Cross-cultural adaptation of Hypertension Knowledge Test into European Portuguese

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We aim to validate a European-Portuguese version of the Hypertension Knowledge Test (HKT) questionnaire and examine its factorial structure with a confirmatory factor analysis (CFA). A process of translation and back-translation was performed. A cross-sectional study was developed in which all adult patients taking at least one antihypertensive drug were invited to participate. Data on personal and family history were collected, and the HKT, Strelec, and the Batalla questionnaires were administered. We enrolled 304 patients with a mean age of 68.12±10.83 years. The mean score of HKT was 15.33±2.79. CFA indicated that the construct being tested was unidimensional, and Cronbach's alpha (α=0.65) showed that the instrument had an acceptable internal consistency. When evaluating concurrent validity, HKT was significantly correlated with the Batalla and Strelec scores. Thus, the Portuguese version of HKT (HKT-pt-PT) can be used either in research or in clinical practice. With this version, a potential standard exists to evaluate knowledge about hypertension, which could avoid the practice of using non-validated questionnaires in Portugal and allow the cross-sectional and longitudinal comparability of studies.

Keywords: Health Knowledge/attitudes/practice. Hypertension/prevention and control. Psychometrics. Surveys and questionnaires/standards. Portugal

INTRODUCTION

Control of hypertension is of central importance in cardiovascular disease prevention strategies (Mittal, Singh, 2010). However, despite all efforts, blood pressure (BP) control remains below expectations, with control rates ranging between 12% and 50% (Mittal, Singh, 2010; Kearney *et al.*, 2005; Wolf-Maier *et al.*, 2003; Erdine, Aran, 2004; Pereira *et al.*, 2009). The Physa study reported that 42.2% of Portuguese adults are hypertensive, 74.9% are being treated with antihypertensives, and 42.6% have BP within the therapeutic objectives (Polonia *et al.*, 2014).

Patients' knowledge about hypertension was highlighted as one of the most important patient-related factors for poor blood pressure control (Atallah *et al.*, 2011). Knowledge on hypertension was associated with medication adherence and subsequently with BP control (Almas *et al.*, 2012). Patients who have been educated about the importance of treatment become more involved with their therapy (Elliott, 2008; Powers, Jalowiec, 1987). The lack of knowledge of appropriate systolic BP was identified as a risk factor for poor blood pressure control (Atallah *et al.*, 2011; Knight *et al.*, 2001; Alexander *et al.*, 2003). These patients are less likely to take their medication, adopt healthy lifestyle changes, or see their physician if their blood pressure is outside the ideal range (Atallah *et al.*, 2011; Knight *et al.*, 2001; Alexander *et al.*, 2003).

While many studies have evaluated patient awareness of hypertension (Pereira *et al.*, 2009; Polonia

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et al., 2014; Joffres *et al.*, 2013; Gee *et al.*, 2012; Guessous *et al.*, 2012; Macedo *et al.*, 2007), critical elements of BP knowledge have not been adequately assessed. Developing instruments to assess knowledge is an important step to design effective intervention strategies for the control of BP. Several instruments have been used to evaluate patient knowledge about hypertension (Pineiro *et al.*, 1997; Batalla-Martínez, 1984; Strelec, Pierin, Mion Jr., 2003), but validated instruments reporting their internal consistency and reliability are scarce. The Hypertension Knowledge Test (HKT) (Han *et al.*, 2011) is a questionnaire initially created to assess the knowledge about hypertension in Korean-American patients. The HKT is an easy-to-use questionnaire covering several aspects of hypertension, as its etiology, diagnosis, treatment and prevention. The HKT presents probably the most robust analysis of psychometric properties, demonstrating good internal consistency (α=0.70), and is a sensitive and reliable instrument (Han *et al.*, 2011).

Although in Portugal some studies have evaluated the knowledge of hypertensive patients regarding their disease and the relationship between knowledge and BP control (Prior *et al.*, 2001; Morgado *et al.*, 2010), no validated instrument for this purpose exists. Thus, the objective of this study was to validate the European-Portuguese adaptation of the Hypertension Knowledge Test questionnaire. Specifically, this study aimed to examine its factorial structure with a confirmatory analysis and to estimate its convergent and construct validities.

METHOD

This was a cross-sectional study. Data were collected in 7 community pharmacies in the central region of Portugal and in the Hospital Infante D. Pedro in Aveiro. The study was approved by the Ethics Committee of the Faculty of Medicine of the University of Coimbra (Registration number CE_105.2013).

Hypertension knowledge test

HKT was developed based on the National HBP Education Program of the National Heart, Lung, and Blood Institute (Check Your High Blood Pressure (IQ)), a literature review and community input. HKT is a 21-item questionnaire created to assess a patient's knowledge about hypertension. HKT comprises the following two parts: 12 true-or-false questions and 9 multiple-choice questions. The level of knowledge is calculated by assigning one point to each correct answer, obtaining a total score ranging from 0 to 21.

Translation and cross-cultural adaptation of the HKT

A process of translation and back-translation according to international guidelines was performed (Guillemin, Bombardier, Beaton, 1993; Wild *et al.*, 2005). After obtaining the author's permission, the original questionnaire was submitted to 3 bilingual translators who knew the goals and concepts of the study, who created 3 independent Portuguese translations. The three versions were compared in order to generate a consensus version. The reverse translation, from European-Portuguese to English, was carried out by another bilingual translator who was not involved in developing the initial version and who did not know the objectives and concepts of the study. This new English version was compared to the original version, and occasional discrepancies were corrected. Finally, a cross-culturally adapted version was obtained through a consensus meeting, attended by 2 experts in pharmacology and 1 expert in Portuguese language, who evaluated the versions' semantic, idiomatic, cultural and conceptual equivalence.

A pilot test was performed in a Portuguese population (n=20) to ensure patient understanding and identify doubts and difficulties in the use of the questionnaire. The patients who participated in this face-validity phase were not further included in the study. After small adjustments based on changes proposed, we obtained the final European-Portuguese version of the HKT. Following the ISO-639 and ISO-3166, the European-Portuguese version of HKT was abbreviated as HKT-pt-PT.

Batalla test

Originally, Batalla was developed to assess patient knowledge regarding hypertension. It consists of 3 questions: "Is Hypertension a disease for life?", "Hypertension can be controlled with diet and/or medication?", and "Name 2 or more organs affected by increased blood pressure". The patient is classified as having good knowledge by correctly answering all questions (Batalla-Martínez, 1984; Pineiro *et al.*, 1997).

Strelec test

Strelec is an instrument developed to assess patients' awareness of hypertension and its treatment (Strelec, Pierin, Mion Jr., 2003). It consists of 10 true-or-false questions. One point is attributed to each correct answer, and the final score is calculated by summing the

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points obtained. Higher scores mean a greater level of consciousness regarding hypertension.

Medida de adesão aos tratamentos

The Medida de Adesão aos Tratamentos (MAT) (Delgado, Lima, 2001) is a questionnaire developed to assess patients' adherence to medication. It consists of 7 items each rated on a six-point Likert scale, ranging from 1 ("always") to 6 ("never"). The level of adherence is obtained by adding the values of each item and then dividing by the total number of items. Higher scores mean a greater level of adherence. The classification of patients as adherent or non-adherent is made according scores near the median values.

Data collection

Data were collected between March and August 2014, and the HKT-pt-PT was applied to a sample of at least 300 patients. Inclusion criteria were adult patients taking at least one antihypertensive drug. All patients who met the inclusion criteria and were being treated by the participating pharmacies and hospital in the study were invited to participate. The interview was conducted by a trained pharmacist in a private office, where data on personal and family history were collected and the HKT-pt-PT, MAT, Strelec, and the Batalla instruments were administered. Due to the use of this interview method, all participants' answers were coded, so there were no missing values.

Statistical analysis

To examine the factorial structure of the HKT-pt-PT, a confirmatory factor analysis (CFA) using MPlus 6 was performed (Muthén, 1998/2010). The model was estimated using the maximum likelihood (MLMV) method, which provides robust standard errors and robust chi-square in case of deviation from normality, adjusting for mean and variance (Muthén, 1998/2010).

According to Kline (2008), samples above 300 participants are considered large and therefore adequate to use analysis such as the CFA. To evaluate overall model fit, we used the chi-square goodness-of-fit statistic, where non-significant values indicate good fit of the model to the data. In addition, we followed the recommendation that other fit indices be used to ascertain model fit (Kline, 2008), namely, the comparative fit index (CFI), the standardized root-mean-square residual (SRMR) and the root mean square error of approximation (RMSEA).

Model fit is considered adequate or good when the CFI is above 0.90 or 0.95, the SRMR is below 0.10, and the RMSEA is below 0.10 or 0.08 (Kline, 2008). The report of the combination of these fit indices has been recommended for a better analysis on the model fit (Hu, Bentler, 1999).

Whenever a model did not fit the data well, the model was inspected for respecification, and alternative models were also tested. The development of competing models was based on theoretical considerations and analysis of the data. Finally, the internal consistency of the HKT-pt-PT was estimated using Cronbach's alpha.

RESULTS

Study participants

There were 304 patients enrolled in the study. The mean age was 68.12 ± 10.83 years, and 162 (53.3%) were female. The average time since hypertension diagnosis was 11.13 ± 8.65 years, with maximum disease duration of 50 years. In this population, 171 (56.3%) had dyslipidemia, 91 (29.9%) diabetes, 89 (27.6%) heart disease, and 28 (9.2%) had already had a stroke. Of the 162 women enrolled, 13 (4.3%) had history of hypertension during pregnancy. The adherence mean score obtained for MAT was 5.78 ± 0.27.

The mean score obtained for HKT-pt-PT was 15.33 ± 2.79. Table I summarizes the proportion of correct responses to each item. Table II describes the frequencies of answers to the multiple choice questions.

Confirmatory factor analysis

The first CFA model included all 21 items of the HKT loaded into one global factor, Overall Knowledge of Hypertension. The model revealed a poor fit to the data, with, with $\chi^2(189) = 226.68$, p=0.03; CFI = 0.78; RMSEA = 0.03 [90% confidence interval: 0.01; 0.4]; and SRMR = 0.05. The analysis of modification indices and the evaluation of each item phrasing suggested that the introduction of error correlations (between items 8 and 11, items 13 and 15 and items 16 and 19) would improve model fit and were included in the model. The final model presented an adequate fit, with $\chi^2(182) = 200.12$, p=0.23; CFI = 0.92; RMSEA = 0.02 [90% confidence interval: 0.00; 0.03]; and SRMR = 0.05, indicating that the construct being tested, knowledge on hypertension, was unidimensional.

Internal consistency and validity

Cronbach's alpha for all items was 0.65, and the

TABLE I - Proportion of correct answers on the Hypertension Knowledge Test (n=304)

Item	Response format	Correct answer	
		n	**%**
Q1. Se a sua mãe ou pai tiverem hipertensão o seu risco de tornar-se hipertenso é maior	T/F	225	74
Q2. Jovens adultos não têm hipertensão	T/F	279	91.8
Q3. A hipertensão tem sempre sintomas	T/F	170	55.9
Q4. A hipertensão não põe a vida em risco	T/F	298	98
Q5. A pressão arterial é alta quando é igual ou superior a 140/90 mmHg	T/F	257	84.5
Q6. Se tiver peso a mais tem um risco 2 a 6 vezes maior de desenvolver hipertensão	T/F	298	98
Q7. Exercício físico regular pode ajudar a reduzir a pressão arterial	T/F	258	84.9
Q8. Os portugueses consomem 2 a 3 vezes mais sal ou sódio do que necessitam	T/F	286	94.1
Q9. Beber bebidas alcoólicas reduz a pressão arterial	T/F	205	67.4
Q10. A hipertensão é um problema apenas dos homens	T/F	303	99.7
Q11. Hipertensão na gravidez é um problema temporário e não necessita de acompanhamento após o parto	T/F	219	72
Q12. A pressão arterial diminui com o tempo frio	T/F	121	39.8
Q13. A hipertensão prejudica o seu organismo ao longo do tempo por:	MC	102	33.6
Q14. Porque é que a Hipertensão é chamada um "assassino silencioso"?	MC	292	96.1
Q15. Uma pessoa é diagnosticada com hipertensão se tiver:	MC	99	32.6
Q16. Uma boa pressão arterial é:	MC	297	97.7
Q17. Qual das seguintes afirmações é verdadeira sobre os medicamentos para a hipertensão:	MC	95	31.3
Q18. Qual das seguintes afirmações é falsa sobre os medicamentos para a hipertensão:	MC	145	47.7
Q19. Todos os seguintes problemas de saúde podem ser provocados pela hipertensão, exceto:	MC	216	71.1
Q20. Todas as seguintes afirmações são alterações que pode fazer na sua dieta para reduzir a sua pressão arterial, exceto:	MC	392	96.1
Q21. Todas as seguintes alterações do estilo de vida podem ajudar a baixar a sua pressão arterial, exceto:	MC	204	67.1

Abbreviation: MC=multiple choice; T/F=true or false.

removal of any item would not have affected alpha significantly. The values of the alphas if an item was deleted and the item total correlations are reported in Table III.

Convergent validity was estimated by correlating the final score of the HKT-pt-PT with other measures assessing the same construct. The HKT-pt-PT was moderately and significantly correlated with the Batalla (0.32, p<0.001) and Strelec scores (0.31, p<0.001), confirming that both instruments assess correlated constructs.

Construct validity was estimated by examining differences in adherence based on knowledge of hypertension, as assessed by the HKT-pt-PT score. Based on the median (15), groups were formed: scores below the mean were considered lower knowledge, and scores above the mean were considered high knowledge. Participants with lower knowledge (<15) had a mean MAT score of 5.74±0.33, and those with higher knowledge (≥15) had a mean score of 5.81±0.22 (t = -2.29, p=0.04)

DISCUSSION

Our study aimed to examine the factorial structure and validity of the European-Portuguese version of the HKT (HKT-pt-PT). To our knowledge, this is the first study using confirmatory analysis procedures to examine the

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TABLE II - Frequencies of answers of multiple choices questions

	n	%
Q13. A hipertensão prejudica o seu organismo ao longo do tempo por:		
Fazer com que tenha diabetes	33	10.9
Fazer com que ganhe peso	6	2
Danificar os seus vasos sanguíneos	102	33.6
Deixá-lo nervoso	114	37.5
Q14. Porque é que a Hipertensão é chamada um "assassino silencioso"?		
O risco de morrer de hipertensão é baixo	0	0
Quando não há dor nem se sente doente é porque se está bem	7	2.3
Pode não ter sintomas e pode por a vida em risco	293	96.4
Q15. Uma pessoa é diagnosticada com hipertensão se tiver:		
Muitas dores de cabeça que persistem há mais de 6 meses	72	23.7
Um familiar com hipertensão	4	1.3
Stress e pressão constantes	92	30.3
Pressão arterial elevada em 3 ocasiões diferentes	99	32.6
Q16. Uma boa pressão arterial é:		
Menos de 90/50 mmHg	0	0
Menos que 140/90 mmHg	297	97.7
145/110 mmHg	5	1.6
180/100 mmHg	0	0
Q17. Qual das seguintes afirmações é verdadeira sobre os medicamentos para a hipertensão:		
Há muitos tipos de medicamentos para a Hipertensão	95	31.1
Deve ser tomada uma medicação extra quando a pressão arterial está alta	147	48.4
Os medicamentos não devem ser tomados se se beber álcool	42	13.8
Todos os medicamentos causam impotência sexual	0	0
Q18. Qual das seguintes afirmações é falsa sobre os medicamentos para a hipertensão:		
Tomar os medicamentos para a Hipertensão durante muito tempo pode prejudicar o seu organismo	145	47.7
A partir do momento em que começa a tomar medicação tem de continuar a tomá-la a vida toda	113	37.2
Mesmo que se sinta bem tem de tomar a medicação como o prescrito	20	6.6
Quando sente que a dose dos medicamentos deve ser alterada, deve falar primeiro com o seu médico	0	0
Q19. Todos os seguintes problemas de saúde podem ser provocados pela hipertensão, exceto:		
Ataque cardíaco	7	2.3
Artrite	215	70.7
AVC	22	7.2
Insuficiência Renal	43	14.1
Q20. Todas as seguintes afirmações são alterações que pode fazer na sua dieta para reduzir a sua pressão arterial, exceto:		
Comer frango assado em vez de frito	6	2
Parar de comer batatas fritas	1	0.3
Evitar adicionar sal de mesa à comida	3	1
Comer fast-food ou fritos	291	95.7
Q21. Todas as seguintes alterações do estilo de vida podem ajudar a baixar a sua pressão arterial, exceto:		
Levantar 50 kg	210	69.1
Andar vigorosamente 30 minutos 3 vezes por semana	21	6.9
Beber menos do que 2 bebidas alcoólicas por dia	48	15.8
Parar de fumar	7	2.3

TABLE III - Internal consistency reliability of the Hypertension Knowledge Test

Item	Item-total correlation coefficient	Cronbach alfa if item deleted
Q1. Se a sua mãe ou pai tiverem hipertensão o seu risco de tornar-se hipertenso é maior	0.30	0,63
Q2. Jovens adultos não têm hipertensão	0.03	0.66
Q3. A hipertensão tem sempre sintomas	0.03	0.67
Q4. A hipertensão não põe a vida em risco	0.13	0.65
Q5. A pressão arterial é alta quando é igual ou superior a 140/90mmHg	0.24	0.64
Q6. Se tiver peso a mais tem um risco 2 a 6 vezes maior de desenvolver hipertensão	0.20	0.65
Q7. Exercício físico regular pode ajudar a reduzir a pressão arterial	0.25	0.64
Q8. Os portugueses consomem 2 a 3 vezes mais sal ou sódio do que necessitam	0.30	0.64
Q9. Beber bebidas alcoólicas reduz a pressão arterial	0.33	0.63
Q10. A hipertensão é um problema apenas dos homens	-0.1	0.63
Q11. Hipertensão na gravidez é um problema temporário e não necessita de acompanhamento após o parto	0.34	0.65
Q12. A pressão arterial diminui com o tempo frio	0.18	0.62
Q13. A hipertensão prejudica o seu organismo ao longo do tempo por:	0.39	0.65
Q14. Porque é que a Hipertensão é chamada um "assassino silencioso"?	0.10	0.63
Q15. Uma pessoa é diagnosticada com hipertensão se tiver:	0.31	0.65
Q16. Uma boa pressão arterial é:	0.23	0.64
Q17. Qual das seguintes afirmações é verdadeira sobre os medicamentos para a hipertensão:	0.28	0.63
Q18. Qual das seguintes afirmações é falsa sobre os medicamentos para a hipertensão:	0.33	0.64
Q19. Todos os seguintes problemas de saúde podem ser provocados pela hipertensão, exceto:	0.26	0.65
Q20. Todas as seguintes afirmações são alterações que pode fazer na sua dieta para reduzir a sua pressão arterial, exceto:	0.05	0.62
Q21. Todas as seguintes alterações do estilo de vida podem ajudar a baixar a sua pressão arterial, exceto:	0.40	0.63

factor structure of the HKT, confirming the measurement model of the instrument and the unidimensional theoretical structure of the instrument (Kline, 2008). Our findings indicate that all the items contribute to the assessment of knowledge on hypertension.

The original validation was performed by administering the questionnaire to two distinct samples, in study 1, to middle-aged hypertensives (mean age=51.9±5.7 years); and in study 2, to elderly hypertensives (mean age=70.9±5.5 years) (Han *et al.*, 2011). The results were presented separately for each study and for the total sample. If we compared our Cronbach's alpha (α=0.65) to that obtained in the total sample of the original validation (α=0.70), ours was lower. However, if we made the comparison with the alpha obtained in study 2 (α=0.62), which had a mean

population age more similar to ours, we obtained a higher alpha. Although we obtained a Cronbach's alpha of <0.70, it was high enough to consider that HKT-pt-PT presents an acceptable internal consistency. One possible explanation for a Cronbach's alpha slightly below the recommended value may be the existence of some uncorrelated items. In the Portuguese version, values of item total correlation (ITC) range between -0.1 and 0.40, and 6 items (Q2, Q3, Q4, Q10, Q14 and Q20) did not meet the cutoff of 0.15 (Nunnally, Bernstein, 1994). In study 2 of the original validation, ITC ranged between 0.11 and 0.32, and two items, Q3 and Q6, did not meet that cutoff. The fact that these items do not contribute much to the final score may be due largely to the high percentage of correct answers that they present. This can be explained by the characteristics of the population surveyed since

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we applied the instrument to hypertensive patients under treatment, with good levels of adherence. If removal of any item would not affect alpha significantly, the removal of this item could cause this questionnaire to cease being valid for application in other contexts, particularly in a less informed population.

Analyzing the answers obtained in the multiple-choice questions, we saw that Q13, Q15, Q17 and Q18 were the questions that caused the most doubt in the patients, as less than 50% of patients provided correct answers. In Q17 ("Which of the following statements is true about HBP medications?"), approximately 48% of patients responded that "An extra medication should be taken when blood pressure is high." One possible reason for this result is that the question could be misinterpreted: the patients confused taking an extra dose of medication with taking another medication. Thus, in future applications of HKT-pt-PT, it may be useful to consider an alternative wording for this question, for example, by replacing the expression "medicação extra" with "medicação adicional".

The difficulties in accurately answering items 13, 15 and 18 may be explained by the low level of health literacy that the Portuguese population presents (Salgado et al., 2013). These results are similar to those obtained by Williams et al. (1998), where patients with poor literacy skills were less likely to answer knowledge questions correctly. Health literacy is independently correlated with disease knowledge (Gazmararian et al., 2003), and there are several studies showing that patients with lower literacy levels have lower levels of knowledge about their disease (Williams et al., 1998; American Medical Association, 1999; Mosher et al., 2012). The Portuguese population's health literacy is low. Salgado et al. (2013), measuring health literacy with the Newest Vital Sign, reported that 95% of the Portuguese respondents scored in the three lowest possible scores, indicating a notable floor effect.

Health literacy is inversely associated with age (Williams et al., 1998; Paasche-Orlow et al., 2005; Kobayashi et al., 2015); thus, patients with marginal and inadequate literacy are older than patients with adequate literacy, meaning that older patients should have worse knowledge about their disease. However, in the HKT original validation study, Han et al. (2011) showed that knowledge about hypertension increases with age and with time of disease. Similar results were obtained by Hyre et al. (2007), where patients diagnosed with hypertension for ten or more years were more likely to have a better understanding of the importance of medication-taking behaviors and their effects on long-term health. These findings suggest that personal experience with hypertension and cardiovascular disease, rather than basic knowledge, may lead to improved adherence behavior. Thus, when developing strategies to improve blood pressure control, particular characteristics of knowledge about hypertension must be taken into account, requiring the utilization of specific validated instruments.

The final score of the HKT-pt-PT was correlated with other measures assessing similar constructs, Batalla and Strelec. HKT-pt-PT was moderately and significantly correlated with both instruments, showing that the construct is correlated but not exactly the same. In fact, HKT allows us to evaluate knowledge about hypertension, not only that related to the symptoms and diagnosis of the disease but also that related to the ways of preventing and controlling high blood pressure, antihypertensive medications, and the harmful effects of hypertension over time. These multifaceted characteristics are an added value that will enable us to obtain more complete and specific information about patients' knowledge about this condition.

LIMITATIONS OF THE STUDY

A potential limitation of our study was the questionnaire application mode used. We used the interviewer-administration method, which may lead to some bias (Okamoto et al., 2002; Puhan et al., 2011). However, we considered the interview the best method to allow the inclusion of patients with very low literacy since we want the validated instrument to be applicable in every type of population, regardless of their degree of literacy.

CONCLUSION

We obtained a European-Portuguese version of the HKT (HKT-pt-PT) with acceptable internal consistency, discriminatory capacity, and predictive power regarding adherence, which can be used either in research or in clinical practice. Now a potential standard exists that could avoid the practice of using non-validated questionnaires in Portugal. This will allow the cross-sectional and longitudinal comparability of studies.

With this questionnaire, not only clinicians and researchers but also health policy decision makers can assess the gaps in patients' knowledge about hypertension and consequently develop educational activities.

Future research is warranted to assess whether knowledge evaluated by the HKT-pt-PT can be associated with process variables, such as adherence or outcome variables, including blood pressure control.

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