

This is the final draft, after peer-review, of a manuscript published in Patient Education and Counseling 2010 79; 225-230 10.1016/j.pec.2009.07.037. The definitive version, detailed above, is available online at www.sciencedirect.com

TITLE

Temporal stability of beliefs about medicines: implications for optimising adherence

AUTHORS

Terry Porteous¹, PhD MRPharmS; Jill Francis² PhD CPsychol; Christine Bond¹, PhD MEd FRPharmS; Phil Hannaford¹ MD FRCGP

¹Centre of Academic Primary Care, University of Aberdeen, Foresterhill Health Centre,
Westburn Road, Aberdeen AB25 2AY

²Health Services Research Unit, University of Aberdeen, Health Sciences Building,
Foresterhill, Aberdeen AB25 2ZD

Corresponding author:

Dr Terry Porteous,
MRC/ESRC Interdisciplinary Post-doctoral Research Fellow,
Centre of Academic Primary Care,
University of Aberdeen,
Foresterhill Health Centre,
Westburn Road,
Aberdeen AB25 2AY.

email: t.porteous@abdn.ac.uk

telephone: 01224 552700

fax: 01224 550683

Acknowledgements: We thank members of the public who completed the postal surveys, and Professor Amanda Lee of the Centre of Academic Primary Care for statistical advice.

Funding: The two original postal surveys were funded by the Chief Scientist Office of the Scottish Government.

Conflict of interests: None

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 four 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 four 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.

Key words

Adherence, Beliefs about medicines questionnaire, Health beliefs

TITLE

Temporal stability of beliefs about medicines: implications for optimising adherence.

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 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 four 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 two 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 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 χ^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. 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 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 four 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 four 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.

~~4.2 Study strengths and limitations~~

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 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.

DECLARATION

I confirm all patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story.

REFERENCES

1. Horne R, Weinman J, Hankins M. The beliefs about medicines questionnaire: The development and evaluation of a new method for assessing the cognitive representation of medication. *Psychology and Health*. 1999;14:1-24.
2. Horne R, Weinman J. Patients' beliefs about prescribed medicines and their role in adherence to treatment in chronic physical illness. *Journal of Psychosomatic Research*. 1999;47(6):555-67.
3. McGavock H. A review of the literature on drug adherence. London: The Royal Pharmaceutical Society of Great Britain and Merck Sharp & Dohme Ltd.; 1996.
4. Horne R, Weinman J, Barber N, Elliott R, Morgan M. Concordance, adherence and compliance in medicine taking. Report for the National Co-ordinating Centre for NHS Service Delivery and Organisation R & D. 2005.
5. Bosworth H. Medical treatment adherence. In Bosworth H, Oddone E, Weinberger M., editors. *Patient treatment adherence: Concepts, interventions and measurement* Psychology Press; 2005. p147-194
6. Atkins L, Fallowfield L. Intentional and non-intentional non-adherence to medication amongst breast cancer patients. *European Journal of Cancer*. 2006;42(14):2271-6.

7. Horne R, Weinman J. Predicting treatment adherence: An overview of theoretical models. In: Myers L, Midence K, editors. *Adherence to Treatment in Medical Conditions*. London: Harwood Academic; 1998. p. 25-50.
8. Llewellyn CD, Miners AH, Lee CA, Harrington C, Weinman J. The illness perceptions and treatment beliefs of individuals with severe haemophilia and their role in adherence to home treatment. *Psychology and Health*. 2003;18(2):185-200.
9. Jones RM, Butler JA, Thomas VA, Peveler RC, Prevett M. Adherence to treatment in patients with epilepsy: Associations with seizure control and illness beliefs. *Seizure*. 2006;15(7):504-8.
10. O'Carroll RE, McGredor LM, Swanson V, Masterton G, Hayes PC. Adherence to medication after liver transplantation in Scotland: A pilot study. *Liver Transplantation*. 2006;12(12):1862-8.
11. Bane C, Hughes CM, McElnay JC. The impact of depressive symptoms and psychosocial factors on medication adherence in cardiovascular disease. *Patient Education and Counseling*. 2006;60(2):187-93.
12. Ramstrom H, Afandi S, Elofsson K, Petersson S. Differences in beliefs between patients and pharmaceutical specialists regarding medications. *Patient Education and Counseling*. 2006;62(2):244-9.
13. Horne R, Frost S, Hankins M, Wright S. In the eye of the beholder: Pharmacy students have more positive perceptions of medicines than students of other disciplines. *International Journal of Pharmacy Practice*. 2001;9:85-9.
14. Horne R, Graupner L, Frost S, Weinman J, Wright SM, Hankins M. Medicine in a multi-cultural society: The effect of cultural background on beliefs about medications. *Social Science and Medicine*. 2004;59(6):1307-13.

15. Mardby A-, Akerlind I, Jorgensen T. Beliefs about medicines and self-reported adherence among pharmacy clients. *Patient Education and Counseling*. 2007;69(1-3):158-64.
16. Bush PJ, Iannotti RJ. Origins and stability of children's health beliefs relative to medicine use. *Social Science and Medicine*. 1988;27(4):345-52.
17. Porteous T, Bond C, Hannaford P, Sinclair H. How and why are non-prescription analgesics used in Scotland? *Family Practice*. 2005;22:78-85.
18. Porteous T, Ryan M, Bond CM, Hannaford P. Preferences for self-care or consulting a health professional for minor illness: A discrete choice experiment. *British Journal of General Practice*. 2006;56(533):911-7.
19. Haynes RB, Ackloo E, Sahota N, McDonald HP, Yao X. Interventions for enhancing medication adherence. *Cochrane database of systematic reviews (Online)*. 2008.
<http://www.cochrane.org/reviews/en/ab000011.html>
20. Horne R, Weinman J. The theoretical basis of concordance and issues for research. In: Bond C, editor. *Concordance*. London: Pharmaceutical Press; 2004.
21. Brown C, Battista DR, Bruehlman R, Sereika SS, Thase ME, Dunbar-Jacob J. Beliefs about antidepressant medications in primary care patients: Relationship to self-reported adherence. *Medical Care*. 2005;43(12):1203-7.
22. Byer B, Myers LB. Psychological correlates of adherence to medication in asthma. *Psychology, Health and Medicine*. 2000;5(4):389-93.
23. Jónsdóttir H, Friis S, Horne R, Pettersen KI, Reikvam Å, Andreassen OA. Beliefs about medications: Measurement and relationship to adherence in patients with severe mental disorders. *Acta Psychiatrica Scandinavica*. 2009;119(1):78-84.

24. Khanderia U, Townsend KA, Erickson SR, Vlasnik J, Prager RL, Eagle KA. Medication adherence following coronary artery bypass graft surgery: Assessment of beliefs and attitudes. *Annals of Pharmacotherapy*. 2008;42(2):192-9.
25. Horne R. Representations of medication and treatment: Advances in theory and measurement. In: Petrie K, Weinman J, editors. *Perceptions of Health and Illness*. Amsterdam: Harwood Academic; 1997.
26. Abraham C, Michie S. A taxonomy of behavior change techniques used in interventions. *Health Psychology*. 2008;27(3):379-87.
27. Clifford S, Barber N, Elliott R, Hartley E, Horne R. Patient-centred advice is effective in improving adherence to medicines. *Pharmacy World and Science*. 2006;28(3):165-70.
28. Michie S, Johnston M, Francis J, Hardeman W, Eccles M. From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology: An International Review*. 2008 10;57(4; 4):660-80.
29. The Improved Clinical Effectiveness through Behavioural Research Group (ICEBeRG). Designing theoretically-informed implementation interventions. *Implementation Science*. 2006;1(1).
30. Cupp MJ. Herbal remedies: Adverse effects and drug interactions. *American Family Physician*. 1999 ;59(5):1239-44.
31. Population estimates 2000. General Register Office for Scotland. 2001. Available from: <http://www.gro-scotland.gov.uk/statistics/>.
32. Scottish Office Department of Health. *The Scottish Health Survey 1995*. Edinburgh: The Scottish Office; 1997.

33. McLoone P. Carstairs scores for Scottish postcode sectors from the 2001 census.
Glasgow: MRC Social and Public Health Services Unit, University of Glasgow; 2004.
http://www.sphsu.mrc.ac.uk/files/File/library/other%20reports/Carstairs_report.pdf