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Psychometric Evaluation of the Brief Illness Perception Questionnaire among Iraqi Patients with Type II Diabetes

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Quantitative Study

Abstract

Background: The Brief Illness Perception Questionnaire (B-IPQ) is one of the most widely used measures of emotional and cognitive representations of illness. The B-IPQ has been translated and adapted into many languages. However, the scale has not been translated into Iraqi Arabic in patients with type II diabetes. The main purpose of the present study was to investigate psychometric properties of the B-IPQ among Iraqi patients with type II diabetes.

Methods: In this quantitative study, the Arabic Version of the B-IPQ was given to 192 Iraqi patients with type II diabetes. The participants were randomly selected from 5 hospitals and a diabetes society in Baghdad, Iraq. The participants included individuals diagnosed at least 1 year before this research. Using WINSTEPS computer program, the Rating Scale Model (RSM) was employed as a polytomous extension of the Rasch model (RM) to evaluate the scale in terms of unidimensionality, local independence, item statistics, and rating structures.

Results: The results indicated that the values of infit and oufit mean square (MNSQ) are within the ideal range of 0.60 and 1.40, suggesting that the items of the scale fit to the RM. The data was found to be unidimensional because the first factor explains 5.5% of the unexplained variance with an eigenvalue of 1.5 (< 2). The results also showed that items

are locally independent, and both persons and items have high Rasch separation reliability indices. More importantly, the response options or categories of the scale work optimally because with the increase in category values, observed averages also increased.
Conclusion: The overall findings showed that the Arabic version of the B-IPQ is a valid and reliable instrument and can be employed to assess illness perceptions among Iraqi patients with type II diabetes.
Keywords: Illness perception; Arabic translation; Type II diabetes; B-IPQ; Rasch rating scale model

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Introduction

Type II diabetes, formerly known as adult-onset diabetes, is a kind of diabetes in which the body does not properly use insulin which, in turn, causes unusual blood sugar levels. Inexplicable weight loss, increased thirst and hunger, frequent urination, sores, and fatigue are the most prevalent symptoms of type II diabetes. Research has demonstrated that illness perceptions of patients can explain outcomes and functioning of disease (de Raaij, Schroder, Maissan, Pool, & Wittink, 2012). For example, illness representations have been shown to remarkably impact physical exercise, dietary management, foot care, medication adherence, self-monitoring of blood glucose, smoking cessation, and appointment attendance (Hudson, Bundy, Coventry, & Dickens, 2014). In fact, there is a relationship between cognitive illness representations and emotional health. Patients with strong beliefs that their diabetes is chronic and has serious effects reported poor emotional health and self-care; however, patients with positive attitude toward their treatment reported higher emotional health and self-care (Broadbent, Wilkes, Koschwanez, Weinman, Norton, & Petrie, 2015; Hudson et al., 2014; Petricek, Vrcic-Keglevic, Vuletic, Cerovecki, Ozvacic, & Murgic, 2009).

Over the last few decades, a great deal of attention has been paid to the way individuals with different diseases perceive their illnesses and understand their situation. Illness perception is defined as the personal beliefs patients have about their illnesses (Broadbent et al., 2015). For the analysis of illness perceptions, Leventhal, Nerenz, and Steele (1984) and Bazzazian and Besharat (2010) developed a self-regulatory model to describe in what ways patients generate their representations of illness perceptions. The five critical dimensions of the model are identity of the illness, causes of the illness, its consequences, the timeline of the illness, and the way the illness can be controlled or cured (Petrie & Weinman, 2012). The model indicates how the patients construct their views or internal representations about an illness with respect to previous experience, causes, symptoms, and expectations.

Early research assessing patients' illness perceptions used open-ended interviews; however, with the increasing use of Leventhal's self-regulatory model, more objective scales have been developed to aid assessment, including the Illness Perception Questionnaire (IPQ; Weinman, Petrie, Moss-Morris, & Horne, 1996), the Illness Perception Questionnaire-Revised (IPQ-R; Moss-Morris, Weinman, Petrie, Horne, Cameron, & Buick, 2002), and the Brief Illness Perception Questionnaire (B-IPQ; Broadbent, Petrie, Main, & Weinman, 2006). Among these measures, the B-IPQ is more widely used to measure the emotional and cognitive representations of illness. The B-IPQ has already been translated and adapted into various languages, such as Arabic, Dutch, French, German, Persian, Polish, Swedish, Turkish, and Vietnamese, to name a few. The B-IPQ was also subjected to further examinations of its validity and reliability (Bazzazian & Besharat, 2010; Shim, Jeong, Song, Lee, Kim, & Hahm, 2020; van Oort, Schroder, & French, 2011; see Broadbent et al., 2015, for more information on the translation, adaptation, and further analysis of the B-IPQ). Previous studies have shown the good psychometric properties of the B-IPQ based on the methods and standards of Classical Test Theory (CTT). However, a more robust psychometric analysis of the B-IPQ based on Item Response Theory (IRT) is required.

To the best of the authors' knowledge, psychometric properties of the B-IPQ have not been analyzed in patients with type II diabetes, especially among Iraqi patients. Therefore, the main purpose of the present study was to, first, translate and adapt the B-IPQ into Iraqi Arabic in patients with type II diabetes, and then, investigate the

psychometric qualities of the translated scale using Rasch Rating Scale Model (RSM; Andrich, 1978) as a polytomous IRT model.

Methods

Participants: For the goal of this quantitative study, the Arabic translation of the B-IPQ was administered to 192 Iraqi patients with type II diabetes. The participants were randomly selected from among patients in 5 hospitals and a diabetes society in Baghdad, Iraq. The participants included individuals diagnosed at least 1 year before this research. The sample consisted of 110 men and 82 women. Their age ranged from 46 to 79 years (Mean ± SD = 62.34 ± 5.49). Respondents were instructed to read each question and rate their perception. As each item is scored on a 0-10 ordinal scale, a total score of 0-80 was possible, and higher scores showed higher negative illness representation of disease for ethical considerations, participants were assured all of their personal information would be kept confidential and used only for research purposes.

Translation Procedure: The Brief Illness Perception Questionnaire (B-IPQ; Broadbent et al., 2006) was translated into Iraqi Arabic by an expert committee composed of the researchers and a psychologist according to principles for the translation and cross-cultural adaptation process for patient-reported measures (Epstein, Santo, & Guillemin, 2015; Wild et al., 2005). The B-IPQ consists of 8 items designed to provide a rapid assessment of the cognitive and emotional representations of illness. In this questionnaire, 5 items assess cognitive illness representations: consequences (Item 1), timeline (Item 2), personal control (Item 3), treatment control (Item 4), and identity (Item 5), 2 items assess emotional representations: concern (Item 6) and emotions (Item 8), and 1 item assesses illness comprehensibility (Item 7). Items are rated on a scale ranging from 0 to 10. The psychometric qualities of the original English version of the instrument have been previously supported (Broadbent et al., 2006). After translating the scale, the translated measure was meticulously examined by a bilingual psychologist. The proposed modifications were applied. The final version of the Iraqi Arabic measure of the B-IPQ was back-translated into English by another bilingual psychologist. Finally, during a session with the expert committee and 11 patients with type II diabetes, the scale was reviewed and compared with the original version of the scale.

Data Analysis: WINSTEPS computer program (version 5.2.2) (Linacre, 2022) and SPSS (version 23; IBM Corp., Armonk NY, USA) were used to analyze the data using the Rasch RSM (Andrich, 1978). The RSM is an extension of the Rasch model (RM; Rasch, 1960/1980) for analyzing polytomous responses to several items. In the RSM, the same structural response format is assumed for all the items, that is, all the items have the same number of response categories. According to Linacre (1994), the sample size (n = 192) used in this study is large enough for RM analysis. The fit of data to the RM can be considered as evidence that a single latent trait explains the covariation among the items, that is, item performances can be described by the expected latent trait, which shows the unidimensionality of the scale (Baghaei & Tabatabaee Yazdi, 2016; Baghaei, 2019).

Results

Item Characteristics: Table 1 illustrates item difficulty (endorsability) estimates, standard error of measurement, mean square (MNSQ) statistics, and point-measure correlations. The item difficulties explained in logits indicate the item locations on the latent trait continuum, and the error of measurement shows the precision of item difficulty estimates.

Table 1. Item characteristics and fit statistics for the Arabic version of the Brief Illness Perception Questionnaire

Items	Item Difficulty	Standard Error of Measurement	Infit MNSQ	Outfit MNSQ	Point-measure Correlation
1	-0.71	0.05	1.01	1.03	0.74
2	-0.74	0.05	1.26	1.20	0.76
3	0.55	0.05	0.86	0.86	0.82
4	0.75	0.05	0.92	0.92	0.79
5	-0.50	0.05	1.09	1.08	0.78
6	-0.36	0.05	0.79	0.84	0.77
7	10.10	0.05	1.03	1.04	0.70
8	-0.07	0.05	0.87	0.86	0.79

MNSQ: Mean square

As can be seen, item difficulties range from -0.74 to 10.10 logits with a separation reliability of 0.99. Item 7 was the hardest item (10.10 logits), and items 2 and 1 were the easiest items with -0.74 and -0.71 logits, respectively. Person parameters, as measures of unobservable latent traits, also ranged from -1.89 to 3.94 with a separation reliability of 0.90. Separation reliability shows the degree to which the individual and item parameters are discriminated upon the measurement of the construct (Linacre, 2009) and refers to the ratio of true score variance to observed variance for the elements of the facet, that is, to what extent the ordering of the measures are reproducible (Linacre, 2009). Separation reliability is used for both person and item parameters. Separation reliability is the Rasch equivalent of the KR-20 or Cronbach's Alpha which shows how reproducible is the ordering of the parameters (Linacre, 2009).

To assess the quality of the items or how well items fit the RM, infit and outfit MNSQs were analyzed. According to Linacre (2002), infit MNSQ is defined as "an information-weighted fit statistic, which is more sensitive to unexpected behavior affecting responses to items near the person's measure level", whereas outfit MNSQ is "an outlier-sensitive fit statistic, more sensitive to unexpected behavior by persons on items far from the person's measure level" (pp. 331-332). The appealing properties of the Rasch model will be attained if the data fit the model (Baghaei, Yanagida, & Heene, 2017) As demonstrated in table 1, the values of infit and oufit MNSQ are within the ideal range of 0.60 and 1.40 (Bond & Fox, 2001; Linacre, 2002).

Point-measure correlations for all the items were further estimated which refer to the correlations between the items and person ability measures. A higher value of point-measure correlation represents higher discrimination for the items. The values of the point-measure correlations in this study showed that all correlations are high, suggesting the conformity of item difficulty patterns to the expectations of the RM.

Unidimensionality and Local Independence: Unidimensionality and local item independence are two important assumptions in IRT and the RM. Unidimensionality indicates that all the items of a scale should measure a single latent trait, and local item independence indicates that items should be independent regarding a certain level of the latent trait intended to be measured. In other words, after conditioning out the latent trait effect, items should be uncorrelated. We examined the unidimensionality of the scale through principal component analysis (PCA) of standardized residuals. As there is not a perfect match between items and the RM, residuals are defined as the differences between the expectations of the RM and observed scores, so they are the part of the data that the model cannot explain. Residuals are expected to have random distributions and be uncorrelated (Baghaei &

Cassady, 2014; Linacre, 2009). PCA is typically used to determine whether the data is unidimensional or not. No extra factor or component should be extracted if the data is unidimensional. The size of eigenvalues is examined to determine if the factor (or contrast) derived from residuals can be ignored. Eigenvalues above 2 suggest that a peripheral factor which jeopardizes the unidimensionality of the measure is at work (Linacre, 2009), and the data do not fit the RM. The results of PCA showed that the measures account for 70.4% of the variance; persons explain 26.1% and items explain 44.3%. However, 29.6% of the variance remains unexplained. The first factor explains 5.5% of the unexplained variance with an eigenvalue of 1.5 (< 2), which is an indication of the unidimensionality of the data.

Figure 1 depicts the distribution of item difficulty estimates and persons, known as the Wright map. Each hash mark (#) denotes 3 persons, and each dot mark (.) shows 1 to 2 persons. On both side of the continuum line, *M* denotes the mean, and *S* and *T* indicate 1 and 2 standard deviations from the mean, respectively. Persons at the upper part of the continuum are those with higher negative illness representation of disease, and persons at the lower part of the continuum are those with lower negative illness representation of disease. Although items cover a wide range of the latent trait continuum, a few difficult items are required to be inserted into the scale to cover the upper part of the scale.

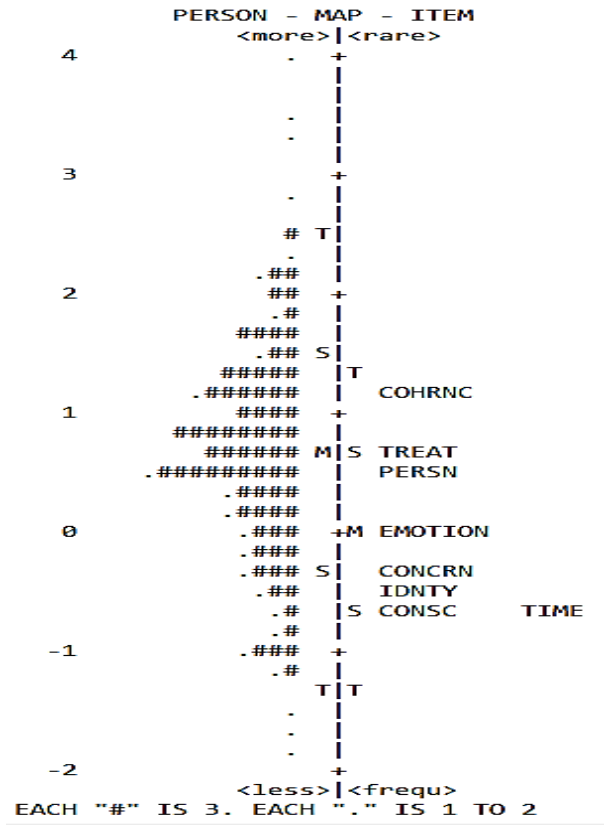

Figure 1. Distributions of items and persons on the latent trait

We also checked the Pearson correlations of linearized Rasch residuals to identify dependent items. When there are high correlations between the residuals of two item pairs, it is an indication of "how much locally easier or harder that item was than expected" (Wright, 1996, p. 510). Correlations higher than 0.70 represent local dependency (Linacre, 2009). In the present study, all correlations were negative and fell between -0.17 and -0.28, indicating that the local independence holds.

Rating Scale Analyses: Table 2 displays the characteristics of the rating scale structure for the Arabic version of the B-IPQ. The first column presents the number of categories which range from 0 to 10. The second column shows the observed count and percentage of each category. A large number of respondents selected categories 5, 7, 6, 4, and 8, respectively, suggesting their negative illness representation of the disease. Column 3 demonstrates observed averages of categories. This is the mean of all respondents in the data who endorsed the categories. As category values increase, observed averages are expected to increase as well. Apart from category 1, shown with an asterisk in the table, the rest of the categories have satisfied the category ordering. The fourth and fifth columns show the average of the infit and outfit MNSQ related to responses in each category level. As can be seen, except for category 0 which is problematic, the values of infit and outfit MNSQ for the other categories are within the ideal boundary of 0.40 to 1.40 (Bond & Fox, 2001; Linacre, 2002). The last column provides the Andrich threshold for each category. This indicates the equal probability between two adjacent categories (Lincacre, 2009, p. 519). The first response option does not have any priori category. With higher response options, threshold estimates should increase. Disordered thresholds indicate that the category "occupies a narrow interval on the latent variable", and that there are substantive problems with the category (Lincacre, 2009, p. 336). In fact, respondents cannot make a distinction between various response options (Bond & Fox, 2001). A suitable strategy is to reduce or merge 2 adjacent categories (Bond & Fox, 2001; Linacre, 2009). For the scale used in this study, threshold estimates represent the ordering of thresholds.

Discussion

This study was performed to translate into Iraqi Arabic and adapt the B-IPQ (Broadbent et al., 2006), and then, investigate the psychometric properties of the Arabic version of the scale in a sample of Iraqi patients with type II diabetes. For the purpose of validation, the RSM (Andrich, 1978) was utilized as a kind of polytomous IRT model for analyzing (ordinal) polytomous items.

Table 2. Characteristics of the rating scale structure for the Arabic version of the Brief Illness Perception Questionnaire

Category	Observed Count (%)	Observed Average	Infit MNSQ	Outfit MNSQ	Andrich Threshold
0	16(1)	-1.18	2.01	1.83	-
1	43(2)	-1.23*	1.33	1.30	-2.61
2	98(5)	-1.05	0.98	0.97	-2.02
3	173(8)	-0.64	0.99	1.03	-1.33
4	258(12)	-0.15	0.98	0.98	-0.73
5	335(16)	0.29	0.98	0.98	-0.19
6	264(13)	0.64	0.95	0.94	0.71
7	272(13)	1.02	0.81	0.76	0.82
8	244(12)	1.40	1.01	1.03	1.32
9	209(10)	1.78	0.97	0.99	1.74
10	160(8)	2.38	0.79	0.85	2.30

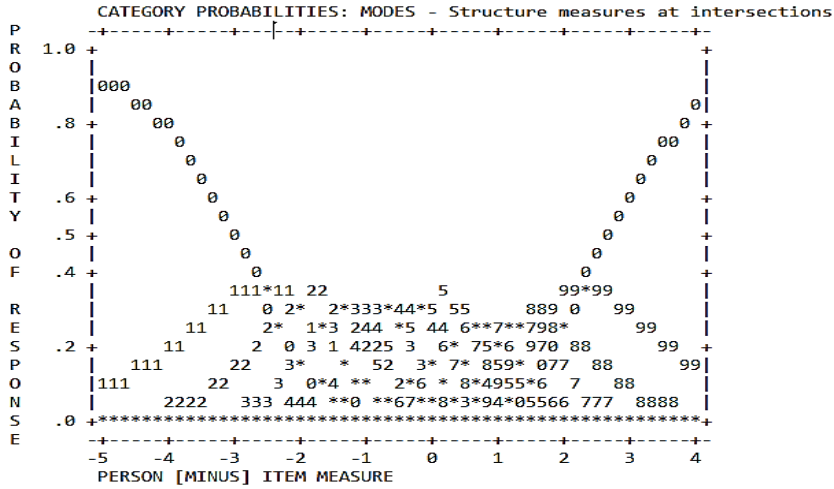

Figure 2. Category probability curves for the Arabic version of the Brief Illness Perception Questionnaire

The B-IPQ consists of 8 items which measure patients' cognitive and emotional representations of their illness including consequences, timeline, personal control, treatment control, identity, coherence, concern, emotional response, and causes (Broadbent et al., 2006, p. 635). A variety of statistics were evaluated to investigate the fit of the data to the RSM. The results of fit statistics, item characteristics, and point-measure correlations were analyzed, and their results showed conformity between the observed data and the RM expectations. The values of item and person separation reliability were satisfactory.

The results of unidimensionality, furthermore, revealed that the scale can provide an effective unidimensional measure of illness perceptions. Using principle component analysis of standardized residuals, the unidimensionality of the scale was checked. The analysis showed that the eigenvalue for the first factor accounts for 70.4% of the observed variance with an eigenvalue of 1.5, indicating the unidimensionality of the scale. The Wright map distributions of the persons and items showed that the items of the scale cover a broad range of the continuum, although more difficult items are suggested to be added to the scale. The analysis of local dependency also confirmed that local independence holds.

More importantly, the rating scale diagnostics showed the effectiveness, sufficiency, and distinctiveness of each response option or category in the scale because observed averages increase with higher response options. This can be considered as evidence for the ordering of thresholds and the ability of respondents to differentiate the categories. Overall, the results of the study support the psychometric property of the Iraqi Arabic version of the B-IPQ in the sample of Iraqi patients with type II diabetes.

Conclusion

Limitations: The present study had some limitations which should be taken into consideration. First, the sample used for analysis in the current study only included patients with type II diabetes. Future research can use other groups of patients with

different illnesses or chronic conditions in various clinical settings to not only investigate the psychometric qualities of the scale, but also support the findings of the study.

Second, as the sample size was not large enough to separate respondents into different smaller subpopulations, we did not examine differential item functioning (DIF) for the items of the scale across different subgroups. Small sample sizes for analyzing DIF would not provide reliable estimates. Future studies with larger sample sizes can determine whether items of this scale are biased against certain groups or work invariably across smaller subgroups.

Conflict of Interests

Authors have no conflict of interests.

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None.

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