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Mechanisms of change in ERP treatment of compulsive hand washing: Does primary threat make a difference?

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Abstract

The present study sought to examine patterns of habituation in exposure and response prevention (ERP) treatment of compulsive hand washing. Sub-clinical compulsive washers ($n = 27$) with illness or non-illness primary threats were compared in order to detect potential differences in response to a single session of ERP. Changes in anxiety, disgust, and urge to wash were analyzed, and significant reductions in both anxiety and disgust were noted. Urge to wash significantly declined among washers primarily concerned with illness; among those concerned with non-illness threats, urge to wash did not significantly decline. Moreover, anxiety was found to decline when controlling for disgust and vice versa. Lastly, when both anxiety and disgust were entered into a model predicting changes in urge to wash, anxiety but not disgust predicted urge to wash for those with illness-related threats; for washers with non-illness threats, the findings were the reverse. Several clinical and theoretical implications are discussed.

Keywords: Obsessive compulsive disorder; Washing; Disgust; Exposure and response prevention

Introduction

Compulsive washing is one of the most common obsessive-compulsive disorder (OCD) subtypes. An effective psychological treatment for compulsive washing that has received much empirical support is exposure and response prevention (ERP). For washers, this technique involves contact with stimuli (e.g., a public toilet) that elicit the urge to wash. After the hands and/or other parts of the body have been "contaminated," patients are asked to refrain from washing for an extended period of time. Repeated sessions of ERP are expected to result in reduction in anxiety and urge to wash both within- and across-sessions. This treatment modality has produced response rates of up to 86% among mixed samples of OCD patients (Foa et al., 2005).

Preliminary evidence indicates that the presence of washing compulsions predicts a less favorable response to ERP treatment (Coehlo & Whitttal, 2001). In addition, one investigation revealed that washers are less responsive to pharmacologic treatment than other OCD subtypes (Alarcon, Libb, & Spitler, 1993). Such

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findings suggest that work is needed in identifying maintaining factors in contamination fears and developing strategies for facilitating symptom reduction.

Evidence has recently accumulated demonstrating an association between disgust and contami nation fear (Mancini, Gragnani, & D'Olimpio, 2001; Muris et al., 2000; Olatunji et al., 2004; Thorpe, Patel, & Simonds, 2003). For example, OC washers score significantly higher on animal and body product disgust relative to anxious and non-anxious controls and OC patients without washing concerns (Woody and Tolin, 2000). It has been postulated that the contribution of disgust sensitivity to anxiety disorder symptoms may be due to shared variance with anxiety (Muris, Merckelbach, Schmidt, & Sandy,1999; Thorpe & Salkovskis, 1998). However, disgust sensitivity has been shown to predict contamination fears even after controlling for trait anxiety and anxiety sensitivity (Olatunji, Sawchuk, Arrindell, & Lohr, 2005).

Fear and disgust have been researched most extensively in relation to anxiety disorders such as spider phobia (cf. Woody & Teachman, 2000). The association between spider fear and disgust led Smits, Telch, and Randall (2002) to investigate whether exposure treatment for spider phobia leads to decline in both fear and disgust. Using hierarchical linear modeling and within-session process measures, they found that exposure treatment contributed to reductions in both fear and disgust. However, fear declined more rapidly than disgust. Furthermore, fear and disgust were found to be partially independent of each other: fear significantly declined when controlling for changes in disgust, and vice versa.

Little research attention has been given towards examining patterns of change in ERP treat ment of compulsive washing, and few studies have been carried out examining the impact of ERP on both anxiety and disgust. McKay (2006) found that anxiety declined more rapidly than disgust in ERP treatment of compulsive washing, but it remains unclear as to whether reductions in both are independent of each other or are uniquely predictive of changes in urge to wash. The present study was intended to address these questions by assessing disgust, anxiety, and urge to wash over the course of a 60-min ERP treatment session for sub-clinical compulsive washers. Sub-clinical washers were considered appropriate for use in this study, given that evidence suggests non-clinical samples exhibit obsessions, compulsions, and beliefs about intrusions that are similar to those found in clinical populations of OCD patients (see Gibbs, 1996, for a review). In addition, the effect of variables such as illness expectancies are similar in studies using both clinical (Jones & Menzies, 1997) and sub-clinical (Jones & Menzies, 1998a) samples.

Jones and Menzies (1997) have argued that the perceived likelihood of becoming ill or diseased is the primary threat associated with compulsive washing. However, others have argued that different non-illness threats exist that could also contribute to compulsive hand washing. Foa and Wilson (2001), for example, suggest that OCD patients with fears of contamination may have a belief that their anxiety will last forever. This is consistent with findings showing elevated anxiety sensitivity among OCD patients relative to normal controls (Taylor, Koch, & McNally, 1992).

In addition, Rachman (1994) distinguished between washers who have their compulsions provoked either by illness concerns or anxiety regarding dirtiness. Fear, but not disgust, figures prominently in the former subtype while discomfort, fear, and disgust, are more characteristic of the latter subtype. More recently, Rachman (2004) distinguished between washers who have their compulsions triggered by fear of illness and those who have "mental health" as their main concern. These theoretical perspectives led us to examine differences between washers with illness- and non-illness-related primary threats through the analysis of patterns of change in anxiety, disgust, and urge to wash between these groups. Three specific questions were addressed:

1. Do changes in anxiety, disgust, and urge to wash during ERP treatment differ between washers displaying illness as their primary threat vs. washers displaying non-illness-related primary threats?
2. Does the decline in anxiety across trials remain significant after controlling for changes in disgust and vice versa?
3. Do declines in disgust and anxiety uniquely predict decline in urge to wash?

Methods

Participants

Participants were recruited through an introductory psychology course at a large southwestern university. To be included in the study, participants had to score in the top 10 percent of the OCI-R (Foa et al., 2002) washing subscale (>4) and report an anxiety level of 50 or more on at least one of three behavioral approach tests (BATs). Of the 71 who completed the pre-treatment assessment, 54 were deemed eligible to participate in the treatment phase of the study, and 27 decided to participate. Participants ranged in age from 18 to 41 ($M = 19.63$, S.D. $= 4.5$), and the ethnic breakdown of the final sample was 51.9% Caucasian, 25.9% Hispanic, 18.5% Asian, and 3.7% African-American.

Measures

Pre-treatment assessment measures

Beck Depression Inventory (BDI; Beck, 1978): This widely used 21-item questionnaire taps various domains of depression, including emotional symptoms (e.g. feelings of sadness, pessimism, feelings of worthlessness) and vegetative symptoms (e.g. fatigue, sleep changes, eating changes). Participants are asked to rate the degree to which they have experienced each symptom in the past week.

Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988): The BAI is a 21-item scale used to assess levels of general anxiety. Participants rate their level of common symptoms of anxiety during the past week on a 0–3 scale. Items include "fear of losing control," "unable to relax," and "scared."

Obsessive Compulsive Inventory-Revised (OCI-R; Foa et al., 2002): The OCI-R is a widely used assessment to measure the degree to which participants are experiencing obsessive compulsive symptoms. This 18-item questionnaire uses a 5-point Likert scale. Participants rate the degree to which each experience listed has distressed or bothered them during the past month, with 0 meaning "not at all" and 4 meaning "extremely." Examples of items include "I feel compelled to count while I am doing things," "I am upset by unpleasant thoughts that come into my mind against my will," and "I wash my hands more often and longer than necessary."

Washing Threat Questionnaire (WTQ): This 8-item scale was constructed specifically for this study. Each item asks participants to rate how strongly they believe each threat will occur, using a 0 (not at all)—100 (extremely) Likert scale. Examples include "I fear my anxiety will never end unless I wash my hands," and "If I don't wash my hands, I fear I will become ill or I will be harmed in some way." Other items assess fear of loss of control, fear of others becoming ill, fear of being overwhelmed by disgust, fear of being incapacitated by anxiety, fear of going crazy, and fear of being unable to manage one's anxiety. Factor analysis of the scale using a sample ($n = 69$) high in contamination symptoms (OCI-R-washing scores >4) found the eight items to fit well into two factors which explained 72.03% of the total variance (Cougle, Lee, Wolitzky-Taylor, & Telch (in preparation)). Factor 1 consisted of 6 items pertaining to fear of negative affect and loss of control, and Factor 2 consisted of the 2 items pertaining to fear of illness (to self or others). The eigenvalues for the affect/control and illness factors were 4.97 and 1.26, respectively. Cronbach's α was .90 for the total scale (affect/control: $\alpha = .92$; illness: $\alpha = .86$). The two subscales were moderately correlated with each other, $r = .47$, $p < .0001$. In addition, the total scale score ($r = .89$, $p < .0001$) and both subscales (affect/control: $r = .86$, $p < .0001$; illness: $r = .83$, $p < .0001$) displayed appropriate test-retest reliability. Scores on the WTQ are calculated by averaging the item scores for each subscale.

Behavioral measures

Three different behavioral approach tests (BATs) were used to assess anxiety, disgust, and avoidance associated with different contaminants that may trigger washing concerns These BATs were used as a behavioral screening measure of contamination fear. The first BAT consisted of a pile of dirty underwear, t-shirts, rags, and socks that were placed in a shallow cardboard box. Participants were told that "some of these items may have been touched with bodily fluids." The second BAT included a mixture of "dirt, dead

insects, and animal hair.'' This mixture was made of potting soil, dead crickets, and dog hair and was placed in a shallow cardboard box. The third BAT involved a porcelain toilet with an open lid. This toilet was made to look dirty by smearing potting soil along the inside of the bowl.

Each BAT consisted of six steps in a graduated hierarchy (see Table 1). If participants were able to complete the first item, they were asked to complete the next one on the hierarchy, and then the next, and so forth. If participants refused to perform a BAT item, that BAT was terminated. Participants rated their peak anxiety and disgust during completion of each task on a 0 (no anxiety/disgust)—100 (extreme anxiety/disgust) scale. After each BAT, participants were given a tissue and instructed to wipe their hands for no longer than 10 s. This was done to minimize carry-over effects between the BATs.

Treatment process measures

After each 4-min treatment trial (see below), participants were asked to rate their highest levels of anxiety and disgust they experienced during the trial using a 0–100 scale, with 0 being no anxiety/disgust and 100 being extreme anxiety/disgust. They also rated their urge to wash after each trial using a 0 (no urge)—100 (extreme urge) scale.

Procedure

Screening

Participants were recruited from an introductory psychology course at a major university. Those who scored 5 or more on the OCI-R washing subscale were invited to come into the laboratory for a face-to-face screening assessment. After signing informed consent, participants completed a battery of questionnaires. Next, behavioral assessments were conducted using the 3 BATs (see ''Behavioral measures''). Participants who reported an anxiety level of 50 or more on any of the 3 BATs were invited to participate in the treatment phase of the study.

Treatment

Eligible and interested participants returned to the laboratory and received ten 4-min trials of exposure and response prevention. The experimenter (JC) reminded the participant of which of the 3 stimuli seemed most bothersome during the pre-treatment assessment, based on anxiety ratings from the BATs. If the participants agreed that the stimulus mentioned was the most bothersome, that stimulus was chosen for the treatment. If the participant did not agree, the experimenter probed to identify the stimulus that was most bothersome to him/her, which was then chosen for treatment.

The experimenter first determined the participant's primary threat by examining the WTQ and discussing with each participant whether the threat they rated as highest was truly the most bothersome to them. Based on this assessment, they were categorized as either having illness or non-illness primary threats. Participants

Table 1
Behavioral approach tests

	Soiled laundry	Dirt (potting soil), dead insects, and animal (dog) hair mixture	Toilet
Step 1	Approach laundry and smell from within 3 ft	Approach mixture and smell from within 3 ft	Approach toilet seat smell from within 3 ft
Step 2	Touch laundry with a sheet of tissue	Touch mixture with a sheet of tissue	Touch toilet seat with a sheet of tissue
Step 3	Touch laundry with a finger	Touch mixture with a finger	Touch toilet seat with a finger
Step 4	Touch laundry with one hand	Touch mixture with one hand	Touch toilet seat with one hand
Step 5	Touch laundry with both hands	Touch mixture with both hands	Touch toilet seat with both hands
Step 6	Touch laundry then touch arms and chest	Touch mixture then touch arms and chest	Touch toilet seat then touch arms and chest

were asked to touch the stimulus with their hands for a 4-min trial. If participants showed any avoidance, they were encouraged to maximize hand contact with the stimulus. After the end of the trial, participants were prohibited from washing and completed post-trial ratings during a 2-min break. This same procedure was used for the 9 remaining trials.

Statistical analyses

Baseline differences were examined using one-way ANCOVAs that controlled for gender. Regression analyses and their follow-up tests were conducted using hierarchical linear modeling (HLM; see Raudenbush & Bryk, 2002, for reviews). HLM is useful in analyzing repeated measures data (Level 1 data) nested within subjects (Level 2 data; Bryk, Raudenbush, & Congdon, 1996). HLM does not require the assumption of independence of observations, improves the estimate of effects within individual units, and has lower Type I error rates (Raudenbush & Bryk, 2002).

HLM is essentially a program that conducts regressions, and is capable of including fixed factors (i.e., independent variable) and multiple random factors (e.g., individuals). It was used in this study to examine change across time with repeated measures for each individual (growth curve modeling). *T*-tests were used to examine whether *y*-intercepts of the regression lines were significantly different from zero, and whether differences between two regression lines (e.g., regression line for change in anxiety across trials for illness-related threats vs. regression line for change in anxiety across trials for non-illness-related threats) were significant. In this example, ''anxiety'' would be the Level 1 predictor, nested within ''threat type'' as the Level 2 variable.

Results

Breakdown of participants' primary threat

Of the 27 participants, 11 (40.7%) reported a primary threat of being overwhelmed by feelings of disgust, 10 (37.0%) reported concerns of illness or harm to self, 3 (11.1%) reported concern that their anxiety would never end, 2 (7.4%) reported that someone else would become ill or harmed in some way, and 1 (3.7%) said that he/she would lose control. Twelve (44.4%) reported concerns of either illness or harm to self/others and were thus categorized as having illness-related primary threats, and 15 (55.6%) participants reported non-illness threats (i.e., fears related to disgust, anxiety, or loss of control). Strength of belief in each washing-related threat is presented in Table 2.

Table 2
Means and standard deviations of washing threat questionnaire items between participants with and without illness concerns

	Illness primary threat ($n = 12$)	Non-illness primary threat ($n = 15$)
1. I fear my anxiety will never end unless I wash my hands	42.50 (29.0)	40.00 (31.2)
2. If I don't wash my hands, I fear I will be incapacitated (unable to function) by my anxiety	19.17 (29.7)	28.00 (24.3)
3. If I don't wash my hands, I fear I will become ill or I will be harmed in some way	63.33 (22.3)	38.00 (28.8)*
4. If I don't wash my hands, I fear someone else will become ill or will be harmed in some way	37.50 (40.5)	30.00 (31.6)
5. If I don't wash my hands, I fear I will go crazy	16.67 (25.3)	16.00 (19.9)
6. If I don't wash my hands, I fear I will lose control	14.17 (26.8)	17.33 (22.8)
7. I fear I won't be able to manage my anxiety if I don't wash my hands	25.83 (32.3)	28.67 (25.6)
8. If I don't wash my hands, I fear I will be overwhelmed by feelings of disgust	33.33 (33.7)	62.00 (30.0)

*$p < .05$.

Baseline differences between participants with and without illness concerns

Baseline differences between participants with and without illness concerns are presented in Table 3. A higher percentage of men were in the illness-related threat group than in the non-illness threat group (illness: 5/12 or 41.7% male vs. non-illness: 1/15 or 6.7% male), $x^2 = 4.34$, $p < .05$. Because of this gender difference, we controlled for gender in subsequent analyses. One-way ANCOVAs comparing participants with illness and non-illness-related threats were performed using the following dependent variables: BDI, BAI, WTQ subscales, OCI-total, and OCI-washing subscale scores, along with strength of belief in primary threat, which was assessed using the WTQ. In addition, the number of steps completed on each of the three BATs was compared, along with average anxiety and disgust ratings taken from steps completed on all BATs. No significant differences in these measures were found between groups, with the exception that participants displaying illness concerns reported significantly lower BAI scores than those displaying non-illness concerns, $F(1,24) = 5.80$, $p < .05$.

Additional ANCOVAs were conducted to compare group scores on individual WTQ items. Compared to participants in the non-illness group, those in the illness group were significantly more likely to be concerned about fear of illness/harm to themselves, $F(1, 24) = 5.12$, $p < .05$. No other group differences in WTQ items were found.

Decline in anxiety, disgust, and urge to wash across treatment trials

HLM analyses were conducted to obtain the decline slopes for anxiety, disgust, and urge to wash across trials. Fig. 1 presents data on anxiety, disgust, and urge to wash across the 10 ERP treatment trials. The decline slopes of anxiety ($\beta = -4.39$), disgust ($\beta = -4.25$), and urge to wash ($\beta = -2.46$) were all significantly different from zero [$t(268) = -7.10$, $p < .001$, $t(531) = -7.32$, $p < .001$, and $t(268) = 3.95$, $p < .001$, respectively]. While the intercept (i.e., initial rating) for disgust was significantly higher than the intercept for anxiety, $t(531) = 5.84$, $p < .001$, the slopes were not significantly different from each other, $t(531) = .39$, $p < .70$. In contrast, the slope of anxiety was significantly steeper than the slope of urge to wash, $t(535) = -3.17$, $p < .01$. While the slope of disgust was also steeper than the slope of urge to wash, this difference did not attain statistical significance, $t(535) = 1.82$, $p < .07$.

Do changes in anxiety, disgust, and urge to wash during ERP treatment differ between washers displaying illness as their primary threat vs. washers displaying non-illness-related primary threats?

HLM analyses were performed separately for anxiety, disgust, and urge to wash. In the first analysis, anxiety was entered as the dependent variable, trial served as a Level 1 predictor, and threat type

Table 3
Means and standard deviations of baseline measures between participants with and without illness concerns

	Illness primary threat ($n = 12$)	Non-illness primary threat ($n = 15$)
BDI	6.92 (7.5)	11.40 (9.3)
BAI	6.50 (5.6)	14.00 (10.9)*
Total OCI-R	31.17 (13.5)	34.64 (15.3)
OCI-R washing subscale	7.25 (2.8)	7.53 (2.6)
Strength of belief in primary threat	68.33 (25.5)	62.66 (28.7)
WTQ-illness	50.42 (27.9)	34.00 (29.2)
WTQ-affect/control	25.28 (24.5)	32.00 (20.3)
BAT steps completed—soiled laundry	5.25 (1.5)	4.80 (1.7)
BAT steps completed—Dirt mixture	5.58 (1.2)	4.80 (1.8)
BAT steps completed—toilet	4.83 (1.5)	4.40 (1.8)
Average anxiety per step for all BATs	45.00 (19.1)	48.13 (18.3)
Average disgust per step for all BATs	53.88 (22.2)	63.06 (16.0)

*$p < .05$.

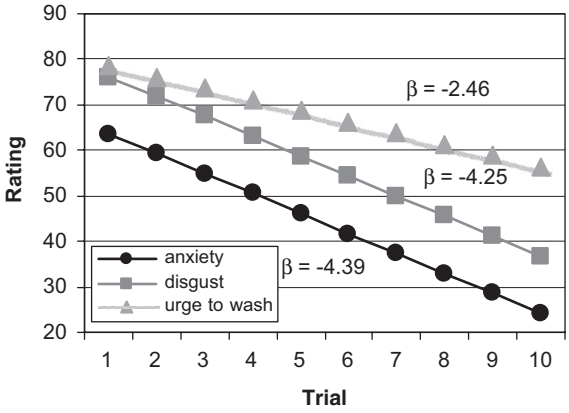

Fig. 1. Decline slopes for anxiety, disgust, and urge to wash.

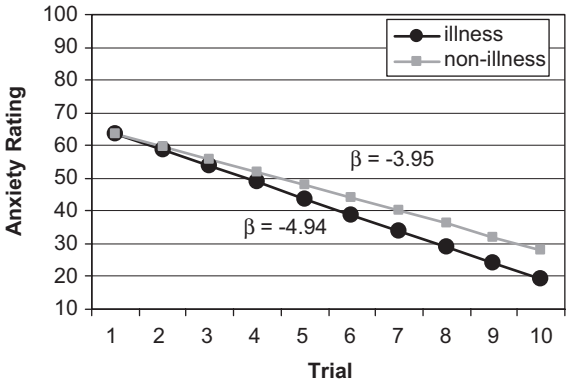

Fig. 2. Anxiety decline slopes by primary threat.

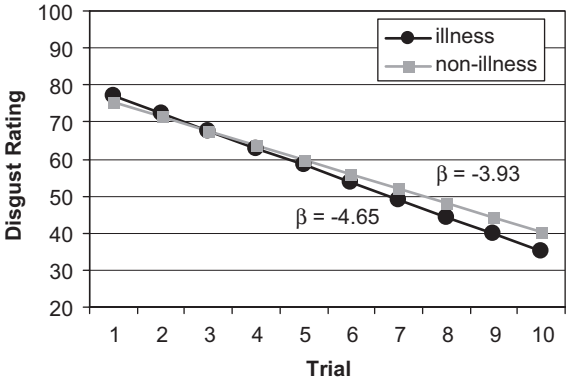

Fig. 3. Disgust decline slopes by primary threat.

(dichotomized as either illness-related or non-illness-related) was entered as a Level 2 predictor. Threat type did not moderate the changes in anxiety across trials (see Fig. 2). A similar analysis was performed for the measure of disgust. Again, threat type did not moderate the changes in disgust across trials (see Fig. 3). When this same analysis was repeated with urge to wash as the dependent variable, primary threat exerted a

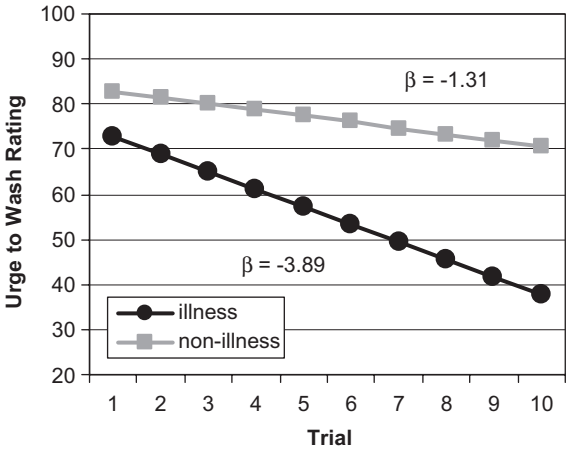

Fig. 4. Urge to wash decline slopes by primary threat.

significant moderating effect on urge to wash across the 10 trials. Those with non-illness-related concerns experienced a significantly smaller decline slope in urge to wash compared to those with illness-related concerns, $t(266) = 2.21$, $p < .05$ (see Fig. 4). Furthermore, while those with illness concerns experienced a statistically significant decline slope for urge to wash, $\beta = -3.89$, $t(266) = -4.22$, $p < .001$, the urge to wash decline slope only approached significance for those participants with non-illness concerns, $\beta = -1.31$, $t(266) = -1.83$, $p = .07$, indicating that the slope for urge to wash for these participants was not significantly different from zero.

Does the decline in anxiety across trials remain significant after controlling for changes in disgust and vice versa?

Tests of 2 Level-1 hypotheses were conducted. The first test examined whether anxiety significantly declined when controlling for decline in disgust and included anxiety as the outcome variable and trial and disgust as Level 1 predictors; the second test examined whether disgust significantly declined when controlling for anxiety and included disgust as the outcome variable, with anxiety and trial as the Level 1 predictors. Anxiety and disgust were each included as time-varying covariates for the other to determine whether each declined to a greater extent than predicted by the effect of the other. Thus, a finding in which trial remained significantly predictive of the outcome variable (e.g., anxiety) suggests that the predictor was still significant above and beyond what is explained by the other Level 1 predictor (e.g., disgust). We also examined whether there were any differences between threat types (i.e. illness-related vs. non-illness-related), which was entered as the Level 2 variable.

Significant declines in disgust across trials were still observed after accounting for the changes in anxiety, $\beta = -2.24$, $t(264) = -2.65$, $p < .01$. A similar result was obtained with changes in anxiety being modeled as a function of disgust and trial, $\beta = -2.81$, $t(264) = -2.81$, $p < .01$. Thus, neither anxiety nor disgust accounted entirely for the level of decline in the other across trials. Threat status failed to exert a significant effect on the decline slopes of either anxiety or disgust.

Do declines in disgust and anxiety uniquely predict decline in urge to wash?

This question was addressed by performing an HLM analysis in which both anxiety and disgust were entered simultaneously as Level 1 predictors of urge to wash. Anxiety and disgust both independently predicted urge to wash, $t(267) = 2.66$, $p < .05$ and $t(267) = 2.78$, $p < .01$, respectively. Next, primary threat type was entered into another model as a Level 2 predictor. For those with illness-related threats, the decline in anxiety over the 10 trials significantly predicted the decline slopes for urge to wash even after controlling for

change in disgust, $\beta = .51$, $t(264) = 7.93$, $p < .001$. In contrast, decline in disgust did not significantly predict changes in urge to wash, $\beta = .13$, $t(264) = 1.27$, $p = .21$, after controlling for the decline in anxiety.

A reverse pattern emerged for the non-illness-related threat group. Decline in disgust over the 10 trials predicted urge to wash even after controlling for the decline in anxiety over the 10 trials, $\beta = .32$, $t(264) = 3.39$, $p < .001$, whereas anxiety decline did not significantly predict urge to wash after controlling for decline in disgust, $\beta = .15$, $t(264) = 1.77$, $p = .08$.

Not surprisingly, when comparing illness to non-illness threat groups, anxiety decline slopes were significantly less predictive of changes in urge to wash in the non-illness-related threat group as compared to the illness-threat group, $\beta = .00$, $t(264) = -6.30$, $p < .05$. However, changes in disgust were significantly more predictive of changes in urge to wash for the non-illness-related threat group as compared to the illness-related threat group, $\beta = .32$, $t(264) = 1.98$, $p < .05$.

Taken together, these findings show that as anxiety decreased, urge to wash decreased more in the illness-related threat group, whereas, as disgust decreased, urge to wash decreased more in the non-illness-related threat group. Further, while anxiety and disgust may have independently predicted changes in urge to wash overall, disgust only predicted changes in urge to wash for the non-illness-related primary threat group, whereas anxiety only predicted changes in urge to wash for those with illness-related primary threats.

Discussion

The present study revealed several findings regarding the effects of ERP on anxiety and disgust in individuals with contamination fear. Both anxiety and disgust significantly declined in the context of one session of ERP treatment. In addition, consistent with the findings of Smits et al. (2002), their decline appeared to be independent of each other: anxiety significantly declined when controlling for changes in disgust, and vice versa. Though disgust ratings at the beginning of the ERP treatment session were initially higher than anxiety ratings, no differences emerged in the rate of decline between anxiety and disgust. These findings run counter to those of Smits et al. (2002), who found more rapid declines in fear than disgust. It is possible that these response differences are due to the fact that Smits and colleagues were assessing reactions to a spider rather than contaminants. However, these data also contradict those from McKay (2006) investigation demonstrating lower across-session habituation in disgust than in anxiety among washers receiving ERP treatment. These differences, in turn, may be due to the fact that the present study only examined within-session habituation.

Interestingly, the contribution of anxiety and disgust to urge to wash was different for washers with illness as their primary threat vs. washers with non-illness-related threats. When both anxiety and disgust were entered into a model predicting urge to wash, decline in disgust but not anxiety significantly predicted decline in urge to wash for washers with non-illness-related threats. For washers whose primary threat was illness-related, decline in anxiety but not disgust predicted decline in urge to wash. These results suggest that disgust and anxiety make unique contributions to compulsive washing. They are also consistent with Rachman's (1994) proposal that washers with illness concerns have their compulsions fueled by fear but not disgust.

The observation that urges to wash did not significantly decline among individuals with non-illness primary threats suggests that this group may benefit less from ERP than washers with illness-related primary threats. These findings seem counterintuitive given that threats of illness seem more distal than those chosen by the non-illness threat group. Individuals in the latter group generally received more immediate corrective information related to their fears that their anxiety would last forever or they would be overwhelmed by disgust. That is, both anxiety and disgust declined for this group in session. Individuals with illness-related primary threats, in contrast, did not appear to receive immediate disconfirmation for this threat, since signs of illness would presumably not appear until later. Perhaps the absence of decline in urge to wash among those with non-illness primary threats was due to their higher anxiety and fear of negative emotion, which in turn might have elicited a stronger urge to wash in order to relieve feelings of disgust or anxiety. It should be noted, however, that the declines in anxiety and disgust among this group were comparable to those experienced by participants with illness-related primary threats, suggesting that both groups may benefit equally from ERP. Habituation in urge to wash, to our knowledge, has not been examined as a predictor of treatment outcome.

In order to fully understand the importance of the present findings, research exploring changes in anxiety, disgust, and urge to wash as outcome predictors in ERP treatment of compulsive washing would be helpful.

Several clinical implications of the present study should be mentioned, though they are presented with a strong note of caution given that our study examined only one ERP treatment session and used a sub-clinical sample. The results suggest that special attention should be given to the themes of OC washers at the initial assessment. Given that urge to wash declined significantly less among the non-illness threat group, they may represent a particularly difficult profile for clinicians to treat. This group tended to report fears of anxiety or disgust, and they may benefit significantly from education about emotions or interoceptive exercises designed to reduce fear of these emotions. Also, since disgust, but not anxiety, predicted decline in urge to wash for this group, it is possible that clinicians may better treat washers with non-illness threats by utilizing interventions targeting disgust. Rachman (2004) proposed techniques such as cognitive reorientation (e.g., conceptualizing rotten milk as yogurt) in the treatment of disgust-based compulsive washing.

Some limitations to the present study deserve comment. First, though the sample of sub-clinical washers reported significant anxiety, disgust, and urge to wash in response to the contaminants and higher self-reported washing scores than those found in an OCD sample (Foa et al., 2002), the use of this sample limits the applicability of the findings to clinical OC washers. Second, since the variables of interest were only tracked over the course of one session of treatment, it is not known whether within-session declines in disgust, anxiety, or urge to wash would predict treatment outcome for multi-session treatment of OC washing. However, given that failure to habituate within-session has been found to predict poor treatment outcome in ERP treatment of OCD (Foa et al., 1983), it would seem that the patterns of habituation examined here would also be relevant in determining treatment outcome over several sessions. Third, the study was limited by the use of a small sample ($n = 27$). Some of the analyses, such as those assessing group differences in WTQ item ratings, would have likely resulted in significant differences had a larger sample been used. Lastly, though we categorized participants based on their primary threat reported, it was generally not the only threat many of them endorsed. However, the strength of belief in participants' primary threats appeared to be greater than that reported for other threats in the WTQ (see Table 2).

In summary, the present findings indicate that both anxiety and disgust play important roles in compulsive hand washing and their declines in the context of ERP treatment are partially independent of each other. In addition, several characteristics appear to distinguish washers whose primary threat is fear of illness from those whose primary threat is non-illness-related. These different washing subtypes may warrant different treatment approaches. Further research is required to examine the potential moderating role of primary threat and the contribution of anxiety and disgust to urge to wash over the course of multiple ERP treatment sessions in a clinical compulsive washing population. As greater understanding of these variables is reached, OC patients with contamination fears are expected to benefit significantly.

References

Alarcon, R. D., Libb, J. W., & Spitler, D. (1993). A predictive study of obsessive compulsive disorder response to clomipramine. *Journal of Clinical Psychopharmacology*, *13*, 210–213.

Beck, A. T. (1978). *The Beck Depression Inventory*. San Antonio, TX: Psychological Corporation.

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*, *56*(6), 893–897.

Bryk, A. S., Raudenbush, S. W., & Congdon, R. T. (1996). *HLM: Hierarchical linear and nonlinear modeling with the HLM/2L and HLM/3L programs*. Chicago, IL: Scientific Software international.

Coehlo, J. S., & Whitttal, M. L. (2001). *Are sub-types of OCD differentially responsive to treatment?*. Vancouver, Canada: World Congress of Behavioural and Cognitive Therapies.

Cougle, J. R., Lee, H. -J, Wolitzky-Taylor, K. B., & Telch, M. J. (in preparation). Beliefs associated with compulsive handwashing.

Foa, E. B., Grayson, J. B., Steketee, G. S., Doppelt, H. G., Turner, R. M., & Latimer, P. R. (1983). Success and failure in the behavioral treatment of obsessive-compulsives. *Journal of Consulting and Clinical Psychology*, *51*, 287–297.

Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., et al. (2002). The obsessive-complusive inventory: Development and validation of a short version. *Psychological Assessment*, *14*, 485–495.

Foa, E. B., Liebowitz, M. R., Kozak, M. J., Davies, S., Campeas, R., Franklin, M. E., et al. (2005). Randomized, placebo-controlled trial of exposure and ritual prevention, clomipramine, and their combination in the treatment of obsessive-compulsive disorder. *American Journal of Psychiatry*, *162*(1), 151–161.

Foa, E. B., & Wilson, R. (2001). *Stop obsessing: How to overcome your obsessions and compulsions*. New York, USA: Bantam Books.
Gibbs, N. A. (1996). Nonclinical populations in research on obsessive-compulsive disorder: A critical review. *Clinical Psychology Review*, *16*, 729–773.
Jones, M. K., & Menzies, R. G. (1997). The cognitive mediation of obsessive-compulsive handwashing. *Behaviour Research and Therapy*, *35*, 843–850.
Jones, M. K., & Menzies, R. G. (1998a). Role of perceived danger in the mediation of obsessive-compulsive washing. *Depression and Anxiety*, *8*, 121–125.
Jones, M. K., & Menzies, R. G. (1998b). Danger ideation reduction therapy (DIRT) for obsessive-compulsive washers: A controlled trial. *Behaviour Research and Therapy*, *36*, 959–970.
Mancini, F., Gragnani, A., & D'Olimpio, F. (2001). The connection between disgust and obsessions and compulsions in a non-clinical sample. *Personality and Individual Differences*, *31*(7), 1173–1180.
McKay, D. (2006). Treating disgust reactions in contamination-based obsessive-compulsive disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, *37*, 53–59.
Muris, P., Merckelbach, H., Nederkoorn, S., Rassin, E., Ingrid, C., & Horselenberg, R. (2000). Disgust and psychopathological symptoms in a nonclinical sample. *Personality and Individual Differences*, *29*(6), 1163–1167.
Muris, P., Merckelbach, H., Schmidt, H., & Sandy, T. (1999). Disgust sensitivity, trait anxiety and anxiety disorders symptoms in normal children. *Behaviour Research and Therapy*, *37*, 953–961.
Olatunji, B. O., Sawchuk, C. N., Arrindell, W. A., & Lohr, J. M. (2005). Disgust sensitivity as a mediator of the sex differences in contamination fears. *Personality and Individual Differences*, *38*, 713–722.
Olatunji, B. O., Sawchuk, C. N., Lohr, J. M., & de Jong, P. J. (2004). Disgust domains in the prediction of contamination fear. *Behaviour Research and Therapy*, *42*, 93–104.
Rachman (1994). Pollution of the mind. *Behaviour Research and Therapy*, *32*, 311–314.
Rachman, S. (2004). Fear of contamination. *Behaviour Research and Therapy*, *42*, 1227–1255.
Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and data analysis methods* (2nd Edition). Thousand Oaks, CA: Sage.
Smits, J. A. J., Telch, M. J., & Randall, P. K. (2002). An examination of the decline in fear and disgust during exposure-based treatment. *Behaviour Research and Therapy*, *40*, 1243–1253.
Taylor, S., Koch, W. J., & McNally, R. J. (1992). How does anxiety sensitivity vary across the anxiety disorders? *Journal of Anxiety Disorders*, *6*, 249–259.
Thorpe, S. J., Patel, S. P., & Simonds, L. M. (2003). The relationship between disgust sensitivity, anxiety and obsessions. *Behaviour Research and Therapy*, *41*, 1397–1409.
Thorpe, S. J., & Salkovskis, P. M. (1998). Studies on the role of disgust in the acquisition and maintenance of specific phobias. *Behaviour Research and Therapy*, *36*, 877–893.
Woody, S. R., & Teachman, B. A. (2000). Intersection of disgust and fear: Normative and pathological views. *Clinical Psychology: Science and Practice*, *7*, 291–311.
Woody, S. R., & Tolin, D. F. (2000). Intersection of disgust and fear: Normative and pathological views. *Clinical Psychology: Science and Practice*, *7*(3), 291–311.