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A Mixed Methods Study of Cognitive Flexibility in Irritable Bowel Syndrome

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Alyse Bedell

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A Mixed Methods Study of Cognitive Flexibility in Irritable Bowel Syndrome

Alyse Bedell
Feinberg School of Medicine
Northwestern University

ABSTRACT

Introduction: Irritable bowel syndrome (IBS) is a disorder of gut-brain interaction associated with reduced quality of life, increased rates of depression and anxiety, and high economic burden to society and the individual. Current behavioral interventions, which target well-known symptom exacerbating factors such as catastrophizing and gastrointestinal- specific anxiety, have demonstrated efficacy. However, not all patients experience symptom improvement. Cognitive flexibility may be an important factor in IBS not targeted by current treatments. This study seeks to develop a preliminary measure of cognitive flexibility in IBS in order to understand its relationship to previously- studied constructs and clinical outcomes.

Methods: This study used an inductive, mixed methods approach to understand cognitive flexibility. First, experts in IBS were interviewed about cognitive flexibility in IBS. This expert opinion was used to categorize IBS into cognitively flexible (CF) or cognitively inflexible (CI) groups. Patients from each group were interviewed about their experiences with IBS, and interview data was analyzed and compared between groups. These differences formed the basis of a preliminary measure of cognitive flexibility in IBS (CI-IBS). In Study 3, we distributed the CI-IBS online sample of individuals with IBS in order to evaluate the range of cognitive flexibility in a larger sample and its relationships with other flexibility and outcome variables.

Results: Six characteristics of CI patients emerged from clinician interviews, which guided recruitment for patient interviews. Patient interview data highlighted differences between CF and CI patients, and these formed the basis of a 20-item measure. This measure was distributed to an online sample of 38 individuals with IBS. The CI-IBS was highly correlated with the AAQ-II (adapted for IBS) ($r=.797$, $p<.01$), a measure of psychological flexibility. The CI-IBS was also significantly correlated with mental health quality of life, depression, anxiety, readiness for psychotherapy and intolerance of uncertainty. Together, severity and mental health quality of life predicted 53.5% of the variance in CI-IBS score.

Discussion: Given the relationship between the CI-IBS and the AAQ-II (adapted for IBS), it may be a measure of psychological, rather than cognitive, flexibility. These findings suggest that less flexible patients may also be more likely to have higher symptom severity and poor mental health quality of life compared to more flexible patients. Limitations of this study include small sample size, which underpowered statistical analyses, and a homogenous, online patient sample, which limits generalizability of results. A larger and more diverse sample should be recruited to further understand this construct.

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Irritable bowel syndrome (IBS) is a disorder of gut-brain interaction (DGBI) that is not associated with any known organic or structural abnormalities. It is characterized by a symptom presentation of recurrent abdominal pain that is either related to defecation or associated with a change in the frequency or form of the stool (Mearin et al., 2016). Historically, U.S. prevalence rates of IBS have been 10-15%, though a 2016 study by Palsson et al. found that it is closer to 6% when using the latest diagnostic criteria (i.e., Rome IV). IBS is associated with multiple negative outcomes, including reduced quality of life (Canavan, West, & Card, 2015; Lackner, Gudleski, Ma, Dewanwala, & Naliboff, 2014), decreased work productivity (Buono, Carson, & Flores, 2017; Frandemark, Tornblom, Jakobsson, & Simren, 2018) and higher rates of anxiety and depression than healthy individuals (MacLean, Palsson, Turner, & Whitehead, 2012). In addition, the economic burden of IBS is high. For patients with IBS-C, annual health care costs have been estimated to be $3,856 higher than controls (Doshi et al., 2014), while for IBS-D, this difference is estimated at $2,268 (Buono, Mathur, Averitt, & Andrae, 2017). While recent studies lack estimates for indirect costs (such as due to absenteeism or presenteeism), a 2006 review estimated indirect costs at $3276 for each patient annually (Maxion-Bergemann, Thielecke, Abel, & Bergemann, 2006).

Medical treatments for IBS have limited efficacy and are primarily aimed at symptom reduction rather than underlying pathophysiology (Halland & Talley, 2013). Behavioral interventions address dysregulation of the brain-gut axis, which is thought to be the underlying cause of symptoms, by targeting maladaptive psychological and physiological factors associated with the disorder. As such, behavioral interventions are garnering significant attention in the clinical and research communities. Two psychological therapies, cognitive behavior therapy

(CBT) for IBS and gut-directed hypnosis, have been shown to be effective treatments for moderate to severe IBS (Ford, Lacy, Harris, Quigley, & Moayyedi, 2019; Li, Xiong, Zhang, Yu, & Chen, 2014).

Still, refinement of existing behavioral interventions and development of novel interventions is warranted. Wide dissemination of behavioral interventions has been difficult due to practical issues such as a shortage of trained therapists, long wait lists, high cost and time requirements (Lackner et al., 2018), demonstrating a need for improved clinical utility. In addition, not all patients experience significant symptom improvement from current interventions. For example, in a recent large-scale trial of CBT for IBS, 39% of patients were non-responders, meaning their symptoms were not considered "substantially" or "moderately" improved (Lackner et al., 2018). By identifying specific cognitive-affective variables that may impact a patient's therapeutic response, we can create more effective and efficient treatments.

Cognitive-affective factors established in IBS and targeted in current treatments include pain catastrophizing (Henrich & Martin, 2018; Sherwin, Leary, & Henderson, 2017) and gastrointestinal-specific anxiety (Labus, Mayer, Chang, Bolus, & Naliboff, 2007; Wilpart et al., 2017) Though less studied, cognitive (in)flexibility may be another symptom-driving construct and a precursor to success for behavioral treatments for IBS. While gastrointestinal (GI) clinicians have used the term cognitive flexibility to describe a patient's ability to engage with or benefit from treatment, researchers have only recently attempted to operationalize and understand this construct in a GI context. According to its neuropsychological definition, cognitive flexibility is an aspect of executive functioning responsible for the ability to appropriately adapt thoughts and behaviors to a changing environment (Scott, 1962). Cognitive

flexibility is associated with many positive outcomes such as higher health-related quality of life (Davis, Marra, Najafzadeh, & Liu-Ambrose, 2010) and increased resilience to stress (Genet & Siemer, 2011). In contrast, cognitive inflexibility is associated with depression (Meiran, Diamond, Toder, & Nemets, 2011), obsessive-compulsive disorder (Lawrence et al., 2006), and schizophrenia (Essizoglu, Kosger, Akarsu, Ozaydin, & Gulec, 2017), as well as both anorexia and bulimia nervosa (Tchanturia et al., 2012).

The concept of flexibility is not entirely new to GI research. In a salient study by Cheng et al., *coping* flexibility was evaluated among individuals with IBS and Functional Dyspepsia, as well as chronic pain and healthy control groups (2000). Previous research in coping suggests active or problem-focused coping strategies, such as problem-solving, are most helpful when facing controllable life events, while passive or emotion-focused coping strategies, such as distraction, are most useful for handling uncontrollable life events. Cheng et al. found that individuals with DGBIs, and not the chronic pain or healthy control groups, demonstrated an inflexible coping pattern, deploying action-focused coping strategies regardless of the controllability of the adverse event. Clinically, this can manifest in individuals with DGBIs over-utilizing problem-focused coping (i.e., diagnostic tests, medications, dietary changes) strategies when they would be better served by using emotion-focused strategies (i.e., relaxation, social support).

Acceptance and Commitment therapy (ACT) is a therapeutic approach that has been studied in physical health domains such as chronic pain (McCracken, Vowles, & Eccleston, 2004), diabetes (Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007) weight control (Lillis & Hayes, 2008) and more recently, IBS (Nuno Bravo Ferreira, Eugenicos, Morris, & Gillanders,

2011). A major goal of ACT is to increase *psychological* flexibility, which is defined as " the ability to contact the present moment more fully as a conscious human being, and to change or persist in behavior when doing so serves valued ends" (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). In a 2006 meta-analysis, psychological flexibility predicted outcomes such as depression, anxiety, and job satisfaction with an effect size of $r = .42$ (Hayes et al.). In one study of IBS patients, higher psychological flexibility was associated with fewer avoidant behaviors, lower levels of stress, anxiety and depression and a higher quality of life (N. B. Ferreira, Eugenicos, Morris, & Gillanders, 2013).

To date, only two studies have evaluated *cognitive* flexibility in GI disorders, with contrasting findings. Aizawa et al. (2012) assessed differences in cognitive flexibility among Japanese individuals with IBS and healthy controls using the Wisconsin Card Sorting Test (WCST) (Heaton & Staff, 2003), a standard neuropsychological measure of cognitive flexibility, and fMRI imaging. While the fMRI results indicated differences between the groups, findings on the WCST were mixed. Bedell et al. (2017) evaluated differences in cognitive flexibility among 30 patients with a broad range of DGBIs and 20 healthy controls, using several measures of cognitive flexibility, including the WCST and the Alternative Uses Task (AUT). Seventeen patients with DGBIs and 15 healthy controls also completed the Cognitive Flexibility Inventory (CFI), a self-report measure of cognitive flexibility (Dennis & Vander Wal, 2010). While there were no significant differences between the groups on any of the three measures, there was a trend toward significance between groups in the expected direction on a subscale of the CFI.

While the results of these studies seem to provide more questions than answers, they reveal important conceptual and methodological considerations for future research. First, both

studies were hindered by low sample size, which was likely driven by the burden of the time-consuming, in-person administration of the WCST. As such, a brief, self-report measure may be a more practical option for researchers to obtain a larger sample. What's more, it is unclear whether the construct of cognitive flexibility seen clinically in GI patients can be measured by neuropsychological tests such as the WCST, or whether it has a broader definition that would be better captured by measures with more practical utility, such as the CFI. Finally, both studies were designed based on the assumption that cognitive inflexibility is a characteristic of all IBS patients, when it may only apply to a smaller subset. If this were true, it may be better to design studies that compare patients within IBS, rather than between IBS patients and healthy controls in order to detect differences.

Taken together, cognitive flexibility may be an important variable in IBS outcomes, but it is unclear whether it has been correctly operationalized and measured in previous studies. It is also unknown if the term "cognitive flexibility", is the most accurate name for the construct observed in clinical GI settings. The present study seeks to further evaluate cognitive flexibility in patients with IBS through a mixed methods approach. First, we aim to identify behavioral and cognitive characteristics of provider-identified "cognitively inflexible" IBS patients through semi-structured qualitative interviews providers specializing in IBS. Second, we aim to evaluate differences among IBS patients characterized as either "cognitively flexible" or "cognitively inflexible" by their provider, using criteria developed in provider interviews. Next, we aim to estimate the prevalence of CI-IBS characteristics from Aim 2 in a larger online sample. Finally we seek to assess the relationship between these characteristics, similar constructs, and important clinical variables.

Study Method

Overview

This study uses an inductive, three-stage approach to understand cognitive flexibility. In the first study, experts in IBS were interviewed about cognitive flexibility in IBS to develop a preliminary consensus of the construct. The main product of Study 1 is a set of patient characteristics associated with cognitive flexibility in IBS. In Study 2, these characteristics are used to categorize IBS patients as cognitively flexible (CF) or cognitively inflexible (CI). Patients from each category were interviewed about how they think about, cope with, and manage their IBS, as well as how IBS impacts their lives. By analyzing responses and identifying differences between the groups, we developed a preliminary measure of cognitive flexibility. In Study 3, we distributed this measure to an online sample of individuals with IBS in order to evaluate the range of cognitive flexibility in a larger sample and its relationships with other flexibility and outcome variables.

Ethical considerations: All studies were reviewed by an Institutional Review Board. Study 1 (IRB#: STU00205831) was determined to not be human subject research , and Study 2 (IRB#: STU00206823) was determined to be exempt, by Northwestern University's IRB. Study 3 (HS#: 18-00794; GCO#1: 18-1623) was determined to be exempt by Mt. Sinai's Medical Center's IRB.

Sample Size: Guidelines for thematic analysis of qualitative interviews for small projects suggest a sample size of 6-10 participants (V. Braun & Clarke, 2013). Therefore, for Studies 1 and 2, we aimed to interview 6-10 patients respectively. Consecutive recruitment continued for both studies until we reached thematic saturation.

For Study 3 an a priori power analysis determined a minimal sample size of 111 to support our primary outcome (one way analysis of variance with effect size of 0.3, power at 0.8 and p = .05). In order to account for 14% drop out rate (10% lost immediately after consent, 2% lost with each 100 items after that, according to a 2010 study (Hoerger, 2010)), we aimed to recruit a total of 132 participants. This sample was sufficient based on power analyses for additional statistical analyses (Pearson's correlation).

Sampling Strategies: Due to the limited scope of the study and small sample size, purposeful and maximum variation sampling strategies were used to ensure diverse and representative interview samples. Purposeful sampling is a sampling technique frequently used in qualitative research that refers to using non-random, strategic selection of cases (Patton, 2002) (e.g. clinicians who specialize in treating patients with IBS). Maximum variation sampling emphasizes diversity in recruitment in order to identify patterns that cut across differences and increase generalizability of findings (e.g. interviewing clinicians across a range of disciplines and patients across a range of flexibility) (Patton, 2002). For Study 3, efforts were made to obtain a large and generalizable sample of IBS patients by advertising and recruiting via social media and a DGBI-specific website.

Study 1

(September 2017- January 2017)

A group of eight clinicians who specialize in IBS were selected to participate in semi-structured interviews about their understanding of the term "cognitive (in)flexibility" and experiences with IBS patients whom they would characterize as CI. The sample included two GI health psychologists, two gastroenterologists, two nurse practitioners, one clinical social worker and

one dietician. Clinicians were contacted via email to inquire about study participation. Interviews were conducted in-person or over the telephone. After providing verbal consent to participate, clinicians answered the following demographic and clinical questions: age, gender, racial background, ethnicity, number of years working with IBS patients, percentage of IBS patients seen weekly in practice, degree, and current practice setting.

Following completion of the demographic questionnaire, clinicians were provided with a working definition of cognitive flexibility and were asked to consider this definition, as well as their own clinical understanding of the term, when responding to interview questions. Clinicians then engaged in an in-depth, semi-structured interview about their experiences with patients whom they considered to be cognitively inflexible. Questions were pre-constructed and open-ended and asked each clinician to consider their perceptions about the term "cognitive (in)flexibility" as well as to provide their opinion of characteristics associated with CI in their IBS patients. The first author conducted the interviews. Interview durations ranged from 11 to 29 minutes. Interviews were audio recorded using a private recorder and transcribed verbatim by first author into text files with identifiable information removed.

Study 2

(February 2017-June 2018)

Thirteen clinicians, including some of the Study 1 sample and others at our institution, were contacted to consider appropriate patients to refer for Study 2. Clinicians were asked to approach patients aged 18-65 with Rome III or Rome IV IBS whom they considered to be cognitively inflexible or cognitively flexible based on criteria developed in the Study 1 interviews (see qualitative analysis of Study 2 for criteria). Patients with medical comorbidities that would

significantly interfere with the interpretation of results (e.g. Inflammatory Bowel Disease, dementias, traumatic brain injury, anorexia nervosa) were excluded. Clinicians approached patients meeting study criteria with the option to be contacted by the first author, who then telephoned patients to verify eligibility and determine interest. Ten patients were invited to participate in semi-structured qualitative interviews. Though patients were offered in-person or phone interviews, all patients chose to participate over the phone. After providing written consent to participate, patients answered the following demographic and clinical questions: age, gender, racial background, ethnicity, relationship status, level of education, occupational status, family household income, duration of IBS diagnosis, symptom severity, types of treatments, prior experience with behavioral therapy for IBS and mental health history.

Following completion of the demographic questionnaire, patients engaged in an in-depth, semi-structured interview about how they think about, cope with, and manage their IBS, as well as how IBS impacts their lives. The first author conducted the interviews. Interview durations ranged from 29 to 55 minutes and were audio recorded using a private recorder and transcribed verbatim into text files with identifiable information removed.

Study 3

(August 2018-April 2019)

Adults between 18-65 were recruited via social media (Facebook, Twitter) and a DGBI-specific website to participate in the study. Data was captured anonymously via Qualtrics. Interested individuals provided informed consent and completed a series of questions to assess for diagnosis and exclusion criteria. Individuals were excluded if they were under 18 or over 65, were not fluent in English, if they did not meet criteria for IBS via the Rome IV Questionnaire:

Bowel Disorders Module (Drossman, 2016), if they had a history of traumatic brain injury, dementia or eating disorder, or if they had comorbid inflammatory bowel disease. Eligible participants provided demographic and clinical information, including age, gender, racial background, ethnicity, relationship status, level of education, occupational status, family household income, whether they had received a formal IBS diagnosis by a physician, and duration of IBS diagnosis. Participants also completed the following questionnaires:

Flexibility Variables

Cognitive Inflexibility in IBS: The CI-IBS is a 20-item, self-report, preliminary measure of cognitive inflexibility in IBS. Items are scored on a 7-point Likert scale from Never True to Always True, with higher scores indicating greater inflexibility. This measure was developed based on qualitative analysis of patient interview data in Study 2. A full copy of this measure is located in the Appendices.

Cognitive Flexibility Inventory: The CFI is a 20-item, self-report measure of cognitive flexibility. It was created to measure the type of cognitive flexibility necessary for individuals to challenge and replace maladaptive thoughts with balanced, adaptive ones. Higher scores reflect greater flexibility. Items are rated on a 7-point rating scale (Dennis & Vander Wal, 2010).

AAQ-II (adapted for IBS): The AAQ-II is a 7-item, self-report measure of psychological inflexibility (Bond et al., 2011). It was adapted for the present study by inserting "gut symptoms" in place of psychological terminology in the original measure (e.g., "painful experiences and memories", "emotions", "worries"). These measure has been similarly adapted for use in chronic

pain patients (McCracken et al., 2004). Higher scores indicate greater inflexibility. A full copy of this adapted measure is located in the Appendices.

Outcome Variables

PROMIS Global Health: The 10 NIH PROMIS Global Health items are used to assess global physical and mental health (Hays, Bjorner, Revicki, Spritzer, & Cella, 2009). PROMIS Global Health items include specific ratings of physical and mental health quality of life (QoL). Item-scale correlations ranged from 0.53 to 0.80 and internal consistency reliability was 0.92. The correlation between mental and physical QoL factors is 0.69. Higher scores on this scale indicate higher QoL.

PROMIS Short Form v1.0 Emotional Distress- Anxiety 8a: The PROMIS Anxiety Short Form is an 8-item questionnaire that measures fear, hyperarousal and worry. Items are rated on a 5-point Likert scale from "Never" to "Always" with higher scores meaning higher levels of anxiety (Pilkonis et al., 2011).

PROMIS Short Form v1.0 Emotional Distress- Depression 8a: The PROMIS Depression Short Form is an 8-item questionnaire that measures feelings of sadness and hopelessness. Items are rated on a 5-point Likert scale from "Never" to "Always" with higher scores meaning higher levels of depression (Pilkonis et al., 2011).

Readiness for Psychotherapy Index: The RPI is a 20-item self-report measure that uses a 5-point rating scale. This scale contains three subscales that are positively associated with readiness for psychotherapy, including Openness, Distress, and Perseverance, and one reverse-scored subscale

of Disinterest. An overall readiness score may also be used. Higher scores reflect greater readiness for psychotherapy (Ogrodniczuk, Joyce, & Piper, 2009).

Intolerance of Uncertainty Scale- 12: The IUS-12 is a 12-item self-report measure that measures responses to uncertainty, ambiguous situations and the future (Carleton, Norton, & Asmundson, 2007). Items are rated on a 5-point rating scale ranging from 1 to 5, with high scores reflecting higher intolerance of uncertainty.

IBS Severity Scoring System: The IBS-SSS assessed the intensity of IBS symptoms, including abdominal pain, distension, stool frequency and consistency, and interference with life, over a 10-day period. Five items are scored on a 0-100 scale and a sum score symptom severity is derived, with higher scores indicating greater symptom severity (Francis, Morris, & Whorwell, 1997).

Statistical Analysis

Studies 1 and 2

Quantitative Analysis

All questionnaire responses were entered into Microsoft Excel (Microsoft Corp., Redmond, WA) for analysis. Descriptive statistics (means, standard deviations, frequency, and percentage) were used to describe participants' demographic characteristics.

Qualitative Analysis

Study 1

Analysis was conducted using Thematic Analysis with influences from grounded theory. Thematic analysis is a qualitative analytic method of identifying, analyzing and reporting themes

within data, including those that may be contradictory, that offers flexibility for use across a range of disciplines (Virginia Braun & Clarke, 2006). Grounded theory aims to produce inductively derived theories that are based on the material from which it was obtained (Harper, Thompson, & Harper, 2011). Characteristics of grounded theory include simultaneous collection and analysis of data, development of analytic codes, categories and comparisons between codes, concepts and categories (Glaser & Strauss, 1967). Both thematic analysis and grounded theory are iterative processes that were deemed most appropriate for the mixed methods design, type of data collected, and goals of the research. Data was analyzed using a 6-step method presented in Braun & Clark's 2006 paper: 1) familiarization with the data; 2) generation of initial codes; 3) searching for themes; 4) reviewing themes; 5) defining and naming themes; 6) producing a comprehensive report (Virginia Braun & Clarke, 2006).

Coding of interviews was conducted by two to three coders (AB, LG, MC), who all have a strong background in both qualitative research methods and IBS. Coders individually reviewed and coded each interview, then met to compare codes. A preliminary codebook was created following coding of the first interview, and the codebook was modified as a group with each subsequent interview. When there was a lack of agreement regarding coding, the coders discussed until they reached a consensus. We repeated this process with each interview until thematic data saturation was reached. Following coding of the final interview, interviews were entered into QSR International's NVivo 11 Software and the revised set of codes was applied to all prior interviews. The first author (AB) completed subsequent analysis with input from the other coders (LG, MC).

Study 2

A preliminary analysis of Study 1 interviews informed recruitment procedures for Study 2. Frequencies were tabulated in NVivo to determine the most endorsed characteristics associated with CI by clinicians. Six characteristics were endorsed by at least half of all eight clinicians, including: 1. Rigidity and perseveration related to IBS symptoms and treatment, 2. Mental health comorbidity, 3. Unique dietary strategies, 4. Unique toileting routines, 5., Resistance or uncertainty about brain-gut model of IBS, and 6., Less or slower treatment response. Thus, for Study 2, referring clinicians were instructed that patients they would consider to be cognitively inflexible should meet at least 3 of the 6 criteria, while patients they would consider to be cognitively flexible should meet less than 3 of the 6 criteria.

The same qualitative procedures described above were used to develop a codebook for Study 2. Upon completion of the codebook, coders (AB, LG, MC) evaluated codes as likely different (2), maybe different (1), or not different (0) between CF and CI groups. In some cases, differences were observed due to perceived variation in responses between CF and CI groups, while in others, differences were identified by the presence of data in one group and lack of data in another group. First, coders independently rated each code with a 2, 1 or 0. Coders then met to discuss their codes, and a final rating was made based on a 2/3 vote. Of 66 codes in the original codebook, 12 were rated as 2, 22 were rated as 1, and 32 were rated as 0. Codes with a rating of 0 were automatically removed from further analysis while codes with a rating of 2 were automatically included. Codes with a rating of 1 were discussed further to determine relevance and whether it could be collapsed with another code. These codes were put to another vote to determine whether or not they would be included in the final set of characteristics, and were

either removed, retained as-is, or collapsed into an existing code. Twenty- one codes, representing 21 characteristics that differed between CI and CF groups, remained following analysis.

The three coders consolidated these 21-items into question form, with input from two GI psychologists (Drs. Keefer and Taft). This resulted in a 20-item questionnaire assessing cognitive inflexibility in IBS (CI-IBS).

Study 3

Quantitative Analysis

Data from Qualtrics was into SPSS v25 for Macintosh (Chicago, IL) for analyses. A cutoff score of +/-2.0 on measures of skewness and kurtosis indicated normality of continuous variables. Descriptive statistics (mean, standard deviation (SD)) were used to evaluate the demographic and clinical characteristics of the sample. To evaluate construct validity of the CI-IBS study-specific measure, Pearson's correlations assessed the relationship between scores on the CI-IBS, the AAQ-II, and the CFI. Next, to evaluate prevalence rates of CI, we divided participants into tertiles (high, medium and low scores) on the CI-IBS questionnaire, with higher scores representing greater cognitive inflexibility. We ran Pearson's correlations to identify relationships between predictor variables (flexibility variables, intolerance of uncertainty) and criterion variables (clinical outcomes: symptom severity, physical and mental QoL, readiness for psychotherapy, mental health). Where significant relationships existed, separate stepwise linear regression analyses were conducted for each criterion variable to identify its relative contribution to predictor variables. We also conducted regression analysis for CI-IBS to determine its relationship to criterion variables. If multicollinearity was present between variables ($r < .8$), we

excluded the variable of lesser interest from regression analysis. The results of regression analyses are reported with adjusted R^2 converted to percentage variance.

RESULTS

STUDY 1

Participant Characteristics

Nine clinicians who specialize in IBS were contacted via email to inquire about study participation. One declined to participate due to concern that she did not see enough IBS patients to provide expert opinion. In total, eight clinicians were interviewed. See Table 1 for clinician characteristics.

Table 1: Clinician Characteristics

	Total N= 8
Profession	
Advanced Practice nurse	2
Dietician	1
Gastroenterologist	2
Health psychologist	2
Clinical Social Worker	1
Practice setting	
Private practice	2
University	6
Years experience with IBS	
Mean	9.6
S.D.	5.7
Caseload with IBS	
Mean	50%
S.D.	17.6%
Age (years)	
Mean	41.4
S.D.	7.7

Race and Ethnicity	
Non-Hispanic White	87.5%
Other	12.5%
Length of interview (min.)	
Mean	18.6
S.D.	5.5
Sex	
Female	87.5%
Male	12.5%

Qualitative Analysis

Analysis of interview data identified three broad themes reflecting clinicians' perceptions of cognitive inflexibility in IBS patients, as well as sub-themes and traits, within those themes. See Table 2 for representative quotations.

Table 2: Representative Quotations Grouped by Theme, Sub-theme, Construct

Theme	Sub-theme	Construct	Quotations
Patient Factors	**Cognitive Characteristics**	*Rigidity, perseveration*	"You know they just kind get stuck on a certain way of responding to symptoms or coping with situations and can't really see their way out of that or kind of aren't open to other kind of options." (HEALTH PSYCHOLOGIST, 1) "People who hold very rigid belief systems about how they have to manage their symptoms, rigid belief systems about behaviors they have to engage in to either not let symptoms happen or prevent symptoms." (HEALTH PSYCHOLOGIST, 2)
		Cognitive Distortions	"I think there's a lot of like kind of "should statements" and like kind of almost like rules they have about the ways that, you know problems, you know should be, like should be you know addressed or resolved or fixed

			in a certain way." (HEALTH PSYCHOLOGIST, 1) "So a lot more tuning into all the sensations in their bodies and then reading into it, catastrophizing." (CLINICAL SOCIAL WORKER)
		IBS Etiology	"I think that one of the barriers are patients continually are searching for a physical finding to explain their symptoms, and they don't necessarily always want to participate 100 percent in the strategies that are provided because they are constantly searching for a physical reason why they have IBS symptoms despite testing." (ADVANCED PRACTICE NURSE, 1) "Her chief complaint was nausea and vomiting from seeing food on a TV screen or smelling things, like that is a brain-gut interaction. And she said, 'I don't believe in any of that.'" (GASTROENTEROLOGIST, 1)
	Behavioral Characteristics	*Unique or Abnormal Eating*	"I think many of them have significantly altered eating behaviors to the point where it can be dangerous or they minimize the types of foods their eating down to a small handful of things that they can do." (DIETICIAN) "A lot of people just use diet and they end up getting into this food avoidance behavior. That's almost like an eating disorder. But it's not an eating disorder, but because that's what they can control, they can control their food." (GASTROENTEROLOGIST, 2)

		Propensity Toward Dieting	"I do think that some of the very cognitively inflexible people have a real interest and drive in dieting. I don't think we've really captured or quantified that very well. It's hard to know if their interest comes out of the fact that they're trying to ameliorate their GI symptoms." (DIETICIAN)
		Rigid Medication Use	"That person might be using handfuls of Imodium throughout the day even though they don't have either symptoms or evidence to suggest that they need to do that, but they're doing it more out of a safety behavior." (HEALTH PSYCHOLOGIST, 2)
		Unique or Abnormal Toileting	"…Sitting on the toilet for long periods of time in the morning before leaving for work or for school. Oh, another big one would be the person who doesn't leave the house or says they won't have a good day unless they actually have a bowel movement. That's a pretty common one too." (HEALTH PSYCHOLOGIST, 2)
		Treatment Seeking	"I do notice sometimes they doctor-shop, so they've been to like 10 different GIs. That's always a red flag to me…just going to be potentially a difficult person." (CLINICAL SOCIAL WORKER) "You know seeing more doctors, wanting more tests, searching for a solution for their IBS. And I think that whole process of, you know kind of getting further work up, further consultation just kind of

			exacerbates the whole picture." (HEALTH PSYCHOLOGIST, 1)
		Alternative Medicine	"Many of these patients have sought care from naturopaths that are using more holistic therapies that are not evidence-based or haven't been proven to be useful, essentially dangerous for people with functional bowel disease or irritable bowel syndrome, which is surprising because they want to go to the naturopath and get the stool tests done and take everything the sun that they give them but they aren't willing to be cognitively flexible enough to talk to a behavioral therapist even though we discussed the fact that there is significant amount of evidence and data supporting it." (GASTROENTEROLOGIST, 1)
		Maladaptive Coping	"They're a planner, they're a problem solver… It's an unpredictable uncontrollable medical issue. It's uncomfortable it's embarrassing. And so now they've really kind of ramped up their problem- focused coping." (HEALTH PSYCHOLOGIST, 1) "So people who try to apply a way of thinking and a way of acting that has been successful in one aspect of their life and when they try to apply it to their health and they think it should succeed and they hit their head against the wall, then that's a problem." (GASTROENTEROLOGIST, 2)
		Morning Routines	"They have to have their cup of tea when they first get up, have their oatmeal, but only with the flax… They can't leave the house until

			they've waited 30 minutes after their tea or coffee to try to go to the bathroom, so you know just overly planned out and kind of rigid routine in the morning." (HEALTH PSYCHOLOGIST, 1)
	Psychological Characteristics	*Mental Health Comorbidity*	"I definitely see a comorbid component of anxiety… in those patients than I do in my other population." (GASTROENTEROLOGIST, 1) "They may have a more clinically-driven anxiety disorder… in more severe cases of cognitive inflexibility that person might have more Generalized Anxiety Disorder." (HEALTH PSYCHOLOGIST, 2)
	Demographic Characteristics	*Socioeconomic Status*	"I think very educated successful people who like I said they have a certain way of their behavior has helped their success. They try to apply it to their health and they can't necessarily do that. They get frustrated and you know they're very intelligent so they want to know why." (GASTROENTEROLOGIST, 2)
		Certain Professions	"Someone who would do well in an engineering job or even attorneys it seems like, you know, these certain professions where that really kind of very analytical kind of precision in their work and their thinking seems to be present, seems to go along with you know, this this kind of inflexible thinking." (HEALTH PSYCHOLOGIST, 1)
	Clinical Characteristics	*Symptom Severity*	"I think one of the reasons their symptoms become more severe is

			because of their inflexibility is leading them to maybe engage in behaviors that are making their symptoms worse making their anxiety worse which then makes the symptoms worse." (HEALTH PSYCHOLOGIST, 1)
Treatment Factors	**Treatment Engagement**	*Less Open*	"Cause it's like, well the pill didn't work, whatever didn't work, and now I'm saying like you have to work through some of these thoughts that are holding you back and that's a lot of hard work so there's some resistance to change, even though they do want the illness to change, they're not necessarily ready to work at it." (CLINICAL SOCIAL WORKER)
		Different Expectations for Types of Treatment	"When people come to see me, and I'm a dietitian, they think I'm going to do blood and hair samples, stool analysis, food sensitivity testing, and I'm going to put them on this really restricted diet. And people want that. And there are some people that are severely disappointed… I mean they want me to say, 'Everything is wrong, you're allergic to nightshades, eggs are your problem, I'm going to take everything out and you're going to feel great.'" (DIETICIAN)
		Expectations for Outcomes	"I have some patients that I'll say you've done a low FODMAP diet and I always ask what percent better are you now that you've done the diet. Some people are like, 'I'm golden. I'm 50 percent better. I have diarrhea in the morning. I'm so good.' Other people say, 'I'm 50 percent better but I'm still not where

			I want to be.' And to me, the cognitively inflexible patient is the one that says, 'I'm more than 50 percent better but I still am not perfect.'" (DIETICIAN)
	Provider Treatment Approach	*Work within Patient's Plan*	"So if someone comes in with an agenda of medication, that's likely what they're getting because… that limits what I can do because I can't force anybody to do anything." (ADVANCED PRACTICE NURSE, 2)
Scope of the Problem and Next Steps	**Treatment Outcomes**	*Slower or Reduced Response*	"I think of these patients as my hardest to treat patients. I think that they're going to be the most difficult patients to, I won't say cure but improve… I don't have pharmaceuticals that can intervene on those types of processes." (GASTROENTEROLOGIST, 1)
		Cognitive Flexibility as Modifiable	"I definitely think they do better. And sometimes they develop more flexible thinking over time. They may start off with more, certain concrete belief system and then it can get better with time. They just kind of have to adapt- the longer they have it, I think they have to be more open." (GASTROENTEROLOGIST, 2)
	Prevalence	*Spectrum*	"I think it's a pretty high percentage that has some degree of mild to severe inflexibility...It's hard to put a number on it... I don't know, maybe 75% have some degree of inflexibility. And I would probably say 50% of those maybe its mild to moderate. And then there's a smaller portion where it's maybe more severe

			cognitive inflexibility." (HEALTH PSYCHOLOGIST, 1) "I would say that it's going to be a spectrum right, it's never going to be black and white." (GASTROENTEROLOGIST, 2)
	Beliefs and Ideas	*Impact on Treatment*	"I mean especially going through these questions, I think it's something that I think it actually is a barrier to care in some ways. And I think this… extends actually further than IBS… I think it really can affect outcomes." (ADVANCED PRACTICE NURSE, 2)

Theme 1: Patient Factors

Cognitive Characteristics:

Cognitive characteristics, or thinking styles or processes, can impact a patient's mood, behavior, and symptoms. When asked to describe cognitive characteristics of CI patients, rigidness, an unwillingness to bend rules, and/or perseveration was a trait suggested by 7/8 clinicians. Cognitive distortions, or irrational thoughts and beliefs, were suggested by 5/8 clinicians as common among CI patients. Clinicians offered specific examples such as catastrophizing, black and white thinking, and "should" statements, which are well known examples of cognitive distortions in the CBT literature.

Clinicians discussed how CI patients tend to be less receptive to the idea that stress and lifestyle factors play a role in their symptoms. Some clinicians pointed out that CI patients are less likely to "buy in" to the brain-gut interaction theory of IBS, and that these patients are

continually searching for an "organic" etiology to their symptoms. This trait was suggested by 5/8 clinicians.

Other notable cognitive characteristics suggested by one or two clinicians include: defensiveness, symptom hypervigilance, superstition, learned helplessness, and an analytical thinking style.

Behavioral Characteristics:

Unique or abnormal eating behaviors were suggested by 6/8 clinicians to be a trait of CI IBS patients. Examples of this included strict rules around food and diet, limiting or abstaining from eating to manage symptoms, and adherence to restrictive and even dangerous diets. Some clinicians reported that CI patients have a tendency to eat the same foods every day and are more likely to avoid dining out or eating with other people than CF patients. One clinician noted that many CI patients have a propensity towards dieting, and she is not sure if this stems from an attempt to manage their symptoms or for weight-related concerns.

Three clinicians suggested that rigid medication use is a behavioral characteristic of CI patients. They discussed a tendency for these patients to be concerned with the timing of medications and to continue taking as-needed medications regardless of whether they are having symptoms. However, one clinician had a contradictory view of medication use, suggesting that CI patients are actually less adherent to medications. She described this as a tendency to try a medication briefly and then to discontinue taking it before it could be expected to have an effect. Another clinician, a dietician, suggested that taking supplements is one behavioral characteristic of her CI patients.

Spending significant amounts of time on the toilet or near a bathroom may also be associated with CI patients, as 5/8 clinicians suggested this theme. This was also frequently discussed in the context of mental preoccupation with bowel movements or bowel sensations. Clinicians provided examples of patients believing that the success of the rest of the day is contingent upon having a bowel movement.

Clinicians described differences in treatment seeking behaviors between their CI and CF patients. In particular, seeking consultation with many different providers was associated with CI IBS patients, with half of clinicians identifying this as a trait. Three clinicians suggested that seeking alternative medicine, such as a naturopath, chiropractor, holistic therapies, or consultation with a functional medicine doctor, to be a characteristic of CI patients. Two clinicians also suggested these patients have also had many types of treatments with little to no success.

Three clinicians suggested maladaptive coping strategies, such as “inflexible” coping or over-utilizing “problem-focused” approaches as characteristic of CI IBS patients. While three clinicians identified “ritualistic” or “scheduled” behaviors as a trait associated with their CI patients, one suggested that CI patients may actually tend to be more “disorganized” in their coping behaviors. Three clinicians discussed extensive morning routines, involving toileting, eating or drinking, or a combination of these, as a rigidly employed coping strategy.

Two clinicians also acknowledged the amount of resources patients spend managing their symptoms, including time, energy and money, with one even suggesting that this has the potential to worsen their situation.

Psychological Characteristics:

All eight clinicians discussed mental health comorbidity as characteristic of CI patients. Anxiety was discussed most frequently, with depression, obsessive- compulsive tendencies, and personality disorders suggested as well.

Clinicians suggested several personality and psychological characteristics that they associated with CI. One trait suggested by half of our clinician sample is a tendency to be easily frustrated or overwhelmed. Two clinicians suggested a Type A personality, anger, fear, and lack of social support to be CI traits. Having chaotic or stressful lives, and a reduced quality of life were each suggested by one clinician.

Demographic Characteristics:

When asked about demographic differences between their CF and CI patients, clinicians provided only a few examples. Half of clinicians suggested that higher socio-economic status, and in particular, higher education, was associated with CI. Two clinicians went on to suggest that people in particular professions, such as engineering or law, may be more likely to be CI due to the analytical nature of their job.

Other demographic characteristics suggested by one or two clinicians include white women, black women, younger patients, and patients with strong cultural beliefs.

Clinical Characteristics:

Three clinicians suggested that CI patients tend to have more severe symptoms. One of those clinicians, a health psychologist, discussed how CI patients can fall into a vicious cycle of inflexible thinking leading to worsened symptoms, and worsened symptoms leading to inflexible thinking.

There was a lack of consensus regarding whether certain types of IBS subtypes were more likely to be associated with inflexibility. Half of clinicians did not comment on a relationship between subtype and degree of flexibility, two stated that it was independent of diagnosis, and two stated that it is more associated with IBS-C patients. One clinician noted that he sees a high overlap of dyssynergic defecation in this population. Other clinical factors suggested by one clinician each include a tendency to have a more unknown symptom etiology, a tendency to refer to their symptoms as a diagnosis, and more visceral hypersensitivity than CF patients.

Theme 2: Treatment Factors

Treatment Engagement:

Four clinicians described CI patients as being less open to treatment and less likely to fully participate in the strategies provided in treatment. These same clinicians described how patients have different expectations for treatment than the clinician does, at times even arriving to an appointment with a specific treatment in mind. Similarly, expectations for treatment outcomes were described as differing between CF and CI patients by two clinicians.

Two clinicians, a gastroenterologist and an advanced practice nurse, also described CI patients as being less receptive to behavioral interventions for their IBS. Two clinicians described these patients as less adept at cognitive therapy, such as cognitive restructuring. Other traits in this category suggested by one clinician include being more interested in medication than other treatments, emotionally hard for providers to treat, and help-rejecting complaining.

Treatment Approach:

Clinicians were asked to describe their approach to treatment with less flexible patients. Four

clinicians explicitly stated they do differ their treatment approach based on a patient's degree of cognitive flexibility, either deliberately or in response to a patient's behavior or preference. Though treatment approaches in this sample are hard to compare due to the variety of professions interviewed, it is clear there is a lack of consensus regarding how to most effectively work with CI patients. Three clinicians shared the view that with CI patients they work hard to try a treatment approach that works for the patients, and in particular to work within the patient's plan.

Other treatment approaches suggested by one or two clinicians include: mindfulness, more CBT, less CBT, a behavioral approach, stress reduction, motivational interviewing, relaxation strategies, psychoeducation, rapport building, neuromodulating medication, and referring out to a different provider.

Theme 3: Scope of the Problem and Next Steps

Treatment Outcomes:

Six of eight clinicians interviewed identified that CI patients would have a slower or reduced response to treatment when compared to CF patients. This finding was found in each profession. Opinions ranged considerably in this response, with some clinicians reporting minimal to no response to treatment and others reporting adequate response to treatment, though acknowledging that it would take more time.

Two clinicians, who discussed seeing cognitive flexibility on a spectrum, noted that patients who have a mild to moderate degree of inflexibility are able to effectively respond to treatment, particularly if their cognitive inflexibility is targeted and modified through treatment.

Prevalence:

Clinicians were asked to provide an estimate of what percentage of their IBS patients they would consider to be CI. Estimates ranged widely, from 10-80%. Half of clinicians specifically described cognitive flexibility as existing on a spectrum, with these clinicians generally providing higher CI estimates than clinicians who did not specify that they viewed it on a spectrum.

Beliefs and Ideas:

Clinicians shared their thoughts on cognitive flexibility in IBS and what they hope for in the future regarding this topic. Three clinicians suggested that these patients might have a different type of cognitive flexibility that is more specific to their IBS rather than a broad trait of cognitive inflexibility. One clinician suggested caution when applying the term cognitive inflexibility to patients, because something else may be moderating this phenomenon, such as family dynamics, level of education, and life experiences. Although many clinicians were candid about the emotional difficulty of treating these patients, all were eager to better understand the construct in order to more effectively treat CI patients.

STUDY 2

Participant Characteristics

In total, the first author contacted 14 patients to participate. In the CF sample, 8 were contacted and five patients participated. One did not respond to initial outreach attempts and two failed to respond to outreach attempts after initially responding to first author. In the CI sample, the first author contacted 6 patients and 5 participated. One failed to respond to initial outreach. See Table 3 for patient characteristics.

Table 3. Patient Characteristics

	Total Sample	Inflexible Group	Flexible Group
	N= 10	N= 5	N= 5
Gender			
Female	5	2	3
Male	5	3	2
Age (years)			
Mean	36	45.6	26.4
S.D.	11	5.2	3.9
Race			
White	8	4	4
Black	1	1	0
Latino	1	0	1
Ethnicity			
Hispanic	9	5	1
Non-Hispanic	1	0	4
Relationship Status			
Never Married	5	2	3
Living with Partner	2	0	2
Married	2	2	0
Decline to Answer	1	1	0
Highest Level of Education			
Secondary/High School	2	2	0
College Degree	4	0	4
Postgraduate Degree	4	3	1
Occupational Status			
Disability	1	1	0
Unemployed	1	1	0
Part-time Employed	1	1	0
Full-time Student	1	0	1
Full-time Employed	6	2	4
Duration of IBS Diagnosis (years)			
Mean	9.5	12.8	6.1
S.D.	7.3	7.3	7.2
Symptom Severity (0-10 scale; 0 = no symptoms)			
Mean	6.5	8.2	4.8
S.D.	3	3	2
Past or Current Therapy or Counseling for IBS			

Yes No	6 4	3 2	3 2
Mental Health Diagnoses Yes No	 4 6	 3 2	 1 4
Length of Interview (min) Mean S.D.	 44.2 10.3	 46.6 11.8	 41.8 9.2

Qualitative Analysis

Analysis of interview data identified five broad themes. Within each theme, coders identified characteristics that did and did not differ between flexible and inflexible groups. See Table 4 for representative quotations.

Table 4: Representative Quotations Grouped by Theme, Characteristic, Patient Group

Theme	**Characteristic**	**Cognitively Inflexible Quotations**	**Cognitively Flexible Quotations**
Intrapersonal and Interpersonal Factors	*Dichotomous Thinking or Black or White Thinking*	"Black and white, definitely... Probably to my detriment. I need to dip my toes more into the gray probably more than I do. "(Male, 51) "Definitely black and white thinking." (Female, 48)	"One of my strengths is that I can see all sides of an issue and all outcomes…I'm not necessarily black and white about anything." (Female, 22) "Gray area. I think there are definite situations that are black and white and there's going to be one way to do it but

			largely that kind of gray area in the middle, maybe some combination of both, which I think has probably been evident in some of my answers, that it's not one way or the other it's some combination of multiple strategies that leads to the best outcome." (Male, 25)
	Introversion/Extroversion	"I don't know if I consider myself so shy but more shy than outgoing, definitely prefer to be by myself or with small groups of people that I like." (Male, 46) "Especially if I don't know someone that well, I'm just quiet, to myself. I won't say much." (Female, 46)	"I think people probably just describe me as pretty outgoing and fun person." (Male, 25) " I'm a big team player. I feel like I'm a person that people want to be around." (Female, 31)
	Discussing IBS with Others	"I have a great best friend who I can talk to about IBS related things." (Male, 37)	"Good social support from my family and friends. I don't mind talking about this stuff with them. They all, you know,

			they're all aware of it. Because I find it quite funny actually." (Male, 25) "People I surround myself with, they don't care, and they all have had embarrassing things happen to them and sometimes in the same kind of arena. So I think there's a connection there too about it being feeling more manageable because again, it's just something I have, it's not that big of a deal… I don't feel that it's so embarrassing anymore." (Female, 30)
	Psychological Comorbidity	"The depression and the anxiety did start before I would say, before my symptoms got serious." (Male, 51) "I've gotten used to sort of having this… as a daily issue, and sort of having to think	"I don't think I have anxiety. I definitely do feel anxious sometimes… but mainly as a factor of stress. I'm understanding that they're slightly different

		about so many different things to do with this daily, that for me, may be so intertwined with the depression at this point in time that I can't see clearly." (Male, 37)	and… I feel like my anxiety or like mainly stress just comes from the fact that like I have a lot of things going on to keep track of." (Female, 22) "Maybe I just have like an anxious personality or when I kind of lose like control of the situation then I become more anxious, which triggers you know the irritable bowel aspect of it. (Female, 31)
Illness Understanding	*Role of Stress and Anxiety*	"I actually don't know what would happen if I now ate a piece of bread, but I'm afraid to find out, like I want to find out, but I'm afraid to." (Male, 46) "I think I've somewhat come to the conclusion of stress and anxiety recently after sort of realizing that everything that they've tried hasn't worked. "(Male, 37)	"And I would focus on when was the last time I ate, when was the last time I actually went to the bathroom… And because I focus on that, that then drives, whether they're real or not, some level of perceived feeling in my stomach. Which then, it will

			either actually drive, some level of your bowels, or the flipside, there will be nothing, and I will just sit there with this increased perception of pain or whatever you want to call it, in my stomach." (Male, 25) And I think the interesting thing too, that's hard just keep in mind too is just like a kind of like a catch 22 where you where when you start to get stressed about having symptoms it makes your symptoms worse. Which then makes you more stressed about having symptoms." (Female, 30)
	Reaction to Terminology	"I'm actually hypersensitive to people saying that I'm hypersensitive. "(Male, 51)	None

		"My old doctor, would say things like gosh you're sensitive.. that you can tune into that and I'm thinking I don't know if that makes me sensitive, if anyone had that amount of tingling they would notice. But maybe they're calling my body sensitive? For having that kind of response. But to me it sounds like it's judgment and it bothers me." (Female, 48)	
	Confidence in Diagnosis	"I think because my symptoms, they're so complex and so complicated, my doctors have not given me a full diagnosis of IB [sic] so the diagnosis of IB is a placeholder until they sort of figure out what else is wrong with me. So they know I have issues--issues related to my gastronomy, but beyond that, in terms of what it is they're still sort of perplexed by them, to the extent that I'm actually seeing a third specialist next month." (Male, 37)	"I had the food poisoning and after that it never completely stopped. So I can point to it. But in terms of what they told me about it continuing, I mean yeah, I think it matches up." (Female, 30)

	Agreement with Healthcare Providers	"Honestly like the doctors and the GI doctors and the dietitians don't really-- I've never gotten kind of any sort of explanation of here's why this happened." (Male, 46)	"So I think based on conversations with Dr. (Gastroenterologist) and Dr. (GI Psychologist) a lot of the things that I-- they kind of affirmed a lot of my own behaviors and so I think I think my thoughts are definitely informed by my conversations with them-- …I don't know if I would have attributed it to this without talking to them. But when I do talk to them it does make a lot of sense you know?" (Female, 22)
Self-Management	*Researching*	"I read all these articles and I do a lot of investigating myself just to see what's new out there…. That's my mission in life… That's every day. I mean I was online this morning at 1:30 on YouTube looking at videos about IBS and about probiotics and this	None

		and that so I'm kind of constantly in search of remedies.“ (Male, 51) “I think that I do a fair amount of planning and research.” (Female, 48)	
	Eating Behaviors	“I know exactly what I'm going to have for lunch and I tend to have, recently I've been having for the past three months I've sort of been having the same things consistently for lunch, or even at home, I mean but it's maybe about five to seven things.” (Male, 37) “With very few exceptions I could tell you what I'm going to be eating every day from now until, for the next two weeks. Breakfast lunch and dinner.” (Male, 51)	“I’m a really social person, so I still like to go to eat, and to do things on the whim, and I'm not so structured when it comes to what I eat.”(Female, 31) “I'm not that organized. And ultimately I don't really care. You know, I'd rather go eat out. “(Female, 30)
	Spending Resources	On spending time and energy and/or money managing symptoms: **“**Emphatically.” (Male, 51)	“I don't think I spend a lot of money or time--or I guess, yeah money or time no, but I do, I guess I spend a lot of energy in that I think about it a lot, and not... And not, I don't think it's like

			super bothersome but at the same time I think I probably have just gotten used to it. I don't think people without these kind of problems consider like the bathroom situation everywhere they're going."(Female, 30)
	Role of diet	"While I eat them there is no guarantee that I'll have success, I know that if I stray away from these foods it's almost a virtual guarantee that I won't have success." (Male, 51) "Yeah it's been the most helpful to, I believe, you know kind of sort out some of the more extreme kind of physical issues. But on the flipside the diet that kind of works for me, or I think works for me, is so restrictive that it's very difficult to deal with and isn't-it's not ideal. It helps on the one side but it hurts on living your	" I kind of mentioned this earlier but I feel like I, no matter what I eat, if I'm like triggered by something or anxious about something, that it will affect my stomach, whether I have a salad or like fried food. So the diet aspect has been hard because I haven't been able to trigger if a certain food is like, causes even more these issues. "(Female, 31)

		life and being able to go do things and eat things.“ (Male, 46)	
	Impact of Bowel Movements	“Now sometimes, I can live without the [bowel movement] before I work out. Like if I'm feeling OK in the morning and I don't have a lot of time and I just want to go work out, I can usually get through the workout, but if I wasn't able to after that, it would be like, I don't know, it doesn't happen, because I always do, but that would throw me off in a big way.” (Male, 46)	“I don't know if I have like a specific strategy. I would say that I do certain things in the morning to try to help me have bowel movement, like drink coffee because that usually does tend to help, and be really hydrated, At one point I was doing the Metamucil thing but also not regularly so I don't think I saw anything from that. I definitely try to do the-- to kind of have a morning routine with the coffee and the water just to get everything going. That being said that doesn't usually happen regularly but I don't have any apprehension or any specific routine once I'm

			in the bathroom." (Female, 22)
Healthcare Engagement	*Alternative Medicine*	"Yeah the acupuncture, and the naturopaths and even going to a chiropractor to have them like adjust. You know because they can adjust things to do with your bowels to try to keep them going or help with them." (Female, 46)	"I did acupuncture…I don't know if it was just the stress relief of it, because it was nice and quiet and meditation and all of that, of if it was the acupuncture itself, but I did see an effect definitely it was just extremely expensive. Because obviously insurance doesn't cover it. So I did it for a little bit. And at that point I was right out of undergrad and it wasn't sustainable for the costs." (Female, 30)
	Number of GI Providers	"Probably 2-3 different primary care doctors. Two different gastroenterologists and three different dietitians." (Male, 46)	"So I mean really I've only seen two people for the IBS specifically." (Female, 31)
	Number of Tests and Treatments	"At this point I started seeing a specialist, Dr. (GE)…and he did the	"And after I started losing a bit of weight… I

		barrage of tests… and everything is ultimately sort of come back, inconclusive, so it shows that there is sort of nothing there. So you know we've tried different medications, in terms of sorting to help me because I think ultimately what has happened is that I think moved from being totally constipated, on the one end, to taking medications." (Male, 37)	said I better start going to a doctor to figure this thing out, and started seeing a gastroenterologis t… for probably for about a year and a half I think or slightly longer than that. And that resulted in the IBS diagnosis and then also the medication of that as well." (Male, 25) "So I've seen four doctors, four GI specialists about it. So yeah, I've seen quite a few doctors and then I've tried yeah various medications currently trying the Xifaxin, hyociamine has worked for me." (Female, 30)
Outcomes	*Employment Impacts*	"I worry about working it's one of the reasons I quit my job. I was trying to find a life that works better, like a job that works--supported a lifestyle where I could better care of my self."	"I mean still live like a normal life, I'm not bound to my house. I have a job that I go to every day, and I'm in meetings, and I

		(Female, 48) "Not a lot of places will work with you with especially the situation that I'm in with, because like say like, you know, that--the other day when I had that episode of really bad cramping, I don't know what I would have done if I was working. Because I had to lay down, all I can do is lay down (Female, 46)	travel still." (Female, 31)
	Quality of Life	"It's a lot of feelings of desperation. Yeah. OK. And it's hard not to give up. Yeah. OK So the last two weeks have not been... too good." (Male, 51) "I still can laugh and walk and stuff and work for the most part. But all of those things have been impacted. I can't participate fully the way I used do. I'm in pain in my body all the time." (Female, 48)	"I like my quality of life. I mean, the IBS was very annoying and has changed--did major changes in my life. But I'm sort of on track on fixing them, and have accepted that, you know sometimes these random events happen and derail things and I'm willing to do the work to sort of fight against that." (Male, 24)
	Social Support	"The issues that I've had for years and my other daughter she don't like to hear it, she don't want to hear	"I have a good family that I'm close with, a boyfriend that's a good support

		it. And when you get that kind of response from someone, it's just like, you know, you don't have any clue until it happened to you." (Female, 46)	system, I have friends that I'm close with, and I have a good network at work too. So I don't think that's a problem area." (Female, 31)
	Treatment Response	"Vitamins, supplements, cleanses. You know your basic Walgreens stuff. Miralax, Metamucil you know all sorts of things varying- with varying degrees of success. The success for essentially every remedy that I've had throughout my IBS experience only lasts a certain amount of time then it seems as if my body starts to figure it out and says Sorry I figured this out and now I'm going to screw you." (Male, 51) "To be honest with you, most helpful, I would say none. Many things I've tried have sort of been temporary stopgap measures." (Male, 37)	"Just the breathing technique, of really just trying to inflate my stomach a couple times and sitting up. And going on a walk and that seems to help." (Female, 22) "The IBGard has been the game changer for me. That has really changed the problem, my low to mid severity of symptoms that I had sort of every day to essentially that has gone to zero. And it has also reduced when I've been stressed out, those symptoms have been reduced from I guess high to

			mid, to now mid to low." (Male, 24)
	Side Effects	"That actually seemed to work a little bit at first but then I got very constipated from it, and she took me off of it."(Male, 46) "The medications that I take, half of the time, they make some of my symptoms go away but seem to bring on other symptoms… side effects, side effects, side effects." (Male, 51)	None

Theme 1: Intrapersonal and Interpersonal Factors

A difference in thinking style emerged between the groups, with CI patients more likely to describe themselves as "black or white" thinkers than flexible patients. CI patients were also more likely to describe themselves as reserved, introverted or shy while CF patients were more likely to describe themselves as outgoing or extroverted. Groups also differed in the extent to which they reported being comfortable discussing their IBS symptoms, with flexible patients more likely to describe being open with their IBS with friends, family and coworkers while the inflexible group was less likely to report doing so. Another difference emerged between groups relating to psychological comorbidity, with inflexible patients being more likely than flexible patients to report a diagnosed mental health disorder.

Clinical characteristics, such as patient's perceptions of their level of hypersensitivity, types of IBS symptoms, and the duration of their symptoms, did not differ between the groups. No differences were found between personality traits or level of stress. Patients in each group did not differ in their perceptions of a tendency toward analytical versus intuitive thinking, or whether they would describe themselves as having an "inflexible" or "flexible" thinking style.

Theme 2: Illness Understanding

While all patients identified some component of stress or anxiety related to their symptoms, some nuance existed between the groups. In the CF group, though one patient discussed an episode of food poisoning to be the initial precipitant to her GI symptoms, 4/5 patients in this group described generalized or symptom-specific anxiety to be the most significant driver of IBS symptoms. In the CI group, two patients expressed belief that their GI symptoms resulted from organic causes and skepticism regarding the IBS diagnosis; another two felt confident that their symptoms were a result of dietary factors or difficulty with digestion. Conversely, one CI patient attributed both the development and maintenance of his IBS to be related to largely relate to stress and mental health factors. Perhaps importantly, this patient had been engaged in longer-term GI-specific psychotherapy.

CI patients were more likely to report taking offense to, or to be confused by, terminology used by their healthcare providers, such as the term "hypersensitivity", or the IBS diagnosis itself (4/5 CI; 0/5 CF). CF patients were more likely to report agreement with their health care providers on the conceptualization of their diagnosis and treatment plan than CI patients.

Theme 3: Self-Management

Differences were found between groups on many aspects of self-management behaviors. CI patients were more likely to discuss researching their diagnosis and treatment options, including reading articles and watching videos online, than CF patients. CI patients were also more likely to engage in eating behaviors such as eating the same foods over and over to avoid symptoms, as well as avoiding eating with others. CI patients were also more likely to follow a strict diet to manage their IBS symptoms than CF patients. While patients in both groups reported engaging in some routine to help their bowels move, CI patients were more likely to have time-consuming, complicated routines, and were more likely to report interference with the rest of their day if they did not have a successful bowel movement. CI patients were also more likely to report spending significant time, energy and/or money on managing their symptoms than CF patients.

Groups did not differ on other self-management factors, such as whether they take medications or supplements and how they decide to take them (e.g. scheduled versus as-needed). There were no observed differences in disordered eating behaviors (e.g., patients in both groups reported current or past history of binge-eating and overly restrictive eating) or whether they had tried structured diets (e.g. low FODMAP) or self-directed dieting. Groups also did not differ in their perceived use of coping strategies to deal with symptoms (e.g. relaxation versus more active problem solving).

Theme 4: Healthcare Engagement

Some differences existed in the way groups engaged with their healthcare. CF patients had seen fewer providers for their IBS, ranging from 2-10 (mean= 5), while inflexible patients ranged from 5-10 (mean = 8.6). CI patients were more likely to describe increased use of conventional medicine treatments and investigative work-ups compared to CF patients, particularly after

receiving the IBS diagnosis. CI patients were also more likely to have tried alternative medicine (e.g. holistic medicine, food intolerance blood tests, acupuncture, naturopaths, chiropractic) with all five CI patients endorsing use of alternative medicine and only one CF patient. It is unclear whether CI patients were initially more open to alternative medicine approaches, or whether they pursued this option after conventional treatments were unsuccessful.

Surprisingly, no differences were found between groups in the way they described their interactions with their healthcare providers, with some in each group describing both positive and negative interactions.

Theme 5: Outcomes

Patients were asked to talk about treatments they found to be most effective. CF patients suggested behavioral strategies (e.g. diaphragmatic breathing) and medications to be helpful. Conversely, CI patients described trying medications or supplements, but these were described as ineffective or resulting in significant side effects. CI patients were also more likely than CF patients to describe employment impacts as a result of their symptoms, with 3/5 unable to work full-time, compared to all CF patients working or attending school full-time. CI patients also reported greater impacts to quality of life and decreased social support compared to CF patients.

STUDY 3

Demographic Information

One hundred and forty- six participants consented to participate in this study. Of these, only 38 participants (26%) were eligible for participation based on their responses to screening items, with the majority excluded due to not meeting Rome IV criteria for IBS or for having comorbid

IBD. Demographic characteristics are listed in Table 5. The sample was primarily female, Caucasian, non-Hispanic, and highly educated.

Table 5: Demographic Characteristics of Study Sample

	N=38
Age in Years (Mean + SD)	41.8 +11.74
Gender	
Female	92.1% (35)
Male	7.9% (3)
Race	
White	89.5% (34)
Asian	7.9% (3)
Other	2.6% (1)
Ethnicity	
Non-Hispanic	97.4% (37)
Hispanic	2.6% (1)
Marital Status	
Married	60% (23)
Never Married	31.6 (12)
Divorced	5.3% (2)
Living with Partner in Committed Relationship	2.6% (1)
Education	
Postgraduate Degree	60.5% (23)
College Degree	21.1% (8)
Some College	7.9% (3)
Secondary/High School	10.5% (4)
Employment Status	
Full Time	57.9% (22)
Part Time	10.5% (4)
Unemployed	2.6% (1)
Student	13.2% (5)
Homemaker	5.3% (2)
On Disability	10.5% (4)
Family Household Income	
Greater than 200,000	18.4% (7)
100,001 to 200,000	21.1% (8)
50,001 to 100,000	31.6% (12)
20,001 to 50,000	23.7% (9)
Less than 20,000	5.3% (2)

Clinical Characteristics

Clinical characteristics are listed in Table 6. The majority of the sample endorsed a diagnosis of IBS by a physician, while three did not. Most participants had a diagnosis of IBS for over nine years. Half of the sample endorsed abdominal pain "most days" in the last three months. Forty seven percent of the sample endorsed diarrhea as their usual stool pattern while 45% endorsed both diarrhea and constipation. Only 10.5% of the sample reported that constipation alone. The average score on the IBS-SSS was 312.5 + 89.1, which falls in the severe range based on the measure's cut-offs (Mild: 75-175, Moderate: 175-300, Severe: >300) (Francis et al., 1997) The majority of the sample was aware of the field of clinical psychogastroenterology prior to completing the study. Forty- five percent of the sample endorsed a mental health diagnosis, with anxiety being the most common.

Table 6: Clinical Characteristics of Study Sample

	N = 38
IBS Symptom Severity (Mean + SD)	312.5 + 89.1
Frequency of abdominal pain in last 3 months	
Once a week	34.2% (13)
Most days	50% (19)
Every day	5.3% (2)
Multiple times per day or all the time	10.5% (4)
Stool consistency in last 3 months	
Usually constipation	10.5% (4)
Usually diarrhea	47.4% (18)
Both diarrhea and constipation	39.5% (15)
I never or rarely had abnormal bowel movements	2.6% (1)
Prior awareness of Psychogastroenterology	
Yes	68.4% (26)
No	31.6% (12)

Have you been diagnosed with IBS by a physician?	
Yes	92.1% (35)
No	7.9% (3)
Length of Diagnosis	
Less than one year	2.6% (1)
1-3 years	21.1% (8)
3-5 years	2.6% (1)
5-7 years	10.5% (4)
7-9 years	13.2% (5)
Greater than 9 years	42.1% (16)
No diagnosis	7.9% (3)
Mental Health Diagnosis	
Yes*	39.5% (15)
Depression	18.4% (7)
Anxiety	29% (11)
Post Traumatic Stress Disorder	2.6% (1)
Bipolar Disorder	2.6% (1)
No	60.5% (23)

Tertiles of CI-IBS

Participants were divided into three scoring ranges on the CI-IBS to estimate prevalence of inflexibility, located in Table 7. Twenty-one percent of the sample fell in the highest range of inflexibility, 68.4% fell in a medium range, and 10.5% fell in the lowest range.

Table 7: Tertiles of CI-IBS

Score Range	**Percentage**
High Inflexibility (100-140)	21.1%
Medium Inflexibility (60-99)	68.4%
Low Inflexibility (20-59)	10.5%

Correlations between Flexibility Variables

Correlations between flexibility variables are listed in Table 8. The CI-IBS was significantly correlated with the AAQ-II ($r=.797$, $p<.01$), suggesting multicollinearity between these

measures. The CI-IBS was also significantly correlated with the CFI (r=-.317, p<.05) and the Control subscale of the CFI (r=-.327, p=<.05). The AAQ-II was also significantly correlated with the CFI (r=-.427,

p<.01) and the Control subscale of the CFI (r=-.550, p<.01).

Table 8: Correlation Coefficients between Flexibility Variables

	1	2	3	4	5
1. CI-IBS	--				
2. AAQ-II	**.797****	--			
3. CFI	**-.317***	**-.427****	--		
4. CFI-Alternatives	-.243	-.212	**.895****	--	
5. CFI- Control	**-.327***	**-.550****	**.903****	**.617****	--

*Significant at *p*<.05 level.
**Significant at *p*<.01 level.

Correlations between Flexibility and Outcome Variables

Correlations between flexibility and outcome variables are listed in Table 9. The CI-IBS was significantly correlated with symptom severity (r= .672, p<.01), mental health QoL (r= .590, p<.01), anxiety (r=.472, p<.05), depression (r= .320, p<.05), readiness for psychotherapy (r=.445, p<.01), and intolerance of uncertainty (r=.476, p<.01). The AAQ-II was significantly correlated with symptom severity (r=.578, p<.01), mental health QoL (r=.658, p<.01), depression (r=.693, p<.01), anxiety (r=.644, p<.01), readiness for psychotherapy (r=.600, p<.01), and intolerance of uncertainty (r=.653, p<.01). The CFI was significantly correlated with Mental Health QoL (r=-.453, p<.01), depression (r=.580, p<.01), and anxiety (r=-.582, p<.01). It was

also highly correlated with intolerance of uncertainty (r=-.787, p<.01), suggesting multicollinearity between these measures. There were no significant correlations between flexibility variables and age, education, income, length of diagnosis or physical health QoL.

Table 9: Correlation Coefficients between Predictors and Outcomes

	Symptom Severity	Mental Health QoL	Depression	Anxiety	Readiness for Psychotherapy	Intolerance of Uncertainty
CI-IBS	**.672****	**.590****	**.320***	**.472***	**.445****	**.476****
AAQ-II	**.578****	**.693****	**.658****	**.644***	**.600****	**.653****
CFI	-.157	**-.453****	**580****	**-.582****	.246	**-.787****
CFI-Alternatives	-.059,	**-.382*,**	**-.384***	**-.419****	-.131	**-.638****
CFI-Control	-.221,	**-.432****	**.654****	**-.625****	-.306	**-.776****

*Significant at *p*<.05 level.
**Significant at *p*<.01 level.

Regression Analyses

Regression statistics are listed in Table 10. The AAQ-II and IUS were not included in regression analyses due to multicollinearity with the CI-IBS and the CFI, respectively.

A multiple linear regression was calculated to predict readiness for psychotherapy from symptom severity, depression, anxiety and the CI-IBS. A significant regression equation was found, with anxiety predicting 25% of the variance in readiness for psychotherapy.

A multiple linear regression was calculated to predict mental health QoL based on symptom severity, the CI-IBS, the CFI, and the Control subscale of the CFI. Two significant regression equations were found. CI-IBS score was the largest predictor of mental health QoL, explaining 32.9% of the variance. In the second, CI-IBS and the CFI together predicted 39.3% of the variance.

A multiple linear regression was calculated to predict symptom severity from mental health QoL, anxiety, readiness for psychotherapy, and the CI-IBS. A significant regression equation was found. CI-IBS score was the largest predictor of symptom severity, contributing to 43.7% of the variance.

A multiple linear regression was calculated to predict CI-IBS score based on the CFI, the Control subscale of the CFI, symptom severity, anxiety, mental health QoL, and readiness for psychotherapy. Two significant regression equations were found. Symptom severity was the largest predictor of CI-IBS score, explaining 43.7% of the variance. In the second, symptom severity and mental health QoL together predicted 53.5% of the variance.

Table 10: Regression Analyses

1. Readiness for psychotherapy with symptom severity, depression, anxiety, and the CI-IBS						
Model	**Variable**	**Adj. R^2**	***b***	**SE *b***	**β**	***p***
1		.248				
	Constant		28.632	5.276		.000
	Anxiety		.809	.223	.518	.001
2. Mental health QoL with symptom severity, the CI-IBS, the CFI, and the Control subscale of the CFI.						
Model	**Variable**	**Adj. R^2**	***b***	**SE *b***	**β**	***p***

1		.329				
	Constant		23.831	4.529		.000
	CI-IBS		.229	.052	.590	.000
2		.393				
	Constant		40.766	8.854		.000
	CI-IBS		.192	.052	.496	.001
	CFI		-.127	.058	-.296	.035

3. Symptom severity with CI-IBS, mental health QoL, anxiety, and readiness for psychotherapy

Model						
1		.437				
	Constant		3.344	57.783		.954
	CI-IBS		3.630	.666	.672	.000

4. CI-IBS with the CFI, the Control subscale of the CFI, symptom severity, anxiety, mental health QoL, readiness for psychotherapy

Model						
1		.437				
	Constant		46.267	7.417		.000
	Symptom Severity		.124	.023	.672	.000
2		.535				
	Constant		14.681	12.697		.255
	Symptom Severity		.095	.023	.512	.000
	Mental Health QoL		.943	.321	.366	.006

Discussion

We sought to evaluate cognitive flexibility in patients with IBS. To our knowledge, this is the first study to evaluate this construct through a mixed-methods approach.

In the first study, we interviewed clinicians specializing in IBS to evaluate their understanding of the term “cognitive (in)flexibility” and to understand their experiences with

patients whom they would characterize as CI. Qualitative analysis of interview data provided a consensus of characteristics of CI patients with IBS that was marked by rigidity in thinking and behaviors, increased mental health comorbidities, and poorer response to treatment, when compared to CF patients. Our clinician samples' descriptions of CI patients parallel statements made by clinicians in other studies when describing subsets of IBS patients. In one study, a general practice physician described a "minority" of IBS patients as being more difficult to manage, referring to them as "somatizers" and "heartsink" patients (Harkness et al., 2013). In another, gastroenterologists and general practice physicians dichotomized IBS patients into "good" and "bad" categories (Dixon-Woods & Critchley, 2000). While "good" patients were described as patients welcoming the IBS diagnosis, "bad" patients were described as high healthcare utilizers that were less likely to accept the IBS diagnosis or psychological explanations for their symptoms, and those who failed to respond to treatment. While some physicians in their study described their negative perceptions of certain IBS patients, the authors noted that many others "were reluctant to accept a negative stereotype of patients, and felt that IBS was inappropriately understood as neurotic in origin" (Dixon-Woods & Critchley, 2000). This was a similar phenomenon in our study, where several clinicians in our sample were candid in sharing the emotional difficulty of treating CI patients, while several expressed reluctance to express their thoughts out of concern that their statements could perpetuate IBS stigma or spread misinformation. In fact, following the formal interview questions, all clinicians in our sample expressed interest in increasing their understanding of cognitive (in)flexibility in order to improve treatment outcomes for their CI patients.

In the second study, we interviewed CI and CF patients about how they think about, cope with, and manage their IBS, as well as how IBS impacts their lives. While all patients identified a contribution of stress or anxiety with their symptoms, CF patients were more likely to describe generalized or symptom-specific anxiety as the biggest driver of their IBS symptoms, while CI patients were more likely to point to organic and dietary causes. CI patients also had a greater symptom severity than CF patients. This is consistent with a 2009 study, which found that IBS patients who reported primarily somatic causes had greater symptom severity than those reporting intrapsychic causes (Riedl et al.). Authors of the study also found that patients who endorsed intrapsychic causes had decreased mental health quality of life compared to those reporting somatic causes, which contrasted with our sample, where there were higher diagnosed mental health disorders in the CI sample.

In Study 3, we hypothesized that the CI-IBS would moderately and negatively correlate with the CFI and moderately and positively correlate with the AAQ-II. We also hypothesized that there would be a negative relationship between flexibility (cognitive and psychological) and readiness for therapy and intolerance of uncertainty, and a positive relationship between cognitive and psychological flexibility and outcomes (symptom severity, physical and mental health QoL, anxiety and depression). Consistent with our hypothesis, the CI-IBS (higher scores indicate greater inflexibility) negatively correlated with the CFI (higher scored indicate greater flexibility. Its relationship with the AAQ-II was larger and more highly significant, but some of this association is likely due to the GI-specific nature of both the AAQ-II adaptation and the CI-IBS. Nonetheless, the modest relationship between the CFI, being a general measure of flexibility, with the AAQ-II and CI-IBS, being GI-specific flexibility measures, provides support

for the theory that CI patients may be inflexible in relation to their thinking and coping with GI symptoms, but not necessarily in other domains.

Contrary to our hypothesis, participants whose scores indicated lower flexibility on the CI-IBS and AAQ-II demonstrated significantly increased readiness for psychotherapy. In order to clarify this finding, we ran analyses on the subscales of the RPI. We found that lower flexibility was positively associated with the Distress subscale and negatively associated with the Disinterest subscale, and no significant relationships were present with the Openness and Perseverance subscales. This suggests that less flexible patients are motivated for GI-focused psychotherapy due to their high levels of distress and because they express interest in GI-focused psychotherapy, but does not indicate that they are ready to talk about their problems or to work hard in a GI-focused therapy. Further, this might point to a tendency to try interventions, like medications and alterative treatments, but they may not necessarily persist.

So what, in fact, does the CI-IBS measure? Regression analyses suggest that CI-IBS score is largely explained by symptom severity. This is consistent with findings from Study 2, where the CI group had a higher symptom severity than the CF group. In Study 1, 3 of 8 clinicians suggested that higher symptom severity was a characteristic of CI patients, when asked to provide examples of clinical characteristics of these patients. Mental health QoL was another large contributor to CI-IBS score, which is also with our clinician sample, since all eight clinicians reported that mental health comorbidity was a characteristic of CI patients.

Given its large relationship with the AAQ-II, it seems possible that that CI-IBS is a better measure of psychological flexibility than cognitive flexibility. In fact, some research suggests that self-report measures are only able to capture psychological flexibility. In a review of

cognitive and psychological flexibility within the traumatic brain injury literature (Whiting, Deane, Simpson, McLeod, & Ciarrochi, 2017) authors note that since cognitive flexibility has traditionally been assessed with task-based measures, it is unclear whether self-report measures developed to measure cognitive flexibility (such as the CFI) are actually doing so, or whether they are assessing a construct more similar to psychological flexibility. This would seem consistent with the fact that cognitive inflexibility has identified neural mechanisms while psychological flexibility does not. The present study is not well suited for making direct comparisons, however, since the CFI was not adapted for GI.

Future studies should include both task-based, neuropsychological measures as well as self-report measures of cognitive and psychological flexibility to evaluate this further. This would help inform future treatments for IBS patients, such as ACT therapies to address psychological flexibility or cognitive remediation therapy to address cognitive flexibility.

It is likely that subsets of IBS patients have deficits in either or both cognitive and psychological flexibility. Though studies have been limited by small sample sizes and findings have been inconsistent, some altered cognitive function has been identified in IBS. For example, Kennedy et al. found a subtle decrease in visuospatial memory compared to controls with no differences in cognitive flexibility (2014). Rey et al. found decreased experiential intelligence in IBS compared to controls (2009) and Attree et al. found decreased Verbal IQ in IBS (2003). Other studies of cognitive deficits in IBS had negative findings (Berrill et al., 2013; Dancey, Attree, Stuart, Wilson, & Sonnet, 2009) If, in fact, cognitive differences do exist in IBS, it is unclear whether they are the cause or a consequence of the syndrome.

Dr. Nuno Ferreira spearheaded investigation into psychological flexibility in IBS in his doctoral dissertation and has suggested that ACT may be an approach preferable to CBT "for cases in which improvements either plateaued or were not obtained via the normal symptom focused approach" (unpublished). If *psychological* flexibility is the construct that best describes the deficits seen clinically in the present study, ACT may be a treatment option to more effectively treat these patients.

One passage from Ferreira et al., (2011) sounds remarkably familiar to descriptions of CI patients in the present study:

"A proportion of IBS patients can be functionally characterized by the use of behaviors that seek to control, eliminate or alter the physical, emotional and cognitive experiences associated with IBS both in the presence or absence of symptoms. These behaviors seem to be motivated by an excessive fusion with a self-conceptualization of being an IBS patient, fusion with unhelpful illness specific beliefs or cognitions and by a dominance of feared future consequences or comparison with an idealized past. IBS patients also tend to choose to engage in these avoidant behaviors that provide short-term relief from their experiences over engaging in behaviors that are values-consistent and that might lead to better life satisfaction on the long-term."

Preliminary studies have shown success when implementing ACT with a broad IBS patient population (N. B. Ferreira et al., 2013; Nuno B. Ferreira, Gillanders, Morris, & Eugenicos, 2018). To our knowledge, researchers have not used ACT to target specific subsets of IBS patients, which is an important avenue for future research.

Our study has several limitations. First, Studies 1 and 2 were comprised of clinicians and patients at a tertiary GI clinic in an urban setting, and may not be representative of all IBS clinicians and patients. Analyses for Study 3 were significantly underpowered due to small sample size, and as such, findings should be interpreted with caution. In addition, findings from

the online sample may not be generalizable to all patients given the larger-than-expected proportion of white, female participants.

There are many pathways for continued research in order to build on the findings of this study. As previously stated, future research should assess IBS patients' performance on both neuropsychological measures and self-report measures in order to better understand the relationship between psychological and cognitive flexibility. Large-scale CBT intervention studies in IBS should have all patients complete flexibility measures to clarify CBT non-responders are more likely to be inflexible compared to responders, as this would suggest that ACT could be a better treatment option for these patients. Regarding the current study, a larger sample size would help to increase confidence in its findings. Future research should determine whether the adapted AAQ-II is sufficient for measurement of psychological flexibility in IBS research, or whether there would be benefit in validating the CI-IBS.

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v.braun@auckland.ac.nz

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Appendices

1. AAQ-II Modified for IBS

Below you will find a list of statements. Please rate how true each statement is for you by using the scale below to fill in your choice.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

1. My gut symptoms make it difficult for me to live a life that I would value
2. I'm afraid of my gut symptoms
3. I worry about not being able to control my gut symptoms
4. My gut symptoms prevent me from having a fulfilling life
5. Gut symptoms cause problems in my life
6. It seems like most people are handling their lives better than I am
7. Gut symptoms get in the way of my success

2. CI-IBS

1	2	3	4	5	6	7
Never true	Very seldom true	Seldom true	Sometimes true	Frequently true	Almost always true	Always true

Using the scale provided, please rate how much you agree or disagree with the statements below.

1. I have had difficulty finding a treatment that is helpful for my gut symptoms.
2. I'm comfortable discussing my gut symptoms with others. ***R***
3. My day revolves around my bowel movements.
4. I tend to research in great detail any new treatments I learn about before adopting them.
5. Others would describe me as reserved, shy, or introverted.
6. My healthcare providers and I tend to agree on what I need to do to manage my gut symptoms. ***R***
7. I have undergone many types of tests (e.g. colonoscopy) for my gut symptoms.
8. I find it easy to see more than one side of an issue. ***R***
9. I've taken offense to the way healthcare providers have discussed my gut symptoms.
10. Stress and anxiety about my gut symptoms makes them worse. ***R***
11. I eat a lot of the same foods over and over to avoid gut symptoms.
12. I have had to see several healthcare providers for my gut symptoms before I found the right care.
13. I tend to experience side effects from gut-related medications or supplements.
14. I feel confident that my gut symptoms have been diagnosed correctly. ***R***
15. I follow a strict diet to help manage my gut symptoms.
16. I tend to have a "black or white" or "all or nothing" thinking style.
17. I have tried many different treatments for my gut symptoms.
18. I am uncomfortable eating with others.
19. I have tried alternative medicine (e.g. acupuncture, chiropractic) for my gut symptoms.
20. I spend a lot of time, energy, and/or money managing my gut symptoms.