A multi-method analysis of incompleteness in behavioral treatment of contamination-based OCD

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ABSTRACT

Contamination fear and washing compulsions are among the most common symptoms of obsessive compulsive disorder (OCD). Though these symptoms have traditionally been viewed as being driven by a desire to avoid harm, recent research has highlighted the importance of feelings of incompleteness (INC) or not-just right experiences (NJREs) in this symptom dimension. However, no study to date has examined the extent to which INC/NJREs may be associated with treatment response for contamination symptoms. The current study used a multi-method approach to examine the role of INC/NJREs in treatment of contamination symptoms. Participants ($n = 88$) with elevated contamination symptoms, half of whom met for an OCD diagnosis, engaged in three sessions of exposure and response prevention (ERP) targeting contamination fears, and completed self-report and in vivo measures of INC/NJRES and contamination symptoms. ERP was associated with significant reductions in INC/NJREs. Further, changes in INC were associated with changes in contamination symptoms, independent of changes in harm avoidance. Greater discomfort in response to an in vivo NJRE task at pre-treatment predicted poor treatment response, though a self-report measure of INC did not predict response. These findings provide novel evidence for the importance of INC/NJREs in contamination-based OCD and its treatment.

1. Introduction

Obsessive compulsive disorder (OCD) is characterized by repetitive and intrusive thoughts that cause distress, as well as behavioral responses aimed to reduce distress (American Psychiatric Association, 2013). OCD is estimated to impact approximately 2–3% of the population and is associated with considerable distress and impairment (Ruscio, Stein, Chiu, & Kessler, 2008). OCD is a notably heterogeneous disorder, with symptoms spanning a myriad of symptom dimensions, including contamination fears, concerns about harm, blasphemous thoughts, and need for symmetry (Abramowitz et al., 2010). Notably, contamination fears are the most common symptoms and are typically characterized by fears of germs, dirt, and other contaminants with accompanying cleaning and washing compulsions (Rachman, 2004).

While contamination fears have traditionally been viewed as being driven by a need to avoid harm (i.e., harm avoidance: HA; Rachman, 2004), recent research has highlighted the importance of internal stimuli, such as feelings of incompleteness (INC) or not-just right experiences (NJREs) in the maintenance of OCD symptoms (Coles, Frost, Heimberg, & Rhéaume, 2003; Coles & Ravid, 2016; Ecker & Gönner, 2008; Pietrefesa & Coles, 2008; Summerfeldt, 2004). INC/NJREs are characterized by an internal sense of discomfort that is typically not

associated with a feared outcome other than the fear of experiencing the sensation itself (Coles et al., 2003). INC and NJREs are somewhat distinct, such that INC is conceptualized as an underlying motivating factor for compulsions, while NJREs are conceptualized as the specific sensations triggered by the external experience (Belloch et al., 2016; Cougle & Lee, 2014). It has also been suggested that INC may be a trait-based factor that underlies one's propensity toward experiencing NJREs (Belloch et al., 2016). However, importantly, they are also closely tied, as they are conceptualized as being different aspects of the same construct, such that they both reflect internal sensory-perceptual disturbances not tied to a specific feared outcome (Belloch et al., 2016).

INC/NJREs are most commonly reported in individuals who experience OC symptoms related to symmetry, ordering, and arranging (Coles et al., 2003; Ecker & Gönner, 2008; Pietrefesa & Coles, 2009; Summers, Fitch, & Cougle, 2014), though they have importantly been linked to all OC symptom dimensions (Rasmussen & Eisen, 1992). Notably, recent research suggests INC/NJREs are strongly associated with contamination fears and washing compulsions (Cougle, Fitch, Jacobson, & Lee, 2013; Cougle, Goetz, Fitch, & Hawkins, 2011; Summers et al., 2014; Wahl, Salkovskis, & Cotter, 2008), but less so with blasphemous thoughts (Ferrão et al., 2012; Summers et al., 2014). It has been posited that INC/NJREs may serve a regulatory function for

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washing compulsions in that they provide a point of reference by which to determine when to complete the compulsion (e.g., when it "feels right"; Cougle et al., 2011; Wahl et al., 2008).

Individuals who have difficulty identifying distinct feared outcomes, such as those characteristic of INC/NJREs, exhibit poorer treatment response in exposure and response prevention (ERP; Foa, Abramowitz, Franklin, & Kozak, 1999), which is the standard treatment for OCD (Foa, Yadin, & Lichner, 2012). Indeed, individuals who endorse INC/NJREs are more likely to refuse or drop out of treatment (Summerfeldt, 2004). In the only study to date to systematically examine internal sensations in treatment, Coles and Ravid (2016) found that individuals with OCD reported less severe NJREs and less associated distress following CBT for OCD. Though this study provided an important extension of the literature, it importantly did not examine the extent to which INC/NJREs may impact overall treatment response for those with contamination OCD.

Taken together, traditional cognitive models of OCD have conceptualized symptoms as being driven by a need to avoid harm or a feared outcome, though research suggests internal sensations surrounding INC/NJREs may be an important, yet sometimes overlooked, motivational factor in the maintenance and treatment of symptoms. INC/NJREs are strongly associated with contamination symptoms, though no research to date has examined these relationships in the context of treatment. Therefore, the current study used a multi-method approach to examine the role of INC/NJREs in contamination symptoms in individuals undergoing ERP for contamination-based OCD. Of note, we chose to specifically examine contamination symptoms for two primary reasons. First, contamination symptoms are the most common OCD symptoms (Rachman, 2004; Van Oppen, Hoekstra, & Emmelkamp, 1995), so elucidating the nature of underlying mechanisms is particularly important. Second, OCD symptoms are heterogenous (Abramowitz et al., 2010), so choosing one symptom dimension improves empirical control and standardization.

Our first aim was to investigate the extent to which pre-treatment INC/NJREs was associated with poor response to behavioral treatment for contamination-based OCD. We hypothesized that greater self-report INC/NJREs and reactivity to an INC/NJREs task before treatment would be associated with greater contamination symptoms following treatment. Our second aim was to examine the extent to which changes in self-report INC/NJREs were associated with changes in contamination symptoms, when accounting for changes in HA. We hypothesized that changes in INC/NJREs would be uniquely associated with changes in contamination symptoms.

In addition to our primary analyses, we conducted specificity analyses to assess whether any observed effects were accounted for by disgust propensity, which has been suggested to be an important maintaining factor and treatment predictor in contamination symptoms (Carraresi, Bulli, Melli, & Stopani, 2013; Melli, Bulli, Carraresi, & Stopani, 2014). Indeed, our research group recently found that disgust propensity was a significant predictor of outcome in the current dataset (Mathes et al., 2018). Additionally, given that OCD commonly co-occurs with depression and anxiety (Marcks, Weisberg, Dyck, & Keller, 2011) and INC/NJREs are transdiagnostic (Fergus, 2014), we explored whether INC/NJREs was significantly associated with depression and anxiety to determine whether observed effects were specific to OCD.

2. Method

2.1. Participants

The sample comprised 88 undergraduate students (72.7% female) at a large Southeastern university. Participants were selected if they scored in the top 5% of the sample on the VOCI (> 21), and rated their fear at least 50 out of 100 on a behavioral task of contamination, reflecting elevated contamination symptoms. Moreover, 46.6% ($n = 41$) of the sample met diagnostic criteria for OCD. The mean score on the DOCS-contamination subscale was 9.47 ($SD = 3.64$), which is higher than scores in other samples of individuals with OCD (Abramowitz et al., 2010). Participants were recruited from the undergraduate subject pool from June 2014 to April 2017, which consisted of 4976 students in total, and received course credit for participation in the study. The mean age of the sample was 19.08 ($SD = 1.79$). Of the sample, 60.2% self-reported as Caucasian, 17.0% as African-American, 18.2% as Hispanic, 3.4% as Asian or Pacific Islander, and 1.1% as Other (e.g., biracial).

2.2. Clinical interview

2.2.1. Mini international neuropsychiatric interview (MINI; Sheehan et al., 1998)

The MINI is a short, semi-structured interview that is used to assess for a diagnosis of OCD. The MINI was administered and audio-recorded by trained research assistants. A random selection of interviews ($n = 18$) was reviewed by an independent interviewer and assessed for diagnostic accuracy and reliability. The average percentage of agreement (94.4%) reflected a high overall agreement between raters Kappa was .87 (range = 0.62–1.00).

2.3. Self-report measures

2.3.1. Dimensional obsessive compulsive scale (Abramowitz et al., 2010)

The DOCS is a 20-item self-report questionnaire that assesses OC symptoms based on four empirically-supported dimensions: germs and contamination, concerns about harm, unacceptable thoughts, and need for symmetry and order. Participants are asked to use a 5-point scale to rate the severity of symptoms, including time spent engaged in obsessions and compulsions, avoidance behavior, and distress derived from symptoms. In the current study, only the contamination subscale was used, which demonstrated good internal consistency ($\alpha = 0.84$).

2.3.2. Obsessive compulsive trait core dimensions questionnaire (OCTCDQ; Summerfeldt, Kloosterman, Parker, Antony, & Swinson, 2001)

The OCTCDQ is a 20-item self-report measure used to assess feelings of INC and HA. The HA subscale includes questions such as, "There are specific things around me that could cause harm to me or to people I care about" and "There are things that I am afraid might happen if I don't take certain steps to prevent them." The INC subscale includes questions such as, "I must do things in a certain way or I will not feel right" and "Routine activities take me longer than they should because they don't seem perfectly completed." Participants were asked to rate each item on a 5-point Likert-type scale from 1 (*never applies to me*) to 5 (*always applies to me*). In the current study, internal consistencies were good for the INC ($\alpha = 0.84$) and HA subscales ($\alpha = 0.86$).

2.3.3. Disgust Propensity and Sensitivity Scale-revised (DPSS-R; Van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006)

The DPSS-R is a 12-item self-report measure that assesses the frequency in which an individual experiences disgust, labeled disgust propensity, as well as the distress an individual associates with disgust, labeled disgust sensitivity. In the current study, we only used the disgust propensity subscale due to research indicating the disgust propensity, specifically, may be a predictor of treatment outcome (Mathes et al., 2018; Melli et al., 2014). The disgust propensity subscale demonstrated adequate internal consistency ($\alpha = 0.78$).

2.3.4. Depression, anxiety, and stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995)

The DASS-21 is a 21-item self-report questionnaire that assesses depression, anxiety, and stress. In the current study, we only used the depression and anxiety subscales to assess symptom severity. The DASS-Anxiety subscale demonstrated adequate internal consistency ($\alpha = 0.78$) and the DASS-Depression subscale demonstrated good

internal consistency ($\alpha = 0.84$) in the current sample.

2.4. Behavioral tasks

2.4.1. Tactile NJRE task (Summers et al., 2014)

The coat task is a behavioral task that has been used in previous studies to evoke tactile NJREs (Summers et al., 2014). For the current study, participants were instructed to put on a lab coat that was several sizes too large and to button it unevenly. Participants were then asked roll up one sleeve to their elbow, and to stand while wearing the coat for 10 s. Once 10 s had elapsed, participants were asked to rate their current discomfort due to the uneven arrangement of the coat and their urge to straighten the coat using a scale from 0 (not at all) to 100 (extreme). Once participants had completed the ratings, they were allowed to remove the coat and an experimenter placed it out of view.

2.5. Treatment

2.5.1. Exposure and response prevention (ERP)

ERP is an evidence-based treatment for OCD in which individuals are asked to confront situations that cause fear and to avoid engaging in rituals associated with their fears (Foa et al., 2012). For the current study, participants engaged in three sessions (4–7 days apart) of a form of contamination-based ERP, in which they were asked to place their hands in a mixture of dirt, dead insects, and human hair for 6 min over the course of 7 trials. After every other trial (i.e. trials 1, 3, 5, 7) participants were asked to respond to several self-report measures regarding their emotional responses resulting from the exposure (these data are not reported here). After the exposure period was complete, participants were asked to avoid washing their hands, using hand sanitizer, or using hand wipes for at least 1 h.

2.6. Procedure

Participants were recruited from introductory psychology classes at a southeastern United States university. All components of this study were approved by the university's Institutional Review Board. Additional findings from the current dataset were reported in a previous manuscript in which we investigated the impact of mental and contact contamination in ERP for OCD (see Mathes et al., 2018). Informed consent was obtained prior to the administration of all self-report batteries and interviews. During the first appointment (i.e. pre-treatment), participants who met eligibility requirements were asked to complete a battery of self-report measures, a diagnostic interview, and various behavioral tasks. Next, participants were provided with the rationale for ERP and engaged in the first session. The second and third appointments consisted of two additional sessions of ERP. The fourth appointment (i.e., post-treatment) occurred one week following the third appointment in which participants were asked to complete the same battery of self-report measures and behavioral tasks that were completed in the first appointment. Follow-up occurred two weeks after the fourth appointment, at which time participants were emailed a battery of self-report questionnaires.

2.7. Data analytic plan

The data were first screened for violations of assumptions, though no violations were identified. Pre-treatment differences between those who did and did not complete treatment were assessed using independent samples t-tests. Relationships between pre-treatment self-report and behavioral measures were examined using correlation analyses. Two sets of regression analyses were used to examine associations between INC, NJREs, and contamination symptoms among participants who completed treatment ($n = 65$). First, multiple regression analyses were used to examine the extent to which INC versus NJREs (entered together) were significant predictors of contamination symptoms at pre-treatment, post-treatment, and follow-up. Next, separate multiple regression analyses were used to examine the extent to which pre-treatment self-report INC/NJREs and reactions to the behavioral NJRE/INC task (entered in separate models) were associated with post-treatment and follow-up contamination symptoms, when accounting for pre-treatment contamination symptoms.

Regression analyses were also conducted using hierarchical linear modeling (HLM7.03). HLM allows for the estimation of change in repeated measures data (Level 1). Further, it allows for estimation of between subject differences (Level 2) that may moderate changes in within subject data. HLM is well suited for the estimation of associations in repeated measures as it does not assume non-independence of data. In the current study, HLM was used to assess the association between feelings of INC and contamination symptoms when controlling for HA and time.

Finally, HLM utilizes multiple imputation to estimate missing data in repeated measures. Thus, the primary analyses were conducted with data from both completers ($n = 65$) and non-completers ($n = 23$) of the treatment, for a total sample of 88 participants. While HLM does exclude data of participants with missing values on level 2 variables (e.g., response to NJRE task at baseline), all participants in the current study had data for these variables and thus no participants were excluded from analyses.

Table 1
Descriptive statistics and change in variables of interest.

Self-report measures	Pre-treatment	Post-treatment	Follow-up	F	P	η^2
DOCS-C	9.47(3.64)	6.94(3.33)	6.17(3.58)	25.83	< .001	.45
OCTCDQ-I	26.87(8.43)	22.05(9.45)	18.78(10.96)	31.59	< .001	.52
OCTCDQ-HA	23.98(8.99)	18.27(9.47)	15.57(10.13)	35.43	< .001	.55
DPSS-R-DP	16.83(3.87)	14.56(4.91)	12.11(4.88)	45.27	< .001	.59
DASS-D	5.98(4.36)	3.79(3.84)	3.84(4.70)	15.17	< .001	.34
DASS-A	7.56(4.22)	4.39(3.22)	3.86(3.81)	30.36	< .001	.52
NJRE task	**Pre-treatment**	**Post-treatment**				
Discomfort	63.94(27.22)	49.09(28.16)		35.49	< .001	.35
Urge to adjust	77.88(22.50)	60.30(29.87)		36.20	< .001	.36

Note. DOCS: Dimensional Obsessive Compulsive Scale- Contamination subscale; OCTCDQ-I: Obsessive Compulsive Trait Core Dimensions Questionnaire-Incompleteness subscale; OCTCDQ-HA: Obsessive Compulsive Trait Core Dimensions Questionnaire- Harm Avoidance subscale; DPSS-P: Disgust Propensity and Sensitivity Scale-Propensity subscale; DASS-D: Depression, Anxiety, and Stress Scale-Depression subscale; DASS-A: Depression, Anxiety, and Stress Scale-Anxiety subscale.

3. Results

3.1. Descriptive statistics

The means and standard deviations for all self-report measures and behavioral tasks at pre-treatment, post-treatment, and follow-up are displayed in Table 1. Pre-treatment DOCS scores (M = 9.47) were comparable to DOCS scores in other studies of individuals with OCD with primary contamination symptoms (DOCS M = 11.30; Melli et al., 2014). Further, pre-treatment OCTCDQ-INC scores (M = 26.87) were consistent with other studies of individuals with OCD (M = 30.11; Belloch et al., 2016). An examination of pre-treatment means indicated there were no significant differences between those who did and did not complete treatment on all measures, ps > .19. Repeated measures ANOVAs indicated there were significant decreases in all self-report and behavioral measures across assessment intervals. Please see Table 1 for full ANOVA statistics.

3.2. NJRE task analyses

At pre-treatment, paired samples t-tests indicated that feelings of discomfort significantly increased from pre- (M = 50.91, SD = 26.47) to post- (M = 63.94, SD = 27.22) NJRE task, t = −3.56, p < .001. Given that urge to adjust was specifically assessing one's urge related to the task stimuli, pre-task urge to adjust was not assessed. However, the mean rating of post-task urge to adjust was 77.88 (SD = 22.50).

3.3. Correlation analyses

Please see Table 2 for all zero-order correlations. Contamination symptoms were positively and significantly associated with INC (r = 0.65, p < .001), HA (r = 0.70, p < .001), and discomfort (r = 0.39, p < .001) and urge to adjust (r = 0.48, p < .001) during the NJRE task.

3.4. Pre-Treatment Predictors INC, NJREs, and contamination symptoms

When entered as simultaneous predictors, pre-treatment INC (β = 0.55, t = 5.28, p < .001), but not discomfort and urge during the NJREs (ps > .48), was significantly associated with greater baseline contamination symptoms. When accounting for pre-treatment contamination symptoms, pre-treatment INC and discomfort and urge during the NJREs task were not significantly associated with post-treatment and follow-up contamination symptoms, ps > .08.

3.5. Pre-Treatment Predictors of Post-Treatment and Follow-Up Contamination Symptoms

When accounting for pre-treatment contamination symptoms, pre-treatment self-reported INC was not significantly associated with post-treatment and follow-up contamination symptoms, ps > .12.

When accounting for pre-treatment contamination symptoms, pre-treatment discomfort during the NJREs task was significantly associated with greater post-treatment (β = 0.22, t = 2.06, p = .04) and follow-up (β = 0.32, t = 2.80, p = .007) contamination symptoms. Pre-treatment urge to adjust during the NJREs task was not associated with post-treatment and follow-up contamination symptoms, ps > .11.

3.6. Treatment mechanisms

HLM analyses estimated the association between changes in contamination symptoms and changes in INC while controlling for changes in HA and time. Estimation of the model revealed that participants did not differ in their associations between contamination symptoms and INC (χ^2 (2, n = 88) = 0.44, p > .05) or INC and HA (χ^2 (3, n = 88) = 0.83, p > .05). When controlling for contamination and HA, the random effect of time and contamination symptoms was no longer significant (χ^2 (2, n = 88) = 1.45, p > .05). Thus, the simpler model, without estimation of random slopes, was used for these analyses. For this analysis, contamination symptoms were entered as the outcome variable and INC and HA were both entered as predictors at Level 1. Collapsed across within and between-person sources of variance revealed a significant effect of INC [β = 0.16; t(125) = 5.74, p < .001] and harm avoidance [β = 0.10; t(125) = 3.37, p < .001] on changes in contamination symptoms, such that greater change in INC and HA were associated with greater change in contamination symptoms.

3.7. Specificity analyses

3.7.1. Correlation analyses

Please see Table 2 for zero-order correlations among all variables of interest, including disgust propensity, depression, and anxiety.

3.7.2. Disgust propensity

When accounting for pre-treatment contamination symptoms, pre-treatment discomfort during the NJREs task and disgust propensity were not significantly associated with post-treatment contamination symptoms, ps > .14. Pre-treatment discomfort during the NJREs task (β = 0.27, t = 2.14, p = .04), but not disgust propensity (β = 0.16, t = 1.28, p = .21), was a significant predictor of follow-up contamination symptoms.

3.7.3. Depression and anxiety

When accounting for pre-treatment depression symptoms, pre-treatment discomfort during the NJREs task was not significantly associated with post-treatment or follow-up depression symptoms, ps > .06. When accounting for pre-treatment anxiety symptoms, pre-treatment discomfort during the NJREs task was not significantly associated

Table 2
Zero-order correlations and ranges for pre-treatment variables of interest.

	1.	2.	3.	4.	5.	6.	7.	8.	Range
1. DOCS-C	—								0–18
2. INC	.65***	—							5–40
3. HA	.70***	.75***	—						0–40
4. NJRE task-discomfort	.37***	.55***	.39***	—					0–10
5. NJRE task-urge	.41***	.58***	.48***	.73***	—				0–10
6. DPSS-P	.46***	.65***	.63***	.40***	.40***	—			5–24
7. DASS-D	.51***	.44***	.56***	.22*	.31**	.48***	—		0–19
8. DASS-A	.56***	.51***	.55***	.33**	.40***	.43**	.72***	—	0–20

Note. DOCS: Dimensional Obsessive Compulsive Scale- Contamination subscale; OCTCDQ-I: Obsessive Compulsive Trait Core Dimensions Questionnaire-Incompleteness subscale; OCTCDQ-HA: Obsessive Compulsive Trait Core Dimensions Questionnaire- Harm Avoidance subscale; DPSS-P: Disgust Propensity and Sensitivity Scale-Propensity subscale; DASS-D: Depression, Anxiety, and Stress Scale-Depression subscale; DASS-A: Depression, Anxiety, and Stress Scale-Anxiety subscale. *p < .05, **p < .001, ***p < .001.

with post-treatment or follow-up anxiety symptoms, $ps > .23$.

4. Discussion

The current study examined the role of INC/NJREs in behavioral treatment of contamination-based OCD. We first examined the extent to which pre-treatment INC/NJREs may predict response to treatment. Results indicated greater discomfort due to a tactile NJRE behavioral task was associated with greater contamination symptoms at post-treatment and follow-up. However, contrary to hypotheses, self-report INC and urge to adjust during the NJRE task were not significantly associated with outcome. This suggests some forms of NJREs may be particularly relevant in maintaining contamination symptoms and points to the need for multi-modal assessment in INC/NJRE research. Indeed, self-report and behavioral data exhibited differential patterns of associations with outcomes of interest, which may reflect measure differences. Prior work has indicated that self-report and behavioral measures purported to measure the same construct often assess different aspects of that construct, as self-report measures often assess the overall presence of a factor, whereas behavioral tasks assess in vivo responses (McHugh et al., 2011). Moreover, a recent study indicated that measures of INC and NJREs may reflect different aspects of the same underlying construct, such that measures of INC assess one's tendency to engage in compulsions to reduce feelings of INC, whereas measures of NJREs assess the propensity to experience NJREs and the distress associated with it (Belloch et al., 2016). Further, in the current study, we examined the extent to which pre-treatment INC versus NJREs accounted for significant variance in contamination symptoms across treatment. At pre-treatment, only INC was a significant predictor of symptoms, and neither INC nor NJREs were significant predictors of post-treatment and follow-up symptoms. However, this is likely due to method of measurement (i.e., self-report versus behavioral task) and the aforementioned differences associated with each method and conceptual definition of INC and NJREs. Therefore, future work should explore overlap and distinction between INC and NJREs to further establish construct validity.

We next examined whether changes in INC were associated with changes in contamination symptoms over the course of treatment. We found three sessions of contamination-based exposure exercises were associated with significant reductions in INC and NJREs (assessed through an in vivo NJRE task). Moreover, changes in INC were uniquely associated with change in contamination symptoms, even when accounting for HA. These findings importantly extend prior work assessing NJREs in OCD treatment (Coles & Ravid, 2016). First, the current study specifically examined reductions in contamination symptoms, which were not examined in Coles and Ravid's study (2016), and accounted for the role of HA, which has been hypothesized to be a salient mechanism underlying contamination symptoms (Rachman, 2004). Therefore, INC/NJREs may be a unique indicator of change in contamination symptoms, which further supports prior work highlighting the importance of INC/NJREs in OCD (Coles et al., 2003; Coles & Ravid, 2016; Ecker & Gönner, 2008; Pietrefesa & Coles, 2008; Summerfeldt, 2004). Additionally, the current study did not directly target INC/NJREs, which suggests that reductions in INC may indeed be an underlying mechanism of change even when not explicitly targeted. Finally, the current study utilized behavioral exercises, rather than a combination of cognitive and behavioral techniques. Prior theoretical work has suggested that behavioral exercises to reduce reactivity to feelings of INC/NJREs may be more effective than cognitive techniques (Summerfeldt, 2004). Therefore, it may be that reductions in INC/NJREs in the current study reflect habituation to these internal experiences, though future work should further dismantle cognitive behavioral approaches to more directly compare the efficacy of each method.

Importantly, we also conducted specificity analyses to explore whether disgust propensity, depression, or anxiety accounted for observed effects. Results revealed that reactivity to the NJREs task remained a significant predictor of follow-up contamination symptoms even when accounting for disgust propensity. Further, discomfort during the NJREs task was not a significant predictor of post-treatment or follow-up depression and anxiety symptoms. Taken together, our findings suggest the observed effects were not accounted for by disgust propensity or comorbid symptoms.

Taken together, though treatment for contamination fears has traditionally been focused on the reduction of anxiety driven by a desire to avoid harm, INC/NJREs may play an important role in the maintenance and treatment of symptoms. Specifically, as has been suggested in prior work (Cougle et al., 2011; Wahl et al., 2008), it may be that washing compulsions are intended in part to reduce feelings that things are "not just right." It should be noted that HA and INC were strongly correlated in the current sample ($r = 0.75$), which is consistent with prior work suggesting HA and INC are distinct, yet highly correlated, constructs (Pietrefesa & Coles, 2008). Therefore, there may be value to assessing both HA and INC/NJREs throughout treatment to determine the extent to which symptoms may be driven by one or both motivational factors. Different treatment strategies specifically targeting HA or INC may yield better treatment outcomes, though such strategies have not yet received extensive study.

Our findings should be interpreted in light of limitations. First, the sample comprised undergraduate students who were primarily White and female; therefore, future work should investigate whether these effects remain in a more diverse sample. Second, participants were not randomized to separate treatment conditions, so the observed effects may be reflective of receiving treatment in general, rather than specific to ERP. Third, though we attempted to account for potential confounding factors that may have explained observed effects, namely disgust propensity, future work should explore additional related factors, such as disgust avoidance, to determine the most robust predictor of treatment outcome. Further, we did not assess reactivity to harm and/or disgust in response to the NJRE behavioral task. Therefore, more research is needed to determine the emotional responses elicited by the NJRE behavioral task used in the current study. Finally, future work should further examine the specificity of the observed effects, as the current study may be limited by its use of only one measure of OCD symptoms, as well as the significant statistical overlap between variables of interest, namely INC/NJREs and HA.

Overall, our results suggest that INC/NJREs may be an important maintaining factor in contamination-based OCD. Within a sample of individuals with elevated contamination symptoms, half of whom met criteria for OCD, significant reductions in INC/NJREs were observed over the course of three sessions of contamination-based exposure exercises. Moreover, these changes were associated with reductions in contamination symptoms, even when accounting for HA. Pre-treatment reactivity to an NJRE task was associated with post-treatment and follow-up contamination symptoms, though this finding was not replicated in a measure of general tendencies towards INC. Taken together, the current findings add to a growing body of research highlighting the importance of INC/NJREs in OCD, and suggest that INC/NJREs may be an important treatment target and indicator of change in behavioral treatment for contamination symptoms.

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