Psychometric Design of a Questionnaire for the Prevention of Induced Demand for Medicine Prescription

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A R T I C L E   I N F O

A B S T R A C T

Background: Unnecessary demand for healthcare services for patients is a major concern in health economics research, and social science researchers primarily use questionnaires. The present study aimed to evaluate the reliability and validity of the questionnaire of the prevention of induced demand for medicine prescription.

Methods: This descriptive study was conducted after designing the primary questionnaire (63 items). The reliability and validity of the questionnaire were assessed by determining the face validity, content validity, construct validity, and reliability.

Results: Initially, no items were eliminated in the qualitative assessment of face validity. To determine the content validity, six items were integrated due to overlapping, and 34 items remained. Principal component analysis revealed a three-factor solution to provide the best fit. Intraclass correlation and Cronbach's alpha for each component of the questionnaire confirmed its reliability.

Conclusion: In order for valid and reliable questionnaires, the views of the target group and experts must be considered and all the psychometric stages should be accomplished. Due to the differences in various studies, a single questionnaire cannot be used in every research.

1. Introduction

Unnecessary demand for healthcare services for patients is a major concern in health economics research [1-3], which may include various medical interventions ranging from medicine prescription to operational interventions [4,5]. According to the literature, some of the main contributing factors to unnecessary medicine prescription include physician-related factors, patient-related factors, and political and institutional factors [6,7]. According to the World Health Organization (WHO), more than 50% of medicines are not prescribed or sold appropriately, and approximately 50% of patients use medicines improperly [8]. Furthermore, a study in this regard indicated that the main consequences of induced demand for medicine prescription were health consequences and social and economic burdens [9]. Irrational medicine prescription imposes an additional burden on the healthcare system and wastes health resources, thereby leading to health and economic costs for patients [8,10]. In a research in this regard, Celik et al. (2013) evaluated the effects of the irrational use of medicine, reporting that irrational medicine use could cause medicine resistance, lack of patient recovery, disease prolongation, treatment ineffectiveness, and waste of economic resources in the healthcare system and patients [11]. Furthermore, Ahmed conducted a study on supplier-induced demand (SID) in health care and denoted some of the consequences of SID, such as catastrophic expenditure for patients, prolonged treatment, and irrational use of medicines [10].

Several studies have suggested that physician-induced demand may potentially increase health expenditures [12,13]. Therefore, induced demand for medication may have health, economic, social, and cultural consequences.

In our previous qualitative study, the strategies for the prevention of induced demand for medicine prescription were classified into two categories of health educational programs and stewardship in the healthcare system [9]. Several studies have also confirmed that increased levels of information in patients [12,14-17], informing patients and their families on disease diagnosis and treatment [10], prioritization of health educational programs regarding the irrational use of medicines [18], and policymaking and setting regulations for the prevention of SID in healthcare providers are essential to the control of induced demand for medicine prescription [10,19]. In the aforementioned studies, no data have been proposed regarding the rate of the consequences of this issue its causes. Questionnaires are extensively employed for data collection, and numerous social science researchers rely on research based on questionnaires. In most studies, valid and reliable instruments are essential to the assessment of complex constructs [20,21]. A designed instrument requires psychometric testing, which is also necessary in case of differences in the sample population despite using developed and tested questionnaires. However, the reporting of the psychometric properties of questionnaires based on prior studies is only an initiative to determine whether the instrument is useful for the items and population under study [22].

To date, no questionnaires have been developed for the measurement of induced demand for medicine prescription. The present study aimed to design an instrument for the prevention of induced demand for medicine prescription and evaluate its reliability and validity.

2. Materials and Methods

This descriptive-analytical study was conducted after designing the primary questionnaire (63 items) based on the interviews in our previous qualitative study, and the reliability and validity of the developed questionnaire were assessed in four steps.

This was the first study to develop an instrument for the prevention of induced demand for medicine prescription based on the interviews in our previous qualitative study. In total, 20 in-depth interviews were conducted with eight non-faculty members and 12 faculty members. The Interviewees were health educationists, health economists, clinical pharmacologists, pharmacologists, pharmaco-economists, pharmacists, general practitioners (GPs), and patients as consumers [9]. The applied instrument contained items regarding the contributing factors to induced demand for medicine prescription, as well as its consequences and preventative strategies.

Step 1) Determining Face Validity

The first step in the process was to determine the face validity of the developed questionnaire using the qualitative and quantitative methods of face validity.

A. Determining the Qualitative Face Validity

At this stage, 15 married women referring to various healthcare centers were interviewed face-to-face regarding the designed questionnaire (63 items). Their comments were received about the levels of difficulty, irrelevancy, and ambiguity for each item. After correcting the items based on the obtained feedback, the quantitative method of face validity (item impact method) was used to eliminate the irrelevant items and determine the significance of each item.

B. Determining the Quantitative Face Validity (Item Impact Method)

The item impact method was used to determine the quantitative face validity. To this end, each item of the questionnaire was graded based on a five-point Likert scale, including Very Important (five points), Important (four points), Relatively Important (three points), Slightly Important (two points), and Unimportant (one point). At this stage, 15 married women were asked to identify the items they considered to be most important and grade the level of importance based on the mentioned scale. The item impact score of the questionnaire items was calculated using the following formula:

Item Impact Score = frequency × Importance

where frequency is the percentage an individual has scored the importance of an item to be four or five, and importance shows the mean importance score of the items. If the item impact of an item was ≥ 1.5, the item would remain in the questionnaire; otherwise, it would be eliminated [22].

Step 2) Determining Content Validity

At the second step, the content validity ratio (CVR) and content validity index (CVI) were utilized to determine content validity. In order to determine the CVR, 15 experts (five health educationists, one health economist, one epidemiologist, one pharmaco-economist, one clinical pharmacologist, one pharmacologist, two GPs, and three researchers in the field of the study) were requested to identify whether an item is essential by grading the items based on a three-point Likert scale (1: Essential, 2: Useful but Not Essential, 3: Not Essential). The CVR of the questionnaire items was calculated using the following formula:

CVR = (Ne - N/2)/(N/2)

where Ne is the number of the experts who considered the item to be essential, and N represents the total number of the experts. The numeric CVR value was determined using Lawshe table. In the present study, if CVR was > 0.49, the item in the questionnaire would be accepted with proper significance [23].

To calculate the CVI, the mentioned 15 experts were asked to identify the three criteria of simplicity, relevance, and clarity separately and grade the items based on a four-point Likert scale. The CVI of the questionnaire items was calculated using the following formula:

CVI = Number of Experts Grading 3-4/ Total Number of Experts

Based on the mentioned formula, the CVI of ≥ 0.79 was considered excellent, 0.70-0.79 required revision, and < 0.70 was considered unacceptable, and the items were eliminated [23].

Step 3) Determining Construct Validity

The construct validity of the questionnaire (34 items) was determined using exploratory factor analysis as the principal component analysis (PCA) model. Initially, the Kaiser-Meyer-Olkin (KMO) and Bartlett's test were used to confirm the sampling adequacy to perform the factor analysis, and the KMO of > 0.7 confirmed the sampling adequacy to perform the factor analysis [24]. Following that, the factor loading of each item was calculated using factor analysis based on VARIMAX rotated solution. Factor loading is the correlation between the item and factor, with the loading values of ≥ 0.4 indicating the favorable correlation of the item with the factor [25], while the items with the factor loading of < 0.4 were eliminated. In addition, the number of the component sets in the construct of preventing the induced demand for medicine prescription was determined. The questionnaire consisted of two sections; the first section contained six items to measure the demographic characteristics of the women (e.g., age, number of children, marriage state, education level, occupation status, and insurance status). The second section had 34 items to measure the construct of preventing the induced demand for medicine prescription. At this stage, the participants were the married women referring to the selected healthcare centers in Tehran (Iran) in 2017. Considering that the researchers recommended that the number of the samples in the factor analysis be 10 times the number of the questionnaire items, the sample size was determined to be 340 [26].

The participants were selected via randomize cluster sampling, and 30 subjects were considered for each cluster sample using the following formula:

Number of Clusters = Sample Size/Cluster Sample;
340/30 = 12

Among the total healthcare centers in Tehran, 12 healthcare centers were selected as one cluster, and 30 women were randomly selected in each cluster. Considering 1.6% sample loss, the sample size was determined to be 360 using the following formula:

Sample Size = Number of Clusters × 30

Finally, 338 questionnaires were completed. The inclusion criteria of the study were married women aged 15-49 years, minimum of primary education, and minimum of one referral to physician within the past year.

Step 4) Determining Reliability

Test-retest reliability and internal consistency were used to determine the reliability of the questionnaire. In order to determine the test-retest reliability, the questionnaire was completed by 30 women referring to the selected

healthcare centers, with the exception of the selected clusters. After two weeks, the respondents were asked to complete the questionnaire. The intraclass correlation (ICC) was used to determine the test-retest reliability of the questionnaire. The reliability coefficient of > 0.7 was considered acceptable and 0.85-0.95 was considered favorable. Moreover, the Cronbach's alpha coefficient was used to determine the internal consistency of each component and the entire questionnaire. The alpha coefficient of each questionnaire item was calculated without changing the necessary contents within the range of 0.7-0.8, and the items with coefficients higher than this rang were eliminated [27].

Informed consent was obtained from all the participants prior to the study (IR.SBMU.PHNS.REC.1394.28). Data analysis was performed in SPSS version 17 using exploratory factor analysis as the PCA model to determine construct validity, as well as ICC and Cronbach's alpha coefficient to determine reliability.

3. Results and Discussion

In step one to determine the qualitative face validity, no items were eliminated from the questionnaire. According to the results of the item impact method, the score of each item in the questionnaire was higher than 1.5, and no items were eliminated.

In step two, the results of CVR indicated that the score of 26 out of 63 items was less than 0.49, and these items were eliminated, with 37 items remaining in the questionnaire. In determining the CVI, six items were integrated due to overlapping, and 34 items remained in the questionnaire. In step three, PCA was conducted on the data provided by 338 married women. The majority of the participants (68%) were aged 29-38 years, with the mean age of 34.1 ± 6 years. In addition, the majority of the studied women had academic education (55%), and most of them had two children (47.8%).

The KMO score was estimated at 0.824, which confirmed the sampling adequacy to perform factor analysis. Moreover, the Bartlett's test of 5254.356 (P = 0.001) indicated that the correlations between the questionnaire items were sufficiently large for PCA. PCA revealed a four-factor solution that provided the best fit. Tables 1-4 show the factor loading of the items by factor analysis based on the VARIMAX rotated solution. Accordingly, three items had the factor loading of < 0.4 and were eliminated, and 31 items eventually remained in the questionnaire. Table 5 shows the eigenvalue and percentage of the variance and cumulative percentage. In the present study, the two factors of two and four were integrated due to the fact that the revealed items in these factors measured the same subject. Therefore, the questionnaire had three components, including the integrated factor (referred to as the causes of the induced demand for medicine prescription), factor one (referred to as the strategies for the prevention of the induced demand for medicine prescription), and factor three (referred to as the consequences of the induced demand for medicine prescription). In the final step, the results of ICC and Cronbach's alpha coefficient for each component of the questionnaire confirmed the reliability (Table 6).

Table 1: Factor 1: Item Factor Loading by Factor Analysis Based on VARIMAX Rotated Solution

	Item	Very Much	Very	Medium	Low	Very Low	Factors Loading
	Please determine the effect of any of the following in reducing the prescription and request of unnecessary drugs.						
26	Receive training for increasing the level of drug information						0.605
27	Promoting the culture of the correct prescribing and drug use						0.732
28	Train physicians about the correct prescription of drugs.						0.754
29	Supervising physicians' performance in prescribing drugs						0.777
30	Supervising the performance of pharmacies						0.793
31	Implementation of the law prohibiting the sale of drugs without prescription						0.492
32	Patient training by a physician against to ask for irrational drug						0.721
33	Fighting physicians who make mistakes in prescribing drugs						0.757
34	Sufficient supervision over the relationships between drug companies and physicians and pharmacies						0.810

Table 2: Factor 2: Item Factor Loading by Factor Analysis Based on VARIMAX Rotated Solution

	Item	Very Much	Very	Medium	Low	Very Low	Factors Loading
	In your opinion, how much of any of the following can be your incentive to ask for a drug from a doctor or pharmacy?						
10	Advertising of drug companies in the mass media (TV, satellite, magazines)						0.387
11	Get drug information from friends and acquaintances						0.465
12	Getting drug information from the internet						0.468
13	Therapeutic advice from relatives because of the similar symptoms of their illness with you						0.594
14	Getting familiar with a doctor who is among your friends and colleagues.						0.468
15	The desire to have drug at home						0.455
16	Believing that a good physician should prescribe more drugs.						0.675
17	Cheaper drug with insurance						0.652
18	Possibility to buy drugs without prescription						0.710
19	Concerned about the lack of drugs needed at pharmacies						0.637

Note: factor loading < 0.4 highlighted; item eliminated

Table 3: Factor 3: Item Factor Loading by Factor Analysis Based on VARIMAX Rotated Solution

	Item	Very Much	Very	Medium	Low	Very Low	Factors Loading
	In your opinion, how much additional prescription and additional drug use can be effective in causing the following problems?						
20	Depriving people in need of drug						0.633
21	Risk of a person's health						0.699
22	Lack of timely recovery due to unnecessary drug use						0.699
23	Make extra patient costs.						0.763
24	Impose additional financial burden on the treatment section						0.788
25	Wasting drugs						0.773

Table 4: Factor 4: Item Factor Loading by Factor Analysis Based on VARIMAX Rotated Solution

	Item	Very Much	Very	Medium	Low	Very Low	Factors Loading
	In your opinion, how much of any of the following can affect the prescription of unnecessary drugs by the physician?						
1	The tendency of the doctor to prescribe more.						0.607
2	Physician's inability to correctly diagnose the disease.						0.672
3	Financial communication between the doctor and the pharmacy.						0.667
4	Financial relationship between pharmaceutical companies and pharmacists						0.700
5	Supervision inadequate supervisory organizations on drug prescription						0.740
6	The weakness in physicians' fines against medication errors						0.688
7	The experience of your previous treatment because of the similar symptoms with your previous illness						0.375
8	Insufficient information on drugs						0.383
9	Insufficient awareness about the correct use of drugs						0.411

Note: factor loading < 0.4 highlighted; items eliminated

The present study aimed to evaluate the reliability and validity of a questionnaire developed for the prevention of the induced demand for medicine prescription. According to the findings, a multi-staged approach was essential to the development of the questionnaire, which is consistent with the previous studies describing questionnaire construction [23,28,29].

Our findings regarding face validity indicated that difficulty, irrelevance, and ambiguity were appropriate, and special attention is required while using various views in responding to the questionnaire items. A possible explanation in this regard is that the both the qualitative and quantitative face validity processes were used in the selection, rephrasing, and deletion of the items. It is also notable that the item impact scores among the positive items emphasized on the importance of such concepts for the target groups in the study, which is in line with the study by Broder et al. (2007) [23].

The essential items remained in the questionnaire based on experts' viewpoints on the CVR using the Lawshe table, and the results on the CVI indicated that the simplicity, relevance, and clarity of the responded items were appropriate. This could be due to several factors, including the design of the questionnaire items based on the interviews with the experts and patients as medicine consumers and modification of the items by the target group in the assessment of face validity.

A research in this regard was conducted by Holli et al. (2007) to evaluate validity and reliability, recommending the use of the process proposed by Lawshe (1975) for the assessment of content validity. Furthermore, the mentioned study demonstrated that content validity was correlated with the number of the items, number of the components, and theoretical framework of the instrument [22].

In the current research, PCA provided the data for the evaluation of construct validity. To this end, the questionnaire was divided into three components, and the results of PCA supported our final questionnaire. PCA was applied in the current research since it is able to extract the maximum variance of a dataset with a few components, thereby facilitating data analysis. Therefore, psychometric tests are essential to the assessment of questionnaires. Our findings provide proper evidence for further investigations in this regard [22,30].

The results of the present study regarding reliability confirmed the stability and consistency of the developed questionnaire. The stability of the questionnaire could be attributed to the application of the feedback provided by the target group and experts in the editing and correction of the questionnaire items. Additionally, the alpha coefficients and ICC for each component of the questionnaire were calculated. Another study in this regard suggested that these parameters are the minimum standards that should be applied in every research project [22].

The main strength of the present study was that several steps were implemented for the psychometric evaluation of the questionnaire, while few similar studies have denoted all the steps of validity and reliability testing. Researchers must set parameters for decision-making regarding validity and reliability and accept responsibility for the interpretation of the psychometric data [22].

Table 5: Variances in Revealed Factors

Factor	Eigenvalue	% of variances	Cumulative %
1	7.729	22.733	22.733
2	3.941	11.590	34.323
3	2.590	7.619	41.942
4	1.976	5.812	47.754

Table 6: ICC and Cronbach's Alpha Coefficient

Components	Numbers of items	Cronbach's alpha (N:338)	ICC (N:30)
Causes of induced demand of prescription	16	0.806	0.911
Strategies of preventing of induced demand of prescription	6	0.873	0.909
Consequences of induced demand of prescription	9	0.892	0.939
Total	31	0.862	0.913

4. Conclusion

According to the results, the designed questionnaire is a valid and reliable instrument. The key stages in the design and assessment of the research questionnaire were implemented in the present study. In order to use valid and reliable questionnaires, in addition to considering the views of the target group and experts, all the psychometric steps should be addressed. Every research is different, and it is not possible for a single questionnaire to meet the requirements of every study. Therefore, it is recommended that further investigations involve psychometric tests while using this questionnaire for other sample populations.

Authors' Contributions

This article was carried out by all the authors. A.M., and A.R., designed the manuscript and contributed to carry out data collection and data analysis and A.M., and A.R., wrote the manuscript.

Conflict of Interest

The Authors declare that there is no conflict of interest.

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