Improving haemodialysis patients’ understanding of phosphate-binding medication: A pilot study of a psycho-educational intervention designed to change patients’ perceptions of the problem and treatment

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Objectives. To evaluate a psycho-educational intervention aimed to improve understanding of the need for phosphate control, provide a rationale for phosphate-binding medication (PBM) and explain its mode of action.

Design. A controlled intervention study comparing the effect of a self-regulatory theory-based psycho-educational intervention versus standard care control on knowledge of phosphate control and beliefs about PBM.

Method. End-stage renal disease (ESRD) patients were assigned to either an intervention group (N = 19) or control group (N = 20). Both groups were assessed at baseline, at 1-month post-intervention and at 4-month post-intervention. The intervention group was also assessed immediately post-intervention.

Results. The intervention had an immediate impact post-intervention on all outcome variables examined. It was also successful in improving knowledge, treatment coherence, medication outcome efficacy beliefs, and general understanding of treatment in the intervention group in comparison to the control group, an effect which was sustained through to the second follow-up.

Conclusions. A simple intervention was successful in changing patients’ understanding and some beliefs around treatment thought to influence adherence behaviour. Further research is needed to inform the design of a more complex intervention targeting the specific beliefs influencing behaviour in order to facilitate treatment adherence.

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DOI:10.1348/135910708X288792
Cardiovascular events constitute the leading cause of death in haemodialysis patients, accounting for nearly half of all deaths (United States Renal Data System: USRDS, 1998). The increased incidence of cardiac disease in patients with end-stage renal disease (ESRD) has been associated with hyperphosphataemia and more specifically an elevated calcium × phosphate product (Block, Hulbert-Shearon, Levin, & Port, 1998), making phosphate control an important goal of treatment. Regular daily use of phosphate-binding medication is essential to this. However, adherence to phosphate-binding medication is a particular challenge for dialysis patients, due to the complex treatment regimen that may have no noticeable effect on symptoms. A recent review of thirty-four studies indicated that between 22 and 74% of ESRD patients are non-adherent with their phosphate-binding medication (Karamanidou, Clatworthy, Weinman, & Horne, 2007). Moreover, a qualitative study of patients’ perspectives of phosphate-binding medication identified gaps in understanding with confusion about the concept of phosphate control and the role of medication (Karamanidou, Weinman, & Horne, 2007), and a recent study has shown that illness perceptions are significantly associated with quality of life in patients with ESRD (Timmers et al., 2007).

Leventhal’s self-regulation model (Leventhal et al., 1997) and adaptations for the study of treatment adherence (Horne, 1997) propose that patients will evaluate the appropriateness of their treatment in the light of their perception of their condition. Hence a lack of fit between understanding of the problem (i.e. high phosphate) and rationale for treatment has been shown to be associated with doubts about personal need for medication and low adherence (Horne & Weinman, 1999). An understanding of these processes has the potential to provide the basis for novel interventions to optimize illness-related behaviours. This approach has been applied to effect behaviour change following myocardial infarction (Petrie, Cameron, Ellis, Buick, & Weinman, 2002) and cervical screening (Hall, Weinman, & Marteau, 2004) but not medication taking.

This study describes a pilot psycho-educational intervention aimed to improve understanding of the need for phosphate control and to provide a rationale for phosphate-binding medication and the way it works.

**Method**

**Design**

This intervention study followed patients over a period of 4 months. To ensure similar numbers in control and intervention groups, participants were alternately allocated to either the control (care as usual) or intervention group, following informed consent and prior to baseline assessment. Both groups were assessed at baseline, immediately prior to the intervention, and were followed up at 1 and 4 months post-intervention. An additional assessment was conducted directly after the intervention in the intervention group to assess immediate effects. Ethical approval for the study was obtained from the Guy’s and St. Thomas’s Ethics Committee.

**Sample**

Adult ESRD patients currently receiving haemodialysis were recruited through three renal satellite units. Eligibility criteria for participation included being (a) on haemodialysis for at least 6 months (b) on phosphate-binding medication. In total 39 patients were recruited, 19 in the intervention group, and 20 in the control.
Materials
The intervention comprised two components: a leaflet to improve patients’ understanding of the problem and its treatment, and a demonstration of the mode of action of the treatment.

Leaflet
The leaflet was designed to improve patients’ understanding of the effects of high phosphate as well as the rationale for the use of phosphate-binding medication and its mode of action. Its content was informed by the results of a previously conducted qualitative study (Karamanidou, Weinman et al., 2007), which had identified various gaps in patient’s understanding of the problem and treatment. Initial versions were presented to a number of patients, the Kidney Patient Association representative at Guy’s Hospital and the renal psychotherapist.

Demonstration
This demonstration of a phosphate binder (PB) binding with a phosphate solution in a transparent plastic stomach-shaped container was developed specifically for the current study. The aim of this was to provide a concrete demonstration of the mode of action of the medication. It was hoped that this would enhance patients’ understanding of how this particular medication works inside their body to protect them from the consequences of high-phosphate levels.

Intervention procedure
For patients in the intervention group, the nature and aim of the study as well as the structure of the session was introduced at the beginning of the session, which proceeded as follows:

- The baseline questionnaire was administered and patients were encouraged to share their thoughts about phosphate level management and phosphate-binding medication.
- The investigator talked patients through the leaflet and gave patients the opportunity to ask questions or engage in discussion.
- The demonstration was performed whereby patients were presented with a transparent plastic container shaped as a stomach and asked to imagine that it was their stomach.
- The investigator poured phosphate solution into the stomach and asked patients to imagine that this was their favourite high-phosphate food which had already travelled down their digestive tract and mixed with gastric juices ready to be digested.
- Phosphate-binding solution was then poured into the container. Patients were asked to describe what they saw while they observed the PB bind with the phosphate solution. They were prompted until they actually articulated that the PB ‘bound’ the phosphate, made it ‘solid’, or words to that effect.
- They were then given the post-intervention questionnaire to complete.

Measurements
Phosphate knowledge questionnaire
This is a 12-item true/false questionnaire assessing the level of renal patients’ knowledge on phosphate level management. Four items were taken from the Renal Knowledge
Questionnaire (McGee, Rushe, Sheil, & Keogh, 1998), and the remaining items assessed knowledge about the problems of phosphate build-up and how the treatment worked. One point was given for each correct response, giving a score range of 0–12 with higher scores indicating greater knowledge.

**Treatment beliefs and understanding**

- **PB Necessity** was assessed using three items from the Beliefs about Medicines Questionnaire (BMQ) (Horne, Weinman, & Hankins, 1999), modified to be phosphate binder specific (e.g. ‘Without my phosphate binding medication I would be very itchy or very much in pain’).

Single items were used to assess the following:

- **PB coherence** (‘My phosphate binding medication is a mystery to me’) – taken from the BMQ, with a Likert-type response scale and a score range of 1–5, where a higher score indicated a less coherent understanding.

- **Understanding problems of high-phosphate levels** (‘How much do you feel you understand about how high phosphate levels can increase your risk of developing heart or bone disease?’), scored 1–7, where a higher score indicated greater understanding.

- **Medication outcome efficacy belief** (‘How much do you feel you understand about how using phosphate binding medication incorrectly can increase risk of heart or bone disease?’), scored 1–7, where a higher score indicated a stronger belief.

- **General understanding** (‘How easy would it be to explain to another patient exactly how phosphate binding medication works?’), scored 1–7, where a higher score indicated a greater understanding.

- **Risk perception** (‘How likely do you think you are to develop heart or bone disease?’), scored 1–7, where a higher score indicated greater perceived risk.

**Medication adherence self-report (MARS)**
The original MARS (Horne & Weinman, 2002) is a five-item self-report measure, in which participants are asked to answer questions about using their medication. For the purposes of this study, only four items were used after being modified to be phosphate binder specific. For example ‘I only use my phosphate binding medication at meal times’. The score range of the scale was 4–20, where a higher score indicates greater adherence.

**Blood phosphate levels**
Patients on haemodialysis have monthly blood tests to monitor their phosphate levels which can be used as an indirect measure of adherence as they reflect phosphate-binding medication intake.

Patients in both groups completed the questionnaires at three equivalent time points (baseline, 1 and 4 months post-intervention) and blood phosphate levels were also available at each time point.

**Results**

Demographic details of the intervention and control groups are shown in Table 1. No significant demographic differences were found between the groups.
Mean scores for the two groups at baseline and follow-up are shown in Table 2. No significant differences were found between the two groups at baseline.

Of the study eligible patients approached three refused to participate (all citing ill-health). At 1-month follow-up, 100% intervention and 80% control group completed assessments, while 69.2% patients completed both follow-ups (84% intervention vs. 55% control group). There were no significant differences between treatment arms in the number of elapsed days at any of the follow-up periods. No differences were found between the patients who completed all of the three measures (baseline, follow-up 1, and follow-up 2) and those who dropped out after the baseline measure or the first follow-up.

**Immediate effects of the intervention**

Related sample Wilcoxon tests were performed to assess whether there were any immediate effects in the intervention group. Significant improvements were found in knowledge ($z = -3.37; p < .01$), medication necessity ($z = -2.06; p < .05$), PB treatment coherence ($z = -2.15; p < .05$), risk perception ($z = -2.07; p < .05$), understanding problems of high-phosphate levels ($z = -2.36; p < .05$), general understanding ($z = -2.01; p < .05$), and medication outcome efficacy ($z = -3.13; p < .05$).

**One- and four-month follow-up**

Analysis of variance showed a significant group effect at both time points for general understanding (1 month: $F = 4.2; df = 1, 32; p < .05$; 4 months: $F = 7.1; df = 1, 24; p < .05$) and at 4 months only for knowledge ($F = 9.05; df = 1, 24; p < .01$) understanding problems of high-phosphate levels ($F = 5.9; df = 1, 24; p < .05$) and medication outcome efficacy ($F = 5.2; df = 1, 24; p < .05$) (see Figures 1–4).

There were no significant group effects for medication necessity, PB treatment coherence, risk perception, MARS, and phosphate levels.

**Patient feedback**

The visual image provided by the demonstration had a powerful impact on patients. When asked what they thought of the demonstration some patients used phrases such as ‘a picture is worth a thousand words’ or ‘the picture has stuck in my mind’. Other patients made remarks spontaneously while still observing the demonstration.
<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
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<th>4-month follow-up</th>
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<td>Control</td>
<td>Intervention</td>
<td>Control</td>
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<td>8.6 (2.4)</td>
<td>10.7 (1.5)</td>
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<td>13.1 (1.4)</td>
<td>12.6 (1.3)</td>
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<td>3.4 (2.2)</td>
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<td>5.3 (1.6)</td>
<td>6.2 (0.8)</td>
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<td>Medication outcome efficacy</td>
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<td>MARS (adherence)</td>
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<td>14.9 (1.3)</td>
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<td>1.4 (0.4)</td>
<td>–</td>
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procedure. They used phrases such as ‘I see now... it has become solid!’ or ‘oh! That’s what they mean by binding’.

Discussion

The results show that this brief intervention had an immediate effect on patients’ treatment beliefs and knowledge but not all of these were maintained at follow-up. Of particular interest is the finding that differences between the intervention and control groups increased over time. As there was no additional intervention between the first
and second follow-up sessions, it is possible that appraisal processes may have reinforced cognitive changes (Leventhal et al., 1997), but further research is needed to confirm this.

Even though the intervention group patients gained an improved understanding of the problems associated with high-phosphate level and of the way in which the treatment worked to counteract these, this did not result in an increase in their perceived need for the treatment or in their level of adherence to it. Although adherence was not the main focus of this study, measurements confirm that there was no

**Figure 3.** Intervention and control group mean general understanding scores at baseline, follow-up 1 and 2.

**Figure 4.** Intervention and control group mean medication outcome efficacy scores at baseline, follow-up 1 and 2.
significant change due to the intervention in patients’ adherence behaviour as assessed by self-report and serum phosphate levels.

This study has a number of obvious limitations. The number of participants was small and not all completed both follow-ups, with particularly high attrition rates in the control group, limiting the power of the study. It was a single session psycho-educational intervention targeting patients’ understanding of their problem and its treatment, and it is possible that this may not be of sufficient intensity or duration either to engender increases in perceived need or to achieve long-term change in medicines use.

Nevertheless, the use of a theoretical model combined with evidence from a previous qualitative study of this patient group did give rise to a novel, 2 step intervention which succeeded in changing patients’ understanding of the problem and the nature of the treatment. Moreover, the demonstration helped patients to develop a concrete representation of the mode of action of the treatment, which should result in a more enduring understanding of the treatment. The key theoretical and practical relevance of the findings are that it is possible to change treatment beliefs through a simple psycho-educational intervention but that more comprehensive approaches are necessary for sustained change in treatment-related cognitions and behaviours.

Future work needs to build on this to provide patients with a coherent model of the fit between the problem and the recommended treatment (e.g. Hall et al., 2004) in order to provide sufficiently convincing reasons for the need to adhere to it. Coupled with procedures to elicit and address individual patients concerns about the possible adverse effects of medication, such an intervention could be targeted to enhance the patient’s medication motivation to adhere to treatment (Horne, 2003). Future intervention attempts should also include clear plans and procedures which will enable the patient to follow the complexities of the treatment regimen in a motivated and sustained way.

Acknowledgements
This paper was supported by an unrestricted educational grant from Shire Pharmaceuticals.

References


Received 31 October 2007; revised version received 31 January 2008