ORIGINAL ARTICLE

Design and Psychometric of Smoking Cessation Instrument according to Precaution Adoption Process Model in Patients Hospitalized in Hospitals Affiliated to Medical University of Babol, Iran, during 2017

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Abstract

Background and Objective: There is no standard questionnaire on smoking cessation in smokers according to precaution adoption process model (PAPM). Therefore, the present study aimed to design and psychometrically evaluate a smoking cessation instrument in patients hospitalized in Babol, Iran, according to PAPM. **Materials and Methods:** This was a cross-sectional descriptive and instrument validation study. In this study, 470 smokers hospitalized in hospitals affiliated to the Medical University of Babol, Iran, were selected based on the available sampling method. Those who were highly dependent on nicotine were selected. The designed questionnaire was examined in terms of face validity, content validity, construct validity, and internal consistency. The reliability of the questionnaire was examined using Cronbach's alpha and internal consistency. **Results:** Most of the people were with moderate dependence on nicotine (86%) at the fourth level (28.9%) of the pattern. The results of content validity showed content validity ratio of 0.83 and content validity index of 0.98. Seven factors were extracted from exploratory factor analysis. The results of exploratory factor analysis according to Kaiser-Meyer-Olkin measure and Bartlett test were 0.93 and 1124.63, respectively. The results of confirmatory factor analysis of instruments for 470 subjects were extracted with X^2 and degree of freedom of 2.86, mean of error square of 0.06, goodness of fit index of 0.9, and adaptive goodness of fit of 0.9 Cronbach's alpha (0.93) and correlation (0.99) confirmed the reliability of instrument in test–retest method. **Conclusion:** The findings showed that smoking cessation instrument based on PAPM has acceptable reliability and validity to determine the behavior of smoking in smoker men and can be used in studies on change in behavior and designing intervention programs to stop smoking.

Key words: Design, precaution adaption process model, psychometric, smoking cessation

INTRODUCTION

Cigarette contains nicotine that is naturally found in plants belonging to the Solanaceae family and is consumed in all countries, cultures, and religions regularly.[1] Each year, thousands of people die due to smoking. Cigarette is currently the biggest deadly substance in human societies. However, it has the highest profitability in country's economy.[2] Furthermore, it causes lung disorders, infertility, congenital defects, and cardiovascular disease. Moreover, it is a risk factor for bladder, cervix, esophagus, kidney, larynx, lung, oral cavity, pancreas, stomach, and acute myeloid cancers.[3] Changes in major causes of death from infectious diseases to chronic disease have attracted the attention of

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experts to the origin of these diseases that include lifestyle and behavior of humans. Factors such as smoking, unhealthy dietary patterns, low activity, and alcohol influence disease and death.[4] Tobacco in low- and middle-income counties is drastically increasing. Most of these countries have very limited resources to cope with this issue and have limited knowledge about the disadvantages of tobacco. However, this issue in high-income countries is more important.[5] According to the reports by the World Health Organization, about 1.22 billion people in the world consume tobacco and about 1 billion people live in low- and middle-income countries. The frequency of tobacco consumption in men is 5 times higher than in women.[6] It is estimated that every day, about 11,000 people and each year about 5 million people in the world die due to smoking. It is predicted that by 2025, this number will reach to 10 million.[1] Mortality resulting from smoking has been taken into consideration.[5] In Iran, about 10 million people smoke. The mortality level due to smoking is about 70,000 people per year. The consumption is supposed to follow the same trend so that the resulting mortality will dramatically increase to 200,000 persons per year by 2025.[7] Identification of smoking cessation interventions is very important in health profession. This key issue has to be taken into consideration, and health experts should take the first steps.[5] Nowadays, smokers are interested in stop smoking more than ever. Among smokers who want to stop smoking, those who are highly dependent on smoking in terms of mental and physical aspects seek for help and this decreases their success. Therapists can design programs that use different methods to help these people.[8] We need to increase awareness regarding prevention and effective treatment of smoking at the global level to stop smoking. This is an important part of the responsibilities of smoking cessation centers.[5] Change in behavior is a part of risk reduction strategies. To change behavior, theories and patterns constitute the bases of educational interventions and create an instrument to justify health plans. Patterns can respond to the questions of planners about why people do not have desirable behavior, how behaviors should be changed, and what factors should be considered in assessing the programs. The success levels of health promotion programs are different; those programs that are prepared according to suitable patterns are more successful. Health experts can use suitable patterns of smoking cessation based on social and individual approaches (e.g. family and friends) and target the person.[4] Common efforts of all health staff are necessary in smoking prevention and cessation.[9] Different approaches, methods, and instruments can be used to assess health and change behaviors.[10] In this regard, one of the main approaches for changing the behaviors in smoking cessation is precaution adoption process model (PAPM). This model explains decision-making process of the person regarding an action or behavior and shows how a person concludes to do something and how makes a decision.[11] The innovator of this model is Weinstein and Sandman and designed in for the first time in 2002.[3] This model includes seven steps: Unaware, unengaged, undecided, decide to not act, decide to act, acting, and maintenance.[13] In Iran, no study has been conducted on smoking cessation based on PAPM. Since smoking is among the major problems of modern societies and a serious threat for the health of people and the biggest factor to prevent early death, scientific studies can increase the understanding of nurses regarding smoking and they can use this knowledge in nursing skills, policies, and health system caring as well as general fields of smoking control. More than half of smokers want to stop smoking, but they do not know how to do that or they cannot stop it easily. This phenomenon is the result of dependence on tobacco and points to a strong psychological relationship between smoking and the thoughts of the person while smoking. Iran has a high smoking prevalence which is associated with significant economic and health burdens. Nurses play important role in promoting the health of smokers and public populations. The PAPM can significantly improve the decision making policies in this regards through identification of the important factors. Therefore,this study aimed to use PAPM to decrease damage to smokers who are not ready to stop smoking or cannot stop it and to propose a strategic plan to decrease smoking and increase motivation to stop it. Since the strategic plan of this study is based on PAPM constructs, fundamental variables in this study are the mentioned constructs and concepts that are modeled by the designer. To collect information and assess the variables, it is normal that the researcher needs necessary instruments. In Iran, no instrument with these characteristics has been designed for the target population. Therefore, this study aimed to design a reliable and valid instrument to stop smoking based on PAPM in patients hospitalized in hospitals affiliated to Medical University of Babol, Iran.

MATERIALS AND METHODS

The present study is a cross-sectional and descriptive, design, and instrument psychometric study that was conducted on 470 smoking men who were hospitalized in hospitals affiliated to Medical University of Babol, Iran, who were selected using the available sampling based on non-probabilistic sampling method. In addition, according to Fagerstrom test, these subjects had moderate or severe dependence on smoking. First of all, the researcher, using scientific sources and studying related texts, adding questions consistent with the research goals, subscales, and suitable items according to PAPM, designed a distinct questionnaire including 4 sections: Demographic information (6 items), determining the steps (7 items), awareness assessment (12 items), and assessing the constructs based on PAPM (64 items) in seven domains (perceived sensitivity with 6 items, perceived severity with 9 items, perceived benefits with 8 items, perceived barriers with 13 items, mental norms with 8 items, action guide with 8 items, and self-efficacy with 12 items). In this study, standard questionnaires including investigating awareness, attitude, and performance in preventing smoking by Heidari *et al*. (2010), attitude toward smoking by Shore *et al*., smoking self-efficacy instrument short form by Velicer *et al*.

(1990), decision-making balance by Velicer *et al*. (1990), smoking cessation stems according to meta-theory pattern of Prochaska *et al*. (1988), GYTS standard questionnaire recommended by the WHO and Center for Disease Control (2012), smoking self-efficacy questionnaire by Colliti *et al*. (2013), and nicotine dependence symptoms by Shyfman *et al*. were designed. Furthermore, by adding suitable options consistent with the research objectives and PAPM constructs, the researcher designed the primary items within 4 weeks. After designing the questions, the method that respondents were supposed to use was selected. The selected response is fully dependent on the nature of the question.[14] Therefore, according to the type of questions about smoking that was based on PAPM, responses were prepared according to response package. For this reason, accordingly in one of the three groups: determining two option step, awareness assessment, and construct assessment. The type of response in the first part was yes/no; in awareness assessment, was true (2), no idea (1), and false (0), and in construct assessment, included absolutely agree (5), agree (4), no idea (3), disagree (2), and absolutely disagree (1).

After designing the items, validity and reliability of the questionnaire were examined. In this study, different aspects of validity were examined including face validity, content validity, and construct validity. To examine reliability, qualitative and quantitative approaches were used. To determine face validity in qualitative step, a complete list of designed items was submitted to five experts of Islamic Azad University Medical Branch of Tehran and Medical University of Babol to examine the appearance of instrument and also examine the questions in terms of difficulty, rate of mismatch, and ambiguity. To compute scoring index for the effect of the item at the quantitative step of examining the face validity and to determine the significance of each item, the questionnaire was submitted to 30[15] smoking patients with similar demographic, economic, and social characteristics to answer the questions and according to their comments and suggestions, and necessary modifications were done. Then, using the following formula, face validity index was computed:

Significance * frequency based on percentage = the impact

In this formula, frequency includes the percentage of people who gave 4 or 5 to the item of interest and significance means the computed credit for each item. If this index is larger than 1.5, it is a suitable item and is maintained for the next steps. The second step was related to determining the content validity. Content validity included qualitative and quantitative parts. At this step, 10 experts, after studying the instrument carefully, proposed their comments in terms of grammatical points, the use of suitable words, and scoring. Then, modifications and final revisions were done. In quantitative part, content validity ratio (CVR) and content validity index (CVI) were used. To compute CVR index, according to Lawshe table, 10 experts from Islamic Azad University Medical Branch of Tehran, Medical University of Babol, and Masih Daneshvari Hospital cooperated. Members judged all items in terms of necessity, beneficial but not unnecessary, and unnecessary.[15]

Since at this step 10 experts cooperated, each item with CVR coefficient larger than 0.62 was maintained.

In determining CVI, to ensure the suitable design of items to measure PAPM, estimation of CVI by Waltz and Bausell with three criteria of relevance, simplicity, and clarity was used. Furthermore, 5-point Likert scale was used for all three criteria (from simple to difficult, relevant to non-relevant, and clear to unclear).[15]

At this step, the experts were asked to examine individual items, and in addition to studying the items, they proposed their views for modifications. When the obtained score was larger than 0.79,[15] the item was taken into consideration in terms of clarity and simplicity. The third stem was determining construct validity. Factor analysis is a valuable approach to determine evidences regarding construct validity of the instrument. Factor analysis was performed based on exploratory factor analysis and confirmatory factor analysis. At this step, the researcher-made questionnaire was distributed among 470 subjects of the target population based on the available sampling method. First, using exploratory factor analysis, to investigate the internal relationship between variables, validity was confirmed. Kaiser–Meyer–Olkin (KMO) and Bartlett tests were used to determine the appropriateness of data for exploratory factor analysis. Decision-making about sample adequacy is the first step to determine the use of factor analysis to examine construct validity. KMO value smaller than 0.5 is acceptable, 0.5–0.7 is average, 0.7–0.8 is moderate, 0.8–0.9 is desirable, and larger than 0.9 is perfect. In the Bartlett test, if the estimated P is smaller than 0.05, factorial nature of data is confirmed.[16]

At the next step, confirmatory factor analysis was performed to confirm the structure resulted from exploratory factor analysis.

X2/df ratio smaller than 3, goodness of fit indexes (GFI), and comparative fit index (CFI) about 0.90 are acceptable. Furthermore, root mean square error of approximation (RMSEA) smaller than 0.8 shows acceptable GFI.[17]

After validity, reliability was examined. In this study, to determine the reliability of instrument, internal consistency and stability were used. In the present study, to determine internal consistency, Cronbach's alpha after content validity (experimentally by 30 patients) and factor analysis was used. If Cronbach's alpha values for different dimensions and constructs are larger than 0.7, reliability was good and confirmed. Otherwise, the related item was removed.[18]

In this study, stability was examined using test–retest method. The instrument was distributed among 30 patients and was

fulfilled again after 2 weeks. The obtained scores at this step were computed using internal consistency reliability. This test is the most acceptable statistical test to estimate stability. If this index is larger than 0.7, the criterion was considered for the instrument.[16] Analyses were performed using SPSS and AMOS.

Findings

- The results of Fagerstrom test showed that the highest percentage (86%) of research units showed average dependence and the lowest percentage (14%) of research units showed severe dependence.
- The results of determining PAPM steps showed that the highest percentage (28.9%) of research units was at the fourth step and lowest percentage (5.1%) of research units was at the first step.
- The results of item impact index showed that in awareness assessment section, 12 items with scores larger than 1.5 were maintained. In construct assessment section, items 6, 24, 26, 50, 49, 57, and 62 with impact score smaller than 1.5 were removed. Items in construct section decreased from 64 to 57 where we had smoking cessation in awareness (12 items). Furthermore, construct section included seven domains of perceived sensitivity (5 items), perceived severity (9 items), perceived interests (8 items), perceived barriers (11 items), mental norms (8 items), full guide (6 items), and self-efficacy (10 items).
- The results of CVR showed that according to the experts, items 1, 4, 5, and 6 related to awareness and items 4, 6, 12, 16, 17, 23, 34, 35, 45, 46, and 56 related to construct assessment were removed due to CVR smaller than 0.62.
- Finally, the number of items in awareness section decreased from 12 to 8. Furthermore, construct assessments decreased from 57 to 42 [Table 1]. The whole instrument was confirmed with CVR 0.83.
- The results of CVI showed that all items with a score larger than 0.79 were confirmed and no item was removed. Questions 11, 26, 35, 40, and 41 were modified in terms of clarity and simplicity [Table 1]. The whole instrument was confirmed with CVI 0.98.
- The results of exploratory factor analysis with KMO test = 0.93 confirmed sampling adequacy Table 2. Furthermore, the results of Bartlett test (11281.63) with $P < 0.001$ showed the obtained correlation matrix and its significant difference with zero; accordingly, factor analysis was not justifiable [Figure 1]. Finally, the results of exploratory factor analysis using scree plot [Table 3] and total variance extracted 7 factors. These factors have special value larger than 1 that explained 61.64% of the variance. The first factor included 11 items (special value of 13.74), the second factor included 8 items (special value of 4.26), the third factor included 3 items (special value of 2.30), the fourth factor included 6 items (special value of 1.58), the fifth factor included 5 items (special value of 1.40), the sixth factor included 5 items (special value of 1.32), and the seventh factor included 4 items (special value of 1.13). At this step, no items were removed from smoking cessation assessment scale of PAPM [Figure 2]. The results of rotated matrix showed that the extracted factors were confirmed transferring item 33 and item 35 from factor 2 to factor 1 and item 11 from factor 4 to factor 5, and all items (42 items) were maintained at the final step of explanatory factor analysis.
- The results of confirmatory factor analysis showed that the presented model with the df of 2.86, root mean square error of 0.06, GFI higher than 0.9, and RFI higher than 0.9 enjoys from goodness of fit [Figure 2].
- Total Cronbach's alpha was 0.93 and the intraclass correlation coefficient was 0.99 with confidence coefficient between 0.996 and 0.999. This showed that the designed instrument has suitable reliability [Table 4]. Finally, the questionnaire with 50 items about awareness and constructs was confirmed, and with items in demographic information and determining the procedure, it was extracted with 63 questions.

DISCUSSION

The present study is the first line of the studies focusing on designing a valid and reliable instrument regarding how to stop smoking according to PAPM in patients hospitalized in hospital. This questionnaire is reliable and valid to determine the behavior of smoking in men smokers and can be used in studies on change in behavior and designing intervention programs to stop smoking. Zhao *et al*.[19] emphasized the identification of factors influencing change in behavior (smoking cessation). Colivicchi and Uguccioni[20] studied smoking cessation interventions in acute coronary syndrome. Ahmed *et al*.[21] investigated the effect of smoking cessation

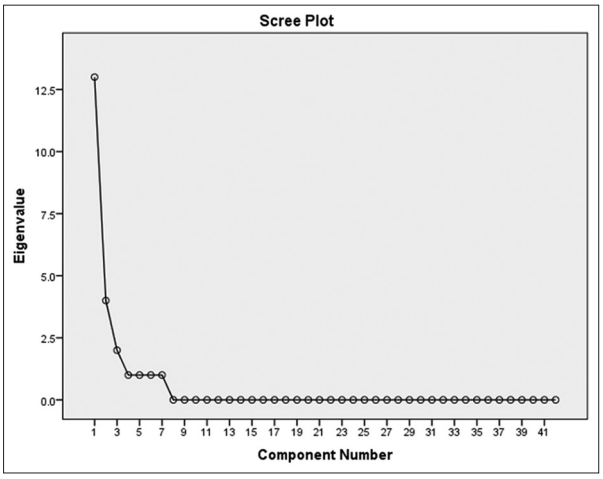

Figure 1: Scree plot of smoking cessation according to precaution adoption process model after confirming construct validity for 470 patients hospitalized in hospitals affiliated to Medical University of Babol, Iran in 2017

Table 1: An example of the results of CVR and CVI of smoking cessation scale based on PAPM according to ten experts

Questions	CVR	CVI
Section 3: Awareness assessment		
The available nicotine in cigarette is addictive like heroin and other drugs	0.8	1
Smoking is one of the main factors for cardiovascular and lung diseases	0.8	1
Smokers are exposed to the risk of lung cancer, asthma, and inflammation of the respiratory tract	0.8	1
Children and relatives of smokers are exposed to the risks of smoking	1	1
Questions	**CVR**	**CVI**
Section 4: Assessing the Constructs		
The perceived sensitivity		
Smoking is related to diseases	0.8	1
I am exposed to the risk of cardiovascular and lung diseases resulted from smoking	0.8	1
Without any since, I may get cancer due to smoking	0.8	1
I do not stop smoking, since I do not see any problem in my body	0.8	0.9
The perceived sensitivity		
Smoking influences general health of my body	0.8	0.9
I must stop smoking since it has caused many disadvantages for me	0.8	1
My smoking influences my relatives and friends	0.8	1
Smoking influences cardiovascular and lung diseases as well as ear infection	0.8	1

CVI: Content validity index, CVR: Content validity ratio

Table 2: The results of KMO test and Bartlett test for smoking cessation scale according to PAPM after confirming the construct validity for 470 patients hospitalized in hospitals affiliated to Medical University of Babol in 2017

KMO	0.93
Bartlett	11281.63
df	861
Sig	0.000

KMO: Kaiser–Meyer–Olkin, PAPM: Precaution adoption process model

on cardiovascular disorders and mortality. Sarbandi *et al*.[17] studied a questionnaire about change in behavior (smoking cessation) according to metatheory model. Tyler[22] studied cyber utilization according to PAPM. Hassan *et al*.[23] studied the perspectives of old drivers and stopped driving according to PAPM. The results of the present study showed that the instrument, in addition to assessing awareness, in constructs assessment section, extracted seven dimensions (perceived sensitivity, perceived severity, perceived interests, perceived barriers, mental norms, action guide, and self-efficacy). Jasempour *et al*. in their study investigated awareness constructs, perceived sensitivity, perceived severity, and perceived interests and did not use perceived barriers, mental norms, and self-efficacy.[24] Hassan *et al*. and Sahbaeiroy *et al*.[25] in their study emphasized awareness level and perceived barriers. Tyler studied awareness levels and determination of steps according to PAPM and suggested changes in the model. Bhat *et al*.[9] in their study considered a lack of time, awareness level, and fear regarding smoking cessation as the main barriers. Ebrahimi and Khamesan[26] studied self-efficacy to avoid smoking.

One of the advantages of this study was the use of face validity (qualitative and quantitative), content validity (qualitative and quantitative), and construct validity. Hoseini *et al*.[7] in their study used face and content validity, but construct validity was not used. Ebrahimi and Khamesan and Sarbandi *et al*. used the judgment of the target group and experts to determine face validity and content validity of smoking cessation instrument. Heseini *et al*. considered acceptable CVR with 14 experts more than 0.59 and CVI with ten experts more than 0.79. The present study with CVR = 0.83 and CVI = 0.98 has acceptable validity. Using construct validity according to confirmatory factor analysis and exploratory factor analysis, this study showed that the designed instrument validity. Sarbandi *et al*. and Ebrahimi and Khamesan used confirmatory and exploratory factor analysis to confirm the construct validity. Sarbandi *et al*. in their study reported KMO = 0.75, $P < 0.001$, RMSEA = 0.06, X^2/df = 1.61, GFI = 0.91, and CFI = 0.93. In the present study, we had KMO = 0.93, $P < 0.001$, RMSEA = 0.06, X^2/df = 2.86, GFI = 0.95, and RFI = 0.94. According to the results, the present study has higher sample adequacy and goodness of fit. In terms of root mean square error, this study is consistent with a study of Sarbandi *et al*., and in terms of root mean square error, it is consistent with a study of Ebrahimi and Khamesan. Cronbach's alpha (0.93) showed

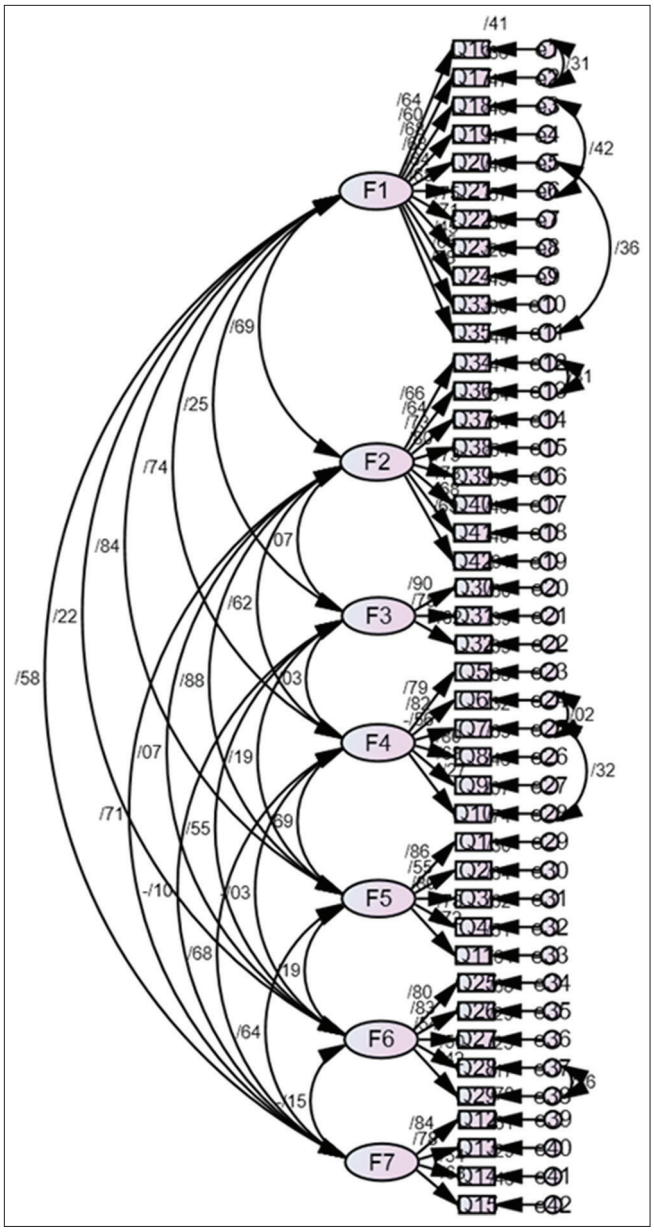

Figure 2: The results of confirmatory factor analysis for smoking cessation scale according to precaution adaption process model after exploratory factor analysis for 470 patients hospitalized in hospitals affiliated to Medical University of Babol, Iran in 2017

Table 3: Total explained variances for smoking cessation scale according to PAPM after confirming construct validity for 470 patients hospitalized in hospitals affiliated to Medical University of Babol, Iran in 2017

Components	Special value			Sum of extraction of squares			Sum of rotation of squares		
	Total	Variance percentage	Cumulative percentage	Total	Variance percentage	Cumulative percentage	Total	Variance percentage	Cumulative percentage
1	13.74	32.72	32.72	13.74	32.72	32.72	5.34	12.71	12.71
2	4.26	10.15	42.87	4.26	10.15	42.87	5.04	12.00	24.72
3	2.30	5.49	48.36	2.30	5.49	48.36	3.99	9.50	34.22
4	1.58	3.76	52.13	1.58	3.76	52.13	3.18	7.58	41.80
5	1.40	3.35	55.48	1.40	3.35	55.48	2.91	6.95	48.75
6	1.32	3.15	58.63	1.32	3.15	58.63	2.84	6.77	55.52
7	1.13	3.01	61.64	1.13	3.01	61.64	2.43	6.11	61.64

PAPM: Precaution adoption process model

Table 4: The results of estimating internal consistency (Cronbach's alpha) and stability (correlation coefficient) for smoking cessation according to PAPM after confirming construct validity for 470 patients hospitalized in hospitals affiliated to the Medical University of Babol in 2017

Section	Cronbach's alpha	Intraclass correlation coefficient
Awareness	0.82	0.91
Constructs	0.92	0.93
The whole instrument	0.93	0.99

PAPM: Precaution adoption process model

that the instrument has high internal consistency, and external consistency of the instrument showed the reliability of the instrument. In Hoseini *et al*.,[7] Cronbach's alpha was 0.89, in Sarbandi *et al*., it was 0.76, and in Ebrahimi and Khamesan, it was 0.96. Hoseini *et al*. and Sarbandi *et al*. reported reliability as 0.88 and 0.75, respectively. In the present study, correlation coefficient of 0.99 confirmed the reliability of the instrument. This study showed that the items can be used as expected behavioral objectives in educating nursing students with emphasis on PAPM to change the behavior (smoking cessation). Furthermore, in assessing the patients hospitalized in hospitals and people who refer to smoking cessation clinics for interventions, these aspects can be used for future planning. Other researchers who are interested in conducting studies on smoking cessation or PAPM can use the instrument of interest to achieve their objectives. Despite advantages in this study, there were limitations. Participants in this study were male smokers. Moreover, those smokers were included who were highly dependent on smoking. Therefore, it is suggested to include women and adolescents in the future studies in different locations such as smoking cessation centers, urban and rural health centers as well as change in behavior such as stopping traditional and industrial drugs according to PAPM.

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