

# **Implicit identification with illness in patients with irritable bowel syndrome (IBS)**

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### Abstract

Identification with pain has been linked to symptom severity in chronic pain conditions. However, the role of identification with illness in patients with Irritable Bowel Syndrome (IBS) is unknown. We investigated whether participants with IBS show identification with illness and if the degree of illness identification is related to IBS symptom severity and additional physical and psychological variables. In this cross-sectional study, 42 participants with IBS and 41 healthy participants completed an Implicit Association Test (IAT) to measure their level of identification with illness and health. Data on illness duration, explicit illness associations, IBS severity, depression, anxiety, stress and additional symptoms were obtained. IBS participants scored significantly lower on identification with health than healthy participants. The level of health identification was negatively correlated with 'Nonspecific Somatic Symptoms'. Reduced health identification may be a maintaining factor of IBS that could be targeted with psychological treatments to reduce symptoms. Further, it may be possible to use the IAT to monitor the course of recovery.

### Keywords

Illness maintenance, Illness-Schema, Implicit Association Test, Irritable Bowel Syndrome, Reactions to symptoms, Self-Schema

## Introduction

Irritable bowel syndrome (IBS) is a chronic gastrointestinal disorder characterised by abdominal pain, discomfort, and bowel dysfunction (Blanchard, Greene, Scharff, & Schwarz-McMorris, 1993; Cash, Sullivan, & Barghout, 2005; Chang et al., 2006). It is a functional syndrome that lacks agreed upon biological markers and is therefore diagnosed using symptom based criteria (Chang et al., 2006; Drossman, 2006; Schoepfer, Trummel, Seeholzer, Seibold-Schmid, & Seibold, 2008). IBS has a prevalence rate of approximately 12% in the European Union and North America (Lovell & Ford, 2012; WGO Advisory Board, 2007; Wilson, Roberts, Roalfe, Bridge, & Singh, 2004). It is now widely recognized that a complex interaction of biological, neural, immunological, social and psychological factors plays a role in the aetiology and maintenance of the illness (Buckley, O'Mahony, & O'Malley, 2014; Drossman, 2006; Elsenbruch, 2011; Enck et al., 2016; Öhman, Törnblom, & Simrén, 2014; Phillips & Clauw, 2011). Between 50% and 90% of IBS patients have a co-morbid mental illness, most commonly general anxiety disorder (GAD) or major depression (Gaynes & Drossman, 1999; Lydiard, 2001; Thakur, Quigley, El-Serag, Gudleski, & Lackner, 2016; Whitehead, Palsson, & Jones, 2002) and depression and anxiety increase the risk of developing IBS (Sibelli et al., 2016). Yet, despite the large number of people suffering from IBS, the cognitive processes involved in the aetiology, maintenance and alleviation of symptoms remain poorly understood.

Given the complexity and burden of the illness, many different treatment approaches have been developed. However, although there are a wide range of pharmacological, psychological and dietary treatment approaches for IBS (Ford, 2014; Ford, Talley, Schoenfeld, Quigley, & Moayyedi, 2009; Foxx-Orenstein, 2016; Grundmann & Yoon, 2010; Halland & Saito, 2015; Henrich et al., 2015; Lackner, Mesmer, Morley, Dowzer, & Hamilton, 2004; Rao, Yu, & Fedewa, 2015; Spiller et al., 2007), not all patients improve after

treatment and improvements in symptom severity and quality of life vary widely among patients and types of treatments. Psychological treatments, including Cognitive Behavioural Therapy (CBT), Mindfulness-Based Interventions and hypnotherapy, have been found to be moderately effective (Ford et al., 2009; Henrich et al., 2015; Lackner et al., 2004) and recently, advances have been made in linking psychological processes to changes in the level of symptoms. For example improvements in psychological distress appear to be correlated with symptom improvements (Henrich et al., 2015). Additionally, a recent systematic review of psychological interventions for IBS indicated that a change in illness-related cognitions is a key process for symptom improvement (Windgassen et al., 2017). However, there is still a shortage of translational studies, that is, approaches that first identify the underlying psychological mechanisms involved in illness maintenance and subsequently develop clinical treatments targeting these maintenance processes.

We aim to explore whether cognitive reactions to symptoms could be an important maintaining mechanism for somatic symptom severity in IBS patients compared to healthy volunteers and to discuss possible clinical implications. The focus on the reactions to symptoms as a risk and maintaining factor has been brought to the fore by the Differential Activation framework in the context of recurrent depression (Lau, Segal, & Williams, 2004; Teasdale, 1988). The Differential Activation Hypothesis (DAH, Teasdale, 1988, Lau et al., 2004) posits that across repeated episodes of depression, associations are established between low mood, cognitions (e.g., dysfunctional attitudes) and behaviours (e.g., withdrawal, self-harm). For recurrently depressed patients in remission, the occurrence of temporary dysphoric mood can reactivate symptomatic patterns of thinking. This re-activation is termed ‘cognitive reactivity’ and, importantly, the DAH posits that such re-activation includes both maladaptive processing *reactions* to symptoms and re-activated content of symptoms, thoughts and cognitive biases. The Differential Activation Hypothesis (DAH) puts *reactions*

to symptoms - typically characterized by over-identifying with symptoms and discrepancy-based processing [i.e., attempts to reduce the gap between current and desired experience, (Williams, 2008)] to the fore as a driver in maintenance of affective instability. Whilst discrepancy-based processing is an understandable response to aversive thoughts and feelings, the strategies evoked to deal with it – typically suppression, avoidance and rumination – predominantly backfire (Abramowitz, Tolin, & Street, 2001; Magee, Harden, & Teachman, 2012; Watkins & Moulds, 2005; Wenzlaff & Wegner, 2000). For example, suppression has been shown to paradoxically increase the intensity and frequency of intrusions rather than reducing them (Abramowitz et al., 2001; Magee et al., 2012; Wenzlaff & Wegner, 2000). Thus, an individual's reactions to their experiences are perceived as impactful (Lau et al., 2004). Whilst the DAH provides a cognitive science account specifically for relapse/recurrence of depression, this point has been seen as important transdiagnostically, including in pain conditions (S. C. Hayes, Follette, & Linehan, 2004). This emphasis on reactions to symptoms as a maintaining factor is also proposed by Pincus and Morley's (2001) Schema Enmeshment Model of Pain. They postulate that as a result of (over-) identification, illness related information (e.g., bloating) may be classified as highly relevant to the self and may thus be processed more elaborately. Hence, self-referential processing of illness related information reinforces a focus on aversive symptoms such as pain and is thus maladaptive. Whilst hypervigilance for gut-sensations (an increased state of alertness to detect early signs of symptoms) also heightens a focus on and sensitivity for aversive symptoms it is thought to be distinct from identification with illness. Identification with illness triggers self-referential processing of the illness (e.g. symptoms) and the context in which it is perceived as problematic (e.g. trying a new restaurant). In keeping with the DAH, this identification with illness presents a form of cognitive reactivity in response to symptoms that encourages maladaptive automatic reactions to suppress, avoid or think about

symptoms. This suggests that a capacity to separate pain and illness from one's own identity is a meaningful clinical goal and that illness identification could be a possible target for psychological treatments.

How might illness identification develop? The Schema Enmeshment Model specifies that in patients with a chronic pain condition, enmeshment between the self, illness and pain schemas (illness identification, pain identification) is a function of frequent, concurrent activation of the self and the pain/illness schema under distress, for example when pain interferes with personal goals. It is thus the chronic, disruptive nature of IBS that is thought to contribute to the development of identification with illness. The degree of identification may vary within the IBS population, based on the interpretation of the events (e.g., if symptoms or their interference with plans is interpreted as particularly negative, identification with illness may be higher). It is the repeated concurrent activation of the self-concept with the illness-concept that strengthens the associations between them and by this token, the cognitive reactivity as specified in the DAH. The ensuing negative self-referent processing of illness related information (i.e., identification with illness) then serves to maintain the illness. For example, even mild symptoms trigger over-identification with them, a process that is considered an important aspect of maladaptive discrepancy-based processing (e.g. worrying about symptoms). In support of this model, pain-self enmeshment was recently found in patients with chronic pain (Van Ryckeghem et al., 2013). In addition, it is likely that at an explicit level, IBS patients will find illness related material particularly relevant to themselves, because their illness may play a prominent role in their lives.

There are several reasons why illness identification might be particularly pronounced in the IBS population. Individuals with IBS often experience many other symptoms in addition to pain, namely diarrhoea, constipation, a feeling of urgency, and feeling nauseous. They also frequently attribute unrelated symptoms to be part of their IBS, for example 50%

rated fatigue, 30% rated headaches and hot or cold spells and sweating and 25% rated palpitations, racing heart or chest pains as part of their IBS (Martin & Crane, 2003).

Hence we propose that an illness schema in IBS is likely to be activated by symptoms that the individual believes to be part of their illness rather than being limited to abdominal symptoms, and that enmeshment between the general illness schema and the self signifies illness identification. Accordingly, the health schema is far less likely to be activated in tandem with the self-schema than an illness schema, thus contributing to an illness bias that skews attention towards bodily symptoms. It is this identification with *illness in general* that is problematic, as a wide range of somatic sensations throughout the body are likely to trigger cognitive reactivity. Identification with Illness is likely to be represented on a continuum and an individual's place on this continuum is likely to be influenced by that individual's association with both illness and health.

We hypothesised that compared to healthy participants, IBS patients (1) will implicitly identify with illness and (2) will show explicit associations with illness. (3) We hypothesised that in IBS patients only, IBS severity, illness duration, presence of additional unrelated somatic symptoms and explicit illness associations will be positively correlated with illness identification in IBS patients.

Identifications with illness could also be a cognitive marker that distinguishes between healthy participants and IBS patients. A biomarker is a physiological index of health that predicts symptoms or the risk of developing a disease [for example an abnormal lipid profile is a biomarker of arterial vulnerability in cardiovascular disease (Vasan, 2006)]. Similarly, a cognitive marker is based on valid psychological measures and, if reliable, could improve accuracy of IBS diagnosis, prognosis and treatment choice. To measure the level of identification with illness we used the Implicit Association Test (IAT). The strength of the

IAT is that it measures associations with the self implicitly and thus prevents the occurrence of response bias that is commonly associated with self-report measures. To the best of our knowledge, this is the first study to experimentally investigate identification with illness in individuals with IBS.

## **Methods**

### **Design and General Procedure**

We adopted a cross-sectional design where participants were matched by gender and age at a group level. Figure 1 shows the subject flow for participants.

The study Cognitive and Emotional Factors in Illness and Health (CEFIH) was given ethical approval by the Oxford University's Research Ethics Committee (Reference Number MSD-IDREC-C1-2014-092) and the NHS Health Research Authority Reference Number 14/NW/1341). A-priori sample size calculations with the programme G\*Power (Faul, 2014; Faul, Erdfelder, Lang, & Buchner, 2007) with a power of .80 and alpha of .05 showed that a sample size of 45 participants per group would be needed to detect between group differences with a medium effect size of  $d = .6$  or higher.

### **Participants**

Participants were recruited between October 2014 and April 2016. Patients with IBS were recruited via a doctor's referral at the Gastroenterology clinic at the local hospital (John Radcliffe Hospital, Oxford), online advertisements, posters and email messages through the University's departments and colleges. Healthy participants were recruited from the University and the general public via University-based study participation recruitment schemes and email messages. Psychology students of the University were able to receive



credits for participating and non-students received monetary compensation for their time and travel costs.

Participants were screened for eligibility by the project coordinator (JH) using a self-report questionnaire. The final sample consisted of 42 participants in the IBS group and 41 participants in the healthy group.

[insert Figure 1 here]

### **Inclusion and exclusion criteria.**

#### ***Inclusion.***

All participants had to (a) be at least 18 years and less than 70 years of age, (b) speak English fluently and (c) have normal or corrected to normal vision. Participants with IBS were required to have a diagnosis of IBS from their GP or Gastroenterologist and meet the Rome III criteria for IBS.

#### ***Exclusion.***

Participants were excluded if they (a) had insufficient manual dexterity to complete the computerized tasks (b) had a diagnosis of dementia, amnesia or delirium; a dissociative disorder; an eating disorder; a personality disorders; schizophrenia or any other psychotic disorder; a substance related or induced disorder (c) a diagnosis of a gastrointestinal disorder other than IBS (e.g. Crohn's disease, ulcerative colitis, coeliac disease) or (d) a chronic physical condition involving pain other than IBS. Healthy participants were excluded if they met the Rome III criteria for IBS.

Participants were excluded if they had any of the listed psychiatric diagnoses because some of these patients may not have been able to give informed consent for the study (e.g. patients with dementia). In addition it was not known how a co-morbid psychiatric illness

would interact with the main outcome illness identity, and thus could potentially confound the specificity of the findings.

### **Questionnaires**

We asked participants for their date of birth, gender, level of education and how long they have had IBS (symptom commencement and time since diagnosis). IBS symptom severity was measured with the Gastrointestinal Symptom Rating Scale for IBS (GSRS-IBS) (Wiklund et al., 2003). The GSRS-IBS is a 13-item self-report rating scales that assesses the severity of IBS specific symptoms over the past week on a 1-7 point scale that ranges from ‘no discomfort at all’ to ‘very severe discomfort’. The total score can range between 13 and 91. Symptoms of depression, anxiety and stress were measured with the Depression-Anxiety-Stress Scale (DASS-21) (Henry & Crawford, 2005; Lovibond & Lovibond, 1995). The DASS-21 has 21 items and three subscales (7 items per subscale): depression, anxiety and stress. Items are measured on a 4 point Likert scale from 0 (not at all) to 3 (almost always). Scores for each subscale were doubled to allow for comparison with the original 42 item scale and its classifications for symptom severity (Henry & Crawford, 2005). Subscale scores range between 0 and 42. The subscales “hyperventilation” and “fatigue” from the self-report Asthma Symptom Checklist (Brooks et al., 1989; Kinsman, Luparello, O’Banion, & Spector, 1973) were chosen for the current study, as they measure generic physical symptoms not restricted to asthma – most people have experienced these symptoms. Although the subscale was called ‘hyperventilation’ (Brooks et al., 1989), the term ‘Nonspecific Somatic Symptoms’ seems preferable for this study. ‘Nonspecific Somatic Symptoms’ consists of the following items: cramps, numbness, headache, dizzy, pins and needles, tingling in spots and chest pain. Fatigue measured energy levels (i.e., weakness, tiredness, fatigue, exhaustion, inertia). Participants were asked to rate how frequently they have experienced the listed symptoms within the past year on a scale ranging from 1 (never) to 5 (always).

### **Cognitive Task**

The IAT is a cognitive task that provides an index of the relative strength of associations between concepts in memory such as illness, health and the self (Greenwald, McGhee, & Schwartz, 1998). It has satisfactory psychometric properties and across studies the IAT had internal consistencies of Cronbach's alpha .70 to .90 (Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Nosek, Greenwald, & Banaji, 2005; Schnabel, Asendorpf, & Greenwald, 2008). The current task was based on an IAT described by Teachman and colleagues (Teachman, Marker, & Smith-Janik, 2008).

It is a reaction time (RT) task that measures automatic associations between concepts in memory. Stronger associations between concepts have been interpreted as closer associations between schema (enmeshment) (Van Ryckeghem et al., 2013). In the current study the relationship between the self/others and illness/health concepts were assessed. Closer association between self and illness reflect identification with illness, whereas closer associations between self and health reflect identification with health. In this version of the IAT (Teachman et al., 2008), two concepts are paired on either side of the screen (Figure 2). Participants were asked to classify word stimuli (e.g. sick, my) into one of the concept pairs (e.g., Illness & Me, Health & Others – please see Table 1 for a list of the stimuli for each concept). Reaction times are typically faster when pairs of concepts match the individual's own associations (e.g., me and illness) compared to those that contradict their associations (e.g., me and health).

The IAT consists of 4 blocks: 1) a brief practice IAT, 2) an experimental block with the congruent illness self-concept (illness-me, health-not me) 3) an experimental block with the incongruent health self-concept (health-me, illness-other) and 4) a word rating block where participants are asked to rate the relevance of each stimulus to their lives on a 1-7 scale. To learn the general procedure of the task, participants complete an unrelated IAT with

a different set of categories (animal and plants, cities and countries) during the brief practice IAT. Prior to each experimental block, participants are shown a list with the correct words for each pair of categories. Each experimental block consists of one 16-trial training period and one 48-trial critical period. Words are presented randomly within each block. The ordering of the experimental blocks is counterbalanced, which produces two versions of the IAT (A, B). Participants were assigned to version A or B based on whether the last digit of their participant ID was odd or even. During the practice IAT and the experimental blocks, stimulus words were presented in a black colour (Arial, size 24) on a white background in the centre of the computer screen for 5 s or until a response had been made. Participants were instructed to classify the stimuli as quickly and accurately as possible, using the 'X'-key for stimuli that belong to either category on the upper left side and the 'M'-key for stimuli that belong to either category on the upper right side of the screen. Feedback was presented for correct ("Correct!" in blue) and incorrect classifications ("Incorrect." in red) and for lack of response ("No response detected" in red) for 1000ms each. The inter-trial interval before a new word appeared was 500ms.

Following the main task, participants completed the Explicit Association Test (EAT). During the EAT, all eight health and illness related words were presented one by one in a random order on the upper half of the screen. A seven-point relevance scale (1= very irrelevant, 4= neutral, 7 is very relevant) was displayed in the centre of the screen and participants were asked to rate each word by pressing the corresponding number on the keyboard.

In line with van Ryckeghem et al (2013) an exclusion criterion was set at an error rate of greater than 30% on the RT trials. No participant was excluded based on this criterion.

[insert Table 1 here]

[insert Figure 2 here]

### **IAT data preparation.**

RT data were scored using the improved scoring algorithm for the IAT D6 index developed by Greenwald, Nosek and Banaji (2003). Only critical trials were used in this analysis, as this is a shortened version of the IAT that does not involve single word categorization. Following the procedure of Greenwald, Nosek and Banaji (2003), a reaction time penalty of 600ms was added to trials in which stimuli had been misclassified.

The final IAT score was calculated by subtracting the mean RT to classify stimuli in the congruent trials (me-illness, not me-health) from the mean RT in the incongruent trials (me-health, not me-illness) divided by the standard deviation of both trials  $[(RT \text{ incongruent} - RT \text{ congruent}) / SD \text{ (across all trials)}]$ . This index is called IAT-D score. A positive IAT-D score reflects relatively faster RTs for self-illness associations and negative score reflects relatively faster RTs for self-health associations.

Mean relevance ratings were computed and an 'EAT-score' was calculated by subtracting the mean relevance rating for health related words from the mean relevance rating for illness related words, divided by the SD of both  $(\text{mean relevance illness} - \text{mean relevance health}) / SD \text{ (across categories)}$ . Positive scores indicate higher relevance of illness words and negative scores indicate higher relevance of health words.

### **Procedure**

Informed consent was obtained from all individual participants included in the study prior to the study procedures. Participants completed a set of questionnaires and provided demographic information via the online platform LimeSurvey (LimeSurvey Project Team & Schmitz, 2015) at least a day before completing the computer-based task. The experimental session took 1.5-2.0 hours per participant. All participants carried out several tasks as part of

the CEFIIH study and the IAT was one of these. The IAT was administered on a Dell desktop computer with a 41×25.5 cm screen. Participants responded by using the computer keyboard. Stimulus presentation and data collection were performed using E-Prime 2.0 (Psychology Software Tools, 2012). Completion of the IAT takes between 10-15 min.

### **Statistical analysis.**

Data were analysed using SPSS version 22 (IBM Corp., 2013). Effect sizes were reported using the Partial Eta Squared index ( $\eta^2$ ) and Cohen's d. Following Cohen (Cohen, 1988) Olejnik and Algina (Olejnik & Algina, 2000) for  $\eta^2$  a small effect size = 0.01; medium effect size = 0.06; large effect size = 0.14, for Cohen's d a small effect size = 0.2; medium effect size = 0.5; large effect size = 0.8.

## **Results**

### **Participant Characteristics**

Participants were between 18 and 69 years old. The two groups did not differ in terms of age, gender or achieved education level (see Table 2). The IBS group had higher IBS symptom severity scores compared to the healthy group, and they reported more nonspecific somatic symptoms and fatigue (see Table 2, Table 3). Participants with IBS had been experiencing symptoms for a mean of 86.9 months (7.2 years), and were diagnosed with IBS on average 45.1 months (3.8 years) ago. Additionally, the IBS group scored significantly higher on DASS depression, anxiety and stress indices (see Table 3).

[insert Table 2 here]

[insert Table 3 here]

## Results IAT

### Error rate and outliers.

Across groups, 98.48% of IAT trials were included in the analysis. In the healthy group, 1.91% and in the IBS Group 1.14% of trials were considered outliers (RTs < 400ms or > 10,000ms) and excluded from further analysis. The mean number of incorrect responses in the healthy group was 3.66 (*SD* 2.81) and 5.05 (*SD* 5.56) in the IBS group.

### IAT versions.

39 participants received version ‘A’ and 44 participants received version ‘B’ of the IAT. We ran a group (healthy, IBS) x Version (A, B) between groups ANOVA to check if these two versions of the IAT produced different results across and between groups on the IAT-D score. Results indicated no main effect of version ( $F(1, 79) = 2.692, p = .105, \eta p^2 = .033$ ) and no interaction ( $F(1, 79) = 0.36, p = .549, \eta p^2 = .005$ ) between version and group. The main effect of group was significant ( $F(1, 79) = 10.85, p = .001, \eta p^2 = .121$ ). This indicated that combining the data collected from the two versions of the IAT in the same analysis of between group differences was appropriate.

### IAT-D score differences between groups.

A one way ANOVA with the IAT-D score as dependent variable and Group (IBS, Healthy) as between group variable showed a main effect of Group ( $F(1, 81) = 11.83, p = .001, \eta p^2 = .128, d = .75, 95\% \text{ CI } [0.308 - 1.198]$ ). The IAT-D score for the healthy group was significantly lower ( $M = -.65, SD = .43$ ) than the IAT-D score of the IBS group ( $M = -.33, SD = .42$ ). Figure 3 shows the differences between groups. Negative scores indicate identification with healthy and away from illness and positive scores indicate identification with illness (away from health). The analysis was then repeated with DASS depression and DASS anxiety scores as covariates. Results indicated that depression and anxiety had no

significant influence ( $p = .429$  and  $p = .415$  respectively) and the main effect of group remained significant ( $F(1, 79) = 9.36, p = .003, \eta^2 = .106$ ).

[insert Figure 3 here]

### **RT differences in the incongruent and congruent conditions.**

To disentangle whether the difference on the IAT-D score comes from RT differences in the congruent (illness/me), the incongruent (health/me) or both conditions, additional independent sample t-test were run with each condition between groups. In the congruent condition (me/illness), RTs were not significantly different between the healthy group ( $M = 892.46, SD = 219.93$ ) and the IBS Group ( $M = 989.59, SD = 440.52$ ), ( $t(60.56) = -1.275, p = .207$ , equal variances not assumed). In the incongruent (me/healthy) condition, the participants in the healthy group ( $M = 701.30, SD = 204.58$ ) were significantly faster than participants in the IBS group ( $M = 873.32, SD = 391.87$ ), ( $t(62.13) = -2.525, p = .014$ , equal variances not assumed). There was no significant difference in overall average response latency between the healthy group ( $M = 797.46, SD = 191.57$ ) and the IBS group ( $M = 931.27, SD = 400.21$ ), ( $t(59.17) = -1.950, p = .056$ , equal variances not assumed).

### **EAT-score differences between groups**

EAT-scores were not normally distributed in the IBS and the healthy group, therefore a bootstrapped independent samples t-test was chosen to investigate differences between groups. The IBS group had significantly higher EAT-scores ( $M = -.05, SD = 1.21$ ) compared to the healthy control group ( $M = -1.49, SD = .488$ ), ( $t(54.099) = -7.109, p < .001$ , (equal variances not assumed). The mean difference in EAT-scores was  $-1.44$ , BCa 95% [-1.805, -1.066], with a large effect size of  $d = 2.96$ .



### Correlational Analysis

In the IBS group only, correlational analyses were run with IAT-D, the EAT-score, ‘time since diagnosis’, IBS symptom severity, ‘Nonspecific Somatic Symptoms’, and fatigue. For correlation analysis, Spearman’s rho was used as two variables (EAT-score and illness duration) were not normally distributed.

The IAT-D score significantly correlated with ‘Nonspecific Somatic Symptoms’ ( $\rho(40) = .36, p = .018$ ). Contrary to our hypothesis, the IAT-D score did not significantly correlate with IBS symptom severity, time since diagnosis, fatigue or the EAT-score in the IBS group (all  $p$ s  $> .05$ ).

### Post-hoc Moderation Analysis

In the IBS group, the EAT-score, rather than being normally distributed showed two distinct subgroups: one group with scores below zero (relevance health  $>$  relevance illness;  $n = 24$ ) and one group with scores above zero (relevance illness  $>$  relevance health;  $n = 18$ ). To evaluate whether the relationship between the IAT-D score and ‘additional somatic symptoms’ differed for each subgroup, we ran a moderation analysis with the PROCESS Model macro for SPSS (A. F. Hayes, 2013).

The subgroup analysis revealed that EAT-scores (below or above zero) moderate the relationship between IAT-D scores and ‘Nonspecific Somatic Symptoms’, as shown by a significant interaction effect between EAT-subgroups and IAT-D scores  $b = 5.126$ , 95% CI [0.375, 9.960],  $t = 2.18$ ,  $p = .035$ . Specifically, when EAT-scores are above zero, there is a significant positive relationship between IAT-D scores and ‘Nonspecific Somatic Symptoms’  $b = 6.39$ , 95% CI [2.295, 10.486],  $t = 3.159$ ,  $p = .003$ . However, when EAT-scores are below zero, the positive relationship between IAT-D scores and ‘Nonspecific Somatic Symptoms’ is non-significant,  $b = 1.22$ , 95% CI [-1.266, 3.712],  $t = 0.995$ ,  $p = .326$ . Please see Table 4.

The EAT-score subgroups did not differ in level of general somatic symptoms ( $t(40) = -1.668, p = .103$ ) or IAT-D scores ( $t(40) = -0.437, p = .664$ ).

[insert Table 4 here]

### Discussion

The current study shows that patients with Irritable Bowel Syndrome have a weaker implicit identification with health compared to healthy participants. To our knowledge, this is the first study to demonstrate reduced identification with health in IBS patients as measured with the Implicit Association Task (IAT). In IBS patients, the magnitude of the identification with health was negatively related to the accumulation of nonspecific symptoms but not to self-reported IBS symptom severity, illness duration, fatigue or explicit illness associations. In other words, IBS patients with nonspecific, unrelated bodily symptoms such as headaches, numbness or dizziness showed a weaker implicit identification with health. In addition, IBS patients showed greater explicit associations with illness than healthy participants. Subgroup analysis showed that in IBS patients, explicit illness associations moderate the relationship between implicit identification with health and the level of nonspecific somatic symptoms.

The current findings with IBS patients are comparable to those found in patients with somatoform disorders (SFD) showing implicit identification away from health and towards illness compared to healthy control groups (Riebel, Egloff, & Witthöft, 2013). The analysis of raw reaction time-scores in the current study showed that the difference between IBS and healthy participants was based on differences in the reaction to health related rather than illness-related stimuli in the IAT. It is possible that a more distinct identification with illness can only be expected in people whose life is more severely affected by IBS (e.g., entailing frequent hospitalisation) or whose symptoms are present most of the time (e.g., chronic pain) (Van Ryckeghem et al., 2013). Additionally, in light of the differential activation hypothesis,

the reduced identification with health may reflect an implicit self-referent form of discrepancy-based processing. Discrepancy based processing is thought to be a self-referential process that involves "...analytic attempts to solve emotional and self-related problems" (Williams, 2008, p. 727). Implicit self-health discrepancy (or reduced identification with health) may thus be related to maladaptive self-referential cognitions in IBS patients. This hypothesis could be tested in future studies that combine implicit and explicit measures (e.g., a rumination questionnaire) of discrepancy based processing.

As demonstrated in this study and others comparing patient groups to healthy participants, IAT-D scores away from health and towards illness could be a cognitive marker that can be found in patient groups where psychological factors play a role in symptom maintenance: patients with somatoform disorders (Riebel et al., 2013), functional illnesses (IBS) and patients with chronic pain (Van Ryckeghem et al., 2013). Future studies should compare IBS patients with patients with illnesses for which biological markers have been found (e.g. inflammatory bowel disease or asthma) to investigate the specificity of illness identification in functional and non-functional patients.

The results from the current study do not support the hypothesis that the self- and illness-schema mesh in IBS patients. The Schema Enmeshment Model of Pain was developed on the basis of research into chronic pain, and may not extend to patients with IBS. However, before drawing this conclusion, it would be worthwhile to test if IBS patients show enmeshment between their self-schema and an IBS-specific schema. Similarly, the expected relationship between the level of illness identification and IBS symptom severity may have emerged, had we used a mixture of IBS specific (e.g., 'bloating') and general illness (e.g. chronic) stimuli. However, the correlation between nonspecific somatic symptoms and identification with illness fits well with Martin and Crane's study (Martin & Crane, 2003) in

which they found that IBS patients consider many unrelated symptoms to be part of their IBS (Crane & Martin, 2002, 2004).

In addition, IBS patients with greater explicit illness associations showed a stronger relationship between reduced identification with health and somatic symptoms. Perhaps the bond between weaker associations with health and somatic symptoms is strengthened in patients who explicitly afford symptoms a greater role in their lives by allowing these symptoms to interfere more with their personal goals. This would be in line with the Schema Enmeshment Model which predicts that frequent disruption due to symptoms affects identity related cognitive processes. Counter to the mechanisms spelled out in the Schema Enmeshment Model, we did not find that distress co-varied with the level of enmeshment between self and illness. The model predicts that the self-schema is most likely to merge with the illness schema when symptoms occur in the context of distress. Thus, assessing schema enmeshment when symptoms co-occur with distress would enable a more valid test of this particular aspect of the model. As the length of time since diagnosis with IBS was not related to reduced identification with health, it would be important to clarify whether the chronicity of IBS is related to the development of this implicit bias. To assess this, it would be necessary to compare IBS patients to participants with a temporary, manageable illness such as a cold or influenza. Finally, the lack of correlation between explicit and implicit associations with illness and health presumably suggests that there are two different processes involved, one below conscious awareness and one above.

### **Implications for Treatment**

Our findings have potential implications for the understanding of change mechanisms in IBS and thus potential treatment targets. They are particularly relevant as a recent review suggests that illness related cognitions are mediators of IBS symptom improvement (Windgassen et al., 2017). Cognitive Behaviour Therapy (CBT) is the recommended

psychological treatment for IBS in the UK (National Institute for Health and Care Excellence [NICE], 2008, updated 2015). CBT for IBS aims to change illness attributions and maladaptive schema (including self-schema) directly (Blanchard et al., 2007; Drossman et al., 2003; Lackner et al., 2012). Perhaps by changing the meaning of symptoms or maladaptive self-schemas such as perfectionism, the focus on one's identity (or threat to one's identity) when symptom occur is reduced, which may lead to increased identification with health. Indeed, one recent study on CBT for IBS found that changes in IBS illness perceptions predicted reductions in illness severity (Chilcot & Moss-Morris, 2013). Mindfulness Based Cognitive Therapy (MBCT) offers another promising approach to develop adaptive ways of relating to self-referential processing of somatic symptoms. MBCT aims to facilitate the development of a decentred perspective on thoughts, emotions and physical sensations (Baer, 2003; Segal, Williams, & Teasdale, 2013). This decentred perspective is characterised by a focus on the present moment, curiosity and a non-judgemental, observing stance to internal bodily sensations (including IBS symptoms), thereby enabling a dis-identification between symptoms and self and the engagement of a different mode of processing. The decentred mode of processing is thought to preclude discrepancy-based processing (Williams, 2008) because the accepting, sensory experience focused attitude is fundamentally different from the conceptual and evaluative qualities of discrepancy-based processing. Indeed, recent empirical evidence suggests that a brief mindfulness meditation can induce dis-identification from fear and self-referential evaluation (measured with a single-category IAT) (Hadash, Plonsker, Vago, & Bernstein, 2016). Decentring and disidentification with thoughts and emotions is hypothesised in recurrent depression to short-circuit the maladaptive rumination over the meaning of symptoms or attempts to suppress them [cognitive reactivity (Lau et al., 2004)]. Applied to IBS, one prediction derived from this framework is that mindfulness training would reduce implicit self-health discrepancy through the engagement of a decentred

mode of processing, including when symptoms occur. Investigating if changes in self-health discrepancy are directly or indirectly correlated with IBS symptom severity would provide important insights into the mechanisms that lead to symptom change. An investigation into changes in self-health discrepancy could be embedded into a study evaluating the treatment effects of mindfulness for IBS.

Our findings show that the IAT is a reliable measure of implicit associations between the self, health and illness, which could be used in future research as well as in clinical settings as a tool informing choice of optimal treatment. Our moderation analysis suggests that treatments targeting self-health discrepancy may be particularly relevant for patients with greater explicit illness associations.

### **Limitations**

Given the cross-sectional design of the current study, no inferences can be drawn about the causal association between IBS and reduced identification with health. Longitudinal and intervention studies would be necessary to establish if the symptoms of IBS and other physical symptoms lead to changes in health identity. An additional limitation of the study is its relatively small sample size ( $n = 83$ ), which was slightly lower than the intended sample size of ( $n = 90$ ). It would therefore be beneficial to replicate the current study with a larger sample.

### **Conclusion**

The study provides evidence that individuals with IBS showed weaker implicit associations with health than healthy participants, and the magnitude of this bias was related to reporting a higher level of non-specific somatic symptoms. The results revealed implicit discrepancy based processing in IBS patients. Implicit self-health discrepancy may be a

maintaining factor of IBS symptoms that could be targeted in psychological treatments for IBS.

### **Ethical Approval**

The study ‘Cognitive and Emotional Factors in illness and health’ (CEFIH) was given ethical approval by the University of Oxford Central University Research Ethics Committee (MSD-IDREC-C1-2014-092) and the NHS Health Research Authority (14/NW/1341). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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### **Conflict of Interest**

The authors declare that they have no conflict of interest.

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Table 1

*Implicit Association Test (IAT) stimuli list*

Category Label	Health	Illness	Me	Not me
Stimuli	healthy	illness	me	not me
	healing	pain	my	other
	strong	chronic	self	them
	vitality	sick	I	they

**Table 2*****Participant characteristics***

	IBS Group (n = 42)		Healthy Control Group (n = 41)		t-value/ $\chi^2$
	Mean	(S.D.)	Mean	(S.D.)	value
Age (years)	34.74	(15.62)	35.49	(16.09)	0.215
Gender	81.0% female; 19.0% male		82.9% female; 17.1% male		0.055
Highest Educational Level Reached	38% Up to and including A-levels <sup>b</sup> ; 62% Tertiary Education <sup>c</sup>		27% Up to and including A-levels <sup>b</sup> ; 73.0% Tertiary Education <sup>c</sup>		1.200
IBS Symptom (GSRS-IBS <sup>a</sup> )	46.48	(10.69)	18.66	(7.58)	-13.65***
Time since symptoms started (months)	86.88	(84.79)			N/A
	(Minimum 7, maximum 360)				
Time since diagnosis (months)	45.1	(61.54)			N/A
	(minimum 0, maximum 246)				

<sup>a</sup>GSRS-IBS is Gastrointestinal Symptom Rating Scale for Irritable Bowel Syndrome; <sup>b</sup>no formal qualifications, GCSE, NVQ or vocational qualification or at least 12 years of schooling; <sup>c</sup>University degree (Undergraduate, Masters, Post-Graduate);

\* is  $p < .05$ ; \*\* is  $p < .01$ ; \*\*\*  $p < .001$

**Table 3*****Psychological and physiological variables for the IBS group and healthy control group.***

	IBS Group		Healthy Control		t-value
	(n = 42)		Group (n = 41)		
	Mean	(SD)	Mean	(SD)	
Nonspecific Somatic Symptoms (ASC <sup>a</sup> )	15.81	(3.71)	12.46	(3.11)	4.45***
Fatigue (ASC <sup>a</sup> )	16.29	(4.22)	11.68	(2.97)	5.74***
Depression (DASS-21 <sup>b</sup> )	12.24	(9.99)	5.22	(5.76)	3.91***
Anxiety (DASS-21 <sup>b</sup> )	10.57	(8.91)	3.22	(3.79)	4.87***
Stress (DASS-21 <sup>b</sup> )	17.52	(8.76)	8.93	(7.95)	4.68***

<sup>a</sup>ASC is Asthma Symptom Checklist; <sup>b</sup>DASS-21 is Depression Anxiety Stress Scale-21 items;

\* is p&lt; .05; \*\* is p&lt; .01; \*\*\* p&lt;.001

**Table 4*****Linear model of predictors of 'nonspecific somatic symptoms' in the IBS Group***

	b [95% CI]	SE B	t	p
Constant	15.7372			
	[14.647, 16.827]	0.5384	29.2315	0.000
EAT <sup>a</sup> -score subgroups (centred)	1.6501			
	[-4.88, 3.788]	1.0562	1.5623	0.127
IAT <sup>b</sup> -D score (centred)	3.4379			
	[1.178, 5.697]	1.1159	3.0807	0.004
EAT <sup>a</sup> -score subgroups x IAT <sup>b</sup> -D score	5.1674			
	[.375, 9.960]	2.3673	2.1828	0.035
Note. R <sup>2</sup> = .23				

<sup>a</sup>Explicit Association Test; <sup>b</sup>Implicit Association Test

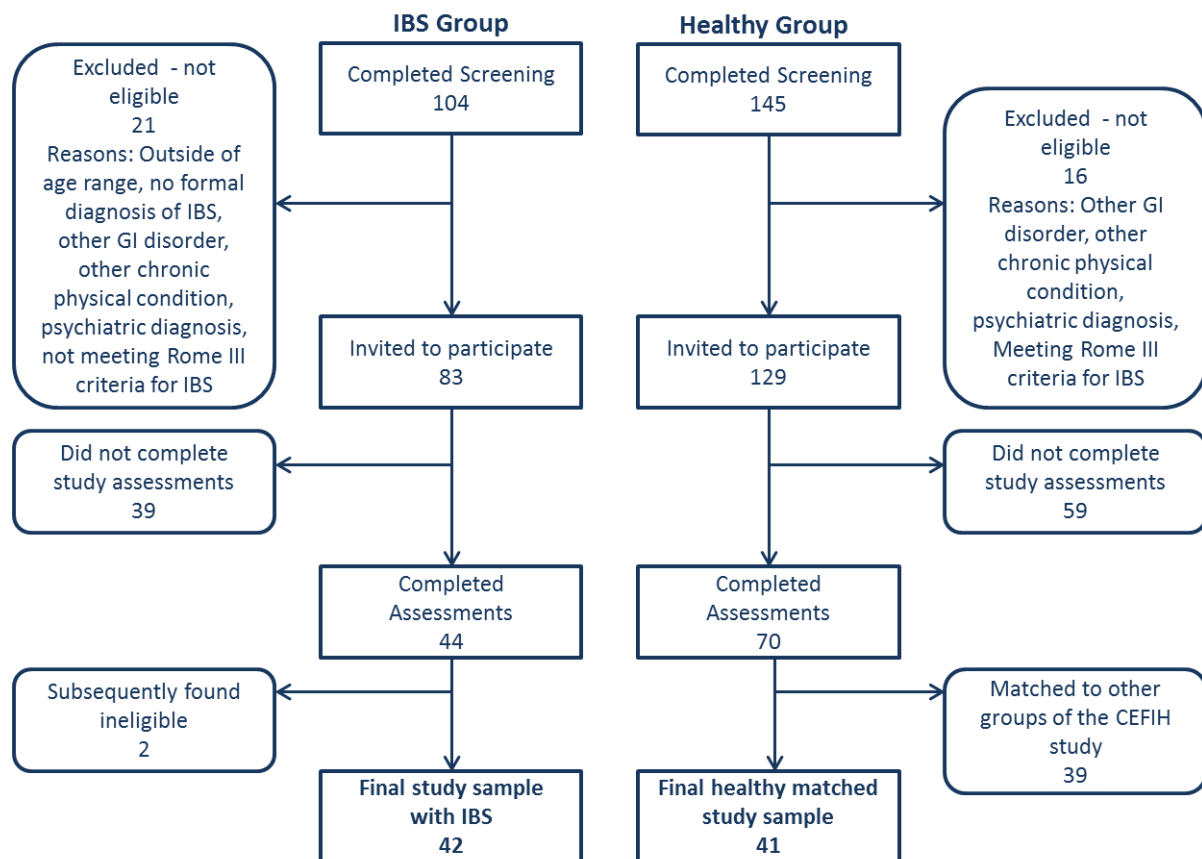


Figure 1. Participant flowchart of the Cognitive and Emotional Factors in Illness and Health (CEFIH) study. *IBS* is Irritable Bowel Syndrome; *GI* disorder is gastrointestinal disorder.

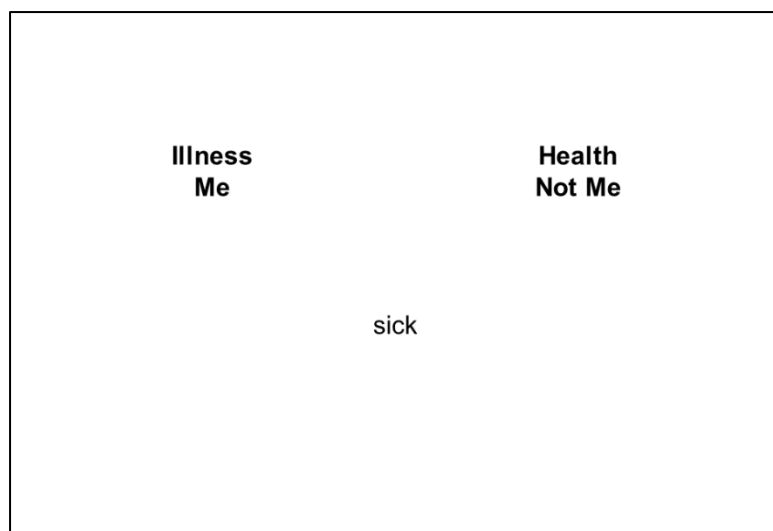


Figure 2. IAT example response screen for the Self-Illness concept with an illness stimulus (sick) in the centre.



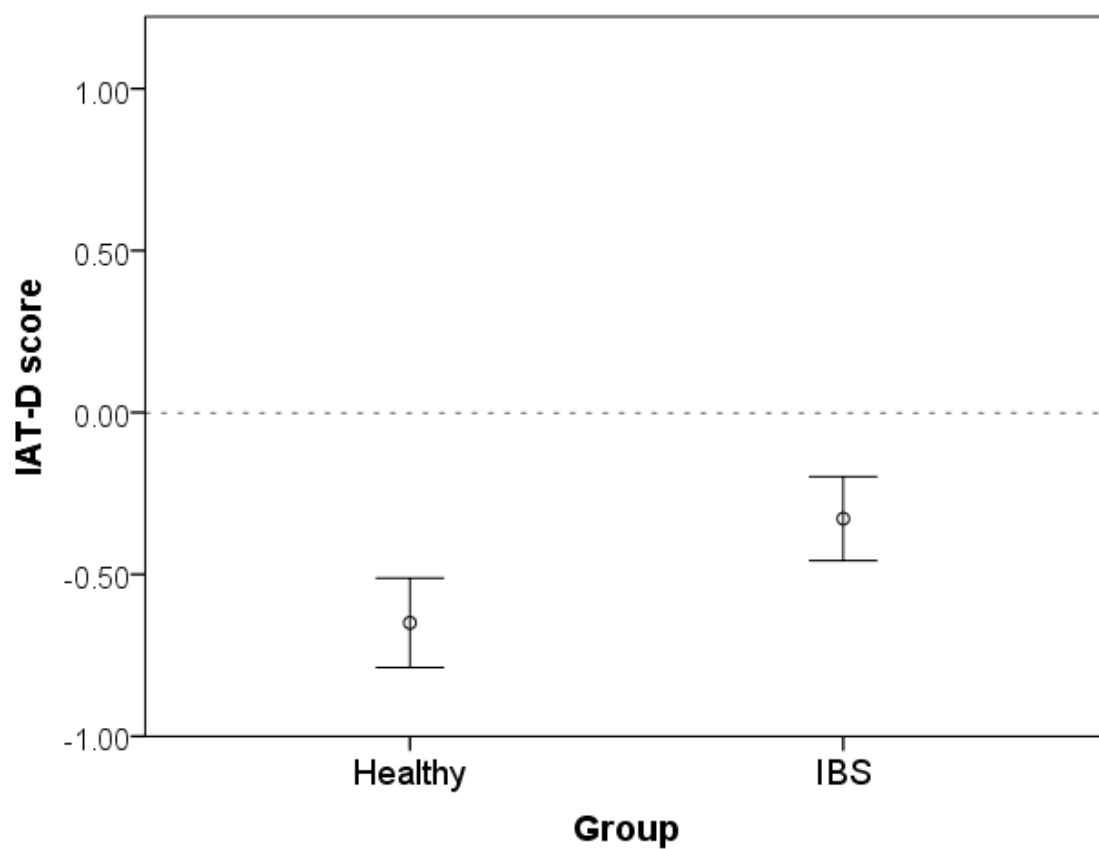


Figure 3. Group Differences on the IAT-D score. The IAT-D score represents Identification with Illness and Health and was calculated from the reaction time data of the IAT. Error bars are 95% CI.