (RMSEA = 0.061) (Table 2). According to confirmatory factor analysis, the structural equation model result of the scale is showing that it is related to the scale structure with 31 items and 6 factors (Figs. 1 and 2).

### *Item Discrimination*

The item-total test correlation values were analyzed, and there were no items below 0.30. Although the item-total test correlation values of all the items varied between 0.439 and 0.828, all the items were related to each other. To determine the discriminability of the items in each scale, the rankings of the items in the scale were ordered from highest to lowest, and the mean scores of the groups in the bottom 27% and the top 27% were compared using an independent group t-test. The comparison showed a statistically signifi-

**Table 2. Findings regarding confirmatory factor analysis of the JDNREI**

| Index | Excellent fit criteria | Acceptable fit criteria | Before modification | After modification |
|---|---|---|---|---|
| $X^2$/SD | $0 \leq \chi^2/df \leq 3$ | $3 \leq \chi^2/df \leq 5$ | 1.960 | 1.739 |
| RMSEA | 0.00≤ RMSEA ≤0.05 | 0.05≤ RMSEA ≤ 0.08 | 0.069 | 0.061 |
| CFI | 0.95≤CFI | 0.85≤CFI | 0.881 | 0.910 |
| GFI | 0.90≤GFI | 0.85≤GFI | 0.789 | 0.814 |
| AGFI | 0.90≤AGFI | 0.85≤AGFI | 0.755 | 0.781 |
| IFI | 0.90≤ IFI ≤1.00 | 0.80≤ IFI | 0.882 | 0.911 |
| TLI | 0.90≤TLI | 0.80≤TLI | 0.870 | 0.900 |
| NFI | 0.90≤NFI | 0.80≤NFI | 0.786 | 0.812 |

SD=Standard Deviation, RMSEA=Root Mean Square Error of Approximation, CFI=Comparative Fit Index, GFI=Goodness-of-Fit Index, AGFI=Adjusted Goodness-of-Fit Index, IFI=Incremental FitIndex, TLI=Tucker-Lewis Index, NFI=Normed Fit Index

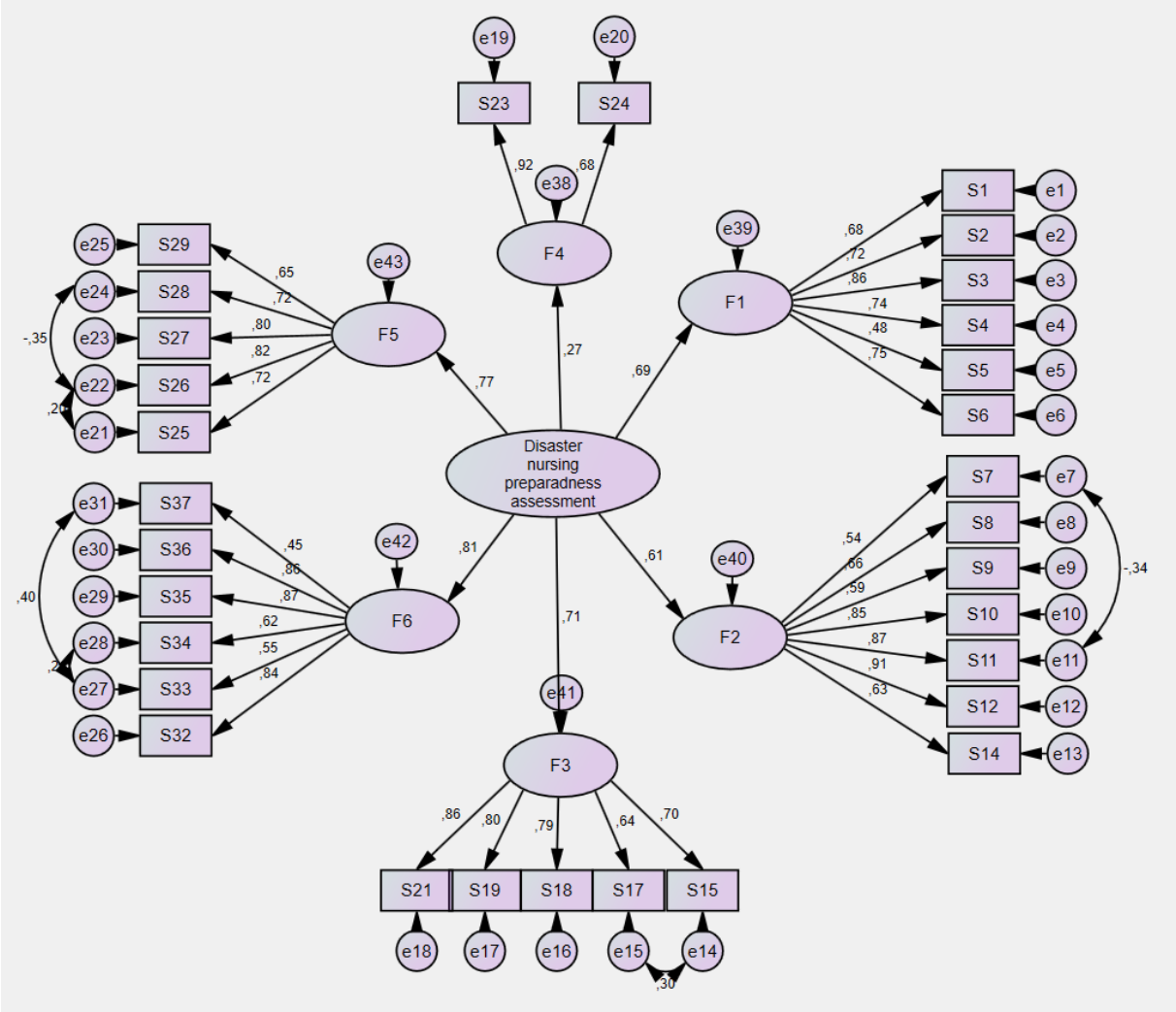


**Fig. 1. Level one multifactor model confirmatory factor analysis of the Japanese Disaster Nursing Readiness Evaluation Index (standardised).**

cant difference between the mean item scores of the lower and upper groups.

### *Reliability*

Upon examination of the results, the overall alpha value of JDNREI was calculated as 0.905. The alpha values obtained from the subscales of the scale range between 0.771 and 0.883 (Table 3). According to the results, the correlation coefficient between the two halves was calculated as 0.899; the Spearman-Brown coefficient was 0.947, and the Guttman coefficient was 0.946. Based on these findings, the tool was deemed reliable (Table 4).

Scale bias was analyzed using the Hotelling T2 analysis method. Individuals answered the items according to their own opinions when answering the items of the scale, and there was no response bias in the scales (P<0.001).

## DISCUSSION

As a result of this study, the findings showing whether the JDNREI is valid and reliable in the Turkish population are discussed in this section in the light of the literature.

JDNREI was first translated from Japanese to Turkish to ensure the linguistic equivalence of the scale. The created form was translated back into Japanese. Finally, the items in the form translated into

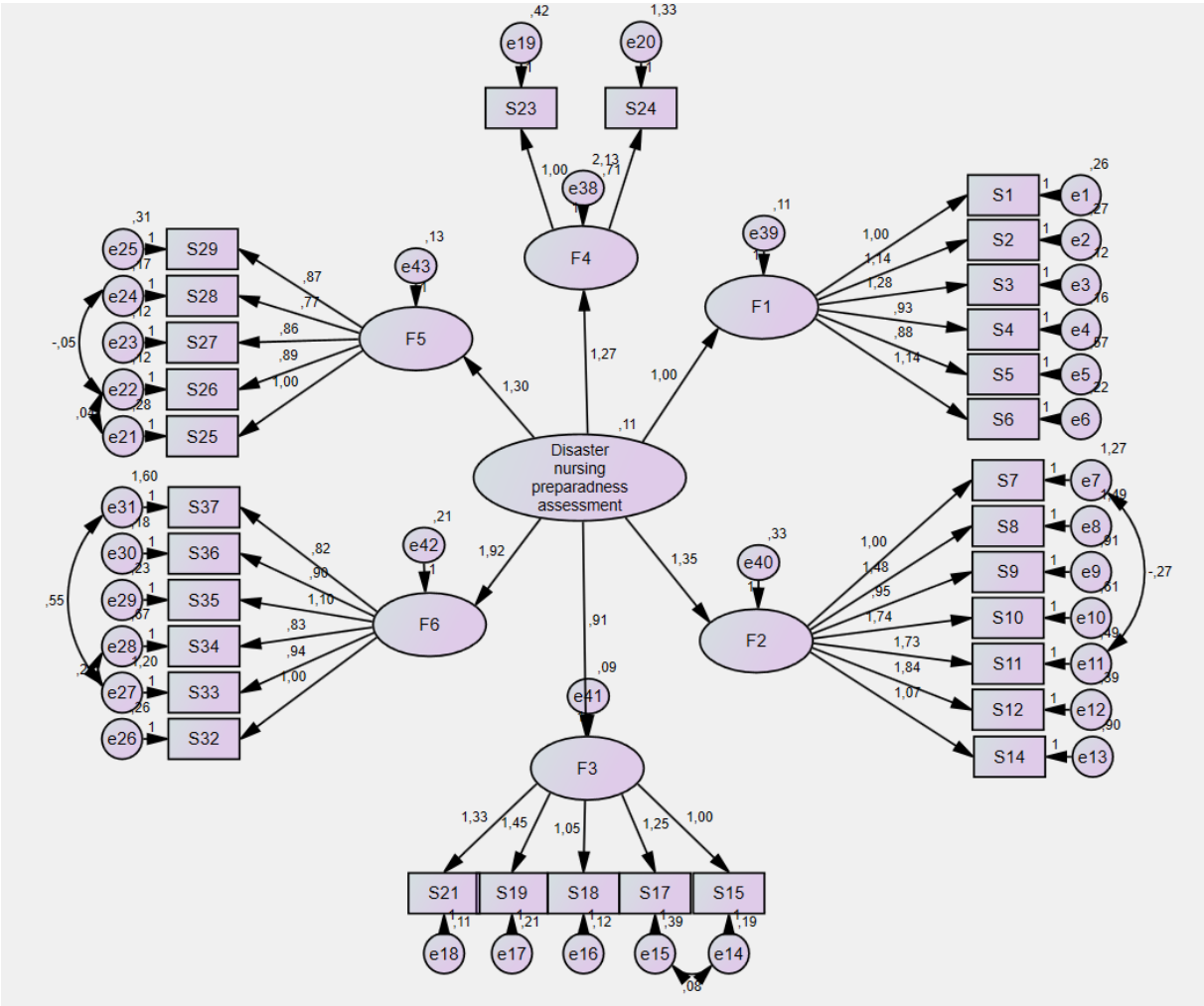


**Fig. 2. Level one multifactor model confirmatory factor analysis of the Japanese Disaster Nursing Readiness Evaluation Index (non-standardised).**

Japanese and the original scale items were presented to expert opinion (seven people) to evaluate scope, content, and language suitability. A consensus was obtained from experts that both forms were similar to each other, and the final version of the scale was achieved. In the literature, conducting a pilot application to a small group representing the sample is recommended after the expert opinion assessment of the scale [13, 14]. Thus, a pilot study was carried out with 29 nurses to ensure the understandability of the draft scale items. After the pilot application, it was determined that there were no expressions that were not understood. The internal consistencies of the measurement tool and its subscales used in the study were found to be good. According to the literature, the high Cronbach alpha coefficient emphasizes that the scale's reliability is high. If this value is between 0.60 and 0.80, the scale is reliable, and if it is between 0.80 and 1.00, it indicates that the scale has high reliability [12]. The alpha value for the responses of the 29 individuals obtained in the pilot application was calculated as 0.893 for the overall scale, while the alpha value for its subscales was calculated between 0.738 and 0.896. It was concluded that the scale was highly reliable, and the main study was started. In Gheshlagh's study adapting the scale into Farsi, a pilot study was conducted with five nurses, and the nurses read the questionnaire aloud and identified ambiguous and unclear statements. They ended the pilot study by making suggestions to improve each item and proceeded to the main study [15]. The pilot study sample of this study is larger than the pilot study sample in the study

**Table 3. Reliability analysis for JDNREI**

| Scale and subscales | Cronbach Alfa |
|---|---|
| **Factor 1** | 0.845 |
| **Factor 2** | 0.883 |
| **Factor 3** | 0.872 |
| **Factor 4** | 0.771 |
| **Factor 5** | 0.852 |
| **Factor 6** | 0.850 |
| **Disaster Nursing Readiness Evaluation Index** | 0.905 |

JDNREI= Japanese Disaster Nursing Readiness Evaluation Index

in which the scale was translated into Farsi. A larger sample provides more robust and reliable results in both validity and reliability analyses. The results of the pilot study in this study made the validity and reliability of the scale stronger than the Farsi study before proceeding to the main study. In calculating the required sample size for scale development studies, 5-10 times the number of people in the scale's total number of items should be reached [14, 16]. The minimum number of people to be reached in the study was calculated as 185, and the study was completed with 202 nurses. Whether the scale had internal consistency was examined using the Cronbach Alpha method. All items of the adapted scale were included in the factor analysis. In a Farsi study [15] of the scale with 200 nurses, five items were removed due to demographic differences between Iranian and Japanese nurses and differences in the perception of problems, while no items were removed in this study. Sample size is one of the factors affecting this situation, but the sample sizes of the two studies are very close to each other. This difference, which is not due to sample size, can be attributed to cultural and linguistic differences as well as professional working experience and conditions.

**Table 4. Split-half method**

| | | |
|---|---|---|
| **Cronbach's Alpha** | Section 1 | 0.803 |
| | Section 2 | 0.832 |
| Correlation between the two halves | | 0.899 |
| Spearman-Brown coefficient | | 0.947 |
| Guttman Split-Half coefficient | | 0.946 |

According to the literature, construct validity determines which concepts and features the scale measures and how accurately it measures [16, 13]. Following confirmatory factor analysis, whether the theoretical structure of the relevant model is sufficient to explain is tested. According to Confirmatory Factor analysis, the Structural Equation Modelling Results of the scale were p=0.000 level and were related to the 31 items and six-factor scale structure that make up the scale. Covariance was created between errors of the same factor in the model. RMSEA, a fit criterion, is a measure that means the square root of the approximate averages with values between zero and one. For RMSEA, below 0.05 indicates a good fit, below 0.08 is a reasonable fit, and between 0.08-0.10 is considered a moderate fit indicator [17]. In the confirmatory factor analysis, items that disrupted model fit were excluded (items 13, 16, 20, 22, 30, 31). According to the first level multifactor confirmatory factor analysis results, when the goodness of fit indices of the relevant scale is examined, RMSEA showed acceptable fit with 0.061, and $\chi^2$ (Cmin/df) showed excellent fit with 1.739, indicating that the structural validity of the scale was established. In Maeda's study, root mean square error (RMSEA)=0.058 [10]. In Gheshlagh's study, items 16, 17, 27, and 29 were excluded, and RMSEA=0.051 [15]. Similar studies have shown reasonable agreement in parallel with the results of this study. In both studies translated into Turkish and Persian, it was observed that the items that disrupted the agreement belonged to the sub-theme of "Collaboration skills". Rapid decision-making, efficient use of resources and coordination skills of emergency medical teams are vital for large numbers of seriously injured and critically ill patients during a disaster [18]. Since it is more important to catch up with the urgency of the work rather than the work done in cooperation during a disaster, it is thought that the skills for cooperation showed poor agreement in both studies.

The minimum value required for the item-total test correlation to be sufficient is stated as 0.30 [19]. Among the scale items whose item correlations we examined, items below 0.30 should not be included in the analysis. By examining the item-total test correlation values of the participants' answers to the scale questions, it was determined that there were no items below 0.30. Since each subscale was evaluated sepa-

rately, when the subscale-based item total correlation values were examined, the correlation coefficients of the items were found to be between 0.439 and 0.828 and were significant. In Maeda's study, correlation coefficients were found between 0.376 and 0.699 and no item was below 0.30, which is parallel to the results of this study [10]. This shows that the scale items adapted into Turkish are compatible and consistent with the scale and have high internal reliability. However, unlike the original study of the scale and this study, in Gheshlagh's study, items 17 and 27 were removed due to low intra-item correlation [15]. It is seen that the removed items are related to humor and error acceptance. In fact, it is known that these situations, which vary depending on personal differences even in a normal process, are difficult to apply and accept during a disaster. It is thought that the place of work and years spent in the profession, especially cross-cultural work and experiences, affect these parameters.

Reliability analysis is carried out to test whether the statements in the scales are consistent among themselves. Cronbach's Alpha (α) coefficients between 0-1 indicate that the scale is not reliable. A value between 0.40 and 0.60 indicates low reliability, between 0.60 and 0.80 moderate reliability, and between 0.80 and 1.00 high reliability [12]. The analysis results showed an alpha value of 0.905 for the overall scale and between 0.771-0.883 for the subscales. In Maeda's study, the alpha value for the whole scale was calculated as 0.93, and the alpha value for the subscales was calculated between 0.83-0.93 [10]. In the Farsi study [15] of the scale, the alpha value was calculated as 0.93 for the whole scale, while the alpha value of the subscales was calculated between 0.83 and 0.93. All three studies demonstrate high reliability in the scale total score. This study concluded that Factor 4 was moderately reliable, in contrast to the original study and the Farsi translation of the scale. In Factor 4, stress was associated with family and financial situations. This result can be attributed to the different family structure and challenging processes of economics in Turkish society.

The split-half method is a reliability assessment technique used when a test can be divided into two halves to obtain a score. The method relies on the assumption that if the measurement tool is reliable, the scores obtained from both halves of the sample should be similar. The method can be performed as odd-even or in random order [20]. The correlation between the two halves indicates whether the measurement tool is reliable. A correlation coefficient above 0.70, that is, close to one, indicates that the tool is reliable [21]. In the present research, the items were divided into two with odd and even order numbers. According to the results, the correlation coefficient between the two halves was 0.899, the Spearman-Brown coefficient was 0.947, and the Guttman coefficient was 0.946, concluding that the instrument is reliable. In the studies on the JNDREI, the split-half method was not found, but in Maeda's study, it was reported that significant, moderately strong correlations were obtained in the scale by looking at Spearman correlation coefficients [10]. The results of the main study and this study are parallel to each other, and it can be concluded that both scales are sufficiently reliable.

The response bias of the scale was analysed using the Hotelling $T^2$ analysis method. The homogeneity of responses for each item is considered in assessing response bias. In other words, it is determined whether the question averages are equal to each other. The Hotelling's T-test helps assess whether participants perceive the questions in the scale in the same way and also measures the difficulty level of each question [17]. In the present study, the participants answered the items according to their own opinions, and there was no response bias in the scales (Hotelling $T^2$ = 572.363; $P<0.001$). In the literature, bias analysis with Hotelling $T^2$ was not found in the studies of JNDREI. However, in the Farsi study, it is reported that the questionnaire was distributed to nurses online to reduce social desirability bias, and the questionnaire was shared with the nurse managers in the hospital [15]. The analyses conducted determined that JDNREI is a sufficiently valid and reliable instrument for the Turkish population.

## Limitations

The research is limited to the information of 202 nurses working in a training and research hospital in Istanbul in 2023 and the data obtained from the scale items. Limiting the study to only one hospital may limit the overall findings. Studies conducted with nurses working in different regions of Turkey will yield different results. The adaptation of the Japanese Disaster Nursing Preparedness Assessment Index to Turkey requires consideration of cultural and local dif-

ferences. Nurses' attitudes towards disasters, their training, and their awareness of disaster response may vary according to the cultural context. Disaster experiences of nurses, Turkey's general policies on disaster response, and past disaster experiences may affect the applicability of the scale. The workload and working conditions of the nurses during the study (such as stress, intensity, and professional experience) may affect the measurement results.

## CONCLUSION

Disasters can be devastating for every society if no precautions are taken. We hope that with the Turkish validity and reliability of this index for nursing, the necessary practices during disasters can be implemented more safely in Turkish society.

*Ethical Statement*

Written approvals were obtained from Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Scientific Research Ethics Committee in İstanbul (Ethics No/Date: 43/08.03.2023) and Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Chief Physician in İstanbul to conduct the study. After stating that participation in the study is voluntary, written consent was obtained from the participants. The research was carried out in accordance with the Principles of the Declaration of Helsinki.

*Data Availability Statement*

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restriction.

*Authors' Contribution*

Study Conception: HA, EK, DHE, BİK, FEA; Study Design: HA, EK, DHE, BİK, FEA; Supervision: HA, EK, DHE, BİK, FEA; Funding: HA, EK, DHE, BİK; Materials: AY, KO; Data Collection and/or Processing: HA, DHE, BİK; Statistical Analysis and/or Data Interpretation: HA, EK, DHE, BİK; Literature Review: HA, EK, DHE, BİK; Manuscript Preparation: HA, DHE; and Critical Review: FEA, EK.

*Conflict of interest*

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

*Financing*

The authors disclosed that they did not receive any grant during conduction or writing of this study.

*Acknowledgement*

Necessary permission was obtained from the scale owner (Takayo Maeda, PhD, RN Postdoctoral Researcher Division of Global Health, Department of Public Health, Kobe University Graduate School of Health Sciences) for Japanese disaster nursing readiness evaluation index.

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