PSYCHOMETRIC PROPERTIES OF DENTAL FEAR SURVEY IN SERBIAN POPULATION

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Summary

Introduction. Between 6 and 15% of the adult population throughout the world faces with the fear of dentists. Fear of dentists directly correlates with the pain experienced during previous visits to the dentist.

Objective. The aim of the study was to assess the validity, reliability and factor structure of the Serbian version of the Dental Fear Survey on a sample of university and high school students.

Method. Two hundred and fifty students and high school students participated in the study and completed the Serbian version of the Dental Fear Survey.

Results. This study's sample showed excellent internal consistency (Cronbach's alpha = 0.98). Descriptive statis-

tics and multinomial logistic regression were calculated; a significance level of $p < 0.05$ was used for all tests. A high fear cut-off point score was determined by calculating the receiver operating characteristic (ROC) curve for the DFS. The ROC curve indicated that a DFS score ≥ 47 corresponds to a sensitivity of 86.1% and a specificity of 88.2%. A large number of participants (n = 102; 40.8%) reported no fear of going to the dentist. The factor analyses resulted in three factors: first represents fear of certain stimulus or situation, second represents anticipatory fear which causes dentist avoidance, and third stands for psychological excitement caused by dental procedures.

Conclusion. DFS satisfies all the criteria of successful validation among Serbian population of university and high-school students. The Serbian version of the DFS will be helpful for the evaluation of fear of dental procedures within this population. DFS is an easily applicable, short and reliable instrument and it can enable physicians to assess fear and anxiety symptoms in a targeted and precise manner.

Keywords:
dental fear, DFS, anxiety, dentistry

INTRODUCTION

Despite recent technological advances, dental treatment is still experienced as painful by most patients [1].

Anxiety and fear before and during dental interventions correlate directly with pain experienced during previous visits to the dentist [2]. A significant number of patients who had a negative encounter during child- hood later developed fear of dentists. According to these findings, fear of dentists stems from emotional imprinting during the critical phase of development [3]. Between 6 and 15% of the adult population worldwide is faced with fear of dentists [4]. Fear of dentists leads to postponement or avoidance of dental treatment, causing additional dental health issues and subsequent increase in pain. Patients visit their dentists only after the pain increases or becomes unbearable, which in turn leads to expansive restorations and high treatment costs [5, 6].

There are many studies that attempt to better understand fear of dental procedures. No matter the instrument used in the assessment of fear of dental procedures, the importance of instrument reliability is always emphasized [7].

OBJECTIVE

The aim of our study was to evaluate the psychometric properties and factor structure of DFS in the Serbian popu-

lation (non-clinical sample of students and high school students).

METHOD

DFS – Dental Fear Survey was designed in Washington in 1973 [8]. DFS has been found to be reliable and valid in samples of college students, general dental patients, and fearful dental patients [9], and has been translated into a number of languages, including Danish, Swedish, Norwegian, Hungarian, Brazilian, Turkish, Chinese and Malay [10–16].

This was an observational, cross-sectional study. The sample consisted of 250 subjects of which 150 were university students and 100 were high school students from Serbia. Mean age of participants was 22.1(±1.6). Participants were selected by inclusion criteria:

1. First and fourth year medical faculty students;
2. First and fourth year grammar school or medical high school students;
3. Signed informed consent by an adult student or by student's parent or custodian.
4. Exclusion criteria were:
5. Participants who did not sign the informed consent;
6. Participants whose parent or custodian did not sign the informed consent;
7. Participants who were diagnosed with psychiatric disorder and were not able to fulfill the survey.

A sample size of 25 faculty students were randomly selected from the first and the fourth year of each faculty program (medicine / pharmacy / dentistry). Students were recruited in the beginning of the summer semester, from the first two practice groups on the day of conducting the survey. At the high school level, a hundred students were selected in total, 50 from two classes from first and fourth grade each. Classes were randomly chosen using the bowl method. if less than 25 children were in a selected class, another class was randomly selected.

The study was conducted after obtaining approval from the Ethics committee for the university students, while the high school students completed their questionnaires after obtaining written consent from the school principal. Participation in the study was voluntary. All adult participants signed the informed consent form, while parents or custodians signed informed consent forms for minors. All participants filled out the questionnaires between classes in high schools, and between lectures on the university.

The first step was translation of DFS from English to Serbian by a bilingual native speaker. The translation was then back- translated, pretested, and revised. There were no major issues during the translation process. Both versions of the survey (the original one in English and the newer, Serbian version) were included in the supplement.

DFS is consisted of 20 questions which assess the quantity of feelings that the subject feels during visits to the dentists in particular situations. Every answer ranges from 'not at all' (score 1) to 'very much' (score 5). The total scores range from a minimum score of 20 to a maximum score of 100, where the higher scores rep- resent higher values of dental fear. Other than DFS, the participants filled out a sociodemographic questionnaire with questions about gender, education, previous experiences with dentists, and frequency of dental visits (Table 1).

The study sample consisted of 250 students aged from 15 to 24, 60 of which were male (24%). Out of those subjects, 100 were first- and fourth-year high school students, and 150 were first- and fourth-year university students (US), 25 students each from medicine, dentistry and pharmacy.

Internal consistency of the sample was assessed using Cronbach's α. For DFS sensitivity, specificity and discriminating capacity, the Receiver Operating Characteristic Curve (ROC) that describes the com- promise between sensitivity and specificity between the values of total DFS scores.

Kaiser-Meyer-Olkin (KMO) was used for assessment of sampling adequacy. Bartlet's sphericity test was used for further factor analysis.

RESULTS

One-hundred participants were first and fourth grade high school students and 150 were first- and fourth-year medicine, dentistry and pharmacy students (25 students each). Sixty students were male and 190 were female. Out of the total number of participants, 85.2% haven't had an unpleasant experience with a dentist. Average number of visits to the dentist per year was 3.6 times (SD = 6.2).

Our sample has shown excellent internal consistency (Cronbach's alpha = 0.98).

ROC curve was used for analysis of optimal cut-off scores. The cut-off point was the one which showed the highest com- promise between specificity and sensitivity. The final question from the DFS scale was used as a binary variable in order to determine the difference between participants who feared dentists and those who did not. Participants who answered the question "How scared are you of dental procedures?" with "not at all" were placed into the "not afraid at all" category. Participants who answered differently to this question (answers "a little bit", "somewhat", "a lot", and "very much") were placed into the "I am afraid" category. The next step was determining the other cut-off point by using a different categorization method. One group was consisted of subjects who answered "not at all", "a little bit", "somewhat", and the other group of those who answered "a lot" and "very much". This

al- lowed us to determine the DFS total scores which separated participants with different levels of fear of dental procedures (Figure 1).

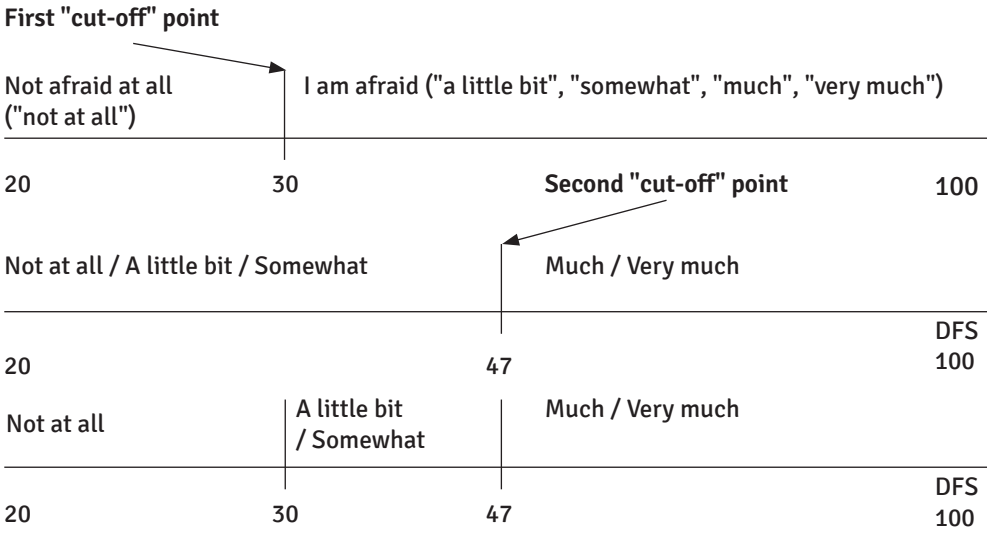


Figure 1. Cut-off points for DFS scale based on ROC characteristics; participants with no fear of dental procedures had a score of DFS < 30, those with average or some fear scored 30 < DFS < 37, while participants with scores of DFS > 47 showed high levels of fear of dental procedures.

The first ROC curve was shown in Figure 2. The surface under the curve (AUC) is 0.904 ($p < 0.001$), and the DFS cut-off point which provided the best compromise between specificity (0.839) and sensitivity (0.822) is 30.5 on the DFS scale.

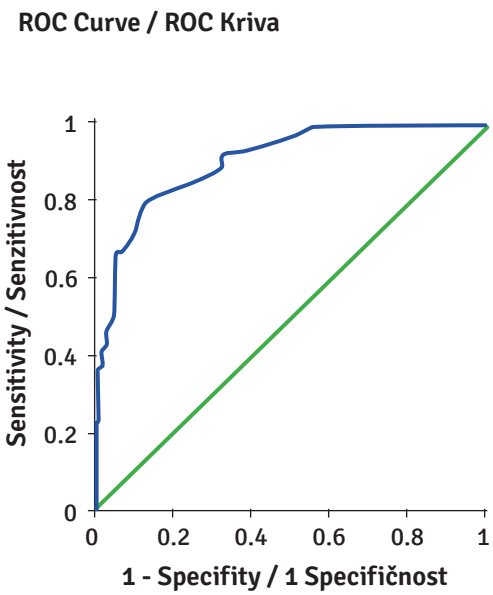


Figure 2. First ROC curve where the chosen cut-off point was DFS score of 30.5

The ROC curve used for the second point of interest (Figure 3) has an AUC of 0.968 ($p < 0.001$) and the cut-off point with the best result was 47.5 DFS with a specificity of 0.861 and sensitivity of 0.882.

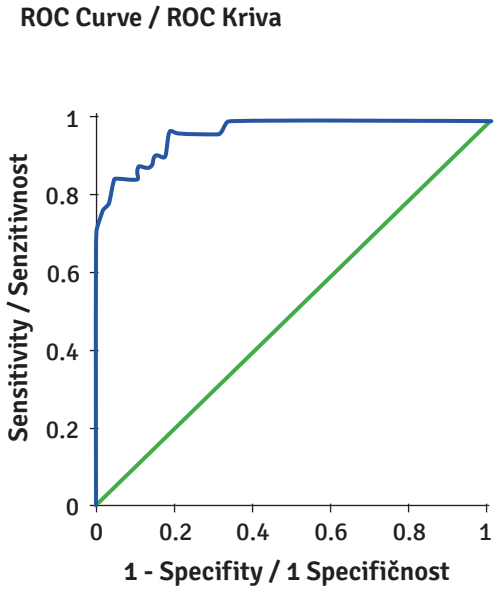


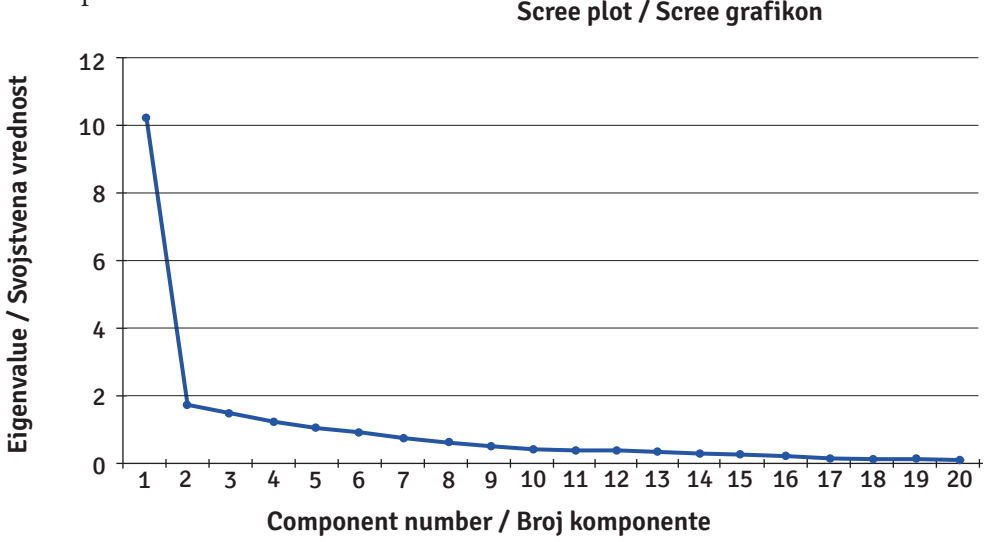
Figure 3.
Second ROC curve where the chosen cut-off point was DFS score of 47.5

Table 4 contains the values of Kaiser-Meyer-Olkin (KMO) for sampling adequacy and Bartlet's sphericity test. The value of KMO was 0.928, which is in line with the desired values — as close to 1 as possible and above the recommended values, thus allowing factor analysis to separate clear and reliable factors. The value of Bartlet's sphericity test showed high significance ($p < 0.001$), which allows for factor analysis to be conducted.

Exploratory factor analysis found three separate factors (three main categories of questions), and after orthogonal rotation, their variances were: 22.82%, 22.33% and 21.49% (Table 5).

A breaking point was determined around the third factor on the scree plot (Figure 4), confirming the number of extracted factors.

Figure 4.
Scree plot



The values of separate factor weights were shown in Table 5, showing that the first factor includes 7 questions, the second factor includes 8, and the third 5 questions.

Out of the total 250 participants, 60 showed high fear of dental procedures (49 female, 11 male), 88 average fear of dental procedures (64 female, 24 male), and 102 participants (77 female and 25 male) showed no fear whatsoever.

DISCUSSION

Our study had similar internal consistency (Cronbach's alpha = 0.98) to studies by Ronis et al.[17] and Tolvanen et al. [18]. Furthermore, similar values were obtained by authors who assessed fear of dentists by the Corah Dental Anxiety Scale with a Cronbach's alpha of 0.82[17] and the Index of Dental Anxiety and Fear — IDAF with a Cronbach's alpha of 0.88[18]. High values of Cronbach's alpha in our study allow for the use of DFS in further research of fear of dentists among various populations[19].

Factor analysis separated three different factors. The first factor (questions 14 to 20 on the DFS) accounted for 23% of total variance and represents fear of certain stim- ulus or situation. The second factor also accounted for 23% of total variance (questions 1, 2, 8, 9, 10, 11, 12, and 13) represents anticipatory fear that causes avoidance of dentists. Similar results were obtained in a multicentric study from 2014 done on a student population. On a sample of 800 dentistry and medicine students from the Faculty of medical sciences in Kragujevac has shown that visits to the dentists were less frequent (OR = 7.02 [2.65; 18.60]) and were done only when a problem occurs (OR = 8.08 [1.28; 50.93]) in people with severe fear of dental procedures[20]. The third factor represents psycho- logical excitement caused by dental procedures (questions 3, 4, 5, 6, 7) and accounts for 20% variance, which is in line with a study from Finland done in 2016 dealing with the connection between fear and dental procedures during various dental procedures. The authors found that the level of fear correlates with the type of procedure, where the lowest amount of fear correlated with preventive procedures, and highest amount of fear correlates with complicated surgical procedures that require anesthesia[21], the most fearful stimulus was "feeling the needle"[22].

The anxious or fear component received the highest factor scores for questions 1, 2 and 18, followed by questions 3, 5 and 8. These results can be explained by the development of anxiousness when making appointments at the dentist's office, causing delays, postponement, or even failure to show up at the appointment.

People with varying amounts of fear of dental procedures were categorized by total DFS scores. The result that we re-

ceived (0.839, $p < 0.001$) was obtained by analyzing optimal "cut-off results" using the ROC curve, which is a method used in most modern scientific research[18]. The results of a study done in 2017[23] using a Likert scale instrument are in line with our results. A study done in Finland that standardized the scale for anxiety assessment in dental students, pointed out the importance of taking into consideration the cognitive and physiological behavioral components of dental fear[18]. As a potential solution to this research issue, Aalboe and Schumacher found that good skills of communication between patients and dentists may reduce anxiety and improve fear of dental procedures[24].

Our results should be interpreted within the context of some possible limitations. Firstly, compared to other similar studies, the number of participants was smaller[23]. The other limitation was the questionnaire itself — DFS cannot replace a diagnostic interview where the fear levels could be more thoroughly assessed, and future studies should include clinical evaluation scales.

By using various statistical methods for the interpretation of the results of this study, we determined the validity, reliability and factor structure of the first version of the DFS scale, which showed excellent characteristics as an instrument for evaluation of fear of dental visits in high school and university students.

CONCLUSION

Our study showed similar results to studies conducted in other countries. Furthermore, it is important to note that DFS satisfies all criteria of successful validation among Serbian population of university and high school students. The Serbian version of the DFS will be helpful for evaluation of fear of dental procedures within this population. Moreover, the practical use of DFS may help in early diagnosis of dental fear among the younger population and recognize the type of help that is necessary to overcome this fear. DFS is an easily applicable, short and reliable instrument and it can enable physicians to assess fear and anxiety symptoms in a targeted and precise manner.

PSIHOMETRIJSKE KARAKTERISTIKE SKALE DENTALNOG STRAHA NA SRPSKOJ POPULACIJI

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Kratak sadržaj

Uvod. Sa strahom od stomatologa suočava se između 6 i 15% odrasle populacije u svetu. Strah od stomatologa direktno je povezan sa bolom koji je nastao prilikom prethodnog iskustva.

Cilj. Cilj studije bio je da se utvrdi, validnost, pouzdanost i faktorska struktura srpske verzije DFS skale na uzorku koji čine studenti i učenici srednjih škola.

Metod rada. Ukupno 250 studenata i učenika srednjih škola učestvovalo je u studiji i popunjavalo srpsku verziju DFS skale.

Rezultati. Skala je pokazala visoku unutrašnju pouzdanost sa Cronbach's alpha koeficijentom od 0,98, što znači da je pouzdanost skale odlična. Izvršene su kalkulacije deskriptivne statistike i višestruke logističke regresije, u svim testovima za nivo statističke značajnosti usvoje-

na je vrednost od p < 0,05. Nivo cut-off tačke visokog nivoa straha je određen računanjem ROC krive za DFS. ROC kriva je pokazala da DFS skor veći od 47 odgovara senzitivnosti od 86,1% i specifičnosti od 88,2%. Veliki broj učesnika (n = 102; 40,8%) je pokazao odsustvo straha od stomatologa. Faktorska analiza je izdvojila tri faktora: prvi povezan sa strahom od određenog stimulusa ili situacije, drugi predstavlja preuranjeni strah koji rezultuje izbegavanjem stomatologa i treći faktor povezan sa psihološkim uzbuđenjima izazvanim stomatološkim procedurama.

Zaključak. Srpska verzija DFS skale zadovoljava sve kriterijume uspešne validacije među srpskom populacijom studenata i učenika srednjih škola. Srpska verzija DFS skale predstavlja pomoć pri evaluaciji straha od stomatoloških procedura među ovom populacijom. DFS skala je lako primenljiv, kratak i pouzdan instrument koji može omogućiti lekarima da ciljano i precizno procene simptome straha i anksioznosti.

Mnogi Džojsovci sugerišu da je Džojs pronalazio inspiraciju za teme koje je istraživao u svom ličnom životu, jer su se njegovi članovi porodice borili protiv fobija, seksualnih devijacija, mentalne nestabilnosti, anksioznosti, delirijuma i alkoholizma. Džejms Džojs, Nora Barnakl, Lusija i Džiordžio, kao i njihovi roditelji, prijatelji, rođaci i partneri dali su inspiraciju za seksualne devijacije, mentalne nestabilnosti, fobije i anksioznosti Moli Blum, g. Bluma, Stefana Dedalusa i Gerti MakDovel među mnogim drugim likovima.

Ključne reči:
strah, DFS, anksioznost, stomatologija

APPENDIX

Table 1: Demographic features of the sample (n = 250)

Demographic features			**Number (%)**
Gender	Male		60 (24)
	Female		190 (76)
Education	US - medicine	First year	25(10)
		Fourth year	25(10)
	US – pharmacy	First year	25(10)
		Fourth year	25(10)
	US - dentistry	First year	25(10)
		Fourth year	25(10)
	Highschool	First year	50(20)
		Fourth year	50(20)
Unpleasant experience	Yes		37 (14.8)
	No		213 (85.2)
Age. M±SD (years)			22.1±1.6
Yearly frequency of visits			3.6 ± 6.2
DFS. x± SD			38.4 ± 15.83

Table 2: Cut-off points for both ROC curves

Cut-off point (total 0DFS score)	Low levels of fear compared to high levels of fear of dental procedures		No fear compared to fear of dental procedures	
	Sensitivity	Specificity	Sensitivity	Specificity
20.5	1	0.083	1	0.207
25.5	1	0.236	0.963	0.517
30.5	1	0.472	0.822	0.839
35.5	1	0.63	0.669	0.943
40.5	0.971	0.764	0.491	0.954
45.5	0.912	0.838	0.393	0.977
47.5	0.882	0.861	0.362	.989
50.5	0.853	0.917	0.282	0.989
55.5	0.853	0.935	0.258	0.989
60.5	0.765	0.981	0.184	1
65.5	0.529	1	0.11	1
70.5	0.382	1	0.08	1
75.5	0.235	1	0.049	1

Table 3: Means and standard deviations of all scores on the scale

	No fear		Low / average levels of fear		High levels of fear		Total scores	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
i1	1.11	0.40	1.56	0.74	2.70	1.18	1.65	**0.99**
i2	1.04	0.20	1.25	0.49	1.87	1.03	1.31	**0.68**
i3	1.44	0.59	2.02	0.90	3.58	1.15	2.16	**1.20**
i4	1.32	0.58	1.52	0.61	3.38	1.19	1.89	**1.15**
i5	1.11	0.34	1.34	0.62	2.53	1.43	1.53	**1.00**
i6	1.06	0.24	1.18	0.56	2.43	1.29	1.43	**0.92**
i7	1.36	0.61	1.78	0.72	3.42	1.25	2.00	**1.17**
i8	1.01	0.10	1.35	0.64	2.07	0.99	1.38	**0.74**
i9	1.12	0.32	1.59	0.78	2.70	0.94	1.66	**0.92**
i10	1.18	0.43	1.76	0.87	2.87	1.11	1.79	**1.03**
i11	1.17	0.37	1.92	0.70	3.40	1.11	1.97	**1.13**
i12	1.20	0.47	1.83	0.94	3.30	1.20	1.92	**1.19**
i13	1.06	0.24	1.61	0.79	3.08	1.12	1.74	**1.08**
i14	1.46	0.70	2.27	1.20	3.12	1.34	2.14	**1.25**
i15	1.68	0.85	2.72	1.26	3.43	1.32	2.46	**1.33**
i16	1.38	0.65	2.52	0.96	3.88	1.01	2.38	**1.30**
i17	1.39	0.58	2.78	1.13	4.13	0.98	2.54	**1.41**
i18	1.52	0.67	2.99	1.18	4.17	0.87	2.67	**1.40**
i19	1.13	0.39	1.49	0.88	2.62	1.14	1.61	**0.99**
i20	1.28	0.45	2.19	0.83	3.52	1.00	2.14	**1.15**
Total scores	**25.01**	**3.57**	**37.69**	**4.75**	**62.20**	**10.73**	**38.40**	**15.83**

Table 4: Values of KMO and Bartlet's sphericity test

KMO		0.924
Bartlet's sphericity test	Approx. Chi-Square	3109.337
	df	190
	Sig.	0.000

Table 5: Factor analysis

Total variance									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.43	52.15	52.150	10.43	52.15	52.150	4.61	23.04	23.044
2	1.79	8.96	61.114	1.79	8.96	61.114	4.61	23.04	46.083
3	1.12	5.58	66.697	1.12	5.58	66.697	4.12	20.61	66.697
4	0.979	4.893	71.590						
5	0.740	3.702	75.292						
6	0.675	3.377	78.669						
7	0.552	2.762	81.431						
8	0.523	2.615	84.047						
9	0.471	2.354	86.401						
10	0.437	2.187	88.588						
11	0.361	1.803	90.392						
12	0.328	1.642	92.034						
13	0.278	1.389	93.423						
14	0.266	1.330	94.754						
15	0.228	1.140	95.894						
16	0.221	1.103	96.997						
17	0.182	0.912	97.909						
18	0.172	0.858	98.767						
19	0.144	0.721	99.489						
20	0.102	0.511	100.000						

Table 6: Distribution of questions by factors after rotation by Varimax method

Rotated factor matrix				
Questions		Factors		
		1	2	3
1	Has fear of dental work ever caused you to put off making an appointment? / Da li Vas je strah od zubara ikada naveo da odložite zakazivanje termina?	0.204	**0.831**	0.130
2	Has fear of dental work ever caused you to cancel or not appear for an appointment? / Da li Vas je strah od zubara naveo da otkažete ili da se ne pojavite u zakazanom terminu?	0.104	**0.836**	0.121
3	When having dental work done, my muscles become tense. / Mišići mi postaju napeti pri vršenju stomatološke procedure.	0.358	0.142	**0.701**
4	When having dental work done, my breathing rate increases. / Ubrzava mi se disanje pri vršenju stomatološke procedure.	0.340	0.372	**0.679**
5	When having dental work done, I perspire. / Znojim se pri vršenju stomatološke procedure.	0.188	0.154	**0.782**
6	When having dental work done, I feel nauseated. / Osećam mučninu pri vršenju stomatološke procedure.	0.233	0.275	**0.648**
7	When having dental work done, my heart beats faster. / Srce mi ubrzano kuca pri vršenju stomatološke procedure.	0.291	0.373	**0.688**
8	I feel anxious when I am making an appointment for dentistry. / Osećam se anksiozno kada zakazujem posetu stomatologu.	0.097	**0.758**	0.299
9	I feel anxious when I am approaching the dentist's office. / Osećam se anksiozno kada prilazim stomatološkoj ordinaciji.	0.190	**0.639**	0.484
10	I feel anxious when I am sitting in the waiting room. / Osećam se anksiozno kada sedim u čekaonici.	0.290	**0.552**	0.453
11	I feel anxious when I am being seated in the dental chair. / Osećam se anksiozno kada sedam u stomatološku stolicu.	0.411	**0.577**	0.521
12	I feel anxious when I sense the smell of the dentist's office. / Osećam se anksiozno kada osetim miris stomatološke ordinacije.	0.440	**0.451**	0.353
13	I feel anxious when I see the dentist walk in. / Osećam se anksiozno kada vidim stomatologa da ulazi u ordinaciju.	0.389	**0.565**	0.457
14	I feel anxious when I see the anesthetic needle. / Osećam se anksiozno kada vidim iglu za davanje anestezije	**0.691**	0.025	0.313
15	I am afraid of feeling the needle injected. / Osećam se anksiozno kada osetim prodor igle.	**0.793**	-0.031	0.205
16	I feel anxious when I see the drill. / Osećam se anksiozno kada vidim bušilicu.	**0.717**	0.316	0.323
17	I feel anxious when I hear the drill. / Osećam se anksiozno kada čujem bušilicu.	**0.772**	0.346	0.182
18	I feel anxious when I feel the vibrations of the drill. / Osećam se anksiozno kada osetim vibracije bušilice.	**0.820**	0.292	0.188
19	I feel anxious when having my teeth cleaned. / Osećam se anksiozno kada mi stomatolog čisti zube.	**0.557**	0.262	0.221
20	All things considered, how fearful are you of having dental work done? / Sve u svemu, koliko se bojite stomatološke procedure?	**0.559**	0.536	0.373

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