A questionnaire on factors affecting the precaution adoption process model for cervical cancer – Psychometric properties

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Abstract:

BACKGROUND: Implementing a cervical cancer prevention program requires an exploration of certain behaviors concerning this disease. This study is aimed to evaluate the psychometrics of a questionnaire that enquired about the factors involved in Precaution Adoption Process Model (PAPM) for cervical cancer among suburban women in Bandar Abbas, south of Iran.

MATERIALS AND METHODS: The primary draft of the questionnaire was developed with a review of the related literature on cervical cancer and the constructs affecting PAPM, with 68 items. The face validity, content validity ratio (CVR), and content validity index (CVI) of the questionnaire were approved by a panel of 10 experts. The internal consistency and test-retest reliability of the questionnaire were estimated too. Field testing sample included 300 women recruited from a women's healthcare center in suburban areas of Bandar Abbas in the south of Iran. Exploratory factor analysis was used to evaluate validity, and Cronbach's alpha coefficient was estimated for reliability.

RESULTS: After the face validation, 11 items were eliminated. Once CVR was estimated, two items were discarded. The remaining items had a CVR >0.79. All had a CVI >0.79. Six items were eliminated in the factor analysis. The final questionnaire included 49 items organized in 8 factors including awareness, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, social norms, fear, and self-efficacy. Principal component analysis with varimax rotation indicated eight main components that explained 56.25% of the variance. Reliability assessment showed a good internal consistency for all subscales and the Cronbach's alpha score ranged between 0.82 and 0.90. The test-retest reliability showed that the correlation coefficients (between 0.81 and 0.89) were significant at the 0.01 level for all sub-scales.

CONCLUSIONS: The final questionnaire was a new instrument comprised the effective constructs of PAPM and had a high reliability and validity. Thus, this questionnaire is recommended to be used to explore and enhance preventive behaviors of cervical cancer.

Keywords:
Cervical cancer, precaution adoption process model, questionnaire validation, women

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Introduction

The Precaution Adoption Process Model (PAPM) explains how people adopt a certain behavior for self-care. This model has seven cognitive and behavioral stages which include respectively: unaware, unengaged, deciding about acting, decide not to act, decide to act, act and maintenance. The probable factors that determine progress from one stage to another, as suggested by Weinstein, include media messages of risk and care (stages 1 and 2), increased awareness, personal experience of risk and relationship

with other important people (stages 2 and 3), perceived threat and fear, perceived social norms, belief in effectiveness and care issue (stages 3–4 or 5), self-efficacy and perceived benefits and barriers (stages 5–6).[1] PAPM has been applied to a variety of research topics such as human papillomavirus (HPV) vaccine[2] and cancer screening.[3]

Cervical cancer is a main cause of mortality among women.[4] Globally, cervical cancers among the four main diseases among women. It is predicted that annually 530 thousand new cases of the cancer emerge along with 270 thousand cases of mortality. About 85% of these mortalities occur in developing or underdeveloped countries. The mortality rate of this disease in lower-income or average-income countries is 18 times as high as the high-income countries.[5]

As the latest body of research show, the occurrence rate of cervical cancer in Iran is lower than other countries in the region. Yet, the risk factors of this cancer are increasing and can lead to an increased occurrence rate of this cancer in future in Iran. The occurrence rate of this disease varies across different regions in Iran.[6] Annually, 917 new cases of cervical cancer are diagnosed in Iran and 467 people die for this reason. This cancer is among the ten prevalent cancers affecting women in Iran. The fatality of this cancer in Iran exceeds 44%.[7]

The reasons why this disease is growing in developing countries are: lacking awareness of the disease, distrust in health-care system, and high costs of HPV vaccination.[8] Biological, socioeconomic, and health-related factors can pave the way for cervical cancer.[9] In different studies, the effect of drug abuse, multiple sex partners, infection with HPV,[10] physical activity, overweight, and consumption of contraceptive pills[11,12] were established as primary prevention and timely Pap smear test were identified as the secondary preventive measures of cervical cancer. Due to the myriad of geographical differences in the occurrence of cervical cancer and its mortality rate and risk factors, conducting certain investigations in different countries is essential. Different studies have been carried out in Iran, each on a particular aspect of the disease.[7,9]

An instrument developed in a particular country only reflects the language and culture of that country and if applied to other contexts even when translated precisely, does not match for content and can cause different problems.[13]

A review of the literature on developing questionnaires for cervical cancer showed that there are several measurement instruments designed in countries such as Brazil for cervical cancer and psychoneurosis,[14] In Serbia, psychoneurosis was also explored.[15] In Vietnam,

it was used for screening measurement[16] and in Chile, the health belief model was used to measure Pap smear test.[17] The same model was used in America along with the health promotion model to delve into awareness and attitude.[18]

As there was no relevant questionnaire in the Iranian context to explore primary and secondary preventive behaviors and effective factors involved in cervical cancer within the PAPM model.

The present paper is actually part of a greater project which aimed to explore the effect of educational interventions for cervical cancer among suburban women in Bandar Abbas in the south of Iran. This research actually aimed to evaluate the psychometrics of a questionnaire which enquired about the factors involved in PAPM in 2019 among women in the field of cervical cancer.

The ultimate goal of the present research was to explore the state of cervical cancer preventive behaviors and to develop appropriate educational interventions to improve cervical cancer prevention among suburban women in the south of Iran.

Materials and Methods

This cross-sectional study was conducted in Bandar Abbas, hormozgan province, south of Iran in 2019.

At first, to prepare the initial questionnaire, a number of keywords were searched in the following databases: PubMed, Web of Science, Science Direct, Google Scholar, Embase, Scopus, Biomedcentral, IranMedex, SID, and Magiran. These keywords were: cervix cancer, uterine cervical neoplasms, screening, prevention and control, Papaniocolaou Test, Pap test, Pap smear, education, intervention, cervical cancer, theory and model, behavior model. Then, the primary draft of the questionnaire was developed based on library research and exploration of national and foreign databases and a review of the related literature in cervical cancer in the light of PAPM by the present researchers.[4,8,14-18] The primary draft included items related to cervical cancer preventive behaviors that comprise the overall effective constructs in PAPM. These constructs led to changes in people's stage of behavior within this model or helped to form the behavior.[1,19] The target group was identified for field testing.

The target research population consisted of women residing in the suburban areas of Bandar Abbas. The participants were randomly selected from 10 regions from among the population of women supported by the healthcare centers.

To estimate the required sample size for factor analysis, Tabachnik and Fidell's approach was followed, according to which to obtain reliable estimates through multivariate analysis, the number of observations should be 5–10 times the number of variables in the model.[20,21] Thus, the minimum sample size in this research for field testing was estimated at 300.

In the questionnaire completion phase, 10 well-trained health workers participated as the research team members. First, they explained the questions and the questionnaire to the participating women. When the participants got to know what they were supposed to do and fully consented to take part in the research, they completed the questionnaires. Moreover, the health workers helped semi-literate participants to respond to items.

Initially, the face validity of the questionnaire was qualitatively and quantitatively checked as well as the content validity by a panel of experts. The reliability of the questionnaire was tested with 30 participating women who met the inclusion criteria, using Cronbach's alpha and the test-retest method. The retest was given within 2 weeks with 30 participants other than the target group.

The primary draft consisted of the relevant constructs to the model, which were 8 in number: awareness (14 items), perceived susceptibility (10 items), perceived severity (8 items), perceived benefits (6 items), perceived barriers (10 items), target social norms (6 items), fear and anxiety (6 items), and perceived self-efficacy (8 items).

The items were to be rated on a 5-level Likert scale: totally agree (score 5), agree (score 4), undecided (score 3), disagree (score 2), and totally disagree (score 1).[20,22]

The face validity of the questionnaire was established both qualitatively and quantitatively. For the former, a panel of 10 experts was used including an obstetrics specialist, a fertility healthcare specialist, an epidemiology specialist and seven health education specialists. Their comments on the appropriateness and relevance of items, ambiguity, probable cases of misinterpretation and difficulty level and intelligibility of items were taken into account and the consequent revisions were made. For the latter, the impact factor was analyzed for each item to test the importance of each and find inappropriate items to discard. All items were to be rated on a 5-level Likert scale: Totally, agree (score 5), agree (score 4), undecided (score 3), disagree (score 2), and totally disagree (score 1).[20,22] The questionnaire was completed by a panel of 10 experts from among the suburban women population. Yet, these were not included in the main research sample. Impact factor >1.5 would be accepted and that below would be deemed unacceptable[23] (impact score = frequency (%) × importance).

To test the content validity of the questionnaire qualitatively, it was submitted to 10 health education and health promotion specialists and their comments on the use of appropriate words, appropriate positioning of items, grammar and scoring were applied to revise the questionnaire.

The content validity was also quantitatively checked using content validity ratio (CVR) and content validity index (CVI). For the former, there were three choices available to raters: essential, useful but not essential, unessential. The rating was done for each item by a panel of experts. The values >0.79 were interpreted as acceptable. The estimation formula was:[24] CVR = ([ne-(N/2)]/[N/2])*.

In which:

N = the number of experts choosing the "essential" choice

N = the total number of expert raters.

According to Lawshe's Table, values >0.79 are taken as acceptable.[24]

To estimate CVI, Basel and Waltz's approach was followed. Thus, for each item, three criteria were checked by experts on a 4-level scale: Clarity, simplicity, and relevance.[25] The score for each item was estimated as the number of experts who scored the item 3 or 4 divided by the total number of the experts. Moreover, a final score >0.79 was taken as acceptable.[26]

To test the reliability of the questionnaire, two approaches were followed: test of internal consistency and test-retest method. For the former, Cronbach's alpha was estimated with 30 women participants filling out the questionnaire. Alpha value above 0.65 was taken as acceptable.[27]

External reliability was estimated through test-retest method with an interval of 2 weeks with 30 adult women participants not belonging to the main research sample, who completed the questionnaires. Then, the significance level and Pearson correlation coefficient were estimated.

A total number of 300 women receiving care services from 10 healthcare centers were randomly selected to participate in the field testing of the questionnaire. These women were >20 years of age and resided in the suburban areas of Bandar Abbas.

Construct validity indicates to what extent the instrument employed to assess a certain characteristic is theoretically supported. In the present research, exploratory factor

analysis (EFA) was used for construct validation. EFA was used to evaluate the questionnaire and the initial EFA was obtained. Kaiser-Meyer-Olkin (KMO) test value was estimated for the questionnaire and confirmed the factor analyzed and the sampling adequacy. KMO >0.7 would confirm the data and adequacy of sample size. Moreover, Bartlett's test was used to ensure that the correlation matrix fitted the factor analysis. If Bartlett's test value was <0.05, the factorability of data was confirmed.[28] Orthogonal rotation of varimax type was used to find independent factors. The factor loading of each item within the rotated matrix needed to be at least. 3 and preferably higher.[22] Principal component analysis (PCA) with varimax rotation was run on all items of the questionnaire.

Data analysis was performed through SPSS22 (Statistical Package for the Social Sciences).

Ethical considerations
This research was approved by the Committee of Ethics at Shahid Sadoughi University of Medical Sciences (Ethics Code: IR. SSU. SDH. REC.1398.015). All participants were informed of the aim of this study and informed consent was acquired from the participants.

Results

The demographic information of the women respondents are: minimum age of 20 and maximum age of 58, average age of 32 years; they were all married and 97% lived with their husband at the time of the study; 35% held a diploma degree and the rest were of a lower education level; all has at least one child; 27% had not conducted the Pap test; 3% had received the HPV vaccine; 8% had cervical cancer in their family background.

In the face validation, some items concerning the constructs were revised. Two items were eliminated from the awareness dimension; two were omitted from perceived susceptibility; two were removed from perceived severity and one item from each of the perceived benefits and barriers, social norms, fear and self-efficacy. The total number of items discarded according to experts' commentaries was 11. As for quantitative face validity, all items whose impact score was at or above 1.5 remained in the questionnaire.

Having calculated CVR, 1 item was eliminated from the fear dimension and another from the self-efficacy. The other items whose CVR was >0.79 remained in the questionnaire. Only 2 items were eliminated. All items had a CVI >0.79 [Table 1].

The measure of internal consistency was done through Cronbach's alpha test. All items showed to reach the

minimum score to remain within the questionnaire. The minimum score for Cronbach's alpha for social norms construct was 0.82 and the maximums score for perceived severity was 0.90. To ensure of the external reliability of the questionnaire, the test-retest method was used. The results showed a statistically significant positive correlation between the test and retest [Table 2].

EFA was run and KMO test result was estimated at 0.816. Bartlett's test of Sphericity result was also statistically significant ($P = 0.001$), which shows the adequacy of correlation among the items within the questionnaire for PCA. 55 items within the questionnaire were analyzed through initial EFA and 3 items were eliminated due to low communalities. The rest of items had communalities >0.3 and thus, remained in the questionnaire.[14,18] The data were analyzed through factor analysis by PCA and varimax rotation, which is presented for each and every item within Table 3. In this stage, three items were eliminated due to cross-loadings.

The constituent constructs of the instrument showed acceptable loadings on 8 factors. Eight factors showed a higher variance than others and accounted for 56.25% of the total variance. The scree plot also confirmed these eight factors, as from the 9th factor above, all are about the same level and have similar eigenvalues [Figure 1].

The first factor "awareness" with 10 items explained 13.03% of the variance; the second factor "perceived susceptibility" with 7 items explained 7.9% of the variance; the third factor "perceived severity" with 5 items explained 6.57% of the variance; the fourth factor "perceived benefits" with 5 items explained 6.43% of the variance; the fifth factor "perceived barriers" with 8 items explained 5.93% of the variance; the sixth factor "perceived social norms" with 4 items explained 5.69% of the variance; the seventh factor "fear" with 5 items explained 5.57% of the variance and the eighth factor
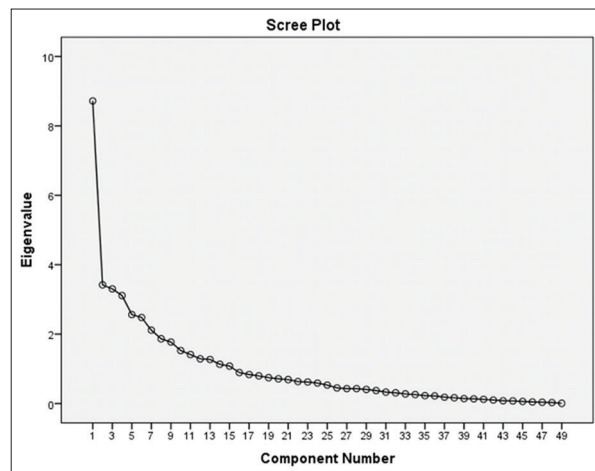

Figure 1: Scree plot of factor in the cervical cancer questionnaire

Table 1: The content validity index and content validity ratio of the questionnaire after applying modifications

Model structure	Items	CVI of each question	CVI of construct	CVR of each question	CVR of construct
Awareness	Cervical cancer is preventable for me	1	0.93	0.80	0.91
Likert 5 option	HPV is correlated with cervical cancer	0.90		1	
(strongly agree to	Vaccination for HPV can help to prevent cervical cancer	1		1	
strongly disagree)	Overweight and obesity increase the occurrence rate of cervical cancer for me	1		1	
	Tobacco consumption (cigarettes and hookah) increases the probability of occurrence of cervical cancer for me	1		1	
	Pap smear is essential for me and I ought to take it regularly	0.83		0.80	
	Pap smear is given only to women with hemorrhage and unnatural uterine secretion	0.83		1	
	Lack of personal and sexual healthcare considerations increases the occurrence rate of cervical cancer	0.80		0.90	
	Genital diseases such as genital warts increase the occurrence rate of cervical cancer for me	1		0.80	
	Pap smear is effective in preventing cervical cancer for me	1		0.80	
Perceived susceptibility	Cervical cancer is a serious concern for me	1	0.91	1	0.90
Likert 5 option	As there is no one in the family with cervical cancer, the probability of affliction with this disease is very low for me	0.96		0.90	
(strongly agree to	Tobacco consumption increases the occurrence rate of cervical cancer	1		1	
Strongly disagree)	If I am overweight, the probability of occurrence of cervical cancer is higher for me	0.96		1	
	I do not need HPV vaccine to prevent HPV or cervical cancer	0.83		0.80	
	I show no symptom such as unnatural secretions or infection. So, I do not need a pap test	0.86		0.80	
	Lack of personal and sexual healthcare increases the probability of cervical cancer for me	0.76		0.80	
Perceived severity	Cervical cancer might disrupt my sexual relationship	1	0.99	0.80	0.96
Likert 5 option	Cervical cancer might lead to hysterectomy for me	1		1	
(strongly agree to	Cervical cancer pushes me toward chemotherapy or radiotherapy	1		1	
strongly disagree)	Cervical cancer might lead to infertility in me	1		1	
	Cervical cancer might lead to my death	0.96		1	
Perceived benefits	Vaccination for HPV relieves me of the probable affliction with cervical cancer	1	1	1	0.95
Likert 5 option	Quitting smoking helps me to prevent cervical cancer	1		1	
(strongly agree to	Weight control helps me to prevent cervical cancer	1		1	
strongly disagree)	Pap smear provides me with higher chances of early diagnosis of cervical cancer and timely treatment of the disease can help to prevent more severe adverse effects	1		0.83	
Perceived barriers	The cost of HPV vaccination is too high for me	1	0.91	1	0.90
Likert 5 option	HPV vaccination is not available to me	0.93		1	
(strongly agree to	It is hard for me to cut down on smoking or quit it as cigarettes and hookahs are ever-available to me	0.83		1	
strongly disagree)	Weight control is hard for me as I am deeply interested in greasy and fried food	0.96		1	
	I am too shy to take a pap smear.	0.90		0.80	
	Pap smear is too expensive for me to take	0.83		0.80	
	It is too time-consuming to take a pap smear in public clinics	0.90		0.80	
	It is neither desirable nor qualified for me to take a pap smear in public clinics	0.96		0.80	
Perceived social norms	Those who care about me persist on my HPV vaccination to prevent HPV and cervical cancer	1	1	0.93	0.95
Likert 5 option	Those who care about me try to talk me into reducing or quitting smoking to prevent cervical cancer	1		0.90	
(strongly agree to	Those who care about me advise me to control weight to prevent cervical cancer	1		1	
strongly disagree)	Those who care about me talk to me about taking the pap smear	1		1	

Contd...

Table 1: Contd...

Model structure	Items	CVI of each question	CVI of construct	CVR of each question	CVR of construct
Fear	I am concerned about affliction with cervical cancer	1	0.91	1	0.91
Likert 5 option (strongly agree to strongly disagree)	As I smoke cigarettes or hookahs, I am afraid of being afflicted with cervical cancer	1		1	
	As I never tried HPV vaccination before, I am afraid of getting afflicted with cervical cancer	0.83		0.90	
	As I hardly control my weight, I am afraid of getting afflicted with cervical cancer	0.90		0.85	
	I do not dare to take a Pap smear with the fear that I am diagnosed with cervical cancer	0.83		0.80	
Self- efficiency	I can afford to pay for HPV vaccination cost to prevent HPV and cervical cancer	0.93	0.92	1	
Likert 5 option (strongly agree to strongly disagree)	I am confident about my ability to reduce or quit smoking to prevent diseases	0.93		1	
	I am sure that I can stick to my diet in order to lose weight	0.96		1	
	I am sure that I can take the pap test in public clinics even if it is time-consuming	0.83		0.80	
	I am sure that I can take the pap smear even if I am totally healthy	1		0.80	
	I can gain information and broaden my knowledge of cervical cancer	0.90		0.80	

HPV=Human papillomavirus, 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 question	Alpha Cronbach's coefficient	Test-retest coefficient
Awareness	10	0.88	0.89
Perceived susceptibility	7	0.85	0.87
Perceived severity	5	0.90	0.84
Perceived benefits	4	0.87	0.85
Perceived barriers	8	0.89	0.86
Perceived social norms	4	0.82	0.85
Fear	5	0.86	0.81
Self- efficiency	6	0.84	0.87

with 6 items explained 5.13% of the variance. Overall, 49 items of the questionnaire explained 56.25% of the variance.

The final draft of the questionnaire consisted of 8 constructs [Table 1]: Awareness (10 items), perceived susceptibility (7 items), perceived severity (5 items), perceived benefits (4 items), perceived barriers (8 items), perceived social norms (4 items), fear (5 items), and perceived self-efficacy (6 items).

Discussion

The questionnaire developed in the present research was a new version based on the factors affecting the constructs of PAPM concerning the primary and secondary behaviors of cervical cancer prevention among Iranian women.

The face validity of the final questionnaire was confirmed by a panel of experts and the face validity of the questionnaire gained standard score. In the present research, CVI and CVR were used for content validation. CVI and CVR of the questionnaire were both >0.79 and interpreted as acceptable according to Lawshe's table.[24]

In this research, the test of internal consistency is used to measure the correlation between and among all items. The measure of internal consistency was done through Cronbach's alpha test; it ranged between 0.82 and 0.90 which indicates the suitability of the questionnaire. To ensure of the external reliability of the questionnaire, the test-retest method was used. The results showed a statistically significant positive correlation between the test and retest. EFA was run and KMO test result was estimated at 0.816. Bartlett's test of Sphericity result was also statistically significant ($P = 0.001$), which shows the adequacy of correlation among the items within the questionnaire for PCA.

The instrument designed consists of the effective constructs of women's behavioral change within PAPM. This instrument is easily readable to women.

The first step in developing and standardizing a questionnaire is to carefully select experts and participants fitting the study design. This can lead to a standardized questionnaire and was, thus, emphasized in the present research and the related literature.[14,29] The required sample size for the field test abided by the existing standards and was large enough.[20]

The internal consistency of the present questionnaire was estimated via Cronbach's alpha at 0.82–0.90 for the constituent constructs. The same estimate was

Table 3: Correlation matrix between the items and domains, according to factorial analysis by principle components and varimax rotation

Item	Component							
	1	2	3	4	5	6	7	8
Awareness 3	0.699							
Awareness 1	0.697							
Awareness 4	0.682							
Awareness 2	0.672							
Awareness 5	0.660							
Awareness 6	0.659							
Awareness 9	0.652							
Awareness 7	0.635							
Awareness 10	0.617							
Awareness 8	0.615							
Perceived susceptibility 3		0.759						
Perceived susceptibility 4		0.757						
Perceived susceptibility 6		0.674						
Perceived susceptibility 7		0.619						
Perceived susceptibility 5		0.608						
Perceived susceptibility 1		0.479						
Perceived susceptibility 2		0.568						
Social norms 2			0.785					
Social norms 1			0.858					
Social norms 4			0.715					
Social norms 3			0.676					
Self- efficiency 2				0.667				
Self- efficiency 3				0.656				
Self- efficiency 4				0.652				
Self- efficiency 1				0.652				
Self- efficiency 5				0.542				
Self- efficiency 6				0.523				
Perceived severity 4					0.811			
Perceived severity 5					0.727			
Perceived severity 3					0.570			
Perceived severity 2					0.506			
Perceived severity 1					−0.481			
Perceived benefit 2						0.776		
Perceived benefits 1						0.776		
Perceived benefit 4						0.684		
Perceived benefits 3						0.688		
Perceived barriers 4							0.401	
Perceived barriers 3							0.686	
Perceived barriers 2							0.535	
Perceived barriers 5							0.526	
Perceived barriers 6							0.495	
Perceived barriers 7							0.466	
Perceived barriers 8							0.376	
Perceived barriers 1							0.681	
Fear 2								0.613
Fear 1								0.466
Fear 3								0.419
Fear 4								0.436
Fear 5								0.576

reported by Jassempour *et al.* in a study of educational interventions and child injuries in the light of PAPM as 0.83–0.94, which is interpreted as desirable.[30] In some other research, Urrutia aimed to validate a questionnaire based on HBM concerning cervical cancer. In this research, Cronbach's alpha was estimated to be 0.73 for the questionnaire.[17] In Vance's and Keele research on the development of a cervical cancer questionnaire,

HBM was used and Cronbach's alpha was estimated as 0.6–0.68.[18] This value shows that the internal consistency of the questionnaire and its reliability were acceptable and this would attest to the suitability of the instrument.

In the present research, the test-retest method was used to make sure of the external reliability of the questionnaire and the coefficient was estimated as 0.81–0.89 and is, thus, interpreted as acceptable. Jaglarz *et al*. attempted to standardize a questionnaire on cervical cancer. They reported test-retest reliability to range between 0.89 and 0.94.[29] In another study, Licc developed a questionnaire to measure Serbian women's psychological diseases affecting their Pap test administration. Their estimated value ranged between 0.80 and 0.89 which attests to the acceptable reliability of the questionnaire.[15]

Factor analysis is another step in evaluating a newly developed measurement instrument. In the present research, EFA was performed. KMO test was estimated at 0.816 which is interpreted as meritorious.[22] In another study, Urrutia investigated the case of Chilean women using the constructs of HBM concerning cervical cancer and Pap test administration. The correlation coefficient was estimated as 0.82.[17]

In their research, Vance *et al*. explored cervical cancer and found KMO to be 0.692. Vance and Urrutia interpreted this KMO value indicative of adequate sample size for factor analysis. This point is consistent with the present research. Yet, the minor difference is in KMO value which can be a function of different sample sizes used in the field test. The present research had a sample of 300 and KMO of 0.816; that of Urrutia had a sample of 333 and a KMO of 0.826; Vance and Keele used a sample of 217 and reported a KMO of 0.692.[17,18]

Moreover, in the present research, varimax rotation was used and led to the omission of three indicators due to cross-loadings. However, in the research by Vance and Keele, only 1 item was discarded due to cross-loading. Moreover, in the present research, 3 indicators were omitted due to low communalities while in the work of research by Vance and Keele, 8 items were discarded for this reason.[18] Probably, the different number of items and factors in these studies led to the elimination of more indicators due to cross-loadings or low communalities.

In this study, the rotation indicated what variables relate more strongly to each factor. According to Table 3, the items were distributed in eight factors.

Items had values above 0.3 which shows a meritorious correlation of variables with each factor. In their attempt to develop a questionnaire on following cervical and breast cancer treatments, Lessa *et al*. showed

that values >0.3 were confirmed and attested to the meritorious correlation of variables and factors. Thus, the present finding is consistent with that of Lessa *et al*.[14]

In the present research, eight factors had a higher variance than the others and managed to explain 56.25% of the total variance. The scree plot also confirmed the eight factors as from the ninth factor on, they are all about the same level and have very similar Eigenvalues. However, Vance and Keele extracted four factors that explained 52.23% of the total variance.[18] This can be due to the different indicator extraction based on the theoretical frameworks used.

The present findings revealed that awareness, perceived susceptibility and perceived severity, respectively, explain a higher percentage of variance that the hypothetical model. The research findings obtained by Nguyen-Truong *et al*. about the psychometrics of cervical cancer questionnaire among Vietnamese women with a focus on Pap test barriers and benefits revealed that perceived susceptibility, benefits and barriers, respectively, explained a higher percentage of the total variance.[16] In the work of research by Vance and Keele, perceived barriers, susceptibility, and awareness explained a higher variance.[18]

In a body of research by Nguyen-Truong *et al*.,[16] the constituent items of all constructs only addressed Pap smear test administration. In the work of research by Vance and Keele concerning cervical cancer,[18] Pap smear test and HPV, there were items exploring Pap smear test administration, HPV vaccination, tobacco consumption, overweight, sex health matters and sex-transmitted diseases, though they were subsumed under the awareness construct. This construct explained 13.03% of the total variance which was above all other constructs. It is admitted that these items and their correlation with cervical cancer was interesting to women participants of the field test.

The perceived susceptibility construct in this research consisted of detailed items on cervical cancer. These included the serious risk of the disease, significance of family background, HPV vaccination, tobacco consumption, overweight, sexually transmitted diseases and Pap smear test administration. However, in similar woks of research by Vance and Keele[18] and Nguyen-Truong *et al*.,[16] only the item enquiring about concerns with cervical cancer was addressed generally in the questionnaires.

For perceived severity, in the questionnaire derived from Vance's and Keele study,[18] only the mortality item (the most extreme perceived condition) concerning cervical cancer was included. However, in the present

questionnaire, mortality and other relevant items such as the effect on sex affairs, hysterectomy, and infertility were addressed. These items can be important measures of the adverse effects of cervical cancer as perceived by women.

The present research attempted to evaluate the psychometrics of a questionnaire on cervical cancer preventive behaviors based on the PAPM among Iranian women.

Conclusions

The final questionnaire in the present research consisting of constructs affecting the stages of PAPM enjoys meritorious psychometric features. There are 49 items and 8 constructs in this instrument the Persian version of which was psychometrically analyzed. There are certain items for each construct derived from preventive behaviors of cervical cancer among women. The underlying constructs of this questionnaire include items that indicate primary and secondary preventive behaviors.

Key items are included within this questionnaire as primary preventive measures of cervical cancer, such as HPV, HPV vaccination, tobacco consumption, overweight as well as instances of secondary preventive measures such as Pap smear test administration. These items help to evaluate the state of preventive behaviors shown by women. If required, healthcare staff help to enhance these behaviors to prevent cervical cancer.

This questionnaire can be used in future investigations of cervical cancer preventive behaviors among women as an effective instrument to measure the effect of interventions aiming to prevent cervical cancer.

Limitations and strengths
The present questionnaire was actually the first Persian version among Iranian women in psychometrics and can be a useful instrument for interventional studies of cervical cancer.

Among the limitations of the present research is that the questionnaire was only applied to suburban women residing in Bandar Abbas in the south of Iran and questionnaire was completed as self-report. Further studies are required to do similar research on adult female participants in other parts of Iran.

Psychometric studies of questionnaire based on different behavioral models in different regions of Iran for cervical cancer in different age groups of women are suggested. Model-based comparative studies in deprived and beneficiary areas of Iran are

also recommended for the development of Cancer Prevention Questionnaires.

Conflicts of interest
There are no conflicts of interest.

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