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PII: S0005-7894(20)30125-8

DOI: https://doi.org/10.1016/j.beth.2020.09.002

Reference: BETH 1028

To appear in: *Behavior Therapy*

Received date: 24 April 2020

Accepted date: 4 September 2020

Please cite this article as: E.E. Reilly, T.R. Perry, T.A. Brown, et al., Intolerance of Uncertainty and Eating Disorder Symptoms over the Course of Intensive Treatment, *Behavior Therapy* (2020), https://doi.org/10.1016/j.beth.2020.09.002

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Acknowledgements: The authors would like to thank Tiffany Nakamura and Noriko Coburn for their significant contributions to participant recruitment and data collection for the current study.

Funding: The research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Abstract

There is a critical need to identify processes that may influence outcome in existing treatments for eating disorders (EDs). Intolerance of uncertainty (IU), which refers to excessive distress regarding uncertain situations, is a well-established feature of anxiety disorders. Emerging work suggests that IU decreases over the course of cognitive-behavioral treatments and may relate to better treatment outcomes. As some literature has suggested IU may functionally maintain ED symptoms, testing whether changes in IU over treatment relate to outcome may result in the identification of novel treatment targets. This study aimed to build upon past work documenting links between IU and ED symptoms by exploring changes in IU over treatment and links between early change in IU (1-month) and discharge symptoms. Participants (*N* = 274) receiving partial hospitalization treatment completed the Eating Pathology Symptoms Inventory and Intolerance of Uncertainty Scale at admission, 1-month post-admission, and discharge. Results suggested that IU significantly reduced from admission to discharge and that reductions in IU scores from admission to 1-month related to cognitive restraint, dietary restriction, and body image at discharge. However, this pattern did not hold for exercise, binge eating, or purging. Altogether, these results replicate past work supporting IU as a common feature across ED diagnoses and provide initial data suggesting that targeting IU early in treatment may enhance treatment outcomes.

Keywords: intolerance of uncertainty; eating disorders; treatment

Intolerance of Uncertainty and Eating Disorder Symptoms over the Course of Intensive Treatment

Eating disorders (EDs) are characterized by disturbances in eating, weight, and body image and are associated with psychiatric comorbidities, medical complications, and mortality (Arcelus et al., 2011; Hudson et al., 2007; Rome & Ammerman, 2003). Data suggests that only around half of individuals who receive existing evidence-based treatments experience remission of symptoms (Keel & Brown, 2010; Watson & Bulik, 2013), highlighting a critical need to improve treatment approaches. One approach that may aid in enhancing the effects of existing interventions is to identify factors that may influence outcome or represent mechanisms of change for a given treatment, as these data can be used to more effectively target symptoms and promote lasting change. Additionally, given that data suggests that early change (consistently operationalized as changes in the first 4 weeks) in psychotherapy provides a strong predictor of outcome (Doyle et al., 2010, Fairburn et al., 2004; Madden et al., 2015; Schibbye et al., 2014), identifying early change processes may offer a particularly salient method for identifying important targets. In the current study, we explored changes in intolerance of uncertainty (IU), a commonly observed clinical characteristic in anxiety disorders and EDs, as one potential predictor of treatment outcome.

A large body of research has documented a robust association and shared mechanisms among anxiety disorders, state anxiety, and EDs, which may offer a fruitful avenue for identification of candidate intervention targets. Previous research has demonstrated that eating disorders are strongly associated with trait anxiety and are highly comorbid with anxiety disorders, with patients most often indicating that their anxiety disorder preceded the onset of their eating disorder (Kaye et al., 2004; Pallister & Waller, 2008). Further, fluctuations in state anxiety throughout the day relate to binge eating, purging, and dietary restriction (Lavender et al., 2013). Emerging evidence supports shared genetic influences in EDs and anxiety (Fairweather- Schmidt & Wade, 2020; Jacobs et al., 2009). Anxiety and EDs also share key

diagnostic features; for instance, fear of weight gain is included in the DSM-5 as a diagnostic criterion for anorexia nervosa (American Psychiatric Association, 2013), and many ED behaviors (e.g., dietary restriction; purging) are hypothesized to serve an avoidance function in a manner similar to avoidance in anxiety disorders (Pallister & Waller, 2008). Finally, individuals with EDs and anxiety disorders also endorse similar personality traits and neurocognitive features, including elevations in perfectionism (e.g., Bardone-Cone et al., 2007), threat-based attentional biases (e.g., Aspen et al., 2013), and harm avoidance (e.g., Cassin & von Ranson, 2005). Altogether, given elevated co-occurrence (Kaye et al., 2004), shared diagnostic features (Pallister & Waller, 2008), and shared auxiliary clinical features in EDs and anxiety (e.g., perfectionism; Bardone-Cone et al., 2007), it is possible that there are shared maintenance processes that hold treatment relevance for both anxiety disorders and EDs.

IU has been widely studied across a range of psychiatric disorders (Mahoney & McEvoy, 2012), and initial data supports the relevance of IU to EDs (Kesby et al., 2017). Therefore, it may represent one useful construct for better understanding changes in ED symptoms over time. IU can be defined as a temperamental characteristic involving negative emotional, cognitive, and behavioral reactions to uncertainty (Buhr & Dugas, 2009). IU is most commonly implicated in generalized anxiety disorder and in obsessive compulsive disorder (Carleton et al., 2007; Holaway et al., 2006), as data suggests that elevated IU likely prompts engagement in symptoms (i.e., compulsions; worry) in an attempt to reduce uncertainty (Gentes & Ruscio, 2011). IU is also associated with a range of other anxiety and mood symptoms, such as social anxiety disorder, panic disorder, and depression (Boswell et al., 2013). Further, in addition to strong cross-sectional and functional links between IU and anxiety symptoms, emerging work suggests that this construct is relevant to treatment outcomes. Specifically, in individuals receiving cognitive behavioral treatment for anxiety or depression, IU scores reduced over treatment, and greater reductions in IU were associated with reductions in anxiety and mood symptoms (Boswell et al., 2013). Overall, this work suggests that IU may represent a prominent

clinical feature of anxiety disorders and a candidate process through which changes in therapy for anxiety occurs over time.

A rapidly growing body of research suggests that individuals with EDs have heightened IU, compared to individuals without EDs (Brown et al., 2017; Kesby et al., 2017), but this work has not included a focus on treatment or longitudinal change. Previous research has suggested that individuals with anorexia nervosa (AN) may have higher IU compared to individuals with bulimia nervosa (BN) and that IU is associated with drive for thinness and body dissatisfaction in AN (Frank et al., 2012). Regarding the link between IU and behavioral symptoms, two qualitative studies indicated that individuals with restrictive EDs reported using dietary restriction as a coping mechanism for dealing with uncertainty (Konstantellou et al., 2019; Sternheim et al., 2011), and one other study suggests that IU is related to increased engagement in ED-relevant and general safety behaviors (Waller & Marcoulides, 2013). Altogether, previous research has consistently supported a cross-sectional link between IU and ED symptoms, and patients with EDs report that they engage in dietary restriction in an attempt to reduce feelings of uncertainty. However, to date, no research has explored whether IU is relevant to ED treatment outcomes. If ED behaviors serve to reduce anxiety associated with feelings of uncertainty, it is likely that successful treatment may target an individual's ability to tolerate uncertainty and/or use other coping skills for managing uncertainty-related anxiety. If IU changes throughout treatment for EDs and is associated with outcome, this would point to IU as a candidate intervention target.

Therefore, the current study sought to examine the relationship between IU and ED symptoms over the course of intensive treatment for EDs. This study aimed to build upon previous research in IU and EDs by evaluating (1) changes in IU over the course of treatment and (2a) whether early changes in IU during treatment (i.e., first 4 weeks) predict ED self-reported symptom outcomes at discharge and (2b) changes in weight from admission to discharge. Drawing upon similar work in anxiety (Boswell et al., 2013), we hypothesized that IU would decrease over the course of treatment, and that early decreases in IU would predict less

ED symptoms at discharge. We also hypothesized that early changes in IU would predict more weight gain.

Methods

Participants

Participants (*N* = 274) were adults and adolescents enrolled in a partial hospitalization program for EDs housed in an academic medical center. The current project represents a secondary analysis from a larger project focused on assessing treatment outcomes at the partial hospital program (see Brown et al., 2018; Reilly, Rockwell, et al., 2020). The sample was predominantly female (*n* = 236; 86.1%) and primarily white (*n* = 208; 75.9%). The mean age of the sample was 21.36 (SD = 8.74; range = 11.92-64.06 years), and the average length of illness was 7.06 years (SD = 8.11; range = 0.23-42.06 years) consistent with prevailing conceptualizations of "severe and enduring" eating disorders (Broomfield et al., 2017). The mean length of stay in the program was 87.71 days (±50.73 days; range = 2-444 days). The most frequent diagnosis was AN, restricting type (*n* = 110; 40.1%). Other diagnoses represented included AN, binge/purge subtype (*n* = 39; 14.2%), bulimia nervosa (BN; *n* = 45; 16.5%), avoidant/restrictive food-intake disorder (*n* = 18; 6.6%), and other specified eating disorder (*n* = 66; 22.3%). Around 44.5% of the sample (*n* = 122) met criteria for at least one anxiety disorder. For a full listing of demographic characteristics and psychiatric diagnoses of the participants, see Table 1.

Measures

Diagnostic Clinical Interviews. Participants' clinical diagnoses, both ED-specific and general, were assessed within a week of admission using well-validated diagnostic clinical interviews. Due to the fact that a subset of the adult participants was participating in another research study that had a distinct interview protocol, the interview assessment tool varied somewhat across participants. Specifically, the majority of the adults (*n* = 112; 40.9% of total sample) were assessed using the Structured Clinical Interview for the DSM-5 (SCID-5; (First et

al., 2015); the remaining adults (*n* = 42; 15.3% of full sample) were assessed using the MINI Neuropsychiatric Interview 7.0 (MINI; Sheehan et al., 1997), due to participation in another research protocol that used the assessment. Finally, all adolescent participants (*n* = 120; 43.8%) were assessed using the Schedule for Affective Disorders and Schizophrenia for School-Age Children (KSADS; Kaufman et al., 1997). All interviews have good reliability and validity for assessing DSM-5 psychiatric disorders. In our sample, interviews were conducted by trained bachelor's level research assistants and doctoral-level trainees (*n* = 9). Interviewers were supervised by the 3rd and 4th authors, licensed psychologists with extensive assessment experience, and diagnoses were determined via consensus. Prior to conducting interviews, interviewers were required to complete an extensive training protocol and undergo several interviewing observations and feedback sessions by the psychologists. Interviewers were also required to attend one-hour of weekly group supervision during which time they were required to present case diagnoses, supporting information for consensus, and answer questions posed by the consensus group regarding consideration of differential diagnoses. Each research assistant also attended one-individual hour of weekly supervision during which interviews were reviewed and additional individual consultation was available as needed.

Intolerance of Uncertainty Scale—Short Form (IUS-12; Carleton et al., 2007). To measure IU, we used the IUS-12, a 12-item measurement of IU that has been well-validated by prior research (Carleton et al., 2007; Khawaja & Yu, 2010). Participants rate items, such as "When it's time to act, uncertainty paralyzes me," on a Likert-type scale ranging from 1 (*Not at all characteristic of me*) to 5 (*Entirely characteristic of me*). The scale is comprised of two subscales—prospective IU (i.e., fear or anxiety based on future events) and inhibitory anxiety (e.g., uncertainty inhibiting action). For our study, we used the total IUS-12 score as a composite measure of the construct. In our sample, internal consistency of the measure across timepoints was excellent (Cronbach's α = .93-.94).

Eating Pathology Symptoms Inventory (EPSI; Forbush et al., 2013). The EPSI is a 45-item questionnaire that gauges various eating disorder symptoms. The scale has eight subscales. We used the six subscales (Body Dissatisfaction, Binge Eating, Cognitive Restraint, Purging, Restricting, Excessive Exercise) to provide a broad assessment of eating disorder symptoms. Participants rate how frequently they experience specific symptoms, using a Likert-type scale ranging from 0 (*Never*) to 4 (*Very Often*). In our sample, internal consistency of the subscales was good, with Cronbach's α ranging from .79-.93 across timepoints.

Weight. In the current study, we used weight as an outcome variable in the subset of patients diagnosed with AN and avoidant-restrictive food intake disorder (ARFID). Weight was taken using an industrial scale by nursing staff at admission and discharge. Height was taken at both time points. We operationalized weight, controlling for height, using body mass index (BMI).

Treatment Center

With regard to the treatment provided, all participants first attended the partial hospitalization program for 10 hours a day, 6 days a week. Generally pending treatment progress, patients were able to decrease their time in treatment to 6 hours a day, 5 days a week, and then stepped down to 3-4 hours a day, 3-5 days a week prior to discharge. Throughout their time in treatment, participants attended group therapy sessions, had weekly therapy sessions with an individual therapist, had weekly or biweekly medical management appointments with a psychiatrist, received regular labs, and met weekly with a nutritionist. The treatment center primarily operates using full model dialectical behavior therapy (DBT; Linehan, 1993); DBT is an evidence-based treatment originally developed for chronic suicidality in the context of Borderline Personality Disorder (Linehan et al., 2006), and uses multi-component structure, including therapist consultation groups, skills groups, individual therapy, and skills coaching (Linehan, 2014; Linehan, 1993). DBT has since demonstrated efficacy across a range of presenting problems characterized by emotion dysregulation, including EDs (Ben-Porath et

al., 2020; Reilly, Orloff, et al., 2020). In addition to DBT, participants received several cognitive behavioral therapy-based groups, and adolescent participants also received Family-Based Treatment (Lock & Grange, 2015).

Procedures

Participants were approached with information about the study during their first week of treatment. After providing informed consent, participants completed self-report questionnaires within 15 days (*M* = 5.40 days after admission ± 3.17 days; range = 0-15) of admission to the clinic. Structured clinical interviews were conducted by Bachelor's-level research assistants who were supervised by two Ph.D.-level clinical psychologists with extensive background in diagnostic interviewing. Interviews were completed within two weeks of admission, and questions regarding diagnoses were discussed in a weekly consensus meeting. One-month questionnaires were completed 30 days following the patient's admission to the program (*M* = 33.90 days after admission ± 4.18 days; range = 20-46 days after admission). Discharge questionnaires were completed within 14 days of discharge from the clinic (*M* = 1.95 days before discharge ± 3.67 days; range = 14 days pre-discharge - 14 days post-discharge). With regard to the treatment provided, please see detailed descriptions of each program published elsewhere (Brown et al., 2018; Reilly, Rockwell, et al., 2020). All procedures were approved by the local institutional review board.

Statistical Analysis Plan

The current analyses represent planned, secondary analyses of a larger treatment outcomes dataset at the partial hospitalization program. Prior to conducting main analyses, all data were screened for, and conformed to, assumptions of each analysis. We used list-wise deletion to handle missing data.[1] To explore changes over treatment (Aim 1), we used a paired samples t-test. We also explored patterns in IU changes through exploring how many patients

[1] *Sensitivity analyses were run using multiple imputation to handle missing data in SPSS (n = 20 imputations). Pooled estimates from imputed data demonstrated the same pattern of results as the list-wise deletion approach.*

made reliable change, operationalized using the Reliable Change Index (RCI; Jacobson & Truax, 1991). To explore whether early changes in IU related to symptoms at discharge (Aim 2a), we conducted a regression analysis, entering discharge symptoms (EPSI subscales) as the dependent variable. For the purposes of this project (and the larger project from which these data were drawn), we operationalized early change as change made in the first 4 weeks following admission to treatment, consistent with past work on early therapeutic change in the ED literature (Doyle et al., 2010; Fairburn et al., 2004; Le Grange et al., 2012; Madden et al., 2015). We simultaneously entered baseline EPSI subscales, baseline IUS-12 scores, and 1-month IUS-12 scores into the model. We also controlled for length of illness in the model, due to previously documented, consistent associations between this variable and treatment outcomes (Vall & Wade, 2015). Due to significant variability in length of stay in the clinic and the likelihood that length of stay in treatment could contribute to variability in discharge symptom reports, we also controlled for length of stay. Finally, due to significant variability in age in the sample, we entered age as a covariate. We conducted a second model in the subset of individuals with "low weight" ED diagnoses (AN; ARFID) exploring whether early change in IU related to changes in weight.

Results

Descriptive Statistics

Descriptive statistics for study variables and bivariate correlations are presented in Table 2. Of note, levels of IU in the sample were similar to those reported in a study exploring IU in individuals with social anxiety disorder (*M*=36.84; *SD*=11.51; (Lock & Grange, 2015), generalized anxiety disorder (*M*=35.12; *SD*=11.66; Mahoney & McEvoy, 2012), panic disorder (*M*=31.97; *SD*=12.90; Mahoney & McEvoy, 2012), and OCD (*M*=27.63; *SD*=14.33; Mahoney & McEvoy, 2012). Bivariate correlations indicated significant small- to medium-sized cross-sectional associations between IU and subscales of the EPSI at baseline. Specifically, IU demonstrated the strongest (i.e., medium, *r*=.3, to large, *r*=.5) relationships with cognitive

symptoms (e.g., body dissatisfaction; cognitive restraint), and then secondarily with restriction, purging, and exercise (i.e., medium correlations, *r*=~.3). The exception to this pattern of results was the cross-sectional correlation between binge eating symptoms and IU, which demonstrated no association with one another (*r*=.07, *p*=.29).

In an exploratory manner, we tested diagnostic differences in both total IU scores as well as Prospective and Inhibitory IU using three ANOVAs. Results indicated significant group differences in IUS-12 Total Scores, $F(4, 266)=4.20$, $p=.003$, as well as IUS-12 Prospective Scores, $F(4, 267)=4.27$, $p=.002$, and IUS-12 Inhibitory Scores, $F(4, 266)=3.61$, $p=.007$. Mean scores for IUS-12 subscales across diagnoses are available in Table 3. Across subscales, trends in diagnosis were consistent, such that individuals with a diagnosis of OSFED endorsed the highest levels of IU, individuals with ARFID endorsing the lowest IU, and individuals with AN and BN endorsing similar levels of IU. Tukey's post-hoc tests indicated that the only consistent significant difference was between ARFID and OSFED and ARFID and AN-R.

Changes in IU Over Treatment & Reliable Change Index (RCI)

A paired-samples t-test indicated statistically significant, yet small, decreases in mean IU from admission (*M*=38.37; *SD*=11.31) to discharge (*M*=35.68; *SD*=11.91), $t(210)=4.16$, $p<.001$, $d=.29$. While the mean decrease in IU over treatment was around 2.68, the range in change across the sample was large, ranging from a reduction of 48.0 to an increase in 21.0 scale points. Accordingly, our calculations regarding RCI indicated that among participants who completed surveys at discharge (n = 211), around 24.6% (n = 52) of the sample reported clinically significant change.

Early Change in IU and Self-Reported Symptoms

Results from regression analyses exploring links between early changes in IU and EPSI subscales are represented in Table 4. Inspection of multicollinearity indicators suggested VIF and tolerance values were within accepted norms (i.e., VIF < 10; tolerance > .1; Berry & Feldman, 1985; Menard, 2002; Myers, 2000). Across models, baseline symptoms remained the

most robust predictor of discharge symptoms. In the models testing changes in body dissatisfaction, cognitive restraint, and dietary restriction, IU at 1-month into treatment accounted for significant variance in outcome. Because we entered in baseline levels of IU into each regression model, these significant effects suggest that changes in IU from baseline to 1-month account for significant variance in discharge outcome in these domains. On the other hand, models exploring changes in exercise, binge eating, and purging across treatment suggested no effect of early change in IU.[2]

Early Change in IU and Weight in Low-Weight Eating Disorders

In the subsample of patients who met criteria for "low weight" EDs (AN; ARFID), we explored associations between early change in IU and change in BMI over the course of treatment (see Table 5 for full results). The models indicated no relation between baseline or 1-month IU and discharge BMI.

Discussion

Consistent research has implicated IU as a commonly-observed characteristic of patients with EDs (Brown et al., 2017; Kesby et al., 2019), and recent work has tentatively suggested that ED symptoms may function as a method for coping with uncertainty (Kesby et al., 2019; Konstantellou et al., 2019; Sternheim & Harrison, 2018). However, to date, empirical work exploring whether IU changes over the course of treatment is limited. Building on existing work in anxiety disorders, the current study explored changes in IU over the course of intensive treatment in a mixed diagnostic sample of patients with EDs and associations between IU and outcome. Findings broadly indicated that patients endorsed decreases in IU over the course of treatment, albeit small in magnitude, and that early changes in IU (i.e., changes in IU over the first month of treatment) related to some symptoms at discharge. Overall, our results replicate past work suggesting that patients with EDs endorse elevated levels of IU and extend this work

[2] Of note, we re-ran models for binge eating and purging in the subsample of individuals for whom these symptoms are most prominent (i.e., AN-BP; BN). Patterns in results did not change.

by preliminarily suggesting that changes in IU may represent an important change process in treatment.

Preliminary analyses replicated past work suggesting elevated IU in ED samples. Mean levels of both inhibitory and prospective IU in our sample were elevated compared to a past study using the IUS-12 in an outpatient sample (Renjan et al., 2016), and were similar to past work in anxiety disorders (Khawaja & Yu, 2010; Mahoney & McEvoy, 2012). Cross-sectional correlations between IU and EPSI subscales indicated that IU demonstrated a strong association with body dissatisfaction (large effect size), and secondary associations with cognitive restraint, restriction, and purging (medium effect sizes). Our findings also replicated past work suggesting no correlation between IU and binge eating behaviors (Kesby et al., 2019; Renjan et al., 2016). Although these associations are cross-sectional, results are consistent with theoretical work suggesting that rigid rules, dietary restriction, purging, and exercise may serve a function of regulating distress associated with uncertainty (either weight/shape specific or more generally), in comparison with binge eating (Renjan et al., 2016). Hypotheses regarding the manner in which ED behaviors or cognitions relate to feelings of uncertainty must ultimately be tested using appropriate research designs (e.g., ecological momentary assessment); however, our descriptive findings reaffirm a significant relation between IU and specific symptoms of EDs and support that IU may be elevated in a similar manner to clinically significant anxiety disorders and OCD.

Across the sample, IU significantly decreased from admission to discharge. This observed decrease in symptoms is broadly consistent with past work in mood and anxiety disorders that suggests IU changes over the course of evidence-based, cognitive-behavioral treatments (Boswell et al., 2013). Of note, our findings were much smaller in magnitude (i.e., a small effect size) than the large effect size reported by Boswell and colleagues (2013), and the mean level of IU reported in our sample at treatment discharge remained elevated. The mean level of IU change in the sample was not clinically significant as operationalized by the RCI.

Instead, results indicated around a quarter of our sample (24.6%) reported reliable changes in IU from treatment to discharge; this percentage is lower than the proportion (48.3%) reported by Boswell and colleagues (2013). The discrepancy in effect sizes is likely secondary to the modality of treatment and level of care for each investigation; transdiagnostic, cognitive-behavioral treatments for mood and anxiety disorders may more explicitly incorporate techniques that target fears of uncertainty, whereas DBT does not include an explicit focus on this construct. Another possibility is that because our patients were enrolled in a higher level of care, there could presumably have been fewer natural challenges to uncertainty (i.e., high levels of structure in the program; predictable schedule and appointments) than would be expected in outpatient care. However, this possibility cannot be tested directly, and thus should be explored by future research. Future research should explore whether the introduction of IU-focused interventions to ED treatment, such as exposure exercises focused on eliciting and tolerating feelings of uncertainty (Robichaud, 2013) or IU-specific cognitive bias modification (Oglesby et al., 2017), results in a greater proportion of participants evidencing clinically-significant, reliable changes in IU.

Analyses exploring associations between early change in IU and discharge symptoms suggested that early change in IU related to changes in body dissatisfaction, cognitive restraint, and dietary restriction at discharge from treatment. On the other hand, there was no association between early change in IU and other ED behavior scales, including binge eating, purging, and exercise scales. Our findings suggest that changes in IU may relate to overall changes in cognitive symptoms of EDs, as well as dietary restriction. This pattern is consistent with prior work suggesting strong, specific links between IU and dietary restriction behaviors (Kesby et al., 2019), as well as associations between IU and cognitive symptoms of EDs (Renjan et al., 2016), and extends this work (which has been mostly cross-sectional) to suggest associations between changes in these variables over time. Again, as described previously, our lack of findings regarding a link between IU and binge eating is not unexpected, given that a number of studies

have failed to find an association among these constructs (Brown et al., 2017; Kesby et al., 2019). Alternatively, our findings regarding no association among changes in IU, purging, and exercise were somewhat surprising, in light of some empirical and theoretical work that has suggested that purging and exercise behaviors may function to increase certainty (e.g., related to future weight gain) or regulate negative affect secondary to more general uncertainty (Brown et al., 2017; Kesby et al., 2017; Konstantellou et al., 2019). While our findings broadly suggest that changes in IU do not relate to changes in these behaviors over the course of treatment, there are several potential explanations for this lack of significant results. Specifically, it could be the case that in higher levels of care, decreases in ED behavior are to be expected given the level of behavioral control and intensity of clinical attention; therefore, decreases in these behaviors over the course of general treatment are secondary to several processes (some of which are environmental in nature), whereas decreases in IU could be predictive of symptom change in other contexts where the client has more autonomy to engage in these behaviors, such as outpatient care. Alternatively, it could also be the case that IU as a cognitive construct, is simply most relevant to cognitive symptoms, including body dissatisfaction and cognitive restraint. Future research should attempt to replicate these findings, explore their applicability in differing levels of care, and perhaps employ real-time assessment methods to more directly test the links between state uncertainty, ED cognitions, and engagement in ED behaviors. Overall, our findings tentatively suggest that change in IU is related to changes in some ED symptoms over treatment, and support the possibility that efforts to more directly target this construct in treatment (e.g., Hildebrandt et al., 2012) could be helpful in improving outcomes.

There are several limitations of the study that are important to note, as well as several characteristics of our sample that are important to recognize when placing our findings into context. First, our patients were enrolled in a DBT-based partial hospitalization program. It is unclear the extent to which these findings regarding changes in IU and links between IU changes and treatment outcome will generalize to other levels of care or treatment modalities.

Second, while all patients enrolled in the program received similar programming in treatment, length of stay varied significantly, which may have influenced outcomes variables and affected our results. Third, our use of self-report, trait-based measurements represents a limitation of both our study and the existing literature; future research should explore the possibility of expanding measurements of IU to include behavioral tasks (several of which have been preliminary employed in ED samples with success, for review, see Brown et al., 2017) and real-time assessment to more aptly capture the proposed relation between uncertainty and symptoms. Fourth, due to the naturalistic design of our study, our lack of consistency in our diagnostic interview tools and lack of inter-rater reliability on interviewing represents a significant limitation. While we have attempted to enhance the validity and reliability of interviews by enacting a consistent interviewing protocol and determining diagnosis via consensus, future research should employ consistent use of validated measurements and have multiple raters code interviews to improve the confidence in future findings. Finally, as a part of their engagement in treatment, participants also received regular medication management appointments; while for the purposes of the current study we were not able to evaluate potential changes in IU linked to medication prescription, this may represent a important possibility to consider in future research.

In sum, increasing transdiagnostic research has implicated IU as an important contributor to symptom maintenance in anxiety and OCD, and recent work has extended this conceptualization to include ED behaviors. In the current study, we replicated past work suggesting heightened IU in a mixed-diagnostic sample, as well as significant, positive associations between this construct and symptoms. Our results provide initial support for the possibility that IU may represent an important treatment target that may aid in improving outcomes for patients that suffer from EDs; for this reason, it is critical that future research continue to explore the nature of this relation across other treatments for EDs.

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Table 1
Admission Demographics: Frequencies

Variable	*n* (%)	Variable	*n* (%)
Race		**Comorbid Disorders**	
White	208 (75.9%)	Mood Disorder	117 (42.7%)
Asian	19 (6.9%)	Anxiety Disorder	122 (44.5%)
Black	6 (2.2%)	Alcohol Use Disorder	36 (13.1%)
Native Hawaiian/Pacific Islander	2 (0.7%)	Substance Use Disorder	43 (15.7%)
Native American/Alaskan Native	1 (0.4%)	Psychotic Disorder	2 (0.7%)
Other	38 (13.9%)	**Psychotropic Medication**	
Ethnicity	-	Antidepressant	157 (57.3%)
Hispanic/Latinx	58 (21.2%)	Atypical Antipsychotic	60 (21.9%)
Eating Disorders	-	Mood Stabilizer	44 (16.1%)
AN-R	110 (40.1%)	Anxiolytic Medication	30 (10.9%)
AN-BP	39 (14.2%)	Substance Use Medication	6 (2.2%)
BN	45 (16.5%)	Sleep Medication	7 (2.6%)
ARFID	18 (6.6%)	ADHD Medication	12 (4.4%)
OSFED		Other Medication	19 (6.9%)
Atypical AN	38 (13.9%)	**Gender**	
Purging Disorder	14 (5.1%)	Male	30 (10.9%)
Subthreshold BN	3 (1.1%)	Female	236 (86.1%)
Other OSFED	5 (1.8%)	Gender Non-Conforming	8 (2.9%)
UFED	1 (0.3%)		
Missing Diagnosis	1 (0.3%)		

Note. AN-R = Anorexia nervosa, restricting subtype; AN-BP = Anorexia nervosa, binge/purge subtype; BN = Bulimia nervosa; ARFID = Avoidant/restrictive food intake disorder; OSFED = Other specified feeding or eating disorder; UFED = Unspecified feeding or eating disorder.

Table 2
Baseline Study Variables: Means & Correlations

Variable	Mean	SD	1.	2.	3.	4.	5.	6.
2. EPSI Binge Eating	8.15	8.05	.24**	-				
3. EPSI Cognitive Restraint	7.72	3.96	.60**	-.01	-			
4. EPSI Purging	3.68	4.91	.50**	.28**	.40**	-		
5. EPSI Restriction	14.57	6.22	.37**	-.18**	.37**	.27**	-	
6. EPSI Exercise	8.04	6.72	.41**	.01	.64**	.33**	.32**	-
7. IUS-12 Total	38.79	11.98	.48**	.07	.36**	.29**	.30**	.27**

Note. EPSI = Eating Pathology Symptoms Inventory; IUS-12 = Intolerance of Uncertainty Scale, Short Form

Table 3.
Diagnostic Differences in Mean Levels of IU

Variable	Mean	SD
IU Total		
AN-R	38.90[a]	11.31
AN-BP	38.56	12.46
BN	37.70	12.72
ARFID	29.61[b]	8.66
OSFED	42.30[a,c]	12.04
IU Prospective		
AN-R	23.03[a]	6.72
AN-BP	23.03	7.46
BN	22.86	7.34
ARFID	17.56[b]	5.22
OSFED	25.20[a,c]	7.11

IU Inhibitory		
AN-R	15.87[a]	5.05
AN-BP	15.53	5.28
BN	14.84	5.79
ARFID	12.06[b]	3.81
OSFED	17.10[a,c]	5.39

Note. Superscripts of different values indicate significant differences at $p < .05$. AN-R = Anorexia nervosa, restricting subtype; AN-BP = Anorexia nervosa, binge/purge subtype; BN = Bulimia nervosa; ARFID = Avoidant/restrictive food intake disorder; OSFED = Other specified feeding or eating disorder; IU = Intolerance of Uncertainty.

Table 4.
Regression analysis exploring associations between self-reported eating disordered symptoms and early changes in IU

DV: Discharge EPSI Body Dissatisfaction	Adj. R^2	B	*se*	*t*	*p*
Full Model: $F(1,169)=25.06$, $p<.001$	.45				
Constant		-0.02	2.51	-0.01	.993
Length of Stay		0.01	0.01	0.52	.605
Length of Illness		-0.10	0.11	-0.89	.377
Age at Admission		0.10	0.10	0.89	.374

EPSI Body Dissatisfaction: Intake		**0.73**	**0.07**	**10.53**	**<.001**
IUS-12: Intake		-0.10	0.06	-1.38	.170
IUS-12: 1-Month		**0.12**	**0.06**	**2.14**	**.034**
DV: Discharge EPSI Binge Eating	Adj. R^2	B	*se*	*t*	*P*
Full Model: *F*(1,168)=10.16, *p*<.001	.24				
Constant		0.04	1.69	0.02	.982
Length of Stay		-0.00	0.01	-0.52	.603
Length of Illness		-0.10	0.07	-1.33	.185
Age at Admission		**0.17**	**0.07**	**2.46**	**.015**
EPSI Binge Eating: Intake		**0.28**	**0.04**	**6.38**	**<.001**
IUS-12: Intake		-0.03	0.04	-0.63	.531
IUS-12: 1-Month		0.03	0.04	0.78	.439
DV: Discharge EPSI Cognitive Restraint	Adj. R^2	B	*se*	*t*	*P*
Full Model: *F*(1,169)=24.17, *p*<.001	.44				
Constant		-1.03	1.08	-0.95	.343
Length of Stay		0.01	0.01	1.16	.246
Length of Illness		0.03	0.05	0.64	.526
Age at Admission		-0.04	0.05	-0.08	.938
EPSI Cognitive Restraint: Intake		**0.57**	**0.06**	**10.10**	**<.001**
IUS-12: Intake		-0.04	0.03	-1.31	.191
IUS-12: 1-Month		**0.06**	**0.02**	**2.44**	**.016**
DV: Discharge EPSI Purging	Adj. R^2	B	*se*	*t*	*p*
Full Model: *F*(1,169)=14.73, *p*<.001	.32				
Constant		-0.52	1.06	-0.49	.624
Length of Stay		-0.00	0.01	-0.57	.569
Length of Illness		-0.02	0.05	-0.46	.645
Age at Admission		0.02	0.05	0.44	.660
EPSI Purging: Intake		**0.39**	**0.05**	**8.36**	**<.001**
IUS-12: Intake		-0.01	0.03	-0.44	.664
IUS-12: 1-Month		0.03	0.02	1.10	.274
DV: Discharge EPSI Restriction	Adj. R^2	B	*se*	*t*	*p*
Full Model: *F*(1,168)=17.99, *p*<.001	.37				
Constant		-0.10	1.96	-0.05	.959
Length of Stay		**-0.02**	**0.01**	**-2.56**	**.011**
Length of Illness		**0.22**	**0.08**	**2.68**	**.008**
Age at Admission		-0.07	0.08	-0.87	.388
EPSI Restriction: Intake		**0.49**	**0.06**	**8.13**	**<.001**
IUS-12: Intake		**-0.01**	**0.05**	**-2.12**	**.035**
IUS-12: 1-Month		**0.16**	**0.04**	**3.67**	**<.001**
DV: Discharge EPSI Exercise	Adj. R^2	B	*se*	*t*	*p*
Full Model: *F*(1,167)=10.80, *p*<.001	.25				
Constant		0.99	1.61	0.62	.537
Length of Stay		-0.01	0.01	-1.09	.276
Length of Illness		0.04	0.07	0.56	.575
Age at Admission		0.02	0.07	0.23	.821
EPSI Exercise: Intake		**0.35**	**0.05**	**7.17**	**<.001**
IUS-12: Intake		-0.02	0.04	-0.44	.664
IUS-12: 1-Month		0.03	0.04	0.78	.436

Note. B = unstandardized beta; *se* = standard error; EPSI = Eating Pathology Symptoms Inventory; IUS-12 = Intolerance of Uncertainty Scale, Short Form

Table 5.
Regression analysis exploring associations between discharge body weight and early change in IUS

DV: BMI	Adj. R^2	B	*se*	*t*	*p*
Full Model: *F*(1,167)=10.80, *p*<.001	.25				
Constant		**9.19**	**1.33**	**6.89**	**<.001**
Length of Stay		**0.01**	**0.00**	**4.27**	**<.001**
Length of Illness		-0.04	0.03	-1.18	.241
Age at Admission		-0.01	0.03	-0.21	.835
BMI at Intake		**0.57**	**0.07**	**8.64**	**<.001**
IUS-12: Intake		0.01	0.02	0.36	.719
IUS-12: 1-Month		-0.00	0.02	-0.18	.857

Note. B = unstandardized beta; *se* = standard error; IUS-12 = Intolerance of Uncertainty Scale, Short Form

- Intolerance of uncertainty (IU) appears to be elevated in eating disorders (EDs).
- Participants with EDs completed measures of IU and ED symptoms throughout treatment.
- IU significantly decreased from intake to discharge.
- Early IU change related to lower discharge dietary restriction, restraint, and body image.
- IU change did not relate to exercise, binge eating, or purging at discharge.