Psychometric Properties of the Romanian Version of Champion's Health Belief Model Scale for Breast Self-examination

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Abstract

Background: This study set out to translate Champion's Health Belief Model Scale and to test its properties on a Romanian sample.

Methods: The study included 502 participants. The structural validity, convergent validity, criterion validity and reliability were evaluated for the Romanian version.

Results: The exploratory factor analysis highlighted six factors. The confirmatory factor analysis upheld the correctness of the six-subscale model as presenting a good fit for the 34-item version. Convergent validity was supported by the fact that the constructs included in the model correlated significantly with similar constructs evaluated using other questionnaires. In terms of criterion validity, those women who perceived fewer barriers and more cues to action and had greater self-efficacy practiced more frequent breast self-examination. Cronbach coefficients ranged between 0.74 and 0.87 and test-retest correlation coefficients for the six subscales fell between 0.47 and 0.69.

Conclusions: The Romanian version of the Champion Health Belief Model Scale is valid and reliable tool.

Background

According to the World Health Organization (WHO), cancer is the second most common cause of death worldwide, accounting for 9.6 million deaths in 2018. Of the various types of cancer, that most often encountered in women is breast cancer, followed by colo-rectal, lung, cervical, and thyroid cancers (WHO, 2021a). As breast cancer progresses, it has a major impact both on patients themselves and on their families: both the sufferers themselves and their family members find themselves facing negative consequences at both physical and psychological levels (Grunfeld et al., 2004; Glajchen, 2012; Campbell-Enns H, & Woodgate, 2015; Vintilă et al., 2019; Ștefănuț et al., 2020; Ștefănuț *et al.*, 2021). Consequences of breast cancer, breast surgery, partial or complete removal of the breast often leads to higher breast awareness, appearance dissatisfaction and lowering of the level of psychological well-being (Swami et al., 2020).

The WHO has drawn attention to the fact that between 30% and 50% of deaths caused by cancer could be prevented by the avoiding of risk factors and by the implementation of proof-based intervention strategies, while the burden of suffering inflicted by this disease could be reduced by early detection (WHO, 2021b). Given that there are no specific methods of preventing breast cancer and that research has demonstrated that early detection leads to a reduction in mortality (Arrospide et al., 2015), such early detection is of paramount importance.

The screening methods that can be utilized in relation to breast cancer are self-examination, mammography, and clinical examination by medical professionals (Siu, 2016). Breast self-examination is a non-invasive procedure that costs nothing, takes only a little time, and does not involve seeking professional help, yet it has been shown that in spite of all these benefits it is little practiced (Carelli et al., 2008; Karayurt et al., 2008; Akhtari-Zavare et al., 2015). An understanding of the factors that influence the adopting of this behavior has therefore become the focus of interest of research concerned with encouraging health-related attitudes and behaviors, and one of the theoretical models employed has been the Health Belief Model (HBM).

The HBM (Rosenstock, 1974) is a psycho-social model that was initially developed in an attempt to explain a low level of adherence to tuberculosis screening and prevention programs. Over time, this model has frequently been used to explain health-related behaviors in the context of a range of chronic conditions such as diabetes (Wdowik et al., 2001), chronic obstructive pulmonary disease (Wang et al., 2014) and coronary heart disease (Ali, 2002). The constructs currently included in the HBM are *perception of susceptibility* (the perceived probability of developing a given disease), *perception of severity* (the seriousness of the consequences of the disease), *perception of benefits* (the helpful effects of the proposed behaviors in reducing the chances of developing the disease or in reducing the negative consequences of having it), *perception of barriers* (obstacles that can appear in the way of adopting the proposed behaviors), *cues to action* (internal and external stimuli involved in the decision to adopt the behaviors), and *self-efficacy* (a person's belief that they are capable of carrying out these actions). Thus, according to the HBM, the chances that a person will carry out breast self-examination increase in line with the strength of their belief that

they are likely to develop breast cancer, that the consequences of that happening are serious, and that the suggested behavior will be effective in reducing the negative outcome of the disease. A high level of confidence in self ability to carry out self-examination is likely to increase the probability that this behavior will be followed, while the existence of barriers such as embarrassment, fear or pain is likely to have a negative effect on the probability of their carrying out this self-examination. Previous studies have demonstrated a significant association between the HBM constructs and this screening behavior (Ashton et al., 2001; Karayurt et al., 2008).

The purpose of Champion's Health Belief Model Scale (CHBMS) is to identify the beliefs that influence breast self-examination from the perspective of the HBM. This instrument was devised in 1984 (Champion, 1984), later revised (Champion, 1993), and subsequently translated and adapted for a variety of cultures (Lee et al., 2002; Karayurt et al., 2008; Dewi, 2018). The psychometric properties of the scale, whether we are talking about the original versions or about the adaptations, were adequate.

In Romania, the incidence of breast cancer is 11.5%, with a mortality rate of 6.6% (WHO, 2021c). Given that over 33% of new cases in this country are diagnosed at stage IV (Tofan et al., 2018) (that is, in the last – most advanced stage in which the disease has spread to other organs), encouraging screening with a view to early detection is a priority. Breast self-examination is a health behavior largely popularized that should be known and practiced monthly by all adult women (Champion, 1984). Research on monitoring breast self-examination is widespread among scientific community but there are no data regarding Romanian population. Understanding the beliefs of women in Romania regarding self-examination as well as knowing the level of adherence to this behavior can help health professionals to create more effective educational programs in promoting this behavior. In order to monitor levels of adherence to breast self-examination, it is necessary to use an instrument that has been adapted to the Romanian population; however, to the best of the present authors' knowledge no such questionnaire is currently available. That being the situation, the aim of this study is to translate the CHBMS for the Romanian population and to evaluate the psychometric properties of this version.

Methods

Study Design

This research made use of a cross-sectional design.

Procedure

The research was carried out online in the months of November and December 2020 in the *[blinded for peer review]*. Undergraduate students in the *[blinded for peer review]* were informed about the opportunity to participate, along with their invitees. Participation was encouraged by the awarding of bonus points in the examinations. In order to be eligible, potential participants had to fulfil the following conditions: being female, knowing Romanian, being at least 18, and being capable of completing online questionnaires. Those who signed the consent form were given access to the questionnaires to be completed.

The study was carried out in two steps. The first involved translating the CHBMS into Romanian and evaluating psychometric properties of this new version on the Romanian population; the second was aimed at evaluating the reliability of the Romanian version using the test-retest method. To this end, a sub-sample of the women who had formed the initial sample were retested four weeks after the initial testing. This four-week time gap was chosen to comply with the recommendation that the interval between the two applications of the instrument should be between two and six weeks – long enough for participants not to remember the answers they gave the first time, but short enough to rule out variables having changed in the meantime (Tabachnick, & Fidell, 2007).

This research has been approved by the Ethics Committee of *[blinded for peer review]*.

Participants

As can be noticed from Table 1 the first stage of the study involved 502 women whose ages ranged from 18 to 70 ($m=24.91$, $SD=9.99$). The second stage of the study involved 129 women aged between 18 and 52 ($m=22.6$, $SD=7.36$) that constituted a sub-sample of the women who had formed the initial sample.

Table 1
Demographic Characteristics

Demographic Characteristics		Stage 1 N (%)	Stage 2 N (%)
Number of participants		502	129
Relationship status	Single	201 (40%)	54 (41.9%)
	In a relationship	216 (43%)	63 (48.8%)
	Married	74 (14.7%)	9 (7%)
	Separated or divorced	9 (1.8%)	3 (2.3%)
	Widowed	2 (0.4%)	-
Level of education	Middle school	8 (1.6%)	-
	High school	354 (70.5%)	106 (82.2%)
	First degree	93 (18.5%)	7 (5.4%)
	Master's	45 (9%)	15 (11.6%)
	Doctorate	2 (0.4%)	1 (0.8%)
Environment	Urban	367 (73%)	94 (72.9%)
	Rural	135 (26.9%)	35 (27.1%)
Occupational status	Student	378 (75.3%)	112 (86.8%)
	Employed	91 (18.1%)	11 (8.5%)
	Business owner	21 (4.2%)	5 (3.9%)
	Unemployed	9 (1.8%)	1 (0.8%)
	Retired	3 (0.6%)	-
General health	Poor	8 (1.6%)	-
	Good	245 (48.8%)	57 (44.2%)
	Very good	249 (49.6%)	72 (55.8%)
Personal history of cancer	No history of cancer	497 (99%)	128 (99.2%)
	History of breast cancer	1 (0.2%) y3 (0.6%)	-
	History of other type of cancer		1 (0.8%)
Family history of cancer	No history of cancer	325 (64.7%)	79 (61.2%)
	History of breast cancer	51 (10.2%)	15 (11.6%)
	History of other type of cancer	126 (25.1%)	35 (27.1%)

CHBMS translation

Since the revision of Champion's questionnaire in 1993, the HBM model has evolved: the motivation construct has been abandoned and the self-efficacy constructs and action indices have been added. Because the Indonesian version had already

taken into account this evolution of the model and having it available in English, the items used for Romanian version of Champion's questionnaire were taken over from the Indonesian version of CHBMS (Dewi, 2018). This version had six subscales: perceived susceptibility ($\alpha = 0.84$), perceived severity ($\alpha = 0.86$), perceived benefits ($\alpha = 0.81$), perceived barriers ($\alpha = 0.82$), cues to action ($\alpha = 0.80$), and perceived self-efficacy ($\alpha = 0.66$). Once the author of the instrument had given permission for it to be used and modified, the process of translating the scale began. The way it was translated from English to Romanian followed the procedure proposed by Beaton et al. (2000). In the first stage, two translators, one familiar with the instrument and the other not, made independent translations from English to Romanian of the items in the scale, the instructions, and the possible answers. In the second stage, a different translator studied the two versions of the translation, resolved discrepancies, and suggested a synthesis. Next, two more translators who did not know CHBMS translated the scale back from Romanian into English. In the fourth stage, all the translators who had been involved in the process, along with the authors of this article, examined the different versions of the translations (in Romanian and English). The fifth stage involved the pre-testing of the Romanian version of CHBMS on a sample of 20 women, who were asked to evaluate the intelligibility of the items on a 5-point Likert scale (from 1 = I don't understand at all to 5 = I understand completely). Since all the items were judged to be thoroughly intelligible, no further modifications were made.

Variables and Instruments

The variables investigated in this study were the HBM constructs, breast self-examination behavior, general self-efficacy, health anxiety, general attitudes towards health, and demographic characteristics.

Demographic characteristics. The items that dealt with demographic data were designed to elicit the following information: age, relationship status, highest level of education completed, living environment, occupational status, general health, personal history of cancer, family history of cancer.

HBM constructs. The items used to evaluate HBM constructs were obtained as described in previous section.

Breast self-examination behavior was evaluated by means of a question that referred to the frequency with which this behavior was carried out, with the following as possible responses: more than once a month/ monthly/ once every 2 months/ once a year or less frequently/ never.

General self-efficacy was measured with the help of the General Self-Efficacy Scale (Schwarzer, & Jerusalem, 1995). This ten-item scale measures the degree to which someone is confident in their ability to react well in new and difficult situations. Responses to these items are evaluated on a 4-point Likert scale (1 = never, 4 = always). An example item on this scale would be "*I can always manage to solve difficult problems if I try hard enough.*". The original version showed high levels of internal consistency with α Cronbach values, ranging from 0.82 to 0.93 for different samples. The α Cronbach value for the sample in this study was 0.91.

Health anxiety was measured using the 18-item version of the Health Anxiety Inventory (Salkovskis et al., 2002). This scale evaluates excessive worrying about health and the alarmist interpreting of various bodily sensations. An example item would be: *I do not worry about my health/ I occasionally worry about my health/ I spend much of my time worrying about my health/ I spend most of my time worrying about my health*. Items are scored from 0 to 3, with the total score being obtained by summing points. The internal consistency of the original version of this scale was 0.84, with the α Cronbach value for the sample in this study being 0.86.

General attitudes regarding health were evaluated using the Health Orientation Scale (Snell et al., 1991). This questionnaire has 10 subscales, each with 5 items, and covers the following aspects. The first subscale, *personal health consciousness*, measures the person's tendency to think about their health and physical condition. The second, *health image concern*, measures what is defined as the tendency to be aware of the impression one's own state of physical health is making on other people. The third subscale, *health anxiety*, highlights the level of anxiety and nervousness displayed in regard to one's health. *Health esteem-confidence* has been defined as the person's overall tendency to evaluate their health positively, while the *motivation to avoid unhealthiness* and *motivation to healthiness* scales are concerned with motivation to not be unhealthy and with motivation to preserve good physical health. Two other subscales, *internal health control* and *external health control*, measure a person's

tendency to believe that health is determined by factors that are (are not) under their own control. The *health expectations* subscale deals with the way a person evaluates their future health, while the final subscale, *health status*, throws light on the way the person assesses their physical condition. An example item from this questionnaire would be “*I’m very motivated to be physically healthy*”. All items are measured on a 5-point Likert scale (0 = not at all true for me, 5 = very characteristic of me). Scores for each subscale were calculated by summing points obtained for its items. α Cronbach values for the subscales of the original version ranged from 0.69 (*external health control* subscale) to 0.92 (*health image concern* subscale). For the sample in this study, α Cronbach values for the subscales used lay between 0.78 (*motivation to avoid unhealthiness* subscale) and 0.90 (*motivation for healthiness* subscale).

Statistical analysis

Statistical analysis was carried out using the SPSS v20 and R (R Core Team, 2014) programs. Given best-practice recommendations (Swami & Barron, 2019; Vintilă et al., 2020), we adopted an Exploratory Factor Analysis (EFA) and a Confirmatory Factor Analysis (CFA) which allowed us to explore and then confirm the best-fitting model of HBM scores for our target population. The EFA was applied to the data collected from 251 of participants included in the first stage of the study and the CFA was applied to the data collected from the other 251 participants included also in the first stage of the research. In order to verify convergent validity, correlation coefficients were calculated between the HBM constructs (susceptibility, severity, benefits, cues to action and self-efficacy) and similar constructs measured using other scales (health anxiety, general self-efficacy and health orientation). Criterion validity was evaluated by assessing the degree to which the HBM constructs functioned as predictors of breast self-examination behavior. To this end, since breast self-examination behavior had been operationalized as the ordinal variable with possible values: “more than once a month”, “monthly”, “once every 2 months”, “once a year or less frequently”, “never”, multinomial logistical regression was employed. The criterion variable was frequency of breast self-examination and the predictor variables were the HBM constructs. To establish reliability, α Cronbach coefficients, item – whole subscale correlation coefficients, and correlation coefficients between the HBM values obtained on the two successive applications were all calculated.

Transparency and Openness

The data associated with the work are available in the OSF repository. Also, the syntax, the code used and the tools described in this section are available on request. The study was not pre-registered.

Results

Demographic characteristics

The first stage of the study involved 502 women. Of these, 57.7% were married or in an unofficial relationship. The majority of participants (70.5%) had finished high school as their highest level of education, 73% lived in the urban environment, and most said that they were healthy (48.8%) or very healthy (49.6%) and that they had no personal history of cancer (99%) and no history of cancer in their families (64.7%). The majority (75.3%) of the women in this stage of the study were students.

The second stage of the study involved 129 women. The majority were married or in an unofficial relationship (55.8%). The majority of participants in this stage had finished high school (82.2%), 72.9% lived in the urban environment, 55.8% regarded themselves as very healthy, 99.2% had no personal history of cancer and 61.2% had no history of cancer in their families. The great majority were students (86.8%). The demographic data of the two samples are summarized in Table 1.

Structural validity

Exploratory Factor Analysis Results

The Kaiser-Meyer-Olkin (KMO) test yielded a result of 0.85, demonstrating that the data were suitable for factor analysis. In addition, Bartlett’s Sphericity Test was statistically significant, indicating that the data are factorizable. Consequently, a principal axis factoring was applied to extract factors. In order to establish the optimal number of factors, we applied a parallel analysis

(Horn, 1965; Sârbescu, 2012). This analysis compares the eigenvalues obtained for real data and the eigenvalues obtained for a random data set. Using for real data a principal axis factoring and Kaiser's criterion resulted a solution with nine factors with eigenvalue greater than 1. Parallel analysis advises to retain a number of factors equal to the number of eigenvalues obtained for random data that are smaller than the eigenvalues obtained for real data set (Hayton, Allen, & Scarpello, 2004). Applying this method, we obtained six factors for which these values are lower than the eigenvalue values obtained for real data. We continued applying exploratory factor analysis for the real data set by forcing six factors and using Oblimin rotation. We obtained that the 42 items loaded the six factors in a significant way, explaining 57.79% of the total variance. Twelve of the items referring to severity loaded in the first factor, accounting for 19.02% of the variance. Factor two accounted for 14.50% of the variance and was loaded by all the five items representing benefits. All six of the items describing susceptibility loaded in factor three, which accounted for 7.68% of the variance. Factor four accounted for 7.02% of the variance, with all the eight items representing barriers contributing. All the eight items linked with cues to action loaded factor five, accounting for 5.74% of the variance. Two of the items representing self-efficacy loaded in factor six, accounting for 3.80% of the variance. One of the items referring to self-efficacy loaded in factor three alongside the items referring to benefits (Table 2).

Table 2
Exploratory Factor Analysis (EFA) Results: Factor loadings for 6 factors

Item no.	A priori scale	F1 Severity	F2 Benefits	F3 Susceptibility	F4 Barriers	F5 Cues to Action	F6 Self-Efficacy
14	Severity	.78		.13			
10	Severity	.71	-.11				.25
9	Severity	.69					
7	Severity	.68		.22		-.12	-.11
15	Severity	.67	.12				-.19
18	Severity	.66	.20	-.11			-.23
16	Severity	.65	.25				-.22
17	Severity	.64		-.10			
8	Severity	.59		.17			.25
13	Severity	.59	.16			.18	-.20
12	Severity	.48		-.16	.29	.17	.22
11	Severity	.41			.14		.19
20	Benefits		.87				-.11
19	Benefits		.84				
22	Benefits		.84				
21	Benefits		.81				
23	Benefits		.74				.23
41	Self-Efficacy		.50			-.16	.48
1	Susceptibility			.88			
3	Susceptibility			.87			
4	Susceptibility			.85			-.12
2	Susceptibility			.74	.12		.11
6	Susceptibility			.64	.13	.14	.20
5	Susceptibility	.45		.57		-.13	
29	Barriers				.85		
26	Barriers				.77		
27	Barriers	.13			.77		
24	Barriers				.70		
30	Barriers				.69		-.25
28	Barriers				.60		.23
25	Barriers				.56		-.36

Item no.	A priori scale	F1 Severity	F2 Benefits	F3 Susceptibility	F4 Barriers	F5 Cues to Action	F6 Self-Efficacy
31	Barriers	.31	-.13	.16	.38		-.28
34	Cues Action					-.80	
35	Cues Action				.17	-.74	
32	Cues Action				-.12	-.73	
33	Cues Action	.14			-.11	-.64	
36	Cues Action	.16	.20		.13	-.56	
39	Cues Action			-.17		-.53	.16
38	Cues Action	-.12	.22			-.52	
37	Cues Action		.16			-.48	.31
40	Self-Efficacy		.25		-.20		.65
42	Self-Efficacy	-.10	.42		-.18		.55
% Variance		19.02	14.50	7.68	7.02	-.11	3.80

Table 3 shows the correlation matrix of the six subscales. It is to be noted that the correlations between the factors are below 0.40.

Table 3
Exploratory Factor Analysis (EFA) Results: Factor Correlations

Correlations	F1 Severity	F2 Benefits	F3 Susceptibility	F4 Barriers	F5 Cues Action	F6 Self-Efficacy
F1 Severity	1					
F2 Benefits	.17	1				
F3 Susceptibility	.22	.10	1			
F4 Barriers	.30	-.11	.15	1		
F5 Cues Action	-.04	-.32	-.08	.38	1	
F6 Self Efficacy	-.09	.19	.04	-.05	-.08	1

Confirmatory Factor Analysis Results

To verify the correctness of the factorial structure identified, confirmatory factor analysis was employed. For this, five models were compared. First, we tested the original form of the questionnaire with its 42 items, for which we considered three possible solutions: with one factor, with six non-correlated factors, and with six correlated factors. Then we excluded the problematic item (item 41) which was associated a priori with self-efficacy but which ultimately loaded in the benefits factor. Thus, what was tested was a model with 41 items and the six correlated factors. Analysis of error variance showed that seven item pairs were strongly correlated. Content analysis demonstrated that these are extremely similar items and after debating each situation, following reaching a consensus we removed one of the items that formed each of these pairs, as recommended in other works (Yadama & Drake, 1995). Items 4, 5, 7, 8, 10, 19, 37 were thus removed. The final model tested contained 34 items and six correlated factors and the goodness of fit indicators obtained had values regarded as suitable from a statistical

perspective. We used the normed model chi-square $\chi^2/df=2.17$ (values smaller than 3 considered indicative of good fit; Hu & Bentler, 1999), CFI=0.91 (values close to or greater than 0.95 indicative of adequate fit; Hu & Bentler, 1999), TLI=0.91 (values close to or greater than 0.95 indicative of adequate fit; Hu & Bentler, 1999), SRMR=0.05 (values smaller than 0.09 indicative of good fit; Hu & Bentler, 1999), RMSEA=0.04 (values close to 0.06 considered to be indicative of good fit and up to 0.08 indicative of adequate fit; Steiger, 2007). We also used a chi-square difference test (Table 4). Consequently, it appears that the model with 34 items and six correlated factors constitutes the most representative solution.

Table 4
Confirmatory Factor Analysis (CFA) Results: Goodness of fit statistics

Model	χ^2	Df	CFI	TLI	SRMR	RMSEA [90% CI]	$\Delta \chi^2$	Δdf
42 items, one factor	7885.146**	819	0.33	0.30	0.15	0.131 [0.12, 0.134]	6770.8	307
42 items, six factors ^a	2901.877**	819	0.80	0.79	0.14	0.07 [0.06, 0.074]	1787.5	307
42 items six factors ^b	2440.599**	804	0.84	0.83	0.06	0.064 [0.061, 0.067]	1326.3	292
41 items, six factors ^b	2321.11**	764	0.85	0.83	0.06	0.064 [0.061, 0.067]	1206.8	252
34 items, six factors ^b	1114.341**	512	0.91	0.91	0.05	0.048 [0.045, 0.052]	-	-
** $p < 0.001$								
^a non-correlated factors; ^b correlated factors								

Reliability

The reliability of each of the six subscales was assessed by use of the α Cronbach coefficient, interpreting the item/total-to-subscale correlations and calculating the test-retest correlation for each of the subscales. α Cronbach coefficients ranged from 0.74 (for the self-efficacy subscale) to 0.87 (for the severity and benefits subscales) suggesting good internal consistency. Similarly, the test-retest coefficients calculated for each of the subscales were highly statistically significant, ranging from $r=0.47$ (for the benefits subscale) and $r=0.69$ (for the severity subscale). In addition, the item/total subscale correlations too were highly statistically significant (Table 5).

Table 5
Test-Retest correlations, Item-total subscale correlations, α Cronbach

	Number of items of the subscale	Test-Retest correlation (N=129)	Item-total Subscale correlation (N=502)	α Cronbach (N=502)
Susceptibility	4	0.56**	0.57-0.80	0.85
Severity	9	0.69**	0.40-0.73	0.87
Benefits	5	0.47**	0.64-0.76	0.87
Barriers	7	0.52**	0.48-0.73	0.85
Cues to Action	7	0.61**	0.45-0.69	0.81
Self-Efficacy	2	0.68**	0.59-0.59	0.74
** $p < 0.01$				

Convergent validity

The convergent validity was assessed by analyzing the relationship between the various HBM constructs and similar constructs such as health anxiety, general self-efficacy, state of health, motivation to avoid unhealthiness and motivation to healthiness (Table 6). It was found that there is a moderate significant positive correlation between the susceptibility subscale and health anxiety ($r=0.30$) and a moderate significant positive correlation between the severity subscale and health anxiety ($r=0.42$). In addition, there is a small significant positive correlation between the benefits subscale and perception of state of health ($r=0.10$). Also, there is a moderate significant positive correlation between cues to action and motivation to avoid unhealthiness ($r=0.45$) and between cues to action and motivation to healthiness ($r=0.46$). Additionally, it was established that there is also a significant positive correlation ($r=0.11$) between the self-efficacy subscale of the HBM questionnaire and general self-efficacy

Table 6
Convergent Validity

	Susc	Sev	Ben	Bar	Cues Act	Self Eff	SES	HA	HOS_ MAH	HOS_ MH	HOS_ HS	HOS_ HA
Susc	1											
Sev	0.28**	1										
Ben	0.14**	0.35**	1									
Bar	0.25**	0.36**	-0.01	1								
Cues Act	0.06	0.06	0.28**	0.03	1							
Self Eff	0.09**	-0.05	0.40**	-0.28**	0.23**	1						
SES	-0.17**	-0.25**	0.04	-0.25**	0.26**	0.11**	1					
HA	0.30**	0.42**	0.15**	0.19**	0.03	-0.06	-0.21**	1				
HOS_MAH	-0.17**	-0.03	0.12**	-0.14**	0.45**	0.14**	0.39**	-0.10*	1			
HOS_MH	-0.19**	-0.10*	0.10*	-0.18**	0.46**	0.14**	0.43**	-0.09*	0.84**	1		
HOS_HS	-0.15**	-0.07	0.10*	-0.11*	0.41**	0.13**	0.43**	-0.06	0.71**	0.75**	1	
HOS_HA	0.22**	0.28**	0.09*	0.15**	-0.04	-0.13**	-0.13**	0.46**	-0.008	-0.02	0.008	1
(**) $p<0.01$, (*) $p<0.05$												

Susc- Susceptibility, Sev- Severity, Ben- Benefits, Bar- Barriers, Cues Act- Cues to Action, Self Eff- Self- Efficacy, SES- Self Efficacy scale, HA- Short Health Anxiety Inventory, HOS-MAH- Motivation to Avoid Unhealthiness (Health Orientation Scale), HOS-MH- Motivation to Healthiness (Health Orientation Scale), HOS_HS-State of Health (Health Orientation Scale), HOS_HA- Health Anxiety (Health Orientation Scale)

Criterion Validity

Since breast self-examination behavior had been operationalized as the ordinal variable with possible values "more than once a month", "monthly", "once every 2 months", "once a year or less frequently", "never", criterion validity was verified by applying multinomial logistical regression. Criterion variable was frequency of breast self-examination and the predictor variables were the HBM constructs. The reference group was considered the group of those who say that they self-examine the breasts "more than once a month", the other groups being compared with this group. According to the χ^2 index, this model is statistically significant ($\chi^2(24) = 370.55$; $p<0.001$). The model correctly predicts 52.6% of responses and the Cox and Snell R^2 is 52%. For the model, only barriers, cues to action and self-efficacy were significant predictors ($p<0.001$) (Table 7).

Table 7
Criterion validity- Results of multinomial logistical regression

	Never Exp(B)	95%CI	Annually or more rarely Exp(B)	95%CI	Every 2 months Exp(B)	95%CI	Monthly Exp(B)	95%CI
Susceptibility	0.97	0.82- 1.14	1.06	0.91- 1.23	1.07	0.92- 1.24	0.99	0.86- 1.15
Severity	0.93	0.87- 1.00	0.96	0.90- 1.03	1.00	0.94- 1.07	0.99	0.93- 1.05
Benefits	1.02	0.89- 1.16	1.07	0.94- 1.21	1.12	0.98- 1.28	1.04	0.92- 1.17
Barriers	1.27**	1.13- 1.41	1.11*	1.00- 1.24	1.03	0.93- 1.15	0.96	0.87- 1.07
Cues to action	0.87*	0.80- 0.96	0.95	0.87- 1.04	0.99	0.90- 1.08	0.94	0.87- 1.02
Self-Efficacy	0.26**	0.20- 0.35	0.42**	0.33- 0.54	0.67**	0.53- 0.84	0.78*	0.62- 0.98
Chi-square (df)	370.553							
% Correct Predictions	52.6%							
Cox and Snell R ²	0.52							
** p<0.001; * p<0.0								

Discussions

While CHBMS is an instrument frequently used to evaluate beliefs that influences a person's decision to carry out breast self-examination, there has up until now been no Romanian version of it in use. Considering the benefits of early detection of breast cancer for reducing mortality from this disease, it is important that such an instrument should be made available for women in Romania too. This study was aimed at evaluating the psychometric properties and factorial structure of CHBMS for a Romanian population. Our findings support structural validity, convergent validity, criterion validity, internal consistency, and test-retest reliability.

Exploratory factor analysis identified a structure with six factors. All the items concerned with susceptibility, severity, benefits, barriers, self-efficacy and cues to action loaded together in these factors. The six-subscale structure obtained through exploratory factor analysis was also supported by the results of confirmatory factor analysis. The latter highlighted a good fit of the six factors in the 34 item version of the questionnaire, with goodness of fit indicators attaining optimal values. On the basis of these results, we may affirm that the data obtained for the sample used in the analysis matched the theoretical structure. We also notice that the factorial structure obtained for the Romanian version of the questionnaire is similar to the structure of the original questionnaire as well as the structure of the translations available for Korean language (Lee et al., 2002) and Turkish language (Karayurt et al., 2008).

Our findings also support convergent validity. Severity and susceptibility show a significant positive correlation with health anxiety, benefits with state of health, cues to action with motivation to avoid unhealthiness and with motivation towards health, and self-efficacy in carrying out self-examination behavior shows a significant positive correlation with general self-efficacy.

Criterion validity too is supported by the results, with the HBM model being significant in predicting breast self-examination behavior. However, we notice the fact that only barriers, cues to action and self-efficacy were significant predictors. This is a

difference from other studies that have found that all the variables in the model are significant predictors of breast self-examination (Ashton et al., 2001; Karayurt et al., 2008). The fact that most of the participants in this study were young people in good health and with no family history of cancer may be an explanation for the fact that for this sample the susceptibility to develop the disease, the severity of its consequences and the benefits of self-examination were not significant predictors.

For the majority of the subscales (susceptibility, severity, benefits, barriers, cues to action), the α Cronbach coefficients calculated indicated good internal consistency; for the self-efficacy subscale internal consistency was acceptable. These values are similar to those obtained in other studies (Champion, 1993; Dewi, 2018). Item-total subscale correlation coefficients were above 0.40, supporting a good differentiation between items (Polit & Beck, 2003). The high values obtained for test-retest subscale correlations provide further evidence of the reliability of this tool.

The existence of a tool for monitoring the breast self-examination has direct benefits for promoting the early detection of breast cancer. It can be used in various settings, such as hospitals, community health centres, or medical centres in companies to assess the adherence of the female population in Romania to this behavior but also the attitudes associated with breast cancer and self-examination. According to HBM, in order for people to perform early detection behaviors, it is necessary to have a high level of perception of the susceptibility to develop the disease but also of the severity of its consequences or of the necessary treatments. It is necessary to perceive a high level of the benefits of achieving the behavior and to have confidence in one's own ability to apply it. Therefore, if the evaluations show low levels of susceptibility, severity, benefits and self-efficacy and high levels of barriers, programs can be designed that lead to the change of these beliefs. Thus, health professional (family doctors, psychologists in the field of health psychology, nurses, social workers) can define interventions to transmit information about breast cancer and its early detection, which should highlight the personal benefits of self-examination but also highlight the resources that can be used to reduce obstacles to adopting this behavior. Changing these beliefs leads, according to HBM, to the adoption of self-examination, in this way women benefiting from early detection of the disease, increased chances of survival and better treatment options. This questionnaire can be used to evaluate the effectiveness of such interventions.

The solid psychometric qualities of this tool also recommend it to be used for research. Thus, studies aimed at testing HBM for the Romanian population and interventions based on this model can be performed without their internal consistency being threatened.

This study has a number of strong points, among them the fact that it evaluates multiple psychometric indices, but it also has its limitations. We should point out that the sample used was a convenience one and cannot therefore be regarded as representative of the Romanian population. Most participants were students so that data were collected from a homogeneous educated sample, which impacts the degree of generalization of the results. Again, since this instrument was initially created for the North American population, it is possible that it may not include beliefs about breast cancer and its prevention that depend on the cultural context.

Future studies could aim at the further testing of this tool on a representative population, and at creating and testing programs to encourage breast self-examination among women in Romania.

Conclusions

Early detection of breast cancer is essential to reducing the mortality of this condition. The results highlighted in this study indicate that the Romanian version of CHBMS has good psychometric properties and is a valid and reliable tool that can be used both in research and in clinical practice. Understanding women's beliefs about breast cancer and its prevention is an essential element in the targeted designing of educational initiatives to promote the early detection of this type of cancer. This instrument may also be used to evaluate the effectiveness of interventions.

Abbreviations

CFA Confirmatory Factor Analysis

CFI Comparative Fit Index

CHBMS Champion Health Belief Model Scale

EFA Exploratory Factor Analysis

HBM Health Belief Model

RMSEA Steiger-Lind Root Mean Square Error of Approximation

SRMR Standardised Root Mean Square Residual

TLI Tucker-Lewis Index

Declarations

Ethical approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This research study has been approved by the Ethics Committee of the University of the West, Timisoara, Romania (decision 5222/03.02.2021).

All participants expressed informed consent.

Consent for publication

Not applicable.

Availability of data and materials:

The datasets generated and/or analysed during the current study are available in the osf.io repository, [10.17605/OSF.IO/2MFS6](https://doi.org/10.17605/OSF.IO/2MFS6).

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contribution

AMŞ contributed to the conception, design of the work, data acquisition, analysis, interpretation of data, drafted the work and revised it. MV contributed to conception, design of the work, data acquisition, interpretation of data, drafted the work and revised it. PS contributed to data analysis, interpretation of data, creation of new software used in the work and revised the work. All authors read and approved the final manuscript.

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