Central European Journal of Nursing and Midwifery

Cent Eur J Nurs Midw 2022;13(3):691–698
doi: 10.15452/CEJNM.2022.13.0011

ORIGINAL PAPER

The Turkish version of the Oxford Covid-19 Vaccine Hesitancy Scale

Neziha Karabulut[1], Dilek Gürçayır[1], Yeşim Yaman Aktaş[2], Özlem Abi[3]

[1]*Department of Surgical Nursing, The Nursing Faculty, Atatürk University, Erzurum, Turkey*
[2]*Department of Surgical Nursing, The Health Sciences Faculty, Giresun University, Giresun, Turkey*
[3]*Department of Nursing, The Health Sciences Faculty, Igdır University, Igdır, Turkey*

Received September 21, 2021; Accepted May 9, 2022.

Abstract

Aim: Covid-19 vaccine hesitancy can be an obstacle to the global effort to control the current pandemic. The study aimed to test the validity and reliability of the Turkish version of the Oxford Covid-19 Vaccine Hesitancy Scale. *Design:* A methodological and descriptive study. *Methods:* The research was conducted as a methodological and descriptive study. The sample size consisted of 476 academics who voluntarily agreed to participate in the research and completed the online questionnaire between February and March 2021. *Results:* As a result of the confirmatory factor analysis (CFA), the fit index values obtained by making two modifications of the one-dimensional Oxford Covid-19 Vaccine Hesitancy Scale were found to be χ^2/df = 1.86; AGFI = 0.96; RMSEA = 0.04; GFI = 0.98; CFI = 0.99 and IFI = 0.99. The Cronbach's alpha internal consistency coefficient of the scale was calculated as 0.95. Test-retest reliability coefficient of the scale was r = 0.93 ($p < 0.001$). *Conclusion:* It can be concluded that the Oxford Covid-19 Vaccine Hesitancy Scale, adapted to Turkish, is a valid and reliable measurement tool for determining hesitancy of Turkish society towards covid-19 vaccines.

Keywords: covid-19, covid-19 vaccine hesitancy, vaccine, validity, reliability.

Introduction

Vaccination is an easy, reliable, and effective method of protecting individuals against infectious diseases before they come into contact with them. Vaccines build resistance to infections by using the body's natural defenses, and thus, the immune system becomes strengthened. In this way, with vaccination, our immune system recognizes when it faces a disease and creates antibodies (Plotkin, 2005; World Health Organization [WHO], 2021a). Vaccines work like antigens, but they do not cause disease in the body. They retain the ability to induce an effective immune response, as they are made from pathogens that have been weakened or killed by biological, chemical, or physical means (Etiler, 2018; Ho & Gibaldi, 2013).

Although infectious diseases are among the major causes of death in developing countries in general, the covid-19 pandemic can be considered a global unifier, with countries worldwide all challenged to contain the spread of SARS-CoV-2 (Dror et al., 2020). Up to 20 October 2021, there had been more than 241 million reported infections with SARS-CoV-2 and nearly 4.9 million reported deaths from covid-19 (WHO, 2021b). In May 2020, the 73rd World Health Assembly issued a resolution recognizing the role of extensive immunization as a global public-health goal for preventing, containing, and stopping transmission of SARS-CoV-2 (WHO, 2020). Globally, a total of 6.5 billion vaccine doses have been administered (WHO, 2021a).

Following the development and administration of covid-19 vaccines, vaccine hesitancy is the next challenge in the fight against covid-19 (Dror et al., 2020). Indeed, the reluctance of people to receive safe and recommended available vaccines, known as 'vaccine hesitancy', was already a growing concern before the covid-19 pandemic (MacDonald et al., 2015). The SAGE Working Group on Vaccine Hesitancy concluded that vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place, and vaccines. Several theoretical models are available to examine the psychological underpinnings of vaccine hesitancy (Larson et al., 2014). It is influenced by factors such as complacency, convenience, and confidence (MacDonald et al., 2015). Complacency denotes that

Corresponding author: Neziha Karabulut, Department of Surgical Nursing, The Nursing Faculty, Atatürk University, 25240, Erzurum / Türkiye, Turkey; email: nezihekarabulut@hotmail.com

the risk of the disease is perceived as being low; hence, vaccination is deemed unnecessary.

Confidence refers to trust in the safety and effectiveness of vaccination, and the competence of healthcare systems. Convenience entails the easy availability, affordability, and delivery of vaccines (MacDonald et al., 2015; Sallam, 2021). Additional factors, including heuristic thinking, success of vaccination, the perceived unnaturalness of vaccination, the nature of scientific evidence, the nature of the pharmaceutical or biological materials involved, and loss of public confidence have contributed to modern vaccine hesitancy (Jacobson et al., 2015).

Promoting the uptake of covid-19 vaccines will require understanding whether people are willing to be vaccinated, the reasons why they are willing or unwilling to do so, and the most trusted sources of information in their decision-making (Machingaidze & Wiysonge, 2021). A study by Solís Arce et al. (2021) investigated these questions using a survey. The authors reported that concerns about side effects were the most common reasons for hesitancy, and health workers were the most trusted sources of guidance about vaccines against covid-19. Another study used self-report to assess vaccine hesitancy and acceptance among medical students towards the novel covid-19 vaccine (Lucia et al., 2021).

Covid-19 vaccine hesitancy can be an obstacle to global efforts to control the current pandemic, with its negative health and socio-economic effects (MacDonald et al., 2015). Previous studies have shown that vaccine hesitancy can be determined using a survey (Solís Arce et al., 2021; Kwok et al., 2021; Lucia et al., 2021; Salali & Uysal, 2020). To the best of our knowledge, there is only one scale to assess expressed intent to accept a covid-19 vaccine, developed by Freeman et al. (2021). After reviewing the literature, we found no previous validation study of this instrument. However, this instrument has been used to determine covid-19 vaccine hesitancy among different populations (Fazel et al., 2021; Joshi et al., 2021; Van Duong et al., 2021). In the light of this information, the study was carried out to specify the validity and reliability of a Turkish adaptation of the Oxford Covid-19 Vaccine Hesitation Scale. Information obtained will help identify potential concerns to be addressed in ensuring adequate vaccination uptake among academics and students.

Aim

The study aimed to test the validity and reliability of the Turkish version of the Oxford Covid-19 Vaccine Hesitancy Scale.

Methods

Design

The research was conducted as a methodological and descriptive study to test the validity and reliability of a Turkish version of the Oxford Covid-19 Vaccine Hesitancy Scale.

Sample

Data were collected from academics at a state university in Turkey. The university consists of 22 faculties, with a total of 2,600 academics. The study used data obtained between February and March 2021. The study questions were answered by 476 academics from the following faculties: Faculty of Dentistry, Faculty of Health Sciences, Faculty of Nursing, Faculty of Medicine, Faculty of Pharmacy, Faculty of Veterinary Medicine, Faculty of Science, Faculty of Theology, Faculty of Tourism, Faculty of Education, Faculty of Letters, Faculty of Fine Arts, and Faculty of Economics and Administrative Sciences. The inclusion criteria were as follows: willingness to answer the questions, and employment as an academic at the university. The response rate of the questionnaires was approximately 20%.

Data collection

The data were collected via an online questionnaire form (Google Forms©) between February and March 2021. During this period, a lockdown was in place, as in many countries. Therefore, data could not be collected face to face. The survey was prepared via Google documents and the link address was sent to all academics via SMS and e-mail. Turkish academics willing to participate in this study first signed an online informed consent form before data collection commenced.

The data were collected using an online survey form Google Forms©, including sociodemographic characteristics of the academics (age, sex, marital status, academic title, working years, vaccination status, and opinions on vaccination), and the "Oxford Covid-19 Vaccine Hesitancy Scale".

Oxford Covid-19 Vaccine Hesitancy Scale

The scale was developed by Freeman et al. in 2021 to determine provisional willingness to receive a covid-19 vaccine. The scale uses a five-point Likert system (1 to 5), with a range between 5 and 35. As the scores obtained from the scale increase,

vaccine hesitancy also increases. Item-specific response options were coded from 1 to 5 (Saris et al., 2010). A "Don't know" option was also provided; however, this option was excluded from the scoring in our study. The Cronbach's alpha value of the scale developed by Freeman et al. was found to be 0.97 (Freeman et al., 2021).

Process of cultural adaptation

To ensure the quality of the adapted scale, international norms were performed while carrying out the adaptation. The phases carried out were 1) translation; 2) content validity; and 3) pilot application and psychometric testing (factor analysis, reliability coefficient, and inter-item correlations).

Translation procedures

The Oxford Covid-19 Vaccine Hesitancy Scale was first translated into Turkish. The Turkish version was then translated back into English by three Turkish English language lecturers, who worked independently on the translation, to check for variation between the content and meaning of the original version and the translated instrument. The two translated versions were then compared by the authors and a final Turkish version was agreed upon.

Content validity

After the language adaptation of the scale, content validity was then conducted using expert opinion to evaluate its validity. Content validity is the degree to which an instrument is an appropriate sample of items for the construct being measured and is an important procedure in scale development. The content validity index (CVI) is the most widely used index in quantitative evaluation. Content validity consists of obtaining expert opinion in order to determine whether the items in the measurement tool are suitable for the purpose of the measurement and whether or not they represent the field to be measured (Yurdugül, 2005). For this aim, expert opinion was obtained from five academics. The scale was sent to them by e-mail, and they were informed about the measurements and concepts involved. The experts were asked to evaluate the scale items by scoring them from 1 to 4 (1 = not relevant; 2 = somewhat relevant; 3 = quite relevant; and 4 = very relevant).

Pilot application

The final version of the scale was then piloted on 20 academics who were not in the sample but had similar characteristics to those on whom the measurement was to be performed. In the pilot application, the intelligibility of the scale items was assessed. At the end of the pilot study, every item of the scale was found to be comprehensible and no changes had to be made. The scale took approximately three–four minutes to complete.

Construct validity

The data were analyzed using principal component analysis with varimax rotation, which minimizes the number of variables that have high loadings on each factor, simplifying interpretation of the factors (Brown, 2009). In order to determine whether or not the size of the sample before factor analysis was suitable for factor analysis, Kaiser-Meyer-Olkin (KMO) and Bartlett's tests were performed. The KMO is the criteria for sample sufficiency, and should be at 0.50 or above so that validity analysis can be conducted (Çokluk et al., 2012; Erdogan et al., 2015). KMO test values between 0.50 and 0.60 are poor, values between 0.60 and 0.70 are weak, values between 0.70 and 0.80 are moderate, values between 0.80 and 0.90 are good, and values greater than 0.90 are very good (Şencan, 2005). Bartlett's test gives a chi-square statistical value, and factors may occur if they have a significance value lower than 0.05 (Şencan, 2005). Bartlett's test was carried out to test the correlation between variables.

Internal consistency

Cronbach's α was calculated to determine internal consistency and homogeneity of the scale. Polit and Beck (2004) suggested that internal consistency is a necessary condition for homogeneity of a scale, and Cronbach's α should be 0.70 or higher. Polit and Beck (2004), and Westen and Rosenthal (2005) recommend using inter-item correlation as a criterion for internal consistency.

Data analysis

The study data were analyzed using the Statistical Package for Social Sciences (SPSS, Chicago, IL) for Windows, version 20.0 and AMOS 20. Descriptive statistics (*number, percentile, mean, standard deviation*) were used in the analysis of demographic characteristics of participants. Kaiser-Meyer-Olkin (KMO) and Bartlett's test, explanatory factor analysis (EFA) and confirmatory factor analysis (CFA), correlation analysis, and Cronbach Alpha value analyses were carried out to analyze the construct validity and reliability of the Oxford Covid-19 Vaccine Hesitancy Scale. In the comparisons, the confidence interval was taken as 95%, and a p-value below 0.05 was taken to specify a statistically significant difference.

Results

Demographic data

The study included 476 participants, whose demographic characteristics are shown in Table 1. Among the participants, 58.8% were male, 39.5% were aged between 35 to 44, and 69.7% were married. While 30.3% of the participants had the title of assistant professor, 56.1% had completed at least one year working as an academic, with the range being from 0 to 10 years. Only 7.6% of the participants had received a covid-19 vaccine, and 79.8% stated that they believed vaccination was necessary. Meanwhile, 56.5% of participants stated that they were against the idea of vaccine rejection, 33.2% stated that legal authorities should be notified of any rejection of the vaccination, and 60.9% stated that there should be no penalty for rejection of the vaccination.

Table 1 Demographic characteristics of participants (n = 476)

Items		n (%)
Gender	female	196 (41.2)
	male	280 (58.8)
Age ranges	23–34	162 (34)
	35–44	188 (39.5)
	45–54	86 (18.1)
	55–64	35 (7.4)
	65 and over	5 (1.1)
Marital status	married	332 (69.7)
	single	144 (30.3)
Academic title	research assistant	84 (17.6)
	lecturer	127 (26.7)
	assistant professor	144 (30.3)
	associate professor	60 (12.6)
	professor	61 (12.8)
Years working as an academic	0–10 years	267 (56.1)
	11–20 years	119 (25)
	21–30 years	69 (14.5)
	31–40 years	15 (3.2)
	41–50 years	5 (1.1)
	51–60 years	1 (0.2)
Received covid-19 vaccine	yes	36 (7.6)
	no	440 (92.4)
Is it necessary to get vaccinated?	yes	380 (79.8)
	no	13 (2.7)
	undecided	83 (17.4)
Thoughts about vaccine refusal	i'm against the idea of vaccine rejection	269 (56.5)
	i support the idea of vaccine rejection	119 (25)
	undecided	88 (18.5)
Should vaccine refusal be notified to legally required authorities?	yes	158 (33.2)
	no	191 (40.1)
	undecided	127 (26.7)
Should there be a penalty for anti-vaccination?	yes	89 (18.7)
	no	290 (60.9)
	undecided	97 (20.4)

Validity

Linguistic adaptation of the scale

Language equivalence of the Oxford Covid-19 Vaccine Hesitancy Scale was achieved using the back-translation method. The scale items were translated into Turkish by three English linguists. The Turkish scale, which was created by choosing the most appropriate expressions from the Turkish translations of the scale items, was then re-translated into English by a linguist whose native language is Turkish and who knows both languages and cultures well. After the back-translation, the scale items were reviewed by comparing the original form of the scale to the translated form. After these procedures, the Turkish version of the scale was ready to be submitted for expert opinion.

Content validity of the scale

The Turkish scale was submitted for expert opinion for content validity. The content validity index (CVI) was used to evaluate the expert opinion. The experts

were asked to evaluate the scale items by scoring them from 1 to 4 (1 = not relevant; 2 = somewhat relevant; 3 = quite relevant; and 4 = very relevant). According to Polit and Beck (2006), a CVI of 0.80 or better indicates good content validity (Polit & Beck, 2006). In this study, the CVI was 0.94. The scale, which was finalized after expert opinion, was piloted on 20 participants similar to those selected for inclusion in the study. After the pilot study, no corrections were made to the item expressions.

Construct validity of the scale

Exploratory (EFA) and confirmatory factor analyses (CFA) were used to determine the construct validity of the scale. Table 3 shows the results of EFA. The KMO index (0.94) and Bartlett's test of sphericity ($\chi^2 = 3943.451$; p = 0.000) indicated that the data were suitable for factor analysis (Table 2). According to EFA, the scale had a single factor with an eigen value above one. The total explained variance was 83.12, and the factor loads of the seven-item scale ranged from 0.87 to 0.93 (Table 3). In the study, CFA was conducted using the Amos 20 program.

Table 2 KMO and Bartlett analysis

Tests		
KMO		0.941
Bartlett Sphericity Test	χ^2	3943.451
	df	21
	p-value	0.000*

KMO – Kaiser Myer Olkin Test; Bartlett χ^2 – Bartlett's test; df – degree of freedom; p-value – p < 0.05

Table 3 The factor loadings of the Oxford COVID-19 vaccine hesitancy scale

Items	**Factor loadings**	**Total variance**	**Eigenvalue**
1. Would you take a covid-19 vaccine (approved for use in Turkey) if offered?	0.927		
2. If there is a covid-19 vaccine available:	0.926		
3. I would describe my attitude towards receiving a covid-19 vaccine as:	0.930		
4. If a covid-19 vaccine was available at my local pharmacy, I would:	0.896	83.127	5.819
5. If my family or friends were thinking of getting a covid-19 vaccination, I would:	0.902		
6. I would describe myself as:	0.923		
7. Taking a covid-19 vaccination is:	0.877		

The first model was run and resulted in a weak congruence. Based on modification indices, a path was added between the disturbance terms for items 6 and 7, producing a developed but poorly-fitting model. Next, according to the modification indices, another path of covariance was added between the error terms for items 4 and 6, and a good model fit was obtained. The estimated fit indices included x^2/df, AGFI, RMSEA, GFI, CFI and IFI and the results were as follows: the ratio of chi-square to degrees of freedom (χ^2/df) = 1.86; Adjusted Goodness of Fit Index (AGFI) = 0.96; the Root Mean Square Error of Approximation (RMSEA) = 0.04; Goodness-of-Fit Index (GFI) = 0.98; Comparative Fit Index (CFI) = 0.99 and Incremental Fit Index (IFI) = 0.99 (Figure 1).

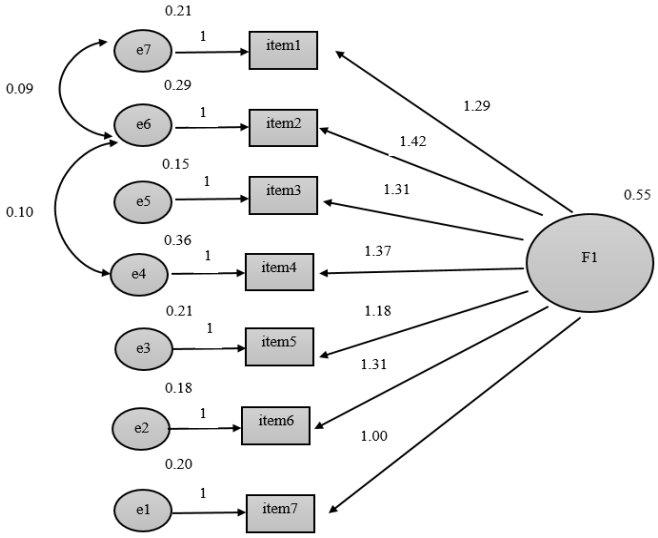

Figure 1 CFA Path diagram of the Oxford Covid-19 Vaccine Hesitancy Scale

Reliability of the scale

The reliability of the scale was analyzed using the item-total correlation, Cronbach's alpha coefficient and retest analysis. The Cronbach's alpha coefficient of the scale was 0.95, and the item-total score correlations ranged from 0.76 to 0.87 (Table 4).

To evaluate the time invariance of the Oxford Covid-19 Vaccine Hesitancy Scale, the scale was administered to 149 academics a second time, two weeks later. The Pearson product-moment correlation was used to analyze the correlation between the pre-test and post-test. This analysis showed that there was a positive and highly significant relationship between the mean test-retest scores ($r = 0.93$; $p < 0.001$). The mean score of the scale was (14.41 ± 6.74), and the item average ranged from 7 (minimum) to 35 (maximum) (Table 5).

Table 4 Cronbach's Alpha, Cronbach's Alpha if item is excluded, item-total correlation

Items	Item-total correlation	Cronbach's Alpha if item is excluded	Cronbach's Alpha
1. Would you take a covid-19 vaccine (approved for use in Turkey) if offered?	0.849	0.937	0.950
2. If there is a covid-19 vaccine available	0.867	0.935	
3. I would describe my attitude towards receiving a covid-19 vaccine as:	0.872	0.936	
4. If a covid-19 vaccine was available at my local pharmacy, I would:	0.762	0.947	
5. If my family or friends were thinking of getting a covid-19 vaccination, I would:	0.822	0.939	
6. I would describe myself as:	0.853	0.936	
7. Taking a covid-19 vaccination is:	0.779	0.943	

Table 5 Mean score, standard deviation, minimum score, maximum score

	mean ± SD	minimum score	maximum score
The Oxford Covid-19 Vaccine Hesitancy Scale	14.41 ± 6.74	7	35

SD – standard deviation

Discussion

In this study, the Oxford Covid-19 Vaccine Hesitancy Scale was adapted to Turkish to evaluate the hesitation of individuals towards the covid-19 vaccine. In this study, the translation-back-translation method was used to ensure the language validity of the scale, and then the scale questions were presented for expert opinion. Content validity analysis was performed (Polit & Beck, 2006) and all items in the scale were revised according to expert recommendations. The lack of difference between the expert opinions (CVI = 0.94) demonstrated the validity of the scope and language (Polit & Beck, 2006).

In exploratory factor analyses, KMO and Bartlett sphericity tests were conducted to show the conformity of the data. In this study, the KMO value was determined to be 0.94, and the Bartlett sphericity test was found to be significant. Based on these results, the data were considered to be appropriate for factor analysis (Akgül, 2005). The variance explained in the factor analysis should be more than 50% of the total variance, and the scale item loadings may be at least 0.30. If possible, the item loadings should be 0.45 and above (Gaskin & Happell, 2014). According to the results of the EFA in this study, it was determined that the scale showed a single factor structure as in the original, and the single factor structure clarified 83.12% of the total variance. The factor loads of the scale items varied between 0.87 and 0.93. In a study by Van Duong et al. (2021) the KMO value of the Oxford Covid-19 Vaccine Hesitancy Scale was found to be 0.85. Bartlett's Test of Sphericity value of the Oxford Covid-19 Vaccine Hesitancy Scale was < 0.001, which determined the suitability of the data for construct validity.

In a CFA, the result of the model should be investigated with fit indices (Albright & Park, 2008). In this study, based on the modification indices, a way of covariance was attached among the error terms to items 6 and 7 and then 4 and 6, and after these modifications, a good model fit was obtained (χ^2/df = 1.86; AGFI = 0.96; RMSEA = 0.04; GFI = 0.98; CFI = 0.99 and IFI = 0.99). There is no standard consensus about the goodness of fit indices that should be reported as a result of CFA. The χ^2, df, χ^2/df, RMSEA, NNFI/TLI, GFI and CFI values were reported in the original scale (Freeman et al., 2021). As a result of the CFA, it can be concluded that this study exhibited a good fit and the fit indices obtained in the study findings were found to be within

acceptable limits (Hu & Bentler, 1998).

The Oxford Covid-19 Vaccine Hesitancy Scale indicated high internal consistency regarding the Cronbach's alpha value. In the same vein, the test-retest reliability of the scale was high for total scores ($r = 0.93$; $p < 0.001$) and high for item scores. It was not necessary to remove any item from the scale since it was determined that it did not significantly affect the Cronbach's alpha value in this study. Cronbach's alpha coefficient is generally considered to be quite reliable in the range of 0.60–0.80 and highly reliable in the range of 0.80–1.00 (Polit & Beck, 2006). Thus, the external reliability of the scale may be considered quite reliable. Our study finding was consistent with a study by Van Duong et al. (2021). The authors found that the Cronbach's alpha value for the Oxford Covid-19 Vaccine Hesitancy Scale was 0.90, reflecting a high level of internal consistency. However, internal consistency was not performed for the original scale (Freeman et al., 2021).

Test-retest refers to the ability of a measurement tool to provide consistent results between repetitive applications and to show invariance over time (Karakoç & Dönmez, 2014). In the test-retest method of the scale, the measurement tool should be applied to the same group for the second time at an appropriate time interval. In line with the literature, the test-retest was completed with 149 academics (over 25%), to ensure sample stability (Seçer, 2015). Measurements obtained from the same participants at different times were found to be highly correlated. The high correlation between both measurements demonstrated that the reliability of the scale was at a high level.

Limitation of study

The data were collected from academics at the university where the researchers were assigned. These results cannot be generalized to other populations. The participation rate (20%) was a limitation of this study.

Conclusion

It can be concluded that the Oxford Covid-19 Vaccine Hesitancy Scale, adapted to Turkish, is a valid and reliable measurement tool for assessing vaccine hesitancy among Turkish academics toward covid-19 vaccines. Academics' attitudes can influence those of university students regarding vaccination, and, thus, help contain the pandemic. Further studies might also be carried out on larger and different populations.

Ethical aspects and conflict of interest

The study was approved by the scientific research and publishing council of ethics at Igdır University (21.01.2021, 2021/3), and written permission was obtained from the director of the institution. All participants were informed of the aims of study and were guaranteed the right to withdraw from the study at any phase. An informed consent form was required from all participants in the study. The anonymity and privacy of participants was assured. In addition, written acknowledgement was acquired from Freeman et al. (2021) to adapt the Oxford Covid-19 Vaccine Hesitation Scale.

Funding

This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Acknowledgement

The authors would like to thank the organization and participants involved in the research.

Author contributions

Concept and design (NK, ÖA), data collection (NK, YYA, DG, ÖA), data analysis and interpretation (NK, YYA, DG), manuscript draft (NK, YYA, DG), critical revision of the manuscript (NK, YYA, DG), final approval of the manuscript (NK, YYA, DG, ÖA).

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