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Disgust propensity and sensitivity in childhood anxiety and obsessive-compulsive disorder: Two constructs differentially related to obsessional content

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ABSTRACT

The role of disgust in anxiety and related disorders has been extensively studied in adults, however its role in childhood psychopathology is in need of further investigation. The adult literature has suggested that two distinct sub-constructs within "disgust proneness" may differentially predict anxiety-related disorders. Namely, disgust propensity (DP) has been defined as the likelihood an individual will experience a disgust reaction, and disgust sensitivity (DS) as the degree to which an individual is distressed by their experience of disgust. The current study aimed to validate the Disgust Propensity and Sensitivity Scale-Revised (DPSS-R) in a sample of youth receiving intensive services for OCD and anxiety, examine the relationship between disgust sub-constructs and obsessional content in a sample of youth with OCD, and examine the relationship between disgust change and symptom severity at discharge. A confirmatory factor analysis supported a two-factor structure of the DPSS-R. DP was found to be uniquely predictive of contamination obsessions, and DS was found to be uniquely predictive of moral obsessions. Lastly, change in DP, but not DS, predicted overall change in OCD symptom severity. The present study provides a valid measure of DS and DP in youth with anxiety and related disorders, and suggests that subconstructs of disgust may serve as distinct risk factors for obsessional content in youth with OCD. Future research should examine the predictive validity of DP and DS longitudinally, as well as examine effective ways to more effectively target DP with exposure therapy.

1. Introduction

Disgust is a universal negative emotional response to a physically or morally offensive stimulus (Oaten, Stevenson, & Case, 2009). Whereas evolutionary theorists have traditionally characterized disgust as a protective response against disease contraction (Chapman & Anderson, 2012), studies within behavioral psychology have demonstrated heterogeneous links between disgust and the development and maintenance of psychopathology (Melli, Poli, Chiorri, & Olatunji, 2019). Burgeoning literature investigating the role of disgust proneness within anxiety disorders has identified *disgust sensitivity* (DS) and *disgust propensity* (DP) as two distinct sub-constructs that may differentially drive avoidant behavior characteristic of anxiety disorders (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). DP has generally been conceptualized as the likelihood an individual will feel disgust, and DS as the degree to which an individual will be distressed by the experience of disgust (van Overveld et al., 2006). Moreover, DP has been associated with avoidant behaviors in response to potentially contaminated stimuli, whereas DS has been associated with sensitivity to aversive emotional experiences (Olatunji, Armstrong, & Elwood, 2017).

Given that many anxiety and related disorders are characterized by avoidance of feared stimuli, researchers have attempted to establish a link between disgust and the development and maintenance of anxiety symptoms (Olatunji et al., 2017). Studies have demonstrated a relationship between DP and the etiology of certain phobias, specifically those relating to animals (Arrindell, 2000; Muris, Mayer, Huijding, &

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Konings, 2008) and blood-injection-injury (Sawchuk, Lohr, Tolin, Lee, & Kleinknecht, 2000; van Overveld et al., 2006). Several studies have also suggested that both DS and DP are linked to the presence of contamination-based obsessions, and may play a role in the maintenance of ritualistic behaviors in those with obsessive-compulsive disorder (OCD; Bhikram, Abi-Jaoude, & Sandor, 2017; Knowles, Viar-Paxton, Riemann, Jacobi, & Olatunji, 2016; Muris et al., 2008; Olatunji, Tolin, Huppert, & Lohr, 2005; van Overveld, Jong, & Peters, 2010).

OCD is characterized by the presence of obsessions or intrusive thoughts, along with ritualistic or compulsive behavior intended to neutralize such thoughts (American Psychiatric Association, 2013). Current conceptualizations of OCD suggest that OC avoidance and ritualistic behaviors are motivated by either fear of harm or feelings of incompleteness, however disgust has emerged as a unique autonomic response that may trigger distinct worry and safety behavior (Curtis, De Barra, & Aunger, 2011; Woody & Teachman, 2000). Importantly, beyond avoidance motivated by fear of germs and illness, OC avoidance driven by disgust may not involve the same cognitive processes as fear and may serve a distinct protective function (Tybur, Lieberman, Kurzban, & Descioli, 2013). Studies investigating disgust levels in patients with OCD have demonstrated a relationship with obsessional content, such that those with contamination, sexual, and religious obsessions tend to exhibit elevated levels of disgust compared to those with other obsessions (Bhikram et al., 2017; Chapman & Anderson, 2012; Jones & Fitness, 2008). Literature is mixed, however, regarding differential levels of DP and DS in individuals with OCD. While studies have shown distinct elevated levels of DS in OCD patients (e.g., Olatunji, Cisler, McKay, & Phillips, 2010) others have pointed to elevated levels of DP (Melli, Chiorri, Carraresi, Stopani, & Bulli, 2015, 2019; Olatunji et al., 2010). Identifying the distinct role of DP and DS across various clinical samples may provide further evidence for the constructs as potential diagnostic risk factors.

Indeed, individual differences in DP and DS are understudied potential mechanisms of obsession development and compulsion maintenance. Several studies examining motivators of safety behaviors within OCD samples have demonstrated that disgust reactions may drive the use of compulsions in those with contamination-based obsessions, above and beyond fear of harm (McKay, 2006; Melli et al., 2015), however the literature is mixed regarding the role of disgust proneness as a predictor of obsession development (Knowles, Jessup, & Olatunji, 2018). Previous research has suggested that, beyond its role to protect individuals from disease contraction, disgust has evolved to protect individuals from situations that may be in conflict with their morals or values (Giner-Sorolla, Kupfer, & Sabo, 2018). For patients with OCD, the link between contamination fear and morality is positively correlated, suggesting a potential underlying relationship between moral and health-related contamination (Jones & Fitness, 2008). For example, one study demonstrated that individuals who were asked to think of moral impurities were more likely to engage in washing behaviors (Lee & Schwarz, 2010). It is critical to better understand the causes of "moral contamination" within this population, as obsessions centered around scrupulosity are common and historically difficult to treat (Ottaviani, Mancini, Petrocchi, Medea, & Couyoumdjian, 2013). Although the link between disgust and moral contamination is clear (Chapman & Anderson, 2012; Giner-Sorolla et al., 2018; Jones & Fitness, 2008), research using more nuanced constructs is necessary to more precisely identify risk factors for the development and treatment of moral obsessions.

Although research is mixed regarding the effectiveness of exposure therapy for reducing disgust symptoms in individuals with contamination-based OCD, burgeoning evidence suggests that DP is consistently elevated in adult patients with these types of obsessions, and decreases in DP are associated with greater improvements in compulsive washing (Athey et al., 2015; Knowles et al., 2016; Olatunji, Wolitzky-Taylor, Willems, Lohr, & Armstrong, 2009). Olatunji et al. (2009) specifically studied how rates of fear and disgust change during a self-guided contamination exposure and found that while subjective fear significantly reduced during the exposure, self-reported disgust did not. McKay (2006) also found significantly lower rates of disgust reduction in adults with contamination obsessions as compared to those with other obsessions. Despite these findings implicating disgust as a potential mechanism for treatment outcome, studies investigating clinical outcomes of OCD patients with elevated disgust levels indicate that disgust may be more resistant to extinction than fear alone. This suggests that targeting disgust directly during exposure therapy may improve treatment outcomes (Knowles et al., 2018), and more research must be conducted to understand the extent to which traditional exposure therapy improves disgust symptoms.

There are several existing measures of disgust that have been validated for pediatric samples, however few examine both DP and DS, particularly in the absence of contextual disgust elicitors. For example, the Disgust Scale for Children is a measure of behavioral and affective responses to disgust (consistent with measures of DS), however does not distinctly measure DP (Viar-Paxton et al., 2015). Similarly, the developmentally adapted Disgust Emotion Scale (Muris et al., 2012) and the age-downward Disgust Questionnaire (Rozin, Fallon, & Mandell, 1984) only measure DS, and examine affective responses in the face of specific disgust elicitors (e.g., foods, blood, insects) which may not be transdiagnostically relevant. Furthermore, while several researchers have examined disgust levels within clinical populations (e.g., Olatunji et al., 2017), few have aimed to validate measures of disgust using clinical samples. Given the heterogeneity of fear and obsessional content across anxiety disorders, a transdiagnostic measure of both DP and DS is necessary to standardize measurement using consistent and reliable constructs.

The Disgust Propensity and Sensitivity Scale-Revised (DPSS-R; van Overveld et al., 2006) is the only measure to date which distinctly measures both DP and DS, however it has only been validated in adult, non-clinical samples (Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007; van Overveld et al., 2010, 2006). A major goal of this study is to examine the factor structure and psychometric properties of the DPSS-R in a sample of youth with severe OCD and anxiety. It was hypothesized that two lower order factors consistent with DP and DS would emerge. Using the DPSS-R, this study will also examine whether DP and DS predict obsessional content in youth with OCD, and consistent with the emotion literature, it is hypothesized that DP will predict contamination-based obsessions while DS will predict moral obsessions. Finally, the paper will examine whether change in DP and DS are related to treatment outcomes after a course of intensive exposure therapy. Consistent with previous literature, it is hypothesized that change in DP will predict a decrease in OCD symptom severity.

2. Method

2.1. Participants

Three hundred and sixty-five participants receiving intensive services for anxiety or OCD were recruited for a naturalistic study to evaluate the efficacy of an exposure-based partial hospitalization program in the Northeast United States. Participants were between the ages of 6 and 18 ($M = 12.2$, $SD = 3.08$) and were 55.1 % female. Racially, participants were mostly White (90.2 %), with 1.6 % identifying as African American, 0.5% identifying as Asian or Pacific Islander, 2.7 % reporting more than one race, and 1.6 % preferring not to report their race. 7.1 % of participants were Hispanic or Latino. The majority of youth had a primary diagnosis of OCD (59 %), with 78 % of all youth receiving a diagnosis of at least one co-occurring disorder (see Table 1 for diagnostic information).

2.2. Procedures

All participants received diagnoses from a licensed child psychiatrist

Table 1
Diagnostic Information.

Diagnoses	N	%
Primary Diagnosis	365	–
OCD	229	62.7
Generalized Anxiety Disorder	61	16.7
Social Anxiety	33	9
OC-Related Disorder	10	2.7
Separation Anxiety	8	2.2
Specific Phobia	5	1.4
Selective Mutism	4	1
Pervasive Developmental Disorder	4	1
Attention-Deficit Hyperactive Disorder	4	1
Post-Traumatic Stress Disorder	3	.8
Mood Disorder	2	.5
Panic Disorder	1	.3
Eating Disorder	1	.3
Unspecified Anxiety Disorder	1	.3
Co-occurring Diagnoses	284	77.8
Attention-Deficit Hyperactive Disorder	126	44.3
Mood Disorder	121	42.6
OC-Related Disorder	63	22.2
Pervasive Developmental Disorder	56	19.7
Generalized Anxiety Disorder	55	19.4
OCD	39	13.7
Social Anxiety	35	12.3
Panic Disorder	19	6.6
Separation Anxiety	14	4.9
Learning or Intellectual Disability	12	4.2
Eating Disorder	7	2.5
Post-Traumatic Stress Disorder	4	1.4
Substance Abuse Disorder	3	1
Specific Phobia	2	.7

or licensed psychologist during the standard intake assessment. Diagnoses were extracted from participant electronic medical records for the present study. All youth received exposure-based intensive treatment based on principles used in previous treatment trials for youth OCD (OCD POTS trials). Treatment included psychoeducation, hierarchy-building, family treatment sessions, and exposure exercises designed to target each participant's core fear (Franklin et al., 2011; Freeman et al., 2014; POTS Team, 2004). Youth attended the partial treatment program daily for 4–6 hours, depending on level of care, and the average length of stay in the program was 34.6 days ($SD = 17.6$). As part of standard clinical care, all participants completed a battery of questionnaires during their initial and final days of the program.

2.3. Measures

2.3.1. Obsessive-compulsive symptoms and severity

Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS; Scahill et al., 1997). The CY-BOCS is a well-established clinician-rated measure of obsessional content and compulsive behavior in youth. The measure includes checklists of both obsessions and compulsions, which capture the presence of topographical OC symptoms, and severity items, which capture frequency and impairment. The checklists include specific worries under broader obsessional (e.g., contamination, aggressive, sexual) and compulsive (e.g., washing, checking, arranging) themes. The 10-item CY-BOCS severity scale assesses the severity of endorsed symptoms across domains (e.g., interference, associated distress, ability to resist). The severity of each item is captured on a 0–4 scale, with 0 indicating that the symptoms are not at all severe or not impairing, and 4 indicating extreme severity. The scales produce an obsession severity score (0–20), a compulsion severity score (0–20), and a total severity score (0–40). The CY-BOCS has demonstrated good reliability and validity in previous work (Stewart et al., 2008; Storch et al., 2004). The severity scales in the current study also demonstrated good internal consistency ($\alpha = .78$).

2.3.2. Disgust propensity and sensitivity

Disgust Propensity and Sensitivity Scale-Revised (DPSS-R; van Overveld et al., 2006). The DPSS-R is a 16-item self-report measure of DP and DS. The measure assesses for the likelihood an individual will experience disgust in a given situation and their distress associated with the sensation of disgust. Items were rated on a 5-point Likert Scale, ranging from 1 ("Never") to 5 ("Always"). Given the measure has only been validated in an adult sample, the measure used in the present study adapted language to be more developmentally appropriate (e.g., "disgusting things make my stomach turn" was modified to "disgusting things make my stomach rumbly or feel funny").

2.4. Statistical methods

Confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) using Mplus version 7.4 (Muthén & Muthén, 2012) was employed to 1) examine the factor structure of the DPSS-R and 2) investigate the relation between DPSS factors and obsessional content in youth with severe OCD. Based on results from van Overveld et al. (2006) and Olatunji et al. (2007), factors were rotated using Geomin, an oblique type of rotation, which allows factors to be correlated. Given data was found to be missing at random, maximum likelihood estimation was used to account for missing data and skew (Rubin, 1976). Eigenvalues, scree plots, factor interpretability, and fit statistics, including the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) were used to determine the number of factors and evaluate model fit. A significant chi-square statistic indicates poor fit; however, this test is sensitive to large sample sizes. For the RMSEA, values approximating between 0.05 and 0.08 reflect reasonable fit and values less than 0.05 suggest a good fit. For the CFI and TLI, values 0.90 or greater suggest acceptable fit and values 0.95 or greater are considered a good fit (Hu & Bentler, 1999). Low factor loadings (<.40) and cross loadings (>.32 on both factors) were noted (Costello & Osborne, 2005).

Multiple regression using SPSS version 26 was conducted to examine the effects of changes in DP, DS, and total disgust scores on OCD symptom improvement. In order to investigate the moderating effect of obsessional content on the association between disgust change and OCD symptom improvement, moderation analyses were also conducted in SPSS.

3. Results

3.1. Confirmatory factor analysis (CFA)

We examined the lower order factor structure of the DPSS-R in youth with both OCD and anxiety disorders using CFA in Mplus version 7.4 (Muthén & Muthén, 2012). As hypothesized, a two-factor solution fit the data best based on examination of the scree plot, fit statistics, and factor interpretability (Fig. 1). Although the chi-square test suggested rejection of the model ($\chi^2(115) = 171.97$, $p < .001$), the overall model, according to fit statistics, provided an adequate fit to the data (CFI = 0.93, TLI = 0.91, RMSEA = .04).

The first DPSS-R factor was comprised of nine items that largely overlapped with items from the DP factor in adult studies (Olatunji et al., 2007; van Overveld et al., 2006). The majority of these items assessed the frequency or degree of disgust; therefore, this factor was also labeled "Disgust Propensity" in the present study. The second factor included six items, which mostly overlapped with items from the DS factor in previous studies. These items assessed emotional or physical consequences and/or perceived harm from disgust, and, therefore, were conceptualized under the "Disgust Sensitivity" factor in the current study. DP and DS were positively and significantly correlated with one another. There were no gender differences in admission DP ($\chi^2(1) = 59.14$, $p = .712$) or DS ($\chi^2(1) = 56.60$, $p = .185$) scores. Further, a comparison of scores based on primary diagnosis (OCD vs. anxiety disorder) found no

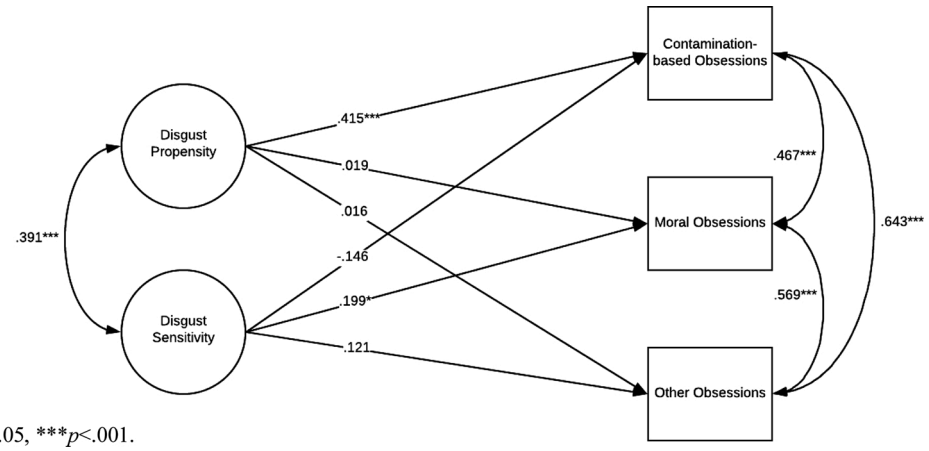

Fig. 1. Path Coefficients.
*$p < .05$, ***$p < .001$.

significant differences in admission DP ($\chi^2(1) = 32.55$, $p = .490$) or DS ($\chi^2(1) = 28.95$, $p = .222$).

Table 2 includes the factor loadings and correlation between factors for the two-factor solution. Notably, item 7 ("I scrunch up my face in disgust"), which loaded onto the DP factor in previous work, did not load highly on either factor in the current study (est < .4) and was therefore dropped from further analyses. Table 2 includes the factor loadings and correlation between factors for the two-factor solution.

3.2. Exploratory structural equation modeling (ESEM)

We investigated the relations between DP and DS and obsessional content using exploratory structural equation modeling (ESEM). The factor structure from the CFA was retained for the ESEM. Contamination obsessions, moral obsessions, and other obsessions were each regressed on DP and DS. DP, but not DS, was significantly and positively associated with contamination obsessions ($\beta = .415$, $p < .001$). DS, but not DP, was significantly and positively associated with moral obsessions ($\beta = .199$, $p < .05$). Contamination obsessional content significantly and negatively covaried with moral obsessional content ($\Psi = 0.47$, $p < .001$). All other paths from the DPSS factors to obsessional content domains were not significant (See Fig. 1).

3.3. Regression analyses

We conducted regression analyses to explore the relation between change in DP and DS and change in OCD severity over the course of intensive outpatient treatment. Results demonstrated that change in DP significantly and positively predicted change in OCD symptom severity, controlling for change in DS. Specifically, for every unit increase in DP change, a .27 change in OCD severity is predicted ($p < .05$). Additionally, based on the results from the ESEM, we conducted a moderation analysis to investigate whether the relation between change in DP and change in OCD severity depended on obsessional content. There were no differences in admission ratings on the DP and DS factors across obsessional content (see Table 3). The relationship between change in DP and severity of OCD symptoms did not significantly interact with obsessional content, suggesting that the relationship did not depend on whether or not an individual experienced contamination or moral obsessions.

4. Discussion

The current study established a measure of DP and DS in youth with OCD and anxiety. Results indicate that the developmentally adapted DPSS-R reliably captures DP and DS as distinct constructs, consistent with the adult literature. Items on each factor mostly replicated results from adult factor analyses of the DPSS-R (Olatunji et al., 2007; van

Table 2
Factor Loadings for a Two Factor Solution.

DPSS-R Item	*Est*	*S.E.*	*p*
Disgust Propensity			
12. I get disgusted more easily than other kids	.869	.033	<.001
5. I feel grossed out a lot	.811	.033	<.001
10. I get disgusted	.758	.033	<.001
14. I find some things disgusting	.750	.031	<.001
9. When I feel disgusted, it is a strong feeling	.701	.040	<.001
13. I worry that I might swallow a disgusting thing	.513	.049	<.001
16. I think feeling disgust is bad for me	.462	.053	<.001
1. I stay away from disgusting things	.452	.054	<.001
15. I get embarrassed when I feel disgusted	.449	.054	<.001
Disgust Sensitivity			
3. It scares me when my tummy feels sick	.736	.044	<.001
11. It scares me when I feel faint or dizzy	.670	.055	<.001
8. When I feel sick, I worry about throwing up	.646	.053	<.001
2. When I feel disgusted, I worry I might get dizzy	.544	.054	<.001
6. Disgusting things make my stomach rumbly or feel funny	.530	.047	<.001
4. I think disgusting things could make me sick	.421	.052	<.001

Note: Item 7 was excluded because its loading was <.3 on both factors.

Table 3
Average Scores on the DPSS-R.

Variable	*M*	*SD*	95 % *CI*
Admission			
Contamination Obsessions			
DP	2.60	.94	[2.39, 2.82]
DS	2.30	.92	[2.04, 2.52]
Moral Obsessions			
DP	2.43	.84	[2.24, 2.62]
DS	2.39	.99	[2.17, 2.62]
Other Obsessions			
DP	2.37	.79	[2.21, 2.55]
DS	2.17	.94	[2.08, 2.49]
Discharge			
Contamination Obsessions			
DP	2.13	.95	[1.90, 2.36]
DS	1.93	.98	[1.71, 2.16]
Moral Obsessions			
DP	1.88	.78	[1.70, 2.06]
DS	1.84	.82	[1.65, 2.02]
Other Obsessions			
DP	1.79	.85	[1.63, 1.94]
DS	1.80	.95	[1.63, 1.97]

Overveld et al., 2010, 2006) however, several differences emerged (see Table 4). Namely, items 13, 15, and 16 loaded onto DP in the present study, while items 4 and 6 loaded onto DS. Every item on the DS factor included physical sensations related to disgust (e.g., feeling sick, dizzy, etc.), whereas no items on the DP factor mentioned *specific* physical sensations. In addition to describing physical sensations, every item on the DS factor, other than item 6 which loaded onto the DP factor in van Overveld et al. (2006), also describes feeling worried or scared about an unwanted outcome that might occur as a result of disgust. Interestingly, items 13 ("I worry that I might swallow a disgusting thing"), 15 ("I get embarrassed when I feel disgusted"), and 16 ("I think feeling disgust is bad for me") describe one's feelings or judgement about the experience of disgust, but load onto the DP factor, which, otherwise, seems to capture the presence and intensity of disgust.

A closer look at discrepant items offer possible explanations for why these items loaded onto the DP factor and are distinct from the DS factor. Whereas items 15 and 16 describe a negative *consequence* or *interpretation* of disgust, they do not assess anxiety, worry, or fear of disgust, nor do they assess physical sensations in response to disgust. Although item 13 clearly articulates worry about a perceived negative outcome, it is unique in that it describes an action that an individual has control over, that is, *swallowing* a disgusting thing. All other items on the DS scale related to worry or a perceived negative outcome describe a physical sensation of which the onset is *uncontrollable*. Finally, item 6 ("disgusting things make my stomach rumbly or feel funny"), which loaded onto DP in previous studies, assesses the *physical consequences* of disgust and includes language similar to other items on the DS factor. In cognitive-behavioral practice, clinicians often define feelings as including both emotions (fear, anger, joy, etc.) as well as physical sensations, including increased heart rate, dizziness, and nausea (Greene, Nystrom, Engell, Darley, & Cohen, 2004). Therefore, item 6 may be better represented as a physical feeling that is a consequence of disgust and/or a negative outcome as a result of disgust, which aligns with the definition of DS in the present study.

Whereas existing measures of disgust in children focus primarily on only one subconstruct of disgust (Muris et al., 2008) or concentrate the experience of disgust within a specific feared context (Muris et al., 2012) the disgust literature has underscored the importance of examining the differential influence of disgust risk factors on OCD symptom topography and therapeutic outcomes (Cervin, Perrin, Olsson, Claesdotter-Knutsson, & Lindvall, 2020). In support of this claim, ESEM results indicate that while DP was significantly predictive of contamination-based obsessions, DS was significantly predictive of moral obsessions. This finding is consistent with previous conceptualizations of contamination and moral obsessions (Bhikram et al., 2017; Jones & Fitness, 2008), however the findings suggest underlying emotional risk factors that may uniquely contribute to the maintenance of obsessive thought. Given the DP factor measures an individual's general likelihood of experiencing disgust, the demonstrated relationship suggests that elevated trait-based disgust may serve to increase the likelihood of developing contamination-based disgust through multiple possible pathways. First, increased likelihood of experiencing disgust may be associated with more frequent appraisals of neutral stimuli as harmful, thus reinforcing behavioral avoidance in the face of potentially contaminated objects. Secondly, consistent with the Cognitive Model of OCD (Rachman, 1998), negative appraisal of specific objects and situations is the most likely predictor of forming intrusive thoughts about the nature of the feared situation. As such, individuals who score higher on the DP factor may demonstrate an inherent predisposition to appraise objects as disgusting, thus increasing the risk for developing contamination-based intrusive thinking.

Table 4
Factor Loading Discrepancies Across Psychometric Evaluations of the DPSS.

DPSS-R items	Current Study		van Overveld et al. (2006)		Olatunji et al. (2007)	
Discrepant Items	DP	DS	DP	DS	DP	DS
4. I think disgusting things could make me sick	.40	**.42**	.01	**.53**	**.53**	.27
6. Disgusting things make my stomach rumbly or feel funny	.29	**.53**	**.68**	.11	**.58**	.23
12. I get disgusted more easily than other kids	**.87**	−.03	**.49**	−.06	.20	**.63**
13. I worry that I might swallow a disgusting thing	**.51**	.17	.07	**.50**	**.41**	.37
15. I get embarrassed when I feel disgusted	**.45**	.23	.06	**.50**	−.02	**.70**
16. I think feeling disgust is bad for me	**.46**	.23	−.01	**.57**	−.25	**.84**

Note: Values in boldface type loaded significantly onto the corresponding factor in each respective study.

Interestingly, results also found that elevated scores on the DS factor significantly predicted the presence of moral obsessions in the current sample. The items in the DS factor largely measure feelings of anxiety associated with experiencing disgust, which may suggest feelings of fear or shame that often accompany moral obsessions (Ivan, 2011). Previous literature has demonstrated a relationship between moral issues that are inconsistent with one's value systems and ratings of DS (Inbar, Pizarro, & Bloom, 2009; Inbar, Pizarro, Knobe, & Bloom, 2009). Although it may be that individuals with moral obsessions are more likely to experience sensitivity or aversion to their thoughts, DS could also serve as an important risk factor for developing intrusive thoughts about moral violations (e.g., sexual aggression).

Furthermore, findings suggest that changes in DP, but not DS, were predictive of OCD severity change in the present sample. These findings are consistent with previous studies that have found associations between disgust change and clinical outcomes, however the unique association between DP and outcomes highlights a distinct treatment target for youth with OCD. Specifically, it may indicate that behavioral exposure, targeting the frequency and consistency of disgust experience, rather than cognitive consequences of disgust, should be prioritized during treatment. Notably, previous work has demonstrated that parental modeling of disgust reactions and overprotection is related to later child avoidance behavior (Oaten, Stevenson, Wagland, Case, & Repacholi, 2014; Olatunji et al., 2017). In order to maximize the effectiveness of exposure therapy, an understanding of core fear is essential (Conelea, Freeman, & Garcia, 2012), however it may be that targeting parental modeling and disgust appraisals is particularly important for this subgroup.

The results of the present study should be examined in light of several limitations. First, the data were collected as part of a naturalistic treatment study, thus hindering standardization of assessment and treatment procedures. Moreover, although the naturalistic nature of the assessment and treatment procedures increase the external validity of the results, the lack of fidelity measurement temper the generalizability of the treatment results. Given the homogeneity of the current sample, the results are also limited in their relevance to more racially and culturally diverse populations. A follow-up examination of the DPSS-R factor structure with a more socio-cultural diverse sample is warranted. Although this study intended to validate a measure of DP and DS for youth across the developmental span, it may be that differences would have emerged if the measure was administered solely to older teens versus younger children. Similarly, given the range of comorbid diagnoses in the current sample, definitive links between complex diagnostic profiles and disgust scores could not be determined. Lastly, although the present study demonstrated a link between two subconstructs of disgust and obsessional content, data were collected cross-sectionally and therefore a longitudinal link between disgust and later obsession development could not be established.

Future research should examine longitudinal effects of disgust factors and OCD symptom development. Moreover, findings that demonstrated an association between DP and DS and obsessional content should be further studied to establish profiles of risk factors that

contribute to obsession development. For example, it may be that youth with elevated anxiety sensitivity and DP together are at higher risk for developing contamination-based obsessions, and this finding would enhance case conceptualization and treatment tailoring. In light of recent calls to examine disgust through a "transdiagnostic framework" (Olatunji et al., 2017), the DPSS-R should be used across samples of youth with anxiety and OCD concerns to examine its reliability to predict a range of fear and obsessional content known to be associated with disgust.

5. Conclusions

The current study validated a measure of both DP and DS in youth with anxiety and OCD. Consistent with predictions, DS uniquely predicted obsessions related to morality, while DP uniquely predicted contamination-based obsessions. Further, change in DP was positively and significantly related to change in OCD symptom severity, regardless of obsessional content. Future research should work to understand the temporal links between early disgust levels and later fear content, as well as evaluate the effectiveness of tailored exposure treatments for both sub-constructs of disgust.

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Declaration of Competing Interest

The authors report no declarations of interest.

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