Changes in illness-related cognitions rather than distress mediate improvements in irritable bowel syndrome (IBS) symptoms and disability following a brief cognitive behavioural therapy intervention

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ABSTRACT

Objective: A previous randomised controlled trial demonstrated that a cognitive behavioural therapy (CBT) self-management intervention significantly improved irritable bowel syndrome (IBS) symptoms and disability compared to treatment as usual (TAU). The current study analysed additional data to establish whether: 1) cognitive, behavioural and emotional factors hypothesized to perpetuate IBS symptoms and disability changed following CBT and, 2) ascertain if changes in these factors over the intervention period mediated treatment effects 6-months later.

Method: IBS patients (CBT = 31, TAU = 33) completed measures pre-and-post intervention including: Brief Illness Perception Questionnaire, Hospital Anxiety & Depression Scale and Cognitive and Behavioural Responses to Symptoms Questionnaire. Path models were evaluated to determine whether changes in cognitive and behavioural factors over the treatment period mediated treatment effects.

Results: Compared to TAU, CBT patients showed significant positive changes on several cognitive variables but not anxiety and depression following intervention. Positive change in illness perceptions following intervention mediated the treatment effect on improved IBS symptom severity and social adjustment six months later. Changes in damaging beliefs mediated the effect on social adjustment.

Conclusions: Change in cognition rather than mood mediated treatment related improvements. Changing negative perceptions of IBS appears to be a particularly important treatment mechanism.

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Introduction

Irritable bowel syndrome (IBS) is a prevalent chronic condition affecting around 10–20% of the population. It is associated with significant morbidity including impaired quality of life, depression and anxiety symptoms (Drossman et al., 1999; Levy et al., 2006). Whilst IBS is not associated with mortality (Owens, Nelson, & Talley, 1995) it significantly impacts upon direct and indirect health care costs (Akehurst et al., 2002).

Psychological therapies have shown to be efficacious in reducing IBS related symptoms, including gastrointestinal symptoms (GI), psychological distress and quality of life (Creed et al., 2003; Lackner et al., 2006, Lackner, Mesmer, Morley, Dowzer & Hamilton, 2004). Cognitive Behavioural Therapies (CBT) have shown to be particularly effective in improving IBS related outcomes (Blanchard et al., 2007; Greene & Blanchard, 1994; Kennedy et al., 2005; Moss-Morris, McAlpine, Didsbury, & Spence, 2010; Payne & Blanchard, 1995; van Dulmen, Fennis, & Bleijenberg, 1996).

Quite how CBT leads to improved IBS outcomes remains less clear, with only a few studies examining mediators of change (Lackner et al., 2007; Reme et al., 2011). One argument is that CBT exerts treatment effects via improvements in psychological distress (Jones, Koloski, Boyce, & Talley, 2011). However, other evidence suggests that CBT has a direct effect on improved GI symptoms that in turn may lead to reductions in psychological distress (Lackner et al., 2007). Other studies of symptom-based disorders suggest that physical symptoms are more responsive to change following CBT than psychological distress (Kroenke & Swindle, 2000). A recent study found that a reduction in maladaptive behaviours and negative cognitions mediated the effect of CBT on improved IBS related outcomes i.e. decreased IBS symptom severity and disability (Reme et al., 2011). This study reported that mediation occurred first through changes in behaviour, then changes in cognition before impacting upon treatment outcome. However, this study used simultaneous assessments of process (mediator) and outcome
variables, a method which is not ideal since to infer causality, mediators should precede in time the outcome variables (Kazdin, 2007).

The present paper explored potential cognitive and behavioural mediators of change following a relatively brief CBT based self-management intervention for IBS, using additional trial data from Moss-Morris et al. (2010). This short intervention was based on an empirical cognitive behavioural model of IBS (Spence & Moss-Morris, 2007) and demonstrated efficacy for improving IBS symptoms and social adjustment up to six months post treatment (Moss-Morris et al., 2010). The aims of the current study were to, 1) evaluate whether CBT altered cognitive, behavioural and emotional factors hypothesized to perpetuate IBS symptoms and disability 2) establish if proximal changes in these factors over the 2-month intervention period mediate the positive treatment effects of CBT 6 months later and 3) to ascertain if changes in cognition and behaviour, rather than mood, mediated improvement.

Method

Patients

A full description of the original RCT, patient characteristics and study attrition rates are presented elsewhere (Moss-Morris et al., 2010). In the RCT, 64 IBS patients meeting Rome criteria (Thompson, 1999; Thompson et al., 1999) were randomized to receive either a CBT based self-management intervention plus treatment as usual (CBT, n = 31) or just treatment as usual (TAU, n = 33). In both groups 73% were female, with the majority having European ethnicity (CBT = 90%, TAU = 97%). The mean age of the CBT group was 40 (±18) years and 39 (±15.9) years in the TAU group. Both groups had similar pre-treatment IBS symptom severity scores (CBT = 228.5 vs. TAU = 222.8, p = 0.85).

Interventions

TAU patients received an IBS fact sheet, which included information on how IBS is diagnosed. The CBT group also received this fact sheet and a comprehensive self-help manual divided into seven chapters to be completed over a 7–8 week period. CBT patients also received a one-hour face-to-face session with a health psychologist (see Moss-Morris et al., 2010 for details).

Instruments and assessment procedures

Irritable bowel syndrome severity scoring system (IBS-SSS)

The IBS-SSS (Francis, Morris, & Whorwell, 1997) was the primary outcome variable, which measures the severity of bowel dysfunction, pain, and distension. The maximum achievable score on the IBS-SS is 500, with a decrease of 50 points on the scale being a clinically significant improvement in symptom severity.

Work and social adjustment scale (WSAS)

WSAS (Mundt, Marks, Shear, & Greist, 2002) was the secondary outcome variable of interest. The WSAS is a valid and reliable self-report scale of functional impairment attributable to an identified problem (in this case IBS). The scale consists of five items that correspond to impairment in work, home management, social activities, private leisure activities and relationships. High scores indicate greater impairment.

Mood

The Hospital Anxiety and Depression Scale (HADS) is a widely used self-report instrument for assessing depression and anxiety in patients with medical illnesses (Zigmond & Snaith, 1983). It has two subscales, anxiety and depression, each consisting of seven items.

Outcomes were assessed at baseline (pre-treatment), immediately post treatment (2 months) and at 5 and 8 months follow-up. Assessments were sent out and processed by a research assistant blind to treatment condition. Participants provided information at baseline on their gender, duration of bowel symptoms, age, ethnicity, marital status and level of education.

Potential mediator variables

Brief Illness Perception Questionnaire (B-IPQ)

The B-IPQ (Broadbent, Petrie, Main, & Weinman, 2006) was used to assess illness perceptions surrounding patients IBS. Seven items measured beliefs about IBS on different dimensions scored on a Likert scale from 0 (not at all) to 10 (extremely) including, Consequences (“how much do your bowel symptoms affect your life”), Timeline (“how long do you think your bowel symptoms will last”), Personal Control (“how much control do you feel you have over your bowel symptoms”), Treatment Control (“how much do you think a self-help treatment can help your bowel symptoms”), Illness Coherence (“how well do you understand your bowel problem”), Concern (“how concerned are you about your bowel symptoms”) and Emotional Representation (“how much do your bowel symptoms affect you emotionally”). Frequency of experiencing IBS symptoms was removed since it overlapped with the outcome measure (IBS-SSS). As used in previous studies (Knoop, van Kessel, & Moss-Morris, 2012), a sum score was calculated for the B-IPQ (with Timeline, Consequences, Concern and Emotional items recoded such that lower sum scores indicated a more negative, unhelpful illness representation of IBS and higher scores a more positive representation). This method was preferred here to avoid examining individual items using multiple tests and thus increasing type 1 error.

Cognitive and Behavioural Responses to Symptoms Questionnaire (CBSQ)

As in previous studies, the CBSQ was used to measure patients’ cognitive and behavioural responses to their symptoms (Knoop et al., 2012; Skerrett & Moss-Morris, 2006). The scale includes five cognitive subscales; fear avoidance, embarrassment avoidance, catastrophising about symptoms, beliefs that symptoms signal damage to the body (damage beliefs), and symptom focus. There are also two behavioural subscales; resting and avoidance of activity and all-or-nothing behaviour.

Causal symptom attribution

Attributions about causes of the symptoms were measured using a single item “Which best describes the nature of your symptoms?” rated on a 5 point scale; [1 = physical, 2 = mainly physical, 3 = physical and psychological, 4 = mainly psychological, 5 = psychological] (Skerrett & Moss-Morris, 2006).

Of the potential mediators, symptom attribution and CBSQ were measured pre and post treatment (2 months). The BIPQ was assessed pre and post treatment and also at 5 and 8 months follow-up (i.e. 6 months post treatment). Negative change scores on the CBSQ reflect a reduction in the unhelpful beliefs and behaviours. Positive change scores on symptom attribution reflect a change towards a bio-psychological or psychological explanation for symptoms, and on B-IPQ reflect more positive beliefs about IBS.
Statistical methods

As per the original RCT analysis, treatment effect was analysed using intention to treat. In order to test whether there were significant differences between the CBT and TAU groups on post-treatment (2-months follow-up) mediator variables ANCOVA was used, with the post-treatment variable as the dependent variable, condition as the factor (CBT vs. TAU) and the pretreatment variable entered as a covariate. This approach to evaluating pre-post intervention differences has been shown to increase power in RCT designs (Van Breukelen, 2006).

Mediation analysis was conducted using Mplus (Muthén & Muthén, 2007) with Maximum Likelihood Estimation (ML). Variables identified as changing significantly from the ANCOVA were evaluated in mediation analysis using path models that estimated the indirect effect of treatment group (coded as CBT = 0, TAU = 1) on outcome (IBS-SSS and WSAS) at 8 months follow-up through the residualized change in the potential mediator at the 2-month follow-up. Both the potential mediator at post-treatment and the outcomes variable (IBS-SSS and WSAS) were adjusted for their baseline (pretreatment) level in the path model. The post-treatment mediator variable was also correlated with the post-treatment outcome variable in order to control for this covariance and thus aid the interpretation of the indirect effects. Bootstrap standard errors and 95% confidence intervals of the indirect effect were calculated since asymptotic estimates are biased (Shrout & Bolger, 2002). All path models tested had acceptable fit as determined standard fit criteria (Hu & Bentler, 1999).

Results

Does treatment change mood, cognitive and behavioural factors?

Table 1 displays mean change scores for each of the proposed cognitive and behavioural mediators for CBT and TAU groups. ANCOVA revealed that following intervention the CBT group reported less fear avoidance, catastrophizing and damaging beliefs compared to TAU patients. Furthermore CBT but not TAU patients had more positive illness perceptions and shifted from attributing symptoms predominantly to physical causes to viewing symptoms as related to both physical and psychological causes. Depression and anxiety symptoms, and CBSQ behaviour subscales did not differ significantly between the groups post intervention. Accordingly change in catastrophizing, damaging beliefs, fear avoidance, symptom attribution and illness perception were selected as possible mediators in subsequent path models.

| Table 1 ANCOVA results and change scores (95% confidence intervals) for behavioural, cognitive and mood variables between groups. |
|---|---|---|---|---|
| **Behavioural variables** | CBT | TAU | F (1,60) | p-value | Effect size (η²) |
| CBSQ resting/avoidance | -1.1 (-2.31, 0.1) | -0.04 (-1.0, 1.0) | 1.44 | 0.23 | 0.02 |
| CBSQ all-or-nothing behaviour | -0.9 (-2.2, 0.5) | 0.07 (-0.9, 1.0) | 0.14 | 0.71 | 0.02 |
| **Cognitive variables** | | | | | |
| CBSQ symptom focusing | -2.4 (-4.1, -0.6) | -0.4 (-1.6, 0.8) | 3.67 | 0.06 | 0.09 |
| CBSQ catastrophizing | -1.8 (-2.9, -0.8) | -0.3 (1.2, 0.6) | 5.55 | 0.02 | 0.09 |
| CBSQ embarrassment | -1.2 (-2.9, 0.4) | -0.6 (-2.1, 0.8) | 0.84 | 0.36 | 0.05 |
| CBSQ damaging beliefs | -4.8 (-6.4, -3.3) | -0.4 (-1.6, 0.9) | 16.9 | <0.01 | 0.22 |
| CBSQ fear avoidance | -1.2 (-2.0, -0.3) | 0.20 (-1.1, 1.6) | 6.7 | 0.02 | 0.09 |
| Symptom attribution | 0.4 (0.1, 0.7) | -0.2 (-0.4, 0.1) | 17.5 | <0.01 | 0.22 |
| B-IPQ total | 11.1 (6.4, 15.8) | 5.3 (2.7, 7.9) | 9.8 | <0.01 | 0.14 |
| **Mood** | | | | | |
| HADS depression | -0.03 (-1.0, 0.90) | -0.3 (-1.3, 0.70) | 0.12 | 0.73 | 0.002 |
| HADS anxiety | -0.40 (-1.8, 1.0) | -0.3 (-1.3, 0.80) | 0.17 | 0.68 | 0.003 |

ANCOVA: DV = post-treatment variable, fixed factor — group, covariate — pre-treatment variable, CBSQ: Cognitive and Behavioural Responses to Symptoms Questionnaire, B-IPQ: Brief Illness Perception Questionnaire, HADS: Hospital Anxiety Depression Scale, CBT: Cognitive Behavioural Therapy Self Management Group, TAU: Treatment as Usual, η²: Partial Eta-Squared (group).

Since illness perceptions were measured at four time points, a multi-level model was conducted to examine whether illness perception changed between the groups over the full study period (see Fig. 1). The results demonstrated that there was a significant effect of group (F = 15.5, df = 1, p < 0.001) and time (F = 31.7, df = 3, p < 0.001). Furthermore there was a significant group*time interaction (F = 7.4, df = 3, p < 0.001) for illness perception scores. Pairwise comparisons adjusted for multiple tests revealed that illness perceptions were significantly higher (i.e. more positive) in the CBT group at 2, 5 and 8-month follow-ups compared with the TAU group.

**Exploratory mediation path analysis**

Since the effect of the intervention on improved IBS symptom severity and WSAS was demonstrated in the original trial, and the effect of the intervention on these mediators shown above (i.e.
Catastrophizing and fear avoidance. WSAS was significantly predicted by changes in illness perception, catastrophizing, damage beliefs and fear avoidance (Table 2).

Mediators of IBS-SSS and WSAS

The effect of treatment on IBS-SSS was partially mediated by change in illness perception (see Table 2). Change in illness perception and damaging beliefs mediated the effect of group upon WSAS. Partial mediation was inferred since the effect of group on the outcome variable was significant in each of the path models. None of the other cognitive variables significantly mediated the effect of group on IBS-SSS or WSAS outcomes.

Discussion

This study explored potential cognitive and behavioural mediators of improved symptom severity and social adjustment following an RCT of a self-management CBT intervention in IBS patients. Specifically we examined whether changes in potential mediating factors over the two-month intervention period predicted outcomes six months later.

In accordance with hypotheses, our findings demonstrate significant change in a number of illness and symptom cognitions following CBT, but not TAU, that in turn help explain improvements in IBS related outcomes. The tendency to catastrophize about symptoms and fear avoidance declined following CBT, as did the belief that symptoms were a sign of damage. Causal attributions for symptoms moved from being predominantly physical or biological in nature to a view that symptoms were caused by a combination of physical and psychological factors. Illness perceptions, as measured by total score on the BIPQ, became more positive following CBT, an effect that was maintained over the full study follow-up. The change on the BIPQ suggests that CBT self-management enhanced perceived control over IBS, facilitated a more coherent understanding of the illness, and reduced perceptions of the severe and distressing consequences of IBS.

In terms of mechanisms of change we explored whether cognitive variables that showed significant change at the end of treatment predicted and mediated improved outcome. Changes in IBS illness perceptions both predicted and partially mediated reduced symptom severity over time. Change in illness perceptions, catastrophizing, damage beliefs and fear avoidance all predicted improved work and social adjustment. In turn, both increases in positive illness perceptions and reductions in damaging beliefs had a significant indirect or mediating effect on improved work and social adjustment. Interestingly, although we found a large significant change in causal attributions in the CBT group, this was not associated with improved outcome. Changing to a biological rather than biological model of the illness may be an important process for engaging patients in a behavioural intervention rather than a mechanism of change in itself. A CBT study in chronic fatigue syndrome also showed that changes in cognitions such as fear avoidance predicted outcome whilst change in causal attributions did not (Deale, Chalder, & Wessely, 1998).

These data support the findings of others in terms of positive changes in IBS related cognitions following CBT for IBS being important mechanisms of treatment outcome (Reme et al., 2011). However, unlike Reme et al. (2011) we were unable to demonstrate any significant change in behaviour following CBT compared to TAU. This may be a result of measuring different behaviours. In the current study we measured self-reported all-or nothing and resting/limiting behaviour. The Reme et al. (2011) study used a specially designed behaviour scale for IBS which included behaviours such as checking stools for abnormalities and avoiding social events (rather than resting) because of bowel symptoms. Although previous work showed that all-or-nothing behaviour was an important predictor of the onset of IBS post food poisoning (Spence & Moss-Morris, 2007), it may be that behaviours which maintain IBS over the long term are avoidance and over-vigilant symptom behaviours, which develop once symptoms have been present for a while. The treatment protocol for the current study addressed these behaviours but did not measure them.

Our data supported the final hypothesis that changes in mood would not mediate improvement in IBS symptoms and social adjustment. Following completion of the intervention, those in the CBT group had similar levels of anxiety and depression compared to the TAU group. Therefore, in this study, CBT did not lead to a significant reduction in distress over the 2-month intervention period suggesting that improvements in IBS symptom severity and social adjustment observed in the original trial were not driven by improvements in psychological distress. Whilst some CBT trials for IBS have shown reductions in distress (Blanchard et al., 2007; Lackner et al., 2007) a mediation analysis using path analysis of this change

<table>
<thead>
<tr>
<th>Mediator (Z)</th>
<th>IBS symptom severity (IBS-SSS)</th>
<th>Social adjustment (WSAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effect of Z → IBS-SSS</td>
<td>Indirect effect (95% CI); group → Z → IBS-SSS</td>
</tr>
<tr>
<td>Illness perception</td>
<td>−0.40*</td>
<td>0.20 (0.03, 0.40)*</td>
</tr>
<tr>
<td>Catastrophizing</td>
<td>0.31*</td>
<td>0.13 (−0.03, 0.29)</td>
</tr>
<tr>
<td>Damaging beliefs</td>
<td>0.28**</td>
<td>0.20 (−0.04, 0.44)</td>
</tr>
<tr>
<td>Fear avoidance</td>
<td>0.28*</td>
<td>0.10 (−0.02, 0.24)</td>
</tr>
<tr>
<td>Symptom Attribution</td>
<td>0.11</td>
<td>−0.09 (−0.36, 0.17)</td>
</tr>
</tbody>
</table>

* p < 0.05 ** p < 0.01.
Standardised estimates are shown (StdY).
High scores on Illness Perception measure (BIPQ) represent more positive beliefs.
High scores on IBS-SSS and WSAS represent more severe symptoms and disability respectively.

Group coded as: CBT = 0, TAU = 1.
concluded that CBT has a direct effect on IBS symptoms independent of its effects on distress (Lackner et al., 2007). Reme et al. (2011) found that changes in IBS specific cognitions and behaviours mediated effects on change in anxiety, symptoms and social adjustment, suggesting that change in anxiety was an outcome of change in cognitions and behaviours rather than a mediator of the treatment effect. Another more recent mediation study disagreed with previous findings and argued that the pathway to improvement in IBS was in fact through distress. However, the fundamental limitation in this study was that their CBT protocol was no more effective than usual care in reducing symptom severity. It may be that their protocol focused on changing distress, rather than treating IBS per se, which explains their null result for change in symptoms (Jones et al., 2011).

Given past findings and the results presented here, it is suggested that modifying cognitive factors is an important therapeutic target for IBS patients in terms of managing the severity of symptoms and their impact. In particular modification of illness perceptions in future psychological interventions appears particularly persuasive. The CBT based intervention here successful altered illness perceptions which mediated the treatment effects, which relates to the findings of others that have shown that changing illness perceptions via psychological intervention is associated with improved patient outcomes (Broadbent, Ellis, Thomas, Gamble, & Petrie, 2009; Petrie, Cameron, Ellis, Buick, & Weinman, 2002).

Future work understanding the nature of illness perceptions in IBS and the impact of altering unhelpful illness beliefs upon IBS related outcomes requires further empirical attention.

**Study limitations**

The findings here are subject to some limitations that should be considered when interpreting the findings. As discussed in the original trial paper (Moss-Morris et al., 2010) limitations pertaining to the study design include the lack of a therapy control group and no fidelity check on the three treatment sessions. Furthermore the study follow-up period of 6 months post intervention was relatively short. In addition patient medications were not recorded which could have influenced the outcomes. However, there is little clear efficacy for IBS medication and as most of the patients recruited were relatively new-onset IBS is likely that many were not prescribed gastrointestinal medication. Furthermore information regarding length of IBS symptoms was not recorded. In the present analysis the relatively small sample size limited the complexity of the mediation models tested due to power considerations. Accordingly exploratory mediation analysis was conducted, with separate models for each proposed mediator tested. Controlling for each of the potential mediators in larger structural models would be beneficial in future studies to further understand the relationship between cognitive factors thought to be associated with improved IBS related outcomes.

**Conclusions**

Changes in cognitive factors appear to mediate treatment effects of CBT upon IBS related outcomes. Altering illness perceptions seem to be a particularly important aspect of therapy in terms of achieving improvements to symptom severity and adjustment. These findings add to the current evidence base regarding the validity of a cognitive model of IBS rather than a model of somatic distress. This paves the way for more cognitive based interventions in this patient population in order to treat the physical and psychological consequences of the condition. Larger trials are needed in order to develop more robust path mediation models.

**Conflict of interest**

The authors declare no conflict of interest.

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