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ORIGINAL ARTICLE

Psychometric assessment of the Persian version of short clinical scale to measure chemotherapy-induced nausea and vomiting: the MASCC antiemetic tool

Mohammad Eghbali[1,2] · Reza Negarandeh[3] · Abbas Ebadi[4,5] · Razieh Bandari[6] · Faeze Mohammadzadeh[7]

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Abstract

Introduction and objective Managing chemotherapy-induced nausea and vomiting (CINV) in patients with cancer is still a challenge for the patients and also the clinicians. The Multinational Association of Supportive Care in Cancer (MASCC) has developed a scale for better measurement and management of CINV. Thus, this paper aims at translating the scale into Persian and assessing the psychometric properties of the proposed translated version of MASCC Antiemesis Tool (MAT).

Methods Having received the necessary permissions and complying with the Forward-Backward translation protocol, we conducted a qualitative assessment of the face validity through cognitive interviewing and content validity assess with 5 experts in Persian Literature. Internal consistency using Cronbach's Alpha Coefficient was applied to determine the scale reliability. In order to determine the construct validity, the three methods of exploratory factor analysis, known group analysis, and convergent validity (assessment of the correlation between Rhodes Index of Nausea, Vomiting and Retching (INVR) scale and the Persian version of MAT scale) were conducted on 300 participants.

Results About 300 patients with a mean age of 50.73 ± 0.81 participated in the study. The results showed a significant difference in the index of nausea and vomiting between the patients who are below 50 years old and those who are above 50 ($P = 0.0001$). The Cronbach's Alpha Coefficient was reported 0.88 for the whole MAT questionnaire. Due to the low factor load (fewer than 0.5) for question 1, it was removed in the factor analysis. Besides, exploratory factor analysis (EFA) led to the exploration of the two factors of nausea and vomiting.

Conclusion According to the results of the study, the Persian version of the MAT questionnaire is considered as a highly reliable and valid tool, in order to efficiently and accurately measure chemotherapy-induced nausea and vomiting and to better manage this side effect.

Keywords Psychometrics · Nausea · Vomiting · Chemotherapy · Reliability · Validity · Scale

✉ Reza Negarandeh
rnegarandeh@tums.ac.ir

[1] Department of Nursing, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[2] Student Research Committee, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[3] Nursing and Midwifery Care Research Center, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran

[4] Behavioral Sciences Research Center, Life Style Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran

[5] Faculty of Nursing, Baqiyatallah University of Medical Sciences, Tehran, Iran

[6] Social Determinants of Health Research Center, Semnan University of Medical Sciences, Semnan, Iran

[7] Medical laboratory science, Hasheminejad Hospital, Mashhad University of Medical Sciences, Mashhad, Iran

Introduction

As a significant medical problem, cancer has noticeable effects on the patients and their families. Cancer is considered as the third biggest cause of death in Iran, following road traffic accident and cardiovascular diseases [1].

Such impacts are due to the disease and also due to its side effects and consequences [2]. Chemotherapy is a routine and effective treatment for cancer, which is becoming prevalent. However, a comprehensive chemotherapy treatment course can lead to a series of side effects such as nausea and vomiting, diarrhea, fatigue, sleeping disorders, cognitive disorders and memory issues, and bone marrow suppression [3, 4].

It is noteworthy that nausea and vomiting are among the most common and the most irritating consequences of chemotherapy, which are experienced by at least 70–80% of the patients with cancer [5]. Such side effects are different among

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patients, but they can have noticeable adverse effects on patients' life quality and their compliance with the treatment [6, 7]. The younger patients and those who drink, even at low quantities, are more susceptible to nausea and vomiting. Women are more likely to suffer nausea and vomiting, particularly those who experienced it during pregnancy. CINV can be classified into these four categories of acute, delayed, breakthrough, refractory, and predictable [5, 8, 9].

Metabolic disorders (hyponatremia, hypokalemia, and metabolic acidosis), immunodeficiency, impairment in physical activities, cognitive and social performances, depression, and problem in taking roles are among the side effects of CINV; therefore, it is essential to avoid, reduce, or even control CINV among the patients [9]. It is reported that in case there is not an effective control over CINV, around 20% of the patients may stop their treatment [10].

It is claimed by many researches that there is great difference between the perception of the patients and the clinicians of nausea and vomiting, particularly in case of acute and delayed nausea and vomiting [11, 12]. Such misperception could lead to unnecessary pains for the patients and could also make it difficult to accurately identify the symptoms. Therefore, it is essential for those who take care of the patients to ask appropriate questions in order for better diagnosis and understanding of these two symptoms [13].

There are some tools measuring nausea and vomiting and their effects on the quality of life, including Morrow questionnaire [14], INVR scale [15], and nausea and vomiting scale regarding quality of life [16]. However, these tools are not fully available, there are limited validity and reliability, there are many items, and they are time-consuming. Thus, they are not easy to conduct in bed [4, 17].

Most of the studies conducted in Iran have used Rhodes' questionnaire in order to measure CINV. This questionnaire is reported to have appropriate validity and reliability; however, it is not specifically designed for patients with cancer and also needs to be completed on a daily basis [18].

Accordingly, there is a need for a tool that is easy to use by the patient to measure nausea and vomiting. In 2007, the Multinational Association of Supportive Care in Cancer (MASCC) developed a tool to measure nausea and vomiting after the treatment of cancer [19]. The MAT questionnaire was designed as a short self-report tool, which is easy to use to measure acute and delayed nausea and vomiting [20]. The main advantage of this tool as compared to other instruments is that it is only conducted once during the chemotherapy course; therefore, it does not always make problems for the patient and the doctor [21]. Furthermore, this questionnaire has been translated into different languages such as Japanese and Chinese, and the psychometrics have shown an acceptable reliability and validity [19, 20].

Because of the importance of identifying and measuring nausea and vomiting in patients with cancer, there is the need for a reliable and valid scale respectively. Such a scale can be used to assess related plans, measures, and treatments. Hence, this paper aimed at translating the MAT questionnaire and identifying the psychometric properties of the translated Persian version among patients with cancer undergoing chemotherapy in Iran.

Materials and methods

Study design

The present study is a methodological study aimed to translate the MAT questionnaire into Persian and to assess its psychometrics.

Patient population

The study was conducted on all the patients with cancer who were undergoing chemotherapy with moderate to high emetogenic drugs. They have received immediate care in the chemotherapy center of cancer institution in Imam Khomeini Hospital in Tehran from September of 2017 to March of 2018.

The inclusion criteria for this study include the following: aged 18 or above, undergoing chemotherapy with moderate to high emetogenic drugs, willingness to participate, and speaks Persian. The patients would be excluded if they did not fill the forms or if they did not consent.

Study procedure

Having contacted the designer of the MAT questionnaire and receiving the related permissions and the instructions, the translation of the scale from English (the original language) to Persian (the target language) started through Forward-Backward approach and based on International Quality of Life Assessment (IQOLA) translation protocol [22]. For that purpose, all the items were carefully translated into the target language by two experts in both English and Persian. After the consultations and finalizing the first translations, the Persian scale was also translated into the original language by two other experts.

Face and content validity

Having matched the translated version with the original English one and making sure the content can be correctly conveyed, we sent the questionnaire to five experts in Persian Literature in order to receive their feedback on language forms, diction, and the placement of the words and phrases. Then, the primary Persian version of the questionnaire was developed.

Cognitive interviewing was conducted to assess the qualitative face validity of the questionnaire. This method has been extensively used for over 30 years in order to pretest a wide range of questionnaires. It has been used to determine the problems within the questions and also to suggest reforms to be

applied on the scales [23]. Cognitive interviewing aims at identifying the sources of errors in the questionnaire items focusing on the cognitive process the respondents apply while filling the questionnaire [24, 25]. Accordingly, the questionnaire was sent to ten patients with cancer undergoing chemotherapy, and they were asked to evaluate the legibility, the clarity, the structure of items, the ease of understanding, the difficulty of the items, the confusing words, the classification of questions, the ease of responding, the language forms, and the diction. The patients with cancer undergoing instant chemotherapy in the cancer institution in Imam Khomeini Hospital in Tehran were interviewed face to face. Applying the necessary modifications, the ultimate Persian version of the questionnaire was proposed.

Construct validity tests

In order to determine the "construct validity" of the proposed scale, the three methods of factor analysis, known groups, and convergent validity were used.

Sample size

There are different ideas regarding the appropriate number of participants to conduct EFA. However, for this study, 300 patients undergoing chemotherapy were selected based on constant sampling [26, 27]. In addition, ten patients with cancer who were undergoing chemotherapy and five experts in Persian Literature participated in the process of evaluating the face validity of the scale.

Factor analysis

Exploratory factor analysis (EFA) was applied to explore the number of hidden factors. Kaiser-Meyer-Olkin (KMO) sampling adequacy and Bartlett's test were conducted. Then, the hidden factors were explored using maximum likelihood, PROMAX rotation, and also scree plot. Each factor was linked to an item based on communalities for items above 0.5 in the EFA test [28].

Contrasted-group analysis

For this purpose, using the obtained data from the very studies claiming that nausea and vomiting are higher in patients who are below 50 years old, the patients in this study were divided into two groups of above 50 and below 50 [6]. Therefore, the difference between the age ranges in the MAT questionnaire, the comparison of the total point, and the comparison of the point for each aspect of the scale between the two groups were calculated. After receiving confirmation on the normal distribution of the data and the parallel variance between the two groups, independent sample t-test was used to compare the known groups.

Convergent validity

In order to evaluate the convergent validity of the scale, the correlation between the results of the proposed questionnaire were compared to the results of the INVR. Pearson Correlation Coefficient was used to test the convergent validity.

Reliability

Cronbach's Alpha Coefficient was used as the internal consistency to determine the reliability of the scale.

Study instruments

Demographic information questionnaire

A specific questionnaire was developed to collect the required demographic information including age, gender, marital status, education, occupation, the duration of cancer, and the type of cancer.

MAT questionnaire

MASCC developed MAT questionnaire to measure CINV. This short questionnaire was mainly developed to measure acute and delayed nausea and vomiting in adult patients undergoing chemotherapy. It includes eight items that are responded in the form of self-report. Each phase (acute/delayed) is assessed using four questions regarding the occurrence, the duration of vomiting (on a scale of 10), and the frequency of nausea. The yes/no questions are scored as 0 (no) or 1 (yes), and the other ratio questions are scored on a scale of 0 to 10 [8, 29]. This questionnaire is advantageous compared to other CINV questionnaires because it is only needed to be applied once during a chemotherapy cycle. Therefore, there is no need for daily investigations, and the patients and their caregivers will not be frustrated by the data collection [8, 29]. The MAT questionnaire was responded on day 1 (acute phase) and day 5 (delayed phase).

The Rhodes INVR scale

This questionnaire includes eight items in the form of a 5-point Likert Scale, which is filled either within 12 h or 24 h. The instrument is responded by the patient and includes nausea severity, nausea frequency, nausea-induced distress, the frequency of vomiting, the amount of vomiting, vomiting-induced distress, the frequency of retching, and retching-induced distress. The actual and imaginary issues regarding nausea and vomiting are measured separately within this scale. The patient should follow the instruction to respond with 0 (the least or lack of symptoms) to 4 (the worst case). Hence, there will be an aggregate score of 0–32 at the end. The validity and reliability of the original and Persian version of the questionnaire are both confirmed [18, 30].

Reliability

Internal consistency using Cronbach's Alpha Coefficient was applied to determine the scale reliability.

CINV was evaluated during a 5-day period. MAT questionnaire was filled on day 1 (acute) and day 5 (delayed) after the chemotherapy. The Rhodes INVR scale was filled on a daily basis for 5 days, simultaneously. The patients were informed of how to complete the questionnaires and both the MAT and the Rhodes INVR scale by the patients themselves. Having completed instant chemotherapy courses, the patients would go home and fill the questionnaires day by day. They would deliver the completed questionnaires on their checkup sessions or on their next chemotherapy session.

The present study was argued in the Nursing and Midwifery Care Research Center of Tehran Medical University with code 27819 and was conducted based on their financial supports. The ethical code of IR.TUMS.VCR.REC.1395.276 was also received for the present study. Having received the required permission and collaborations with the related authorities, the first author explained the study procedure for all the participants and asked for their written consent. The participants were also informed that all the data within this study would remain confidential and they are able to leave the experiment at any moment.

Besides, SPSS-22 statistical software was used to analyze the data after they were reviewed two times. The maximum first type error of 5% was considered for all the tests.

Results

Socio demographic and clinical status

The participants include 300 patients with cancer undergoing chemotherapy in cancer institute in Imam Khomeini Hospital from April 2017 to March 2018. Almost half of the participants (136 patients) aged between 36 and 55. More than 60% of the participants were women (62.3%) and held university degrees (65%). It is reported that 43.3% were retired and the majority of the patients were married (92.3%). Besides, more than half of the patients (50.7%) were in their second stage of disease. As it is shown in Table 1, almost all patients have breast cancer and gastrointestinal cancer.

Table 1 Sociodemographic and clinical status in patients ($N = 300$)

		N (%)
Gender	Male	113 (37.7)
	Female	187 (62.3)
Marital status	Single	22 (7.3)
	Married	264 (88)
	Divorced/separated	5 (1.7)
	Widow	9 (3)
Age-group (year)	18–35	42 (14)
	36–55	138 (46)
	56–75	109 (36.3)
	76–95	11 (3.7)
Stage of disease	Stage I	131 (43.7)
	Stage II	152 (50.7)
	Stage III	14 (4.7)
	Stage IV	3 (1)
Education level	Illiterate	8 (2.7)
	Primary	36 (12)
	Secondary	61 (20.3)
	Collegiate	195 (65)
Employment status	Housewife	80 (26.7)
	Employee	142 (43.3)
	Retire	78 (26)
Type of cancer	Breast cancer	115 (38.3)
	Gastrointestinal cancer	113 (37.7)
	Ovarian cancer	43 (14.3)
	Other	29 (9.6)
Duration of cancer (month)	0–24	234 (78)
	25–48	59 (19.7)
	>48	7 (2.3)

Validation

Factor analysis

KMO sampling index was reported at 0.685 in this study. In addition, the results of Bartlett's test were significant (2646.367) at 0.0001. The hidden factors were extracted using maximum likelihood and PROMAX rotation. Regarding eigenvalue, two factors were reported to value above 1, and the scree plot was extracted. According to Table 2, two factors with the values of 5.125 and 1.59 were extracted. Based on the factor analysis results, among all the eight items in MAT questionnaire, item 1 was omitted because of a factor load lower than 0.5. On aggregate, the two extracted factors could define

Table 2 Exploratory factor analysis for the MAT items

	Item	Factor loadings	% of variance	Eigenvalues
Factor 1	MAT 3	0.99		
	MAT 4	0.85		
	MAT 7	0.91	69.14	5.12
Factor 2	MAT 8	0.74		
	MAT 2	0.94		
	MAT 5	0.7	14.96	1.05
	MAT 6	0.99		

84.118% of the total variance. Factor 1 was related to nausea, and factor 2 was pertinent to vomiting.

Contrasted group validity

Independent samples t-test was used to measure the distinguishing ability of the Persian version of MAT questionnaire through age-group parameters (patients who are over 50 years old vs. those who are below 50). The results showed that the total score of MAT questionnaire and also the subcategories are significantly higher among the patients who are below 50 years old; $P < 0.05$. (Table 3).

Convergent validity

Pearson Correlation Coefficient was used to measure the correlation between the MAT questionnaire and the Rhodes INVR scale. The correlation between the scores in the acute and delayed phases of nausea and vomiting within MAT and the Rhodes INVR scale is presented in Table 4. The results showed that there is a strong and significant correlation between the two questionnaires in the acute phase of nausea ($r = 0.912$) and vomiting ($r = 0.900$); moreover, there was reported a strong and significant correlation in the delayed phase of nausea (0.809) and vomiting (0.856).

Reliability

The internal reliability of the Persian version of the MAT questionnaire was acceptable. The Cronbach's Alpha Coefficient was reported 0.887 for the whole scale. In addition, the Cronbach's Alpha Coefficient was reported between 0.65 and 0.75 for nausea and vomiting (Table 5).

Table 4 Correlation Coefficients between MAT and Rhodes INVR

Item	MAT					
Rhodes			Nausea		Vomiting	
	Nausea		Acute	Delayed	Acute	Delayed
		Delayed	0/784	0/809	0/45	0/486
		Acute	0/912	0/766	0/598	0/574
	Vomiting	Delayed	0/85	0/681	0/794	0/856
		Acute	0/719	0/636	0/9	0/831

All significant at $P < 0.0001$

Discussion

Although there are many questionnaires available to measure nausea and vomiting, it is only Rhodes INVR scale whose psychometrics have already been evaluated in Iran. It concerns measuring nausea and vomiting in different diseases and is completed on a daily basis. MAT questionnaire has not been evaluated in Persian so far. This is specifically designed to measure chemotherapy-induced nausea and vomiting in acute and delayed phases among patients with cancer.

Nowadays, the MAT questionnaire is the only scale measuring chemotherapy-induced nausea and vomiting in both acute and delayed phases, separately [31]. It includes eight items which is easy and quick to respond by the patients. The findings showed that the Persian version of the MAT questionnaire is appropriate to measure chemotherapy-induced nausea and vomiting among patients in Iran. Feasibility and clarity of the proposed scale are also confirmed by the patients and also by the experts.

Through factor analysis, the two extracted factors of nausea and vomiting were claimed to encompass 84% of the total score variance, while the factor analysis on the original scale showed the extraction of three factors of vomiting, acute

Table 3 Contrasted group analysis: mean scores of nausea and vomiting by age-group ($N = 300$)

Item[a]	< 50 years old $N = 153$ Mean ± SE	≥ 50 years old $N = 147$ Mean ± SE	P value [b]
Total MAT score	1.95 ± 0.09	1.65 ± 0.05	0.01
Total nausea score	2.29 ± 0.12	2.15 ± 0.1	0.39
Total vomiting score	1.61 ± 0.08	1.15 ± 0.02	0.001
Acute CINV score	1.75 ± 0.12	1.36 ± 0.07	0.005
Delayed CINV score	1.77 ± 0.08	1.58 ± 0.06	0.06
Acute nausea score	2.48 ± 0.13	2.127 ± 0.11	0.23
Acute vomiting score	1.76 ± 0.09	1.19 ± 0.03	0.001
Delayed nausea score	2.07 ± 0.11	2.03 ± 0.11	0.7
Delayed vomiting score	1.46 ± 0.06	1.12 ± 0.03	0.01

MAT: the MASCC Antiemesis Tool

[a] Scores were presented as mean ± SE (standard error)

[b] Independent Samples t Test

Table 5 Cronbach's Alpha Coefficient for the MAT

Dimension of scale	Item	Cronbach's Alpha Coefficient
Nausea	4	0.75
Vomiting	4	0.65
Total	8	0.88

nausea and delayed nausea [31]. This difference in results could be because of the type of cancer, the chemotherapy course, and also differences in cultures. Even though we omitted question 1 – due to low factor load – it did not affect the whole structure of the questionnaire. Therefore, the proposed scale can be used to evaluate nausea and vomiting.

The results of the study on the known groups showed that the patients who are below 50 years of age reported higher nausea and vomiting. A variety of studies have suggested that the predictive value of age is higher [29]. Moreover, Jing-Yu Tan (2016) conducted a study in China aiming at evaluating the psychometrics of the Chinese version of MAT questionnaire. The researcher claimed that nausea and vomiting are significantly higher among the patients who are below 50 years old [20]. Therefore, the results of this study are in line with those of ours.

The results of the present study showed that there is a high convergent validity between the MAT and the Rhodes INVR scale. It was reported that there was a convergent validity of 0.912 in acute nausea, 0.809 in delayed nausea, 0.90 in acute vomiting, and 0.856 in delayed vomiting between the two questionnaires. Yuka Matsuda (2015) conducted a similar study investigating the assessment of the psychometrics of the Japanese version of MAT questionnaire. The results of that study indicated that there is homogeneity of 86.2% between the original scale and the Japanese version. Besides, a correlation coefficient of 0.71 was reported accordingly. Thus, the Japanese version of MAT questionnaire enjoys high validity and can be used to measure CINV among patients who received immediate care [19]. Furthermore, there was reported a convergent validity of 94% between the Chinese version of MAT and the Rhodes INVR scale [20].

Previous studies investigating the translation of MAT questionnaire into other languages have reported the high reliability of the scale. The Cronbach's Alpha Coefficient of 0.73 and 0.71 were reported for the Chinese and Japanese versions of MAT respectively. The original questionnaire was tested again by the designer in 2007, and the Cronbach's Alpha Coefficient of 0.77 to 0.82 was sought [31]. We can now claim that the Persian version of the questionnaire is of high reliability as well (Cronbach's Alpha Coefficient $\alpha = 0.88$).

Nevertheless, the present study would not be without flaws and limitations. In order to overcome such limitations, it is suggested to conduct the study on a more versatile sample from different parts of the country with different cultures. It is also recommended to evaluate the responsiveness of the scale in future studies.

Meanwhile, the researchers can claim that the high number of participants and the application of factor analysis and known group comparison are among the main advantages of the present study. Moreover, the Persian version of the Rhodes INVR scale was used as the golden standard to evaluate the convergent validity in the present study [18].

Conclusions

The results of this study indicate and approve the face, content, construct validity (factor analysis, convergent and known group), and also reliability of the proposed scale. In general, it can be claimed that the Persian version of the MAT questionnaire can be applied as an easy and user-friendly scale to measure chemotherapy-induced nausea and vomiting among the patients.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest

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