



## Patient Perception, Preference and Participation

## Temporal stability of beliefs about medicines: Implications for optimising adherence

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## ABSTRACT

**Objective:** To compare beliefs about medicines, as measured by the BMQ-General questionnaire, at two time points for the same respondents.

**Methods:** Respondents completed the BMQ-General as part of two separate postal questionnaires, administered with an intervening period of almost 4 years. BMQ-General scores were compared for all respondents at the two time points (2002 and 2005). Scores were also compared for three mutually exclusive groups based on changes in self-reported health status (better, worse or no change) during the intervening period.

**Results:** BMQ-General scores remained stable over time: no statistically significant differences were observed in individuals' scores after almost 4 years. This finding persisted amongst respondents who reported changes in health status during the intervening period.

**Conclusion:** General beliefs about medicines appear to remain stable over time, irrespective of changes in health status. Further research should be done to establish whether specific beliefs about medicines prescribed for individuals are similarly stable.

**Practice implications:** Adherence is known to be associated with beliefs about medicines. The observed stability in such beliefs could have implications for the design of interventions to improve adherence to prescribed medication regimes.

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## 1. Introduction

## 1.1. Background

The Beliefs about Medicines Questionnaire (BMQ) was developed as an aid to understanding people's perceptions about medicines [1], and their adherence (or non-adherence) to prescribed medication regimes [2]. Its development was one response to mounting evidence that many patients do not use their medicines as directed by the prescriber [3]. Estimates of the extent of non-adherence vary across studies, largely because of differing methods of measurement, difficulties in measuring and inconsistency in the definitions used for the term 'adherence' [4]. However, one source reports that across different definitions and settings, around 50% of medicines are not used as intended by the prescriber [5]. Non-adherence to prescribed medicines can pose a

significant threat to the success of medical treatments and intended improvements in health outcomes. Adherence to evidence-based curative or preventive drug treatments for most medical conditions is likely to affect the success of those treatments, since maintaining optimal blood levels is necessary for efficacy. Poor health outcomes following low adherence can in turn impinge on secondary outcomes, such as the cost to society of subsequent unresolved and/or worsening illnesses.

Various reasons for low adherence have been reported, and these can be categorised as non-intentional and intentional non-adherence. Non-intentional non-adherence is often the result of poor memory or understanding [5]. The reasons for intentional non-adherence are less straightforward and include problems experienced as a direct result of taking medicines (such as adverse drug reactions), inability to pay for medicines, disagreement with the need for pharmacological treatment, or other patient-specific issues associated with complex behavioural characteristics [6]. Beliefs about medicines are most likely to be associated with intentional non-adherence.

Previously, a number of theories from health psychology such as the Health Belief Model, Theory of Planned Behaviour and the Common Sense Self-regulatory Model of Illness, have been used to

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try to explain variation in adherence to medicines [7]. The authors of the BMQ, however, argued that a separate, specific measure to gauge patients' beliefs about medicines would add to the explanatory power of such models [1]. It was proposed that an enhanced understanding of people's beliefs about medicines could inform the development of interventions to improve adherence and optimise the benefits users derive from their medicines. It is unclear, however, whether these beliefs are stable over time, or whether they change depending on concurrent circumstances.

The BMQ comprises two separate scales [1]. The BMQ-specific scale has two sub-scales and assesses respondents' beliefs about prescribed medicines that they are currently using for specific conditions, for example, hypertension, diabetes or asthma. Studies using the BMQ-specific sub-scales have shown that respondents with stronger beliefs about the necessity of their medication and fewer concerns about their medication (as measured by the BMQ) are more likely to use their medicines as recommended by the prescriber [2,8–11].

The BMQ-General scale measures respondents' attitudes to medicines in general. It has two sub-scales, each with four items. The General-overuse sub-scale measures respondents' beliefs about the extent to which medicines are overused or over-prescribed by doctors. The General-harm sub-scale assesses beliefs about the harmfulness of medicines. Items are scored using a 5-point Likert scale. Higher scores indicate stronger beliefs about the corresponding concepts in each sub-scale, i.e. more negative beliefs about medicines. Scores for each of the BMQ-General sub-scales can range from 4 to 20. The BMQ-General scale has been used separately to assess attitudes towards medicines among people who do not share a common condition or treatment. For example, one study in Sweden suggested that pharmaceutical specialists (pharmacists and prescriptionists) had fewer concerns than patients that medicines were harmful or overused [12]. Horne et al. have reported that pharmacy students have a more positive attitude towards medicines than students studying other subjects [13], and that beliefs about medicines vary between people from different cultural backgrounds [14]. A recent Swedish study found that adherence was associated with general attitudes to medicines (as measured by the BMQ-General scale); people who believed that medicines were harmful were less likely to take medicines as intended by the prescriber [15].

### 1.2. Temporal stability of beliefs about medicines

Temporal stability is a property of a construct (e.g. beliefs about medicines) which indicates whether the construct changes over time, or under different conditions; for example, whether beliefs

about medicines are stable or change in response to changes in health state. This would be important to know because where such beliefs are associated with behaviour (in this example, medicine-taking behaviour), and where that behaviour is maladaptive (such as low adherence), changing the behaviour using interventions that target beliefs may be harder to achieve when those beliefs are very stable. Previous researchers have proposed that health beliefs (including some related to medicines use) are formed at an early age and change little thereafter [16]. This US study compared the health beliefs and behaviours of 270 children, allocated to two groups depending on age ('11 years and over' and 'under 11 years'). Their findings seemed to indicate that "children's health related beliefs and behaviors are relatively stable" by the time they reach 9–10 years, and that "few changes take place in these orientations as the children move into adolescence". It is unknown however, whether this stability persists into adulthood, or whether experiences such as changes in health status, are likely to modify health-related beliefs in later life.

### 1.3. Aim

The aim of this paper is to compare the results of two separate applications of the BMQ-General scale in the same respondents, over a period of almost 4 years, in order to explore the temporal stability of BMQ scores. The hypothesis was that scores for the two BMQ-General sub-scales would remain stable over time (suggesting stability of people's general beliefs about medicines) and would not alter with changes in health state.

## 2. Method

The BMQ-General sub-scales were included in a postal questionnaire, mailed in 2002 to 3000 individuals randomly selected from the Scottish electoral roll as part of a study about non-prescribed analgesics [17]. The wording of the introductory text preceding the BMQ items was adapted slightly from the original [1] for this study (Box 1). As well as the BMQ-General, the questionnaire collected information about respondents' characteristics, their lifestyle and recent (within the previous 2 weeks) use of prescribed and non-prescribed medicines. Respondents were also asked to rate their general health using a 5-point Likert scale, ranging from excellent to poor.

The BMQ-General scale was administered again 44 months later in 2005. It was incorporated into a discrete choice experiment (DCE) questionnaire that measured relative preferences for different ways of managing flu-like symptoms [18]. This questionnaire was mailed to 652 respondents to the original survey

### Box 1. The Beliefs About Medicines Questionnaire-General (adapted from Horne et al. [1]).

	<i>Sub-scale</i>
Below are some general statements that other people have made about medicines. Please indicate how much you agree or disagree with them by ticking the appropriate box. There are no right or wrong answers. We are interested in your personal views, even if you personally do not use medicines.	
<i>Rated: strongly agree, agree, uncertain, disagree, strongly disagree</i>	
<b>BMQ-General</b>	
Doctors use too many medicines.	<i>Overuse</i>
People who take medicines should stop their treatment for a while every now and again.	<i>Harm</i>
Most medicines are addictive.	<i>Harm</i>
Natural remedies are safer than medicines.	<i>Overuse</i>
Medicines do more harm than good.	<i>Harm</i>
All medicines are poisons.	<i>Harm</i>
Doctors place too much trust on medicines.	<i>Overuse</i>
If doctors had more time with patients they would prescribe fewer medicines.	<i>Overuse</i>

**Table 1**

Self-reported characteristics of 321 respondents (in 2002) with at least one BMQ-General score available for comparison at the two time points.

	Respondents, N = 321% (n) <sup>a</sup>	National data (Scotland), %
<b>Sex</b>		
Male	50.5 (162)	47.8 [31]
Female	49.5 (159)	52.2
<b>Age range</b>		
18–29	2.5 (8)	19.9 [31]
30–39	13.8 (44)	20.5
40–49	25.9 (83)	17.7
50–59	24.4 (78)	15.6
60–69	19.7 (63)	12.4
70+	13.8 (44)	13.9
<b>Marital status</b>		
Single	12.1 (38)	
Married/living with partner	68.7 (215)	
Divorced/separated	9.3 (29)	
Widowed	9.9 (31)	
<b>Smoking</b>		
Smoker	21.0 (66)	37 [32]
Never-smoker	43.3 (136)	35
Ex-smoker	35.7 (112)	28
<b>Alcohol drinker</b>		
Yes	81.8 (256)	92 [32]
No	18.2 (57)	8
<b>Health status</b>		
Excellent	11.0 (35)	
Very good	36.8 (117)	
Good	33.3 (106)	
Fair	15.4 (49)	
Poor	3.5 (11)	
<b>Deprivation category (1,7 = least, most deprived)</b>		
Carstairs Depcat [33]		
1	9.8 (31)	6
2	15.2 (48)	14
3	21.9 (69)	22
4	26.7 (84)	25
5	14.0 (44)	15
6	8.9 (28)	11
7	3.5 (11)	7
<b>Prescription exemption status</b>		
Pays prescription charges	50.6 (162)	
Exempt from charges	49.4 (158)	

<sup>a</sup> Total number of respondents to each question varied due to missing data. Percentages given are valid percent.

who had agreed to participate in further research. The questionnaire collected similar demographic and lifestyle information as before, and asked respondents to again rate their general health using the same question as in 2002. Both questionnaires are available on request from the authors. Respondents' personal characteristics were compared with other statistics describing the Scottish population using the  $\chi^2$  test.

BMQ-General sub-scale scores were calculated for the two time points (2002 and 2005) and compared using a paired *t*-test. This test compares the means of two related samples when the difference between the two groups is Normally distributed.

**Table 2**

Summary of BMQ-General scores and paired *t*-test comparing mean scores at 2002 and 2005.

BMQ scale (time point)	General-overuse (2002)	General-overuse (2005)	General-harm (2002)	General-harm (2005)
N	321		320	
Mean score (SD)	12.24 (2.92)	12.19 (2.87)	9.41 (2.31)	9.26 (2.75)
Median score	12.0	12.0	9.0	9.0
Range of scores	4–20	4–20	4–17	4–20
Mean paired difference (95% CI)	–0.05 (–0.36 to 0.27)		–0.15 (–0.44 to 0.14)	
<i>p</i> -Value	0.76		0.3	

Further comparisons were made of the scores of individuals for each item of the sub-scales at the two time points using the Wilcoxon signed ranks test. This tests for differences between two related samples where the variable of interest (in this case, the BMQ item score) is measured on an interval scale.

Respondents were divided into three mutually exclusive groups: those whose self-reported health status had improved or deteriorated (by at least one point on the Likert scale), or remained the same at the two time points (2002 and 2005). Mean differences in BMQ scores at the two time points were compared for the three groups using one-way analysis of variance (ANOVA), a test for Normally distributed data when there are more than two groups to compare.

### 3. Results

In total, 292 subjects were excluded from the 2002 survey because the questionnaire could not be delivered ( $n = 257$ ) or the addressee was unable to participate ( $n = 35$ ) because they no longer lived in Scotland, were under 18 years of age or were deceased. Removing these subjects from the denominator, we had an adjusted response rate of 55% ( $n = 1501/2708$ ). In the 2005 survey, after excluding 70 subjects whose questionnaire could not be delivered and nine who were unable to participate because they were not resident in Scotland, were nursing home residents, suffered from dementia or were deceased, the adjusted response rate was 57% ( $n = 326/573$ ). A total of 321 respondents to the 2005 survey had scores available for comparison with General-overuse scores from the 2002 survey, and 320 paired scores were available for the General-harm sub-scale. Missing data for the remaining cases meant that BMQ scores could not be calculated. The characteristics of respondents with at least one available paired BMQ-General score are given in Table 1. Compared to other statistics for Scotland, the respondents had a lower proportion of younger people, smokers and drinkers of alcohol ( $p < 0.001$ ).

The BMQ-General sub-scale scores for respondents at each survey and differences between the two time points are summarised in Table 2. BMQ scores for both sub-scales and the differences between scores over time were Normally distributed. The paired samples *t*-test revealed no significant differences in the mean scores between both time points, for either sub-scale (Table 2). Results of the Wilcoxon signed ranks test which compared the scores of individuals on each of the eight items in the BMQ-General over time, are shown in Table 3. The number of paired observations for each of the eight items varied between 316 and 323 because of missing data. There were no statistically significant differences for six of the eight items in the scale. The difference between scores for 'Doctors use too many medicines' was of borderline significance ( $p = 0.05$ ). The difference between scores for 'Natural remedies are safer than medicines' was strongly statistically significant ( $p = 0.001$ ); there was a tendency to agree less with this item in 2005 compared to 2002.

Comparison of results for both surveys indicated that the self-reported health of 20.5% respondents had deteriorated, 24.0% had improved and 55.5% had remained the same. Data was available to compare General-overuse scores for 313 respondents

**Table 3**  
Wilcoxon signed ranks test—comparing individual BMQ-General item scores at 2002 and 2005.<sup>a</sup>

BMQ-General item	Number of paired observations	Median score (IQR) 2002	Median score (IQR) 2005	p-Value
Doctors use too many medicines	317	3 (2–4)	3 (2–4)	0.05 <sup>b</sup>
People who take medicines should stop their treatment for a while every now and again	318	3 (2–4)	2 (2–4)	0.32
Most medicines are addictive	321	2 (2–3)	2 (2–3)	0.82
Natural remedies are safer than medicines	317	3 (2–3)	3 (2–3)	0.001 <sup>c</sup>
Medicines do more harm than good	316	2 (2–2)	2 (2–2)	0.50
All medicines are poisons	318	2 (1–2)	2 (1–2)	0.29
Doctors place too much trust on medicines	319	3 (2–4)	3 (2–4)	0.93
If doctors had more time with patients they would prescribe fewer medicines	323	4 (3–4)	4 (3–4)	0.69

<sup>a</sup> 2005 scores were subtracted from 2002 scores.

<sup>b</sup> Borderline statistical significance at the 95% level. Frequency of negative ranks exceeded frequency of positive i.e. tendency to greater agreement with the item over time.

<sup>c</sup> Statistically significant at the 99% level. Frequency of positive ranks exceeded frequency of negative i.e. tendency to less agreement with the item over time.

**Table 4**  
One-way ANOVA: comparing mean BMQ-General scores at 2002 and 2005 for groups based on changes in self-reported health status.

BMQ-General sub-scale	Change in health status between 2002 and 2005	Difference in BMQ score between 2002 and 2005 Mean	95% confidence interval for mean	p-Value
Overuse (n = 313)	Worse (n = 65)	–0.18	–1.00 to 0.63	0.12
	Same (n = 173)	0.21	–0.21 to 0.63	
	Better (n = 75)	–0.59	–1.14 to –0.03	
Harm (n = 312)	Worse (n = 65)	–0.40	–0.96 to 0.16	0.61
	Same (n = 171)	–0.12	–0.50 to 0.26	
	Better (n = 76)	0.04	–0.68 to 0.76	

and General-harm scores for 312 respondents. The remainder could not be allocated to one of the three groups because of missing data on self-reported health in at least one survey. ANOVA revealed no statistically significant differences in mean changes of either General-overuse scores or General-harm scores over time between the health status groups. However, at the group level, the 'Better' group did show a small but significant decrease in General-overuse score (Table 4).

## 4. Discussion and conclusion

### 4.1. Discussion

Our findings support the study hypothesis that general beliefs about medicines remain stable over time. No statistically significant differences in the BMQ-General scores of respondents were observed after an intervening period of almost 4 years. In addition, when assessed separately, there were no statistically significant differences over time for six of the eight BMQ-General items, with one of the other items having only borderline statistical significance. Further support for the study hypothesis was the observation that, irrespective of changes in self-reported health status, general beliefs about medicines did not differ significantly over time. At the group level, General-overuse scores for those whose self-reported health improved over time showed a slight decrease suggesting a more positive attitude towards medicines. The clinical significance of this decrease is uncertain but warrants further investigation in future studies. The observed stability in general beliefs about medicines is consistent with the conclusions reported in a previous study, that health beliefs, including some related to use of medicines, are stable from an early age [16].

Optimising the way in which people take medicines is important if the benefits are to be maximised and adverse effects minimised. There is a substantial literature describing interventions that have aimed to improve adherence, but few have proved effective. For example, a recent Cochrane review identified 78 trials that tested 93 interventions to change adherence to prescribed

medication [19]. The authors concluded that even the most effective interventions were of limited value in improving adherence.

A number of published studies covering a variety of clinical areas report that adherence to medication regimes is associated with beliefs about medicines [1,20–24]. If, as their findings suggest, low adherence is associated with negative beliefs about medicines, one approach to improving adherence would be to apply an intervention that could modify those beliefs. A possible explanation for the lack of successful interventions noted in the Haynes et al. Cochrane review could be the failure of those interventions to modify patients' knowledge of, and beliefs about, their illnesses and treatments. This could be because beliefs about medicines are particularly stable and resistant to change, or because inappropriate methods were used to try to modify those beliefs.

In this study we observed that general beliefs about medicines remained stable over time. According to the Common Sense Self-Regulatory Model, we might expect that, in the face of a change in health status, people's beliefs about the health threat together with their coping behaviours (for example, adherence to medication) would be reappraised [25]. Their attitudes to medicines would therefore be expected to change in the light of this experience. For example, use of a successful drug therapy (leading to improved health status) might be expected to engender more positive beliefs about medicines than an unsuccessful one. The stability of BMQ-General scores over time observed in this study, even in the face of changing self-reported health status, suggests that such reappraisal of general beliefs about medicines may not occur. However, we do not know if this means that all beliefs about medicines are resistant to change. It is possible that beliefs about specific medicines might change according to experience while general beliefs remain stable, but our research did not measure those specific beliefs. Further work will be necessary to explore this in more depth.

An alternative explanation for the scarcity of effective adherence interventions might be the failure of investigators to apply appropriate techniques to target and change beliefs about

medicines. Interventions have been developed that can modify other psychological constructs such as attitudes or intentions, leading to behaviour change and improved patient outcomes. Techniques used have included self-monitoring and feedback [26]. Given the apparent link between beliefs about medicines and adherence, it would seem reasonable to develop interventions that modify negative beliefs about treatment. None of the 93 interventions reviewed by Haynes et al. in their Cochrane review appeared to specifically target beliefs about medicines or use this as an outcome in their evaluations. Other published trials may, however, provide some evidence that changing beliefs can improve adherence. For example, one trial, excluded from the Cochrane review because it did not measure any treatment outcomes, described a theory-based intervention involving provision of telephone advice by a pharmacist to 255 patients with a variety of chronic conditions [27]. Although a higher than expected level of drop-outs left this study underpowered, the findings suggested that intervention patients had more positive beliefs about their medicines and better adherence after 4 weeks. Future 'adherence' interventions should be designed using a theory-based approach that identifies which techniques are most likely to modify beliefs about medicines [28]. Interventions specifically designed in this way may have a greater chance of success [29].

The BMQ-General item that showed the greatest change over time in this study was 'Natural remedies are safer than medicines'. Recent increases in the use of 'natural' remedies such as herbal and homeopathic preparations, and the high profile of such products in the media, might suggest that attitudes towards allopathic medicines are more negative now than in the past. However, the reverse was found to be the case in our study as indicated by the tendency towards less agreement with this item in 2005 compared with 2002. It could be that warnings from the scientific community about potential adverse effects of natural remedies, or their interaction with prescription drugs, influenced the perceptions of the public during this time [30]. Further investigation is necessary to explain this finding.

To our knowledge, this is the first time that the BMQ has been administered twice to the same respondents after a period of several years. Our participants were self-selected because they were volunteers who agreed to take part in further research when responding to our first questionnaire. This could have introduced response bias. In addition, there were proportionately fewer younger people, smokers and drinkers of alcohol in our study than in the Scottish population in general. However, the differences were fairly small and the relatively large sample spanned a broad range of other personal characteristics and health status, increasing the generalisability of our results. Although some changes were made to the wording of the instructions to participants completing the BMQ to suit our original study aims, these were very minor and are not expected to have affected the way in which the questions were answered. We do not know whether people's specific beliefs about prescribed medicines, as measured by the BMQ-specific scale of the questionnaire, are also stable over time. A study measuring BMQ-Specific scores at two time points would be needed to investigate this.

#### 4.2. Conclusion

We have found that general beliefs about medicines appear to remain stable over time, irrespective of changes in health status. We do not know, however, if beliefs about medicines prescribed for specific conditions will be similarly stable, whether interventions specifically designed to influence beliefs about medicines can modify those beliefs and/or adherence, or whether such modifications would result in beneficial outcomes. Further research is needed to address these issues.

#### 4.3. Practice implications

For the reasons discussed above, the observed stability in beliefs about medicines could have implications for interventions to improve adherence to prescribed medication regimes. Given the association between beliefs about medicines and adherence to medication regimes, it may be helpful for practitioners to assess these types of beliefs in patients for whom they prescribe medication. Such assessment would provide the opportunity to discuss patients' beliefs with them. However, practitioners should avoid the assumption that such discussions, or changes in patients' health status, will alter their patients' beliefs. This study presents evidence to suggest that these beliefs may not be easily changed. Furthermore, at present there appears to be no RCT-level evidence that coaching interventions or other attempts at persuasion would modify beliefs about medicines, as none of the trials in the Cochrane review [19] evaluated the effect of interventions on this variable.

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#### Conflict of interests

None.

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