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Validity and Reliability of the Preventing Hookah Smoking (PHS) Questionnaire in Adolescents based on the Protection Motivation Theory

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Abstract

Background: Considering the importance of preventing smoking hookah in adolescents and the lack of a standard questionnaire in this field, this study aimed to develop and validate a Persian Preventing Hookah Smoking (PHS) Questionnaire in adolescents based on the Protection Motivation Theory.

Materials and Methods: After conducting focus groups discussion, reviewing the literature and scientific resources, an initial self-administered questionnaire including 68 questions was designed and then validated. *For face* validity, the questionnaires were evaluated by 10 experts considering difficulty, inappropriateness, and ambiguity of the phrases. Both quality and quantity methods were used to evaluate the content validity. *T*he content validity ratio (CVR) and the content validity index (CVI*)* were determined by a group of experts (10 people). Its internal consistency was estimated and its reliability was determined by the test-retest method. Confirmatory Factor Analysis (CFA) was done using Amos 21.0.

Results: From 68 questions in the initial questionnaire, eventually 64 questions remained in the final questionnaire. The CVR value for most questions, except for 3 questions, was above 0.79 and the CVI value of all questions was above 0.79. The Cronbach's alpha coefficient was 0.79-0.91 and the test-retest coefficient was 0.81-0.91. The results of CFA showed the following values, Chi-square (x2): 1254.712, degree of freedom (df): 3.456, adjusted goodness of fit index (AGFI): 0.964, the root mean square error of approximation (RMSEA): 0.072 which indicates the appropriateness of the tool among Iranian adolescents.

Conclusion: The results of this study showed that this Persian questionnaire about preventing hookah smoking in adolescents based on the Protection Motivation Theory has a good validity and reliability and can be used in investigating about prevention of hookah smoking in adolescents.

Key Words: Adolescents, Hookah, Protection Motivation Theory, Reliability, Validity.

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1- INTRODUCTION

Today the lifestyle of humans has gone through major changes. These changes have caused health problems such as cancer, cardiovascular disease and other chronic diseases. One of the hazardous lifestyle factors is increased tobacco use, especially among adolescents and young people (1). Tobacco is the fourth most important risk factor in increasing the burden of disease and has caused health, social and economic problems worldwide (2). Smoking causes different diseases such as cancer, cardiovascular disease, respiratory disease, infertility, oral and dental problems (3). Smoking Tobacco in 1990resulted in one out of every six deaths in the world, but because of the increasing epidemic of tobacco use, it is anticipated that tobacco will result in one out of every three deaths in adults by 2020. Tobacco consumption caused the death of about 6 million people in the world in 2011 (4), and tobacco-related deaths are expected to reach 8 million by 2030 (5), and if no intervention is done in this regard, we will see billions of smoking related deaths in the 21st century (6).

Tobacco is used in many ways, such as chewing, cigarette smoking and hookah. Smoking hookah is an ancient smoking method. There is disagreement about its source, but India, Turkey and Iran are the main consumers of hookah (7). Hookahs use has complications because tobacco smoke contains more than 4,000 different chemicals, which most of them are produced during the burning process and includes more than 40 carcinogens, including hydrocarbons and heavy metals. Hookah use can also cause infectious diseases such as respiratory infections, tuberculosis, digestive diseases and herpes through its oral tube (8). A study done by Momtazi and Rawson about the prevalence of smoking hookah among high school students in Iran, reported that 51.9% of the boys and 34.4% of the girls had smoked hookah (9). Another study done in Tehran reported a prevalence of 29% of hookah use among Iranian students (10). A study done in the University of Florida (USA) indicated that 46.4% of students smoked hookah (11), and another study revealed that 59% of male and 13% of female Jordanian medical students smoked hookah (12). Researchers have used various behavioral science theories to investigate and understand smoking behaviors. The Protection Motivation Theory, which has been used as the main framework for designing the questionnaire of this study, is one of the theories about protective behaviors introduced by Rogers in 1975 and thenceforth has been accepted as a framework for predicting and intervening in health behaviors (13).

This theory consists of seven structures which are perceived susceptibility, perceived severity, internal and external rewards, perceived self-efficacy, response costs, response efficiency, and protection motivation. Each of these structures can be in two intermediary processes which are the Threat Appraisal and Coping Appraisal process (**Figure.1**) (14). The Threat Appraisal process investigates incompatible behaviors, and factors effective on engaging in potentially unhealthy behaviors including internal and external rewards associated with unhealthy behaviors and perceived threats. This item is actually the total of susceptibility and perceived severity. Rewards of misbehavior increase the possibility of choosing maladaptive responses, while the threats reduces this possibility (15). The Coping Appraisal process is the sum of response efficiency and perceived self-efficacy, minus the cost of the response. Thus, increasing response efficiency and self-efficacy, and reducing the response cost will increase Coping Appraisal.

Response efficiency and self-efficacy increase the likelihood of choosing adaptive responses; while cost responses can reduce adaptive responses. The efficacy of the two mediation processes creates the motivation and protection behavior (16). Considering that no reliable and valid tool has been designed and developed according to this model in Iran, the authors of this study tried to design a tool for identifying the causes of smoking hookah, and planning and implementing educational interventions to manage this health problem. This study was conducted with the aim of developing and verifying a Preventing Hookah Smoking (PHS) Questionnaire in adolescents based on the Protection Motivation Theory.

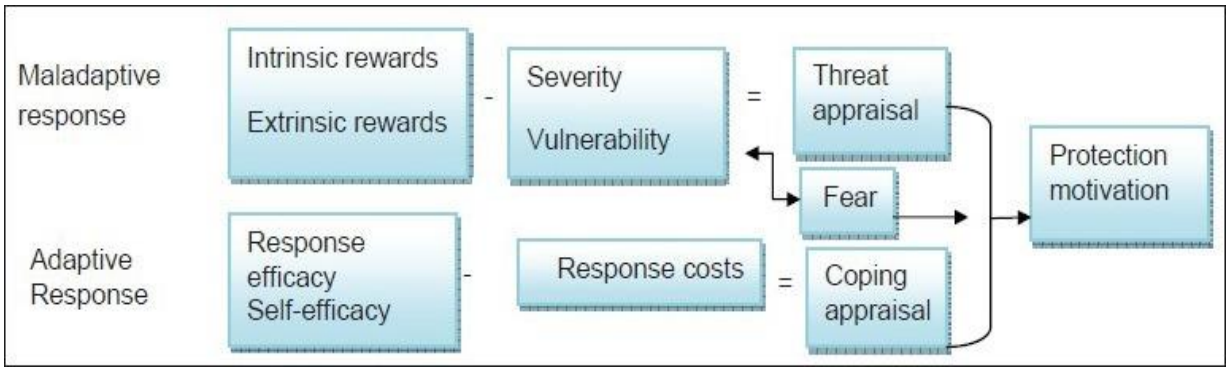

Fig.1: The Protection Motivation Theory.

2- MATERIALS AND METHODS

2.1- Study Design and Population

This cross-sectional, validation study was conducted in Sirjan city, Kerman province, Iran in 2018. A Persian self-administered questionnaire was designed by the authors of this study, to assess and evaluate prevention of hookah smoking in adolescents according to the Protection Motivation Theory. The initial questionnaire was designed after conducting focus group discussions, reviewing the literature, and reviewing several scientific resources and questionnaires (17-21). At first, the qualitative and quantitative face validity of the questionnaire was assessed through expert panel suggestions; and items were scored. Then, quantitative and qualitative methods of content validation were done. Reliability was assessed by alpha-Cronbach and test-retest reliability. In order to do test–retest reliability the questionnaires were completed on two occasions, two weeks apart by 30 adolescents. Confirmatory Factor Analysis (CFA) was also done. The initial version of this questionnaire included perceived susceptibility (10 questions), perceived severity (8 questions), rewards (9 questions), response cost (9 questions), response efficiency (8 questions), self-efficacy (9 questions), fear (8questions), and protection motivation (7 questions) constructs. Responses were scored by a five-point Likert scale including: "strongly agree" (score 5), "agree"(score 4), "don't know" (score 3), "disagree" (score 2) and "strongly disagree" (score 1) (22). The sample population of this study was adolescent boys and girls aged 12-18 years, who were invited to the health centers of Sirjan and completed the questionnaire. In this study, two health centers were randomly selected, and then the eligible individuals were randomly selected from family health files and were enrolled in the study.

2-2. Validity

2-2-1. Face validity

Quantitative and qualitative methods were used to determine the face validity. Qualitative face validity was determined

by a panel including 6 health education specialists, 2 psychologists and 2 epidemiologists. These specialists evaluated the level of difficulty, inappropriateness, and ambiguity of the phrases. Their comments were applied in the questionnaire. An impact score was calculated for each question to determine its quantitative face validity. For each of the 63 questions, a 5-point Likert scale was used to determine impact score. This scale range included strongly agree (score 5), agree (score 4), no idea (score 3), disagree (point 2), and strongly disagree (score 1). After completing the questionnaire by the target group (by 10 adolescents and 10 health expert), the face validity of the item was calculated by using the Impact Score equation (23).

(Impact Score = Frequency (%) × Importance)

2-2-2. Content *validity*

The Qualitative Content Validity of this questionnaire was reviewed and commented by a panel of experts. For this purpose, the questionnaire was sent to 10 professors and experts in health education and health promotion. It was emphasized that they should consider the use of proper words, the importance of the questions and the placement of questions in a proper place. After collecting expert opinion, necessary changes were made to the tool. In order to evaluate the quantitative Content Validity of the questionnaire, the Content Validity Ratio (CVR), was determined by a group of experts (10 people), who examined each question based on a3-item scale including "necessary, useful but not necessary, and not necessary". Then, CVR was calculated according to this formula (18):

$$CVR = [(n_e - (N / 2)) / (N / 2)]*$$

Where $n_{e:}$ the number of experts who have chosen the necessary item; N= Total number of experts. According to the Lawshe table, CVR was considered favorable if it was higher than 0.79 (24). In order to evaluate the Content Validity Index (CVI), according to the Waltz and Basel method, three criteria, including simplicity, specificity and clarity were used for each question, on a4- point scale (25). The validity of each question was evaluated by adding the number of experts who had scored the question as 3 or 4, divided by the total number of experts. If this quantity was≥0.79, the question was acceptable (26).

2-3. Reliability

2-3-1. Cronbach's alpha

A preliminary study was conducted and 30 people from the target population completed the questionnaire. Cronbach's alpha equal or more than 0.7 was considered acceptable (27).

2-3-2. Test-retest

In order to examine the external reliability of the questionnaire, the test-retest method was used. The two scores of the questionnaires and its dimensions, which were completed two weeks apart by 30 adolescents not enrolled in the study, were compared. Pearson correlation coefficient and its significance level were calculated.

2-4. Confirmatory Factor Analysis

Confirmatory Factor Analysis was used to evaluate the factor structure of the questionnaire with AMOS 21.0 software. First, a list of all health centers in Sirjan city was provided and then two centers were selected randomly. After visiting the selected centers, the list of the study subjects was extracted from the family health documents, and the study population was selected randomly. In this part of the study 180 people were enrolled and completed the questionnaire. In confirmatory factor analysis, the cut-off point is 0.3 for the factor loadings. Several indicators have to be considered to determine the *fit*, which chi-square is one of them (28). However, it is better to

consider the χ^2/df index, which is the ratio of chi-square to degree of freedom as well. For this index, values from 1 to 5 show a good fit (29). Other study indexes, such as GFI (Goodness of Fit Index), the NFI (Normed Fit Index*)*, RFI (Relative *Fit* Index*)*, IFI (Incremental Fit Index), CFI (Comparative Fit Index), range between zero and one, and as the values become close to one, the model achieves better fitness (30). If the Root Mean Square Error of Approximation (RMSEA) stands in the range of 0.08 to 0.1, this indicates a moderate fit and, if it becomes less than 0.08, it indicates an appropriate fit of the model. In addition, for the optimal fit of the model, the Parsimony Ratio (PRATIO ratio) should be higher than 0.50. This index is the ratio of the fixed parameters to the free parameters (31).

2-5. Ethical considerations

This study was approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences (Ethics Code: IR.SSU.SDH.REC.1396.134). All participants were informed about the aim of this study and informed consent was inquired from the participants and their parents.

3- RESULTS

This study aimed to develop and validate a Persian Preventing Hookah Smoking (PHS) Questionnaire in adolescents based on the Protection Motivation Theory. The process included: determining the validity (face validity and content validity), determining the reliability (internal reliability and external reliability) and confirmatory factor analysis. In qualitative face validity, some of the questions were corrected and one of the questions in the response cost construct was deleted according to expert comments. In quantitative face validity, all questions had an impact score of ≥1.5 and therefore remained in the questionnaire. After calculating the CVR coefficients, all questions except one from the self-efficacy construct and 2 questions from the perceived susceptibility construct, had a CVR above 0.79; and only these 3 questions were deleted. All questions had a CVI above 0.79 (**Table.1**). No question was removed due to lack of internal reliability; the minimum Cronbach's alpha was in the response costs construct and was 0.798 and the maximum Cranach's alpha was in the perceived susceptibility construct and was 0.912 (**Table.2**). In the next step, a test-retest method was used in order to ensure the external reliability of the questionnaire. Because of the normal distribution of data, Pearson test was used to determine the correlation between the two scores. The results showed a positive and significant correlation **(Table 2)**.

The final version of the questionnaire included9 constructs and was as follows: perceived susceptibility (8 questions), perceived severity (8 questions), rewards (9 questions), response costs (8 questions), response efficiency (8 questions), self-efficacy (8 questions), fear (8 questions) and protection motivation (7 questions). The Factor loadings of the structures of each item in the Confirmatory factor analysis are shown in **Table.3**. The factor loadings of all items are 0.3 or above, which is acceptable. Some indexes had a small difference with the desirable fitness criteria, but after correcting the model, the fitting indexes met the desirable criteria. The amount of χ^2 was not significant in our model. This value should be meaningless in a model with proper fitness (31). The χ^2 / *df* index was 2.456 in the present model, which is suitable for fitting the model. The CFI, IFI, RFI, NFI, and GFI indices were all more than 90%, which means the model is suitable. The PRATIO index was more than 0.50 and was suitable for fitting the model. Finally, the RMSEA index was 0.032 in the current model, which it is considered desirable (**Table.4**).

Table-1: The Content Validity Index and Content Validity Ratio of the questionnaire after applying modifications

Model Structure	Questions	CVI of each Question	CVI of Construct	CVR of each Question	CVR of Construct
Perceived susceptibility Likert 5 Option (Strongly agree to Strongly disagree)	1. Hookah is harmful to my health.	.93	.87	.80	.87
	2. Hookah is harmful and addictive to my health as Smoking cigarettes.	.83		1	
	3. I sometimes use Hookah so it is not harmful to my health.	.93		.80	
	4- Smoking the hookah (Fruit Tobacco) does not cause any health problems.	.76		1	
	5. All hookahs smokers are at risk of smoking diseases.	.93		.80	
	6) Smoke of hookah can cause blackness of my teeth.	.9		.80	
	7. Having addictive friends to hookah can cause to be smoker of it.	.96		1	
	8- People around the smoker of hookah are exposed to hookah smoke.	.79		.80	
Perceived severity Likert 5 Option (Strongly agree to Strongly disagree)	1- Hookah is a dangerous behavior and can lead to a loss of life.	1	.94	1	.92
	2- Smoking hookah can cause a fatal illness such as cancer.	.93		.8	
	3. Smoking hookah can cause pulmonary diseases like asthma.	1		1	
	4- Smoking hookah can cause heart attack.	.8		.80	
	5- Smoking hookah can cause stroke.	1		1	
	6. Smoking hookah can cause infertility.	.96		1	
	7. The hookahs reduce the economic efficiency of the person.	.83		.80	
	8. Hookah case to Rejection of the person from the community.	1		1	
Internal and external rewards Likert 5 Option (Strongly agree to Strongly disagree)	1- Hookah is fun and enjoyable for people.	1	.94	1	.93
	2-Hookah pulls down psychological stress.	1		1	
	3. Smoking Hookah will fill your leisure and entertainment time.	1		1	
	4. The Smoking hookah is a sign of an individual's grow.	1		.80	
	5. The Smoking hookah makes the person more interested and respectful among others.	.80		.80	
	6. By Smoking hookah, the person can find more friends.	.80		.80	
	7- The Smoking hookah gathers the Friends together.	1		1	
	8- Smoking hookah creates an intimate atmosphere among friends.	1		1	
	9. Smoking hookah will increase the going picnic by your friends.	1		1	
Response cost Likert 5 Option (Strongly agree to Strongly disagree)	1- Because I do not have any information on the smoking hookah's harm, I do not take an action to prevent it.	.83	.92	1	.90
	2. Not smoking of the hookah will cause the person to lose his hobby.	1		.80	
	3. Agreeing parents with their children's smoking hookahs will courage them to continue.	.80		.80	
	4- Not smoking hookah is a hard work.	1		1	
	5. Easy access to hookah is the reason of its smoking.	1		1	
	6- The Cheapness of hookahs can be the reason of its smoking.	1		1	
	7. If the person does not smoke hook, he will not be longer respected by his friends.	1		.80	
	8. If a person does not smoke hookah, he will lose his friends.	.80		1	
Response efficiency Likert 5 Option (Strongly agree to Strongly disagree)	1. If I do not smoke hookah, I will have a healthier body.	1	1	1	.92
	2. I will fill my leisure time with activities such as exercise and study, instead of smoking hookah.	1		1	
	3. If I do not smoke hookah, I will not get cancer.	1		1	
	4. If I do not smoke hookah, I will not *have* asthma.	1		1	
	5. If I do not smoke hookah, I will not have a heart attack.	1		.80	
	6. If I do not smoke hookah, I will not *have* stroke.	1		1	
	7. If I do not smoke hookah, I will not suffer from infertility problem.	1		.80	
	8. If I do not smoke hookah, I will be more successful in life.	1		.80	
Self- efficiency Likert 5 Option (Strongly agree to Strongly disagree)	1- I can resist on the smoking hookah temptation.	.93	.98	1	.92
	2- I can refuse the compliments of friends to smoke hookah.	.96		1	
	3. I can Stay away from the environment in which hookahs is smoked.	.96		1	
	4. I can stay away from smoking in the places where the hookah is smoked.	1		.80	
	5. I can find good fun instead of smoking hookah.	1		1	

	6. If someone smoke hookah in my house, I can control myself o not smoke it.	1		.80	
	7. I can be away from my friends who smoke hookah.	1		1	
	8. I can relinquish myself from smoking hookah when I feel stressed.	1		.80	
Fear Likert 5 Option (Strongly agree to Strongly disagree)	1- I'm worried about addicting to hookah.	1	.97	.80	.90
	2. I'm afraid of having a heart attack with smoking hookah.	1		1	
	3- I'm scared of having stroke by smoking hookah.	1		1	
	4. I'm worried about having trouble in breathing with smoking hookah.	1		1	
	5. I'm scared of having infertility problems with smoking hookah.	1		.80	
	6. I'm worried that my teeth will be more dirty and black by smoking the hookah.	1		1	
	7. I'm afraid of being unsuccessful in my daily activities with smoking hookah.	.82		.80	
	8- I'm scared of being rejected from the community by smoking hookah.	1		.80	
Protection Motivation Likert 5 Option (Strongly agree to Strongly disagree)	1- I decide to pay more attention to educational messages about hookah harms.	1	.99	1	.91
	2- I decide not to smoke hookah when I feel tired and fatigued.	1		.80	
	3- I want to replace smoking hookahs with positive activities such as exercise and study.	1		1	
	4- I decide to tell "No" to my friends when they want to persuade me to smoke hookah.	.96		.80	
	5. I decided not to have relationship with the friends who smoke hookah in the future.	1		1	
	6. I want to warn my friends and relatives about the harms of smoking hookah.	1		1	
	7. I want to be away from the places where the hookahs are being smoked.	1		.80	

CVI: Content validity index; CVR: Content validity ratio.

Table-2: Internal reliability index (Cronbach's alpha coefficient) and external reliability index (test-retest coefficient) of the questionnaire.

Model Structure	Number of questions	Alpha Cronbach's Coefficient	Test-retest coefficient (r)
Perceived susceptibility	8	.91	.89
Perceived severity	8	.87	.86
Internal and external rewards	9	.89	.91
Response costs	8	.79	.81
Response efficiency	8	.89	.83
Self- efficiency	8	.82	.84
Fear	8	.84	.86
Protection Motivation	7	.85	.81

Table-3: Results of Confirmatory Factor Analysis of the Hookah Prevention Questionnaire Constructs in Adolescents Using Protection Motivation Theory.

Protection Motivation		Fear		Self-efficacy		Response efficiency		Response costs		Rewards		Perceived severity		Perceived susceptibility	
Factor Loadings	Item	Factor Loadings	Item	Factor Loadings	Item	Factor Loadings	Item	Factor Loadings	Item	Factor Loadings	Item	Factor Loadings	Item	Factor Loadings	Item
.74	1	.63	1	.61	1	.49	1	.45	1	.74	1	.65	1	.48	1
.68	2	.49	2	.43	2	.51	2	.51	2	.67	2	.78	2	.59	2
.54	3	.59	3	.56	3	.83	3	.66	3	.72	3	.66	3	.62	3
.83	4	.71	4	.65	4	.67	4	.63	4	.80	4	.82	4	.56	4
.57	5	.44	5	.48	5	.75	5	.81	5	.79	5	.59	5	.65	5
.49	6	.82	6	.68	6	.49	6	.62	6	.76	6	.84	6	.81	6
.69	7	.61	7	.79	7	.65	7	.61	7	.74	7	.78	7	.59	7
		.49	8	.81	8	57	8	.57	8	.84	8	.67	8	.71	8
										.78	9				

Table-4: Model fitting statistics using Amos software to validate structural constructs

Model fitting indicators	$\chi 2$	Df	$\chi 2$/df	AGFI	CFI	RMSEA	PRATIO
Values	1254.712	467.324	2.456	.937	.892	.032	.874

X2: Chi-square; df: Degree of Freedom; AGFI: Adjusted goodness of fit index; RMSEA: root mean square error of approximation.

4- DISCUSSION

Smoking hookah can predispose people to addiction and is one of the most important risk factors for non-communicable diseases (3). In order to prevent this problem, we need a certain framework or theories. The protection motivation theory has been effective in predicting and changing intent and preventive protective behaviors in some studies (13). A review of past studies showed that, there was no suitable questionnaire based on this theory to prevent smoking hookah in Iran. Therefore, this study aimed to develop and validate a Persian Hookah Smoking Prevention Questionnaire in adolescents based on the Protection Motivation Theory. In this study, a comprehensive tool was designed and developed after focus group discussion, reviewing the literature, scientific resources and questionnaires used in previous studies. This questionnaire was later modified and approved. Content validity is defined as the ability of the features of the construct to measure the selected items (32). Since content validity is a prerequisite for other validities and is the most important step in the design of the questionnaire, in the present study, the CVI and CVR indices were determined. Investigating the content validity of the questionnaire by experts is one of the best ways for improving the validity of questionnaires (33). In this study, 10 professors and experts of health education and health promotion determined the validity of the questionnaire. Valuable and diverse points of view from the individuals were obtained in this stage, and by determining the content validity ratio and content validity index, the content validity of the instrument was confirmed. Items need to have internal consistency, when they are used to form a scale. The items should be correlated with one another, so they should all measure the same thing. Researchers intend to use scales rather than develop them (34). Therefore, a useful coefficient for assessing internal consistency is Cronbach's alpha. A Cronbach's alpha of ≥ 0.7 represents optimal internal consistency(35). In this study the Cronbach's alpha results were in the range of 0.79 to 0.91, which indicates the suitability of this questionnaire. These findings are consistent with the findings of Sayed Abadi et al. about nutritional preventive remedies of osteoporosis in women, in which the Protection Motivation Theory (PMT) was used for designing the questionnaires (36). But the results of Bredemeier et al. in Brazil about the Quality of Life instrument for people with intellectual and physical disabilities, had a weak Cronbach alpha (0.66) (37). Test-Retest reliability measures test consistency, the reliability of a test is measured over time. In other words, the same test is given twice to the same people at different times, to see if the scores are the same (38). In the next step, the test-retest method was used to ensure the reliability of the questionnaire and its coefficient was 0.81 to 0.91. The results showed a positive and significant correlation. These results are consistent with the results of Brigham et al. on the self-report of tobacco exposure and risk (39), and Foerde et al. on food choice tasks among healthy individuals (40). Confirmatory factor analysis (CFA) is a

multivariate statistical procedure that is used to test how well the measured variables represent the number of constructs (41). In confirmatory factor analysis, researchers try to test the veracity of the factor structure for a set of observed variables (questions).This hypothesis examines the existence of a relation between obvious variables (questions) and the latent structures (factors) (42). According to the results of confirmatory factor analysis, the designed questionnaire had a suitable fit and the results of this study were consistent with the results of Rahaei et al. about the psychometric properties of a protection motivation theory based questionnaire used for early cancer detection (43), and Sayed Abadi et al (36); while the results of Helmes et al. did not confirm the validity of a questionnaire based on the protection motivation theory in performing a genetic test for cancer diagnosis (44).

4-1. Limitations of the study

One of the limitations of this study was that the questionnaire was validated on the adolescents' age group and its validity for adults and the wider community might be limited. Also, its predictive and concurrent validity was not determined. Therefore, it is suggested that in later studies, this questionnaire be used in different age groups and other psychometric methods be considered as well.

5- CONCLUSION

From 68 questions in the initial questionnaire, eventually 64 questions remained in the final questionnaire. The results of this study showed that this Persian questionnaire about preventing hookah smoking in adolescents based on the Protection Motivation Theory (PTM) has a good validity and reliability and can be used in investigating about Prevention of Hookah Smoking in adolescents.

6- CONFLICT OF INTEREST: None.

7- ACKNOWLEDGMENT

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