

## Original Research

# Psychometric properties of the Belief about Medicines Questionnaire (BMQ) in the Maltese language

Ingrid GATT , Lorna M. WEST , Neville CALLEJA , Charles BRIFFA , Maria CORDINA .

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## Abstract

**Background:** Investigating beliefs about medicines has been of interest over the past years, with studies aiming to better understand theoretical reasons behind development of such beliefs.

**Objective:** This study aimed to produce a culturally and contextually appropriate version of the Beliefs about Medicines Questionnaire (BMQ) in the Maltese language and to assess its psychometric properties.

**Methods:** Medication beliefs were evaluated using the BMQ which is divided into two sections: BMQ-General (sub-scales: Overuse and Harm, 4 items per sub-scale) and BMQ-Specific (sub-scales: Necessity and Concerns, 5 items per sub-scale). Following translation/back translation, the Maltese version of the BMQ was applied to patients having asthma, diabetes, cardiovascular disease or depression who attended out-patients' clinics at the main state general hospital in Malta between June and September 2013. Cronbach's alpha coefficient, alpha, was used to determine internal consistency of the BMQ and Principal Component Analysis using Varimax rotation with Kaiser normalisation was carried out to analyse component loading of the items on the respective sub-scales.

**Results:** The Maltese version of the BMQ showed acceptable internal consistency for the harm scale (alpha=0.56), the necessity scale (alpha=0.73) and the concerns scale (alpha=0.66), however the overuse scale gave poor internal consistency (alpha=0.48) due to the item on natural remedies which posed some difficulty in the Maltese sample. The final solution for Principal Component Analysis yielded a four-factor structure representing the 4 sub-scales of the BMQ, with results being comparable to previous studies out in different languages.

**Conclusion:** The Maltese version of the BMQ was found to have acceptable psychometric properties for the beliefs about medicines in the Maltese population.

## Keywords

Medication Adherence; Attitude to Health; Psychometrics; Reproducibility of Results; Surveys and Questionnaires; Malta

## INTRODUCTION

Medicines are vital components which are needed to maintain and improve health, however, they may still be perceived as unsafe, expensive, and unavailable, and on most occasions, are not taken properly. This has been identified as a universal problem, with around 50% of all medication being improperly prescribed, sold or dispensed and with 50% of patients, especially those with chronic diseases, failing to adhere to their prescribed medication.<sup>1</sup> This problem may be partially addressed by having a better understanding of people's beliefs about medicines in

general and in specific contexts. Beliefs are based on the individual's education and knowledge, and on the influence of health care providers, thereby giving rise to a mutual relationship between individuals' beliefs and the environment to which they are exposed.<sup>2,3</sup>

The Belief about Medicines Questionnaire (BMQ), developed by Professor Robert Horne and colleagues, as a method for assessing cognitive representations of medication, was validated for use in patients suffering from common chronic diseases.<sup>4-6</sup> The BMQ has been translated into several languages including German<sup>7</sup>, Spanish<sup>8-10</sup>, Italian<sup>11</sup>, Portuguese<sup>12</sup>, Norwegian<sup>13</sup>, Swedish<sup>14</sup>, Danish<sup>15</sup>, and French<sup>16</sup> where it was used as a measure for the assessment of beliefs about medicines, all of which gave reproducible results.

When using a psychometric instrument in a different language to that in which it has been original constructed, it needs to be appropriately translated, taking into consideration cross-cultural issues, conceptual equivalence and it needs to possess adequate psychometric properties.<sup>17-20</sup> To date there is no version of the BMQ in the Maltese language and therefore this valuable instrument cannot be used in studies aimed at better understanding Maltese patients' beliefs about medicines.

The principle aim of this study was therefore, to produce a culturally and contextually appropriate version of the BMQ in the Maltese language and to assess its psychometric properties.

**Ingrid GATT.** BSc (Hons) Biology & Chemistry, MSc (Clin Pharmacol). Department of Clinical Pharmacology and Therapeutics, Faculty of Medicine and Surgery, University of Malta. Msida (Malta). [gatt.ingrid@gmail.com](mailto:gatt.ingrid@gmail.com)

**Lorna Marie WEST.** BPharm (Hons), MSc (Clin Pharm), PhD. Post-Doctoral Researcher. Department of Clinical Pharmacology and Therapeutics, Faculty of Medicine and Surgery, University of Malta. Msida (Malta). [lorna.west@um.edu.mt](mailto:lorna.west@um.edu.mt)

**Neville CALLEJA.** MD, MSc(Melit) MSc, PhD (Open), FFPH. Senior Lecturer. Department of Public Health, Faculty of Medicine and Surgery, University of Malta. Msida (Malta). [neville.calleja@gov.mt](mailto:neville.calleja@gov.mt)

**Charles BRIFFA.** BA (Hons), MA, PhD. Professor. Department of Translation, Terminology and Interpreting Studies, Faculty of Arts, University of Malta. Msida, (Malta). [charles.briffa@um.edu.mt](mailto:charles.briffa@um.edu.mt)

**Maria CORDINA.** BPharm (Hons) (Melit), PhD. Associate Professor. Department of Clinical Pharmacology and Therapeutics, Faculty of Medicine and Surgery, University of Malta, Msida (Malta). [maria.cordina@um.edu.mt](mailto:maria.cordina@um.edu.mt)



## METHODS

### Instrument

The BMQ consists of an 18-item questionnaire which assesses medication beliefs in general and in specific conditions allowing for the investigation of the overall perceptions of medication in general (BMQ-General), as well as perceptions of medication in more definite situations such as chronic illnesses (BMQ-Specific).<sup>21</sup>

The BMQ-General comprises 8 items which are subdivided into two sub-scales. The General-Harm sub-scale assesses beliefs about how harmful medicines are and the General-Overuse sub-scale addresses the concept of over-prescription of medication by doctors who place too much trust in them. The items are scored on a 5 point Likert scale with scores ranging from 4 to 20.

The BMQ-Specific comprises 10 items which are subdivided into two sub-scales. Specific-Concerns scale assesses perceptions of the likelihood of adverse reactions as a consequence of taking the prescribed medication. The Specific-Necessity scale addresses the patients' belief about their personal need to adhere to the prescribed medication.

Higher scores in the General-Harm and General-Overuse scales represent an overall negative perception of medication. Likewise, high scores in the Specific-Concerns scale represent the notion that adverse reactions are potentially harmful when taking medication on a regular basis, and high scores in the Specific-Necessity scale are

indicative of the patient's need to adhere to medication to maintain health.

### Translation of the BMQ to the Maltese Version

The translation into the Maltese language was conducted in accordance with 'Principles of good practice for translation and cultural adaptation process for patient reported outcome measures'.<sup>18</sup> A detailed account of the steps followed are illustrated in Table 1.

### Patient selection and recruitment

Four different chronic illness groups were selected based on those selected by Horne *et al.*<sup>21</sup> All consultant physicians at Mater Dei Hospital, the main general hospital in Malta, who held outpatient clinics for patients having the conditions of interest were approached by the principal investigator during their outpatient clinics, briefed about the study and were asked permission for their patients to participate. The physicians were briefed about the aims of the study, the BMQ itself and the target number of patients to be recruited. All consultants accepted to participate. The patients selected were those with a confirmed diagnosis of asthma, diabetes, depression or cardiovascular disease. For the purpose of the present study, only the Maltese version was used. Inclusion criteria for patients were: Maltese nationality; taking medication for their condition for at least two months; and being 18 years of age and over.

Participants were informed that the study was on a voluntary basis, that all information would be kept confidential, and that the information would only be

Steps	Critical components
Preparation	Permission was obtained from Prof Robert Horne (the developer) for use of the instrument. He clarified ambiguities and provided a document on how to use and analyse the BMQ. This form of consultation was essential for better translation equivalence.
Forward translation	One independent forward translation was carried out using Maltese fonts by the principal investigator. Harmonisation of this initial translation was carried out with the Department of Translation at the University of Malta, where items were discussed within the context to be measured, in an attempt to avoid literal translations which can mislead the purpose of the study. At the same time, free translation was also avoided as it could wander too far from the meaning of the original. The translation was based on the SkoposTheory. <sup>34</sup>
Reconciliation	The forward translation was discussed and revised for better harmonisation of concepts in the instrument, with the intention of capturing the conceptual meaning of the items. This was done through an expert panel in order to resolve discrepancies and allow for agreement between speech habits and preferences in the translated language. This functional approach in the translation was considered to respect the target patients and their situation and cultural background.
Back translation	The Maltese version was back translated to English by a certified translator who had no access to the original version of the BMQ, since reversibility is crucial to equivalence.
Back translation review	The back translation was reviewed against the English version so as to ensure conceptual equivalence of the translation carried out, avoiding mistranslations and translation losses which would render an incomplete replication of the source questionnaire in the target one.
Cognitive debriefing results and finalisation	Finalisation of the translation allowed for any necessary modifications or rewording of the items. Satisfactory review of comparison of both English versions (back translation and original) resulted in the finalisation of the Maltese language version of the BMQ. This editing process was needed to create a Maltese text which is maximally suitable for the intended patients. Improvements were considered necessary to fix problems which may hinder the mental processing of the questions, and to tailor these questions to the intended patients.
Proofreading	The draft in the Maltese language was checked for minor errors that might have been disregarded during the translation process by the principal investigator and a colleague. Conforming to the rules governing Maltese writing is important since it respects the general feeling of the people – errors in Maltese are often regarded as denigrating the language in the Maltese Islands
Final report (translation and validation)	The explanation of the process undertaken to effectively translate the BMQ into the Maltese language is presented in the results and discussion section under the section BMQ.

Procedure as per Wild *et al.*, 2005 - *Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures*.<sup>34</sup>

	Diabetes (N=100)	Asthma (N=100)	Cardiac (N=100)	Depression (N=100)	Total (%)	
Gender	Male	51	44	60	37	48
	Female	49	56	40	63	52
Mean Age (SD)	58 (15.83)	50 (18.81)	62 (19.04)	53 (16.38)	56 (18.13)	
	Age Range	18-88	18-84	18-57	18-86	18-88
	Median	62	51	68	54	60
Education	Primary	34	20	42	31	31.8
	Secondary	51	37	37	43	42.0
	Post-secondary	8	20	8	14	12.5
	Tertiary (University)	4	18	7	5	8.5
	Post Graduate	2	3	1	0	1.5
	N/A	1	2	5	7	3.8
Occupation	Employed	14	38	24	13	22.3
	Unemployed	12	13	4	31	15.0
	Housewife/stay-home dad	17	11	6	18	13.0
	Pensioner	53	32	64	31	45.0
	Other	4	6	2	7	4.8
Mean number of prescribed medicines (SD) / patient	3 (2.40)	3 (1.74)	5 (2.95)	4 (2.54)		
Mean Duration on medication in Years, (SD), (Range)	10 (9.33) (2 m - 46 y)	17 (13.61) (2 m - 66 y)	11 (11.25) (2 m - 53 y)	17 (11.73) (2 m - 50 y)		
m: months; y: years						

handled by the principal investigator and would not be accessible to the hospital staff. The questionnaire was self-administered. Approval for the study to be carried out was obtained from the University Research Ethics Committee (UREC) Malta.

#### Sample size determination

A target sample size of 100 patients per disease group was established. This was based on the sample sizes used by Horne *et al.* in the original development of the BMQ.<sup>21</sup>

#### Sampling strategy

Patients were recruited through the outpatient clinics, of the main general hospital, in Malta, between July 2013 and September 2013. Consecutive patients were approached until the target of 100 patients per chronic illness group was achieved.<sup>11,21</sup> All outpatient clinics held by the participating physicians during the above time period were visited. The principal investigator, who was present during the entire duration of the outpatients' clinics, approached patients in a sequential order on entering the clinic waiting area and invited them to participate in the study. The principal investigator asked the patients for a few minutes of their time, explained to them that she was conducting a

study on the beliefs about medicines and asked them if they would be kind enough to fill in the questionnaire. She explained that this was not a test, that there were no correct or incorrect answers. In the case of patients attending psychiatric clinics, there were some patients who were omitted from the study due to their condition, as per their doctor's request. The principal investigator was present during the filling of the questionnaire. The questionnaire was collected and checked on completion.

#### Statistical analysis

Cronbach's alpha coefficient, alpha, was used to determine internal consistency of the BMQ, thus defining the degree to which all items in the BMQ sub-scales measure the same construct, also referred to as inter-relatedness of items which ensures reliability.<sup>22</sup> Cronbach's alpha was calculated for each individual validation chronic group (N=100) per sub-scale and as a whole chronic group (N=400) per sub-scale. Spearman's rho was used as a measure of reliability of the items present on each sub-scale, further confirming the Cronbach alpha values obtained. Significance was defined at  $p < 0.05$ .

	Asthmatic sample (N=100)	Diabetic sample (N=100)	Cardiac sample (N=100)	Depression sample (N=100)	Total (N=400)	Original study*
BMQ General Overuse G1, G4, G7, G8	0.53	0.50	0.40	0.42	0.48	0.60-0.80
BMQ General Harm G2, G3, G5, G6	0.49	0.57 <sup>a</sup>	0.42	0.66	0.56 <sup>b</sup>	0.47-0.83
BMQ Specific Necessity S1, S3, S4, S7, S10	0.80	0.67	0.72	0.71	0.73 <sup>b</sup>	0.55-0.86
BMQ Specific Concerns S2, S5, S6, S8, S9	0.71	0.67	0.60	0.65	0.66 <sup>b</sup>	0.63-0.80
* Horne <i>et al.</i> , 1999; <sup>a</sup> Sample taken on n=99, <sup>b</sup> Significant values for alpha						

BMQ (items per scale)	Items used	Cronbach alpha
BMQ General Overuse (3)	G1, G7, G8	0.54
BMQ General Overuse (3)	G1, G4, G7	0.37

Principal Component Analysis (PCA) using Varimax rotation with Kaiser normalisation was carried out to analyse component loading of the items on the respective sub-scales. This was done for both the General and Specific sub-scales. Since the original English version presents a 4-component structure, PCA was conducted with restriction to 4 components.

## RESULTS

### Demographics

A total of 679 patients were approached in order to recruit the necessary 100 patients per chronic illness group. Mean scores obtained (N=400) were as follows: General-Overuse 13.85 (SD=2.24); General-Harm 11.23 (SD=2.51); Specific-Concerns 19.21 (SD=2.89); Specific-Necessity 14.65 (SD=3.76). The demographics for the study subjects are presented in Table 2. There were no statistically significant differences between the groups.

### Internal Consistency

Cronbach alpha values are presented in Table 3. All values fall within the range obtained by the original study<sup>21</sup>, with the exception of the General-Overuse scale. This scale presented some anomalies with respect to the internal consistency. During the analysis of alpha, items G4 (Natural remedies are safer than medicines) and G8 (If doctors had more time with patients they would prescribe fewer medicines) resulted in unexpectedly lower values. Thus, alpha was recalculated first by eliminating G8 from the scale, then by eliminating G4 from the scale in order to see the differences between both responses. Recalculated Cronbach alpha values obtained are shown in Table 4. As seen in Table 4, the re-calculated alpha value for the overuse scale with elimination of G4 gave a marginally higher value (alpha=0.54), when compared to the alpha obtained when using all four items of the overuse scale (alpha=0.48) in Table 3. Table 5 shows reliability results for this study.

### Principal Component Analysis

Principal component analysis with Varimax rotation confirmed the original four factor structure (Table 6 and

Table 7) explaining 47.17% of variance. Items loading on component 1 (overuse), included items G1, G4, G7, G8, G2 and G3. Both items G4 and G3 loaded on two components, component 1 (overuse) and component 4 (concerns), with G4 having a higher loading on component 4. Item G2 loaded on component 1 (overuse) despite the item belonging to the Harm sub-scale. Items G5 and G6 loaded on component 2 (harm).

Due to the nature of the items loading, component 1 was identified as the General-overuse scale, with the items developed as representative of the overuse scale, G1, G4, G7, G8 all loaded on component 1. Component 2 was identified as the General-harm scale with items G5 and G6, two items that were originally developed for this scale, having high loadings for this component (items developed as representative of scale include G2, G3, G5, G6).

In the case of the BMQ-Specific items, S1, S3, S4, S7 and S10 loaded all on component 3 (necessity), confirming this as the Specific-necessity scale, as all items correspond to the items developed as representative of this scale. Items S2, S3 and S9 loaded on component 4 (concerns) with S6 and S8 having higher loadings on component 2 (harm) rather than component 4 (concerns). Due to the nature of the items loaded on component 4, this was identified as the Specific-concerns sub-scale (items developed as representative of the scale include S2, S5, S6, S8, S9).

To further confirm factor loading, PCA was then carried out on the items in each sub-scale in order to verify that the items in each sub-scale were loading on one component. In each case one component was extracted. Due to the items loading on different components, PCA was conducted with restriction of up to four factors, by loading each item on its respective component, as was done in the Portuguese study.<sup>12</sup> Table 8 shows that each item loaded on the respective scale, thus confirming the emergent core-themes identified during the development of the BMQ.<sup>21</sup>

Thus, the final four components were identified as:

- Component 1 representing the overuse scale,
- Component 2 representing the harm scale,
- Component 3 representing the necessity scale
- Component 4 representing the concern scale.

## DISCUSSION

This is the first study to assess psychometric properties of the BMQ in the Maltese language. Significant care was taken during the translation process, engaging professional academic translators of the Maltese language together with

General Overuse				General Harm					
	G1	G4	G7		G2	G3	G5		
G4	0.093			G3	0.226**				
G7	0.311**	0.096		G5	0.166**	0.176**			
G8	0.240**	0.135**	0.245**	G6	0.192**	0.156**	0.394**		
Specific Necessity				Specific Concerns					
	S1	S3	S4	S7	S5	S6	S8		
S3	0.415**				S5	0.419**			
S4	0.402**	0.477**			S6	0.160**	0.126*		
S7	0.376**	0.417**	0.364**		S8	0.342**	0.238**	0.132**	
S10	0.140**	0.258**	0.274**	0.182**	S9	0.411**	0.387**	0.223**	0.354**

\*Correlation significant at a level of 0.05 (2-tailed); \*\*Correlation is significant at a level of 0.01 (2-tailed).

Table 6. Principal component analysis using varimax rotation with Kaiser Normalisation. Eigenvalue > 1. BMQ-General items

		General Overuse	General Harm	Specific Necessity	Specific Concerns
<b>Percentage of Variance explained (47.17%)</b>		11.15	10.13	13.94	11.94
G1	It-tobba jużaw wisq mediċini <i>Doctors use too many medicines</i>	0.651			
G4	Rimedji naturali huma ta' inqas periklu mill-mediċini <i>Natural remedies are safer than medicines</i>	0.238			0.446
G7	It-tobba jafdaw wisq fuq il-mediċini <i>Doctors place too much trust on medicines</i>	0.559			
G8	Kieku t-tobba kellhom iktar ħin mal-pazjenti jiktbu inqas mediċini <i>If doctors had more time with patients they would prescribe fewer medicines</i>	0.617			
G2	Nies li jieħdu l-mediċini għandhom iwaqqfuhom għal ftit kull tant żmien <i>People who take medicines should stop their treatment for a while every now and again</i>	0.608			
G3	Ħafna mill-mediċini jwassluk biex tiddependi fuqhom <i>Most medicines are addictive</i>	0.440			0.392
G5	Il-mediċini jagħmlu iktar ħsara milli ġid <i>Medicines do more harm than good</i>		0.604		
G6	Il-mediċini kollha huma velenu <i>All medicines are poisons</i>		0.690		
Factor loadings >0.2 are reported					

healthcare professionals highly proficient in both the Maltese and English language. This was done to ensure a translation which was linguistically, culturally and contextually appropriate thereby avoiding the pitfalls described in the paper highlighting issues identified in the three Scandinavian versions of the BMQ.<sup>23</sup> The present study had similar demographic characteristics to the other analogous studies.<sup>7,9-12</sup>

The level of education of most of the participants in Malta was similar to the Portuguese version where the majority of patients had completed elementary school and with the original BMQ where the majority of participants had a secondary level of education.<sup>12,21</sup> Education has been shown to be a significant factor in relation to BMQ overuse and necessity. Therefore, patients with different levels of education should be targeted differently when counselling patients about their medicines. Age was also comparable to the other studies.<sup>7,9-12,21</sup> The

reported mean age for the present study was 56 (SD=18.13) with an age range of 18-88, and a median age of 60 years. Age is also reflective of employment status with 45% of the Maltese patient population, being pensioners, similar to the Italian study.<sup>11</sup> This study also revealed that patients of a younger age would require more counselling about personal necessity to adhere to the prescribed medication.

Psychometric evaluation of the BMQ revealed satisfactory results with minor problems on the sub-scale relating to the statement of 'natural remedies', an inconsistency which was also reported by Horne *et al.*<sup>21</sup> The harm, concerns and necessity sub-scales gave acceptable results for internal consistency (Table 3) as well as reliability (Table 5) in this study. Internal consistency and reliability for these sub-scales were also comparable to the other studies with the closest values being those reported in the Greek version used to study patients with inflammatory bowel disease.<sup>7,9-12,21,24</sup>

Table 7. Principal component analysis using varimax rotation with Kaiser Normalisation. Eigenvalue > 1. BMQ-Specific items

		General Overuse	General Harm	Specific Necessity	Specific Concerns
<b>Percentage of Variance explained (47.17%)</b>		11.15	10.13	13.94	11.94
S1	Saħhti, fil-preżent, tiddependi mill-mediċini tiegħi <i>My health, at present, depends on my medicines</i>			0.728	
S3	Kieku ħajti tkun impossibbli mingħajr il-mediċini tiegħi <i>My life would be impossible without my medicines</i>			0.783	
S4	Mingħajr il-mediċini tiegħi nkun marid/a ħafna <i>Without my medicines I would be very ill</i>			0.750	
S7	Saħhti fil-futur tiddependi fuq il-mediċini tiegħi <i>My health in the future will depend on my medicines</i>			0.704	
S10	Il-mediċini tiegħi jipproteġuni milli nsir aghar <i>My medicines protect me from becoming worse</i>			0.396	
S2	Li jkolli nieħu l-mediċini jinkwetani <i>Having to take these medicines worries me</i>				0.683
S5	Kultant ninkwieta dwar l-effetti fit-tul li jista' jkollhom il-mediċini fuq saħhti <i>I sometimes worry about long-term effects of my medicines</i>				0.660
S6	Il-mediċini tiegħi huma misteru għalija <i>My medicines are a mystery to me</i>		0.369		0.129
S8	Il-mediċini tiegħi jfixkluni ħajti <i>My medicines disrupt my life</i>		0.449		0.432
S9	Kultant ninkwieta li nsir wisq niddependi fuq il-mediċini tiegħi <i>I sometimes worry about becoming too dependent on my medicines</i>				0.743
Factor loadings >0.1 are reported					

**Table 8. Principal component analysis carried out on individual sub-scales to confirm factor loading. No rotation. Eigenvalue >1.**

		General Overuse	General Harm	Specific Necessity	Specific Concerns
G1	Doctors use too many medicines	0.729			
G4	Natural remedies are safer than medicines	0.323			
G7	Doctors place too much trust on medicines	0.718			
G8	If doctors had more time with patients they would prescribe fewer medicines	0.675			
G2	People who take medicines should stop their treatment for a while every now and again		0.598		
G3	Most medicines are addictive		0.541		
G5	Medicines do more harm than good		0.726		
G6	All medicines are poisons		0.737		
S1	My health, at present, depends on my medicines			0.748	
S3	My life would be impossible without my medicines			0.685	
S4	Without my medicines I would be very ill			0.379	
S7	My health in the future will depend on my medicines			0.630	
S10	My medicines protect me from becoming worse			0.764	
S2	Having to take these medicines worries me				0.728
S5	I sometimes worry about long-term effects of my medicines				0.801
S6	My medicines are a mystery to me				0.751
S8	My medicines disrupt my life				0.715
S9	I sometimes worry about becoming too dependent on my medicines				0.402
Factor loadings >0.3 reported					

By convention, acceptable internal consistency is proven by obtaining values of alpha that are over 0.70<sup>25,26</sup> thus, the higher the value of alpha, the higher the degree or internal consistency<sup>27</sup> and the more reliable a scale is in measuring what it is designed to measure. However, alpha is very dependent on the number of items in a test, which might result in a reduced value of alpha.<sup>22,28</sup> In this study, the overuse sub-scale, which constitutes 4-items, gave an internal consistency of alpha=0.48 (N=400), with the lowest values of alpha reported in the cardiac group, alpha=0.40, and the group suffering from depression, alpha=0.42. Low alpha values were also obtained in the harm scale for the cardiac group, alpha=0.42 (Table 1). Reason for this low internal consistency remains unclear. Low alpha values could be indicative of certain items on the general overuse scale not measuring the same concept. Psychometric evaluation was further investigated through inter-item correlation, a measure of reliability. As shown in Table 4, item G4 (Natural remedies are safer than medicines) showed non-significant correlations with the other items (G1 (Doctors use too many medicines) and G7 (Doctors place too much trust on medicines)), whereby item G8 (If doctors had more time with patients they would prescribe fewer medicines) had the lowest correlation with item G4 when compared to items G1 and G7. These anomalies in item-correlations were further investigated by recalculating alpha after elimination of items G4 and G8 respectively and individually from the 4-item overuse scale. Recalculated alpha values are presented in Table 4. A recalculated alpha value of 0.54 was obtained when eliminating G4, and an alpha of 0.37 was obtained when eliminating G8 when compared to alpha=0.48 for all 4 items on the scale (Table 3). It was clear at this point that G4 was the item that was mostly inconsistent with the rest of the items on the general overuse scale. This could be indicative of the item being relatively unstable in the overuse scale. Granas *et al.*<sup>23</sup> argue that some items, such as G4, may be of lesser importance in some populations than in others.

At this stage, a potential modification was considered on the overuse scale, where G4 would be eliminated from the scale. However, this was not done as the recalculated alpha value of 0.54 was only slightly higher than the original 4-item alpha value of 0.48. Therefore, the minor improvement from this potential alteration would not justify the structural equivalence between the Maltese and English versions of the questionnaire. Irrespective of chronic illness and age, low alpha values in the Maltese study are thought to be related to the concept of natural remedies being relatively new and thereby misunderstood by the cohort.

When comparing alpha values obtained for the Maltese study with other studies carried out<sup>7,9-12,16,21,24,29-30</sup> (Table 9) it was noted that despite the notion that alpha values of 0.70 show good and reliable internal consistency, developers of the BMQ did not obtain alpha values of 0.70 for all the sub-scales analysed (Table 3).<sup>21</sup> However, an alpha value between 0.6-0.7 indicates intermediate internal consistency.<sup>21</sup> Based on the fact that the BMQ has been verified to be a reliable and valid tool during its development, alpha values obtained were assessed as acceptable if they fell within the range obtained by the developer. Internal consistency values for the German study<sup>7</sup> and the Spanish studies<sup>9,10</sup> were all above 0.70 (Table 3). However, Mahler *et al.*<sup>7</sup> commented that natural remedies and complementary medicine have been in the German tradition for a long time and are regarded as a substitute for conventional medicine. This is indicative of familiarization of the term 'natural remedies' in this population, which is reflected in item G4 having good internal consistency on the overuse scale for this particular population. In the Spanish study by De las Cuevas *et al.*<sup>10</sup> an internal consistency of alpha=0.75 was reported for all the 8 items on the General scale, with no distinction between sub-scales, which might be a misleading result. Tordera *et al.*<sup>9</sup> on the other hand obtained good internal consistency for the overuse sub-scale alpha=0.70. The sub-scales in the French version also demonstrated good internal

Table 9. Comparisons of Internal consistency (alpha values) obtained in the Maltese study with the original and others published in different languages.

	General Overuse	General Harm	Specific Necessity	Specific Concerns
Developer of BMQ (Horne <i>et al.</i> , 1999) <sup>a</sup>	0.60-0.80	0.47-0.83	0.55-0.86	0.63-0.80
Portuguese (Salgado <i>et al.</i> , 2013) <sup>b</sup>	-	-	0.76	0.67
German (Mahler <i>et al.</i> , 2010) <sup>c</sup>	0.80	0.79	0.83	0.83
Italian (Argentero <i>et al.</i> , 2010) <sup>d</sup>	-	-	0.78	0.72
Spanish (Tordera <i>et al.</i> , 2009) <sup>e</sup>	0.70	0.68	0.83	0.72
Spanish (De las Cuevas <i>et al.</i> , 2011) <sup>f</sup>	0.75 <sup>▲</sup>		0.80	0.72
Maltese version of BMQ <sup>g</sup>	0.48	0.56	0.73	0.66

<sup>a</sup> The original BMQ was developed using six chronic illness groups. Ranges of alpha are shown for all groups involved in the study.

<sup>b</sup> Portuguese version analysed the BMQ-Specific for the general population of medicine users.

<sup>c</sup> German version analysed the BMQ-General and BMQ-Specific across patients with a variety of chronic illnesses.

<sup>d</sup> Italian version analysed BMQ-Specific in four chronic illness groups (asthma, diabetes, cardiovascular and depression).

<sup>e</sup> Spanish version analysed BMQ-General and BMQ-Specific for a sample of asthmatic patients.

<sup>f</sup> Spanish version analysed BMQ-General and BMQ-Specific in a sample of psychiatric patients and undergraduate students reading medicine and psychology (patients are tabulated).

<sup>g</sup> Maltese version analysis was carried out using BMQ-General and BMQ-specific on four chronic illness groups (asthma, diabetes, cardiovascular and depression).

<sup>▲</sup> General items in the patient population gave a mono-factorial solution, therefore alpha was calculated on all 8-items together.

consistency with alpha values in the range of 0.79-0.85 for patients with diabetes and 0.064-0.72 for HIV patients.<sup>16</sup> Therefore, internal consistency for the present study can be taken to be acceptable within the scope of the psychometric properties of the scale.

Item loadings (Table 6 and Table 7), showed a varied outcome with items from one sub-scale loading elsewhere. Similar loadings were observed in other studies.<sup>7,10,21</sup> It is clearly noted that all the items for Specific-Necessity sub-scale loaded on the same factor. In the case of the Specific-concerns factor, all items loaded on the concerns factor, however items S6 (My medicines are a mystery to me) and S8 (My medicines disrupt my life) gave higher loadings on the General harm factor. In the development of the BMQ, during confirmatory factor analysis, S6 had a loading of 0.39 on the concerns factor, and a higher loading of 0.55 on the harm factor.<sup>21</sup> The same issue arose in the Portuguese translation, with S6 loading on three components in the original PCA analysis, with a loading of 0.202 on the concerns factor, and 0.804 on a third component which was not identified as a factor but was assumed to be the harm factor. After conducting PCA with restriction to two factors, item S6 loaded on two components, with a loading of 0.383 on the concerns factor.<sup>12</sup> The authors suggest that the inclusion of "mystery" posed a challenge to the translation process in the Portuguese language. However, elimination of item S6 gave only minor gains with respect to the internal consistency of the tool. Salgado *et al.*<sup>12</sup> thus concluded that the slight gains from the potential modifications tested by excluding item S6, were not strong enough to justify the loss of structural similarities between both translations and they opted to retain S6 in their translation. The same reasoning was applied for this study.

Due to the items loading on different components, PCA was conducted with restriction to four factors, by loading each item on its respective component, as was done in the Portuguese study<sup>12</sup> as presented in Table 8. Item G4 (Natural remedies are safer than medicines) was still problematic, giving a low factor loading of 0.323 on the overuse sub-scale when compared to the other items. Problems with G4 were also present in other studies.<sup>7,21</sup>

In the original and German version, item G4 loaded on both the overuse and the harm scale. Factor loadings include 0.47 on overuse and 0.45 on harm for the original BMQ English version, and 0.57 on overuse and 0.47 on harm for the German version. The overuse sub-scale for the Spanish version also presented some anomalies, with items G7 (Doctors place too much trust on medicines) (overuse) loading on the harm scale and G5 (Medicines do more harm than good) (harm) loading on the overuse scale. Tordera *et al.*<sup>9</sup> did not justify this shift of items on different factors. However, anecdotally, when taking the items into consideration, G5 (Medicines do more harm than good) might have loaded on the overuse scale as patients might associate harm to be directly related to over-prescription, whereas G7 (Doctors trust medicines too much) might lead patients to assume that too much trust in medicines by practitioners leads to over-prescription and overuse, which could in turn lead to adverse effects which might be harmful.

Factor loadings have been a challenge in most of the similar studies carried out due to cultural adaptations and translated items, which might have posed a difficulty during the translation process. PCA was also challenging during the development of the BMQ, where the General-Harm scale gave good results for PCA but disappointing results with internal consistency. However, authors argue that item deletions and recalculations of Cronbach alpha showed that low internal consistency was not linked to a single item but was rather a true reflection of low internal consistency, with a reason for such discrepancy remaining unclear. Authors proceeded to comment that further studies were required in order to resolve this issue and recommend caution in using this scale.<sup>21</sup>

In summary, throughout the present study, the main problem was with the item on natural remedies, with this term presenting difficulties in conceptual equivalence amongst other translations. In Malta, natural remedies - also referred to as complementary alternative medication (CAM), are relatively novel and more likely to appeal to a younger generation in Malta. This could possibly be the reason why older generations might be misguided in understanding the meaning of natural remedies. Natural

remedies were part of folklore which people in Malta moved away from upon introduction of what is today considered to be conventional medicine.<sup>31</sup> In addition, Maltese healthcare professionals might be mistrusting of natural remedies, resulting in less promotion of such remedies, as is the case with other medical professionals worldwide. There is in fact a tendency for healthcare professionals to be weary of them, due to the fear that patients would stop using the prescribed conventional medicine altogether in favour of natural remedies.<sup>32,33</sup> Further studies need to be carried out to determine whether the Maltese version of the BMQ correlates with adherence to medicines. To our knowledge, a validated tool to assess adherence to medicines is not available in the Maltese language.

## CONCLUSIONS

The Maltese version of the BMQ for use in the Maltese population demonstrated acceptable psychometric properties which are consistent with those reported in the original English version.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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