THE EFFECTS OF PREVENTATIVE AND RESTORATIVE SAFETY BEHAVIORS ON CONTAMINATION FEAR

by

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ABSTRACT
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Recent research suggests that safety behaviors may not preclude cognitive change or treatment gains in exposure-based therapy for obsessive-compulsive disorder (OCD). However, it is relatively unknown *what* categories of specific behaviors may be detrimental to the therapeutic process. Some researchers argue that classifying safety behaviors based on their function may be the best solution. The current study sought to examine the extent to which different safety behaviors enhanced or weakened treatment outcomes for contamination fear and washing symptoms. Fifty-one non-clinical students were randomly assigned to one of three conditions: (1) exposure with no safety behaviors (NSB), (2) exposure with preventative safety behaviors (PSB), or (3) exposure with restorative safety behaviors (RSB). Among the primary outcomes, greater reductions in fear, disgust, and behavioral avoidance were found for RSB in comparison to PSB, and the gains made by RSB were generalizable to other sources of potential contamination. Overall, the current study suggests that restorative safety behaviors may be beneficial as an adjunct to therapy whereas preventative behaviors are potentially detrimental. Results of the study are discussed in terms of the cognitive-behavioral theory and treatment of anxiety disorders, and future research directions are suggested.

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Introduction

Exposure is currently the first-line treatment for anxiety disorders yet a sizable number of treatment-seekers terminate therapy in the early stages (Kessler et al., 2001; Edlund et al., 2002). More specifically, 25-45% of clients drop out, relapse, or fail to respond during exposure and response prevention (ERP) for obsessive-compulsive disorder (OCD; Franklin et al., 2000; Stanley & Turner, 1995). For example, one study found that out of 521 individuals screened for OCD, 10% declined to schedule an initial appointment due to a refusal to undergo ERP (Foa et al., 2005). Researchers have suggested that OCD patients may dislike ERP due to fear or apprehension about the difficulty and intensity of the treatment (Maltby & Tolin, 2005) and patients may prefer less frightening and demanding interventions.

Given the number of OCD sufferer's who refrain from therapy or experience overwhelming distress during treatment, modifying exposure-based treatment to increase effectiveness and satisfaction is an important research avenue. Researchers have turned to different augmentation strategies in the hopes of boosting client retention and treatment efficacy. For example, d-cycloserine, a memory enhancing partial agonist, has been examined as an adjunct to cognitive-behavioral therapy for a number of anxiety disorders (Hofmann, Sawyer, & Asnaani, 2012). Another area that has received some empirical support is the use of safety behaviors in the early stages of exposure therapy. Little is known regarding safety behaviors in OCD treatment; however, according to cognitive-behavioral models of anxiety disorders, safety behaviors maintain pathological anxiety and should be eliminated in therapy (Salkovskis, 1991; Clark, 1999; Clark & Wells, 1995).

Rachman (1984) first implicated the presence of safety cues and safety signals as central in maintaining agoraphobia. Salkovskis et al. (1996) later expanded Rachman's model and applied it to panic disorder. Safety behaviors within panic disorder included: (1) avoidance of situations (e.g., crowded places), (2) escape from a situation, and (3) subtle avoidance (e.g., relaxing, sitting down). Safety behaviors can take various forms, including both behavioral and cognitive strategies. For example, a reliance on safety signals, avoidance, escape, compulsive behaviors, and other overt safety-strategies function as behavioral; and on the other hand, thought suppression, excessive preparation and worrying, distraction and refocusing constitute the cognitive subtype of safety behaviors. Barlow and colleagues (2004) modified the conceptualization of safety behaviors to include emotion-driven behaviors (i.e., action tendencies such as escape) and emotional avoidance strategies e.g., cognitive avoidance. Prior to Barlow's work, safety behaviors had been primarily thought of as behavioral strategies.

Research indicates that individuals with psychopathology tend to use more safety behaviors than non-clinical controls (McManus, Sacadura, & Clark, 2008; Tang et al., 2007; Salkovskis et al., 1996). Nonetheless, the majority of individuals utilize anxiety-reducing behaviors to cope with situations, leading researchers to believe that maladaptive safety behaviors and adaptive coping strategies exist on a continuum. However, it can be difficult to distinguish between maladaptive safety behaviors and adaptive coping in clinical settings. Thwaites and Freeston (2005) recommend clinicians take into account the context of the behavior (e.g., the intention of the behavior, whether the behavior is situationally appropriate, consequences of the behavior) when determining whether or not a behavior is occurring non-essentially. Theory suggests that

in the case of real, and not imagined threat, anxious behaviors can be adaptive whereas, in the absence of threat, anxiety-reducing behaviors are likely to function as ineffective strategies designed to seek safety. Such safety seeking strategies are attempts to regulate emotions by preventing feared outcomes (Helbig-Lang & Petermann, 2010).

The term 'safety behavior' suffers from ambiguity given its idiosyncratic nature. It is difficult to distinguish between what is considered a safety behavior versus an adaptive coping strategy, compulsion, mental ritual, habit, escape, and avoidance. Safety behaviors can be found across the anxiety disorder spectrum, though they have not been systematically studied across the disorders. Behaviors associated with social anxiety may include avoiding eye contact, mental rehearsal, and monitoring one's speech. In panic disorder, carrying medication, heightened and/or effortful focus towards bodily cues, checking for the presence of exits, and avoiding arousal-inducing sensations (e.g., caffeine, exercise, sex) are all common behaviors used to prevent an increase in anxiety or decrease heightened levels of anxiety. Within the realm of specific phobias, individuals may avoid or escape confrontation with a feared object or situation, distract themselves, or seek out safety aids (e.g., wearing and obtaining safety gear). Compulsive behaviors such repeated checking, neutralizing (e.g., praying, counting) and thought suppression are common safety behaviors in OCD. And within health anxiety and hypochondriasis, individuals may seek reassurance (e.g., calling family members, visiting the doctor repeatedly, "doctor shopping").

Traditional cognitive-behavioral models of anxiety argue that safety behaviors be dropped as they are thought to play a role in maintaining anxiety disorders (Rapee & Heimberg, 1997; Salkovskis et al., 1999). Furthermore, elimination of safety behaviors is

one of the most common cognitive-behavioral techniques used by clinicians (Hipol & Deacon, 2012). It is thought that when individuals use safety behaviors, they are unable to test their faulty negative beliefs regarding how dangerous or harmful a situation really is. Instead, the individual may (mis)attribute the non-occurrence of a feared outcome (e.g., for the social phobic, appearing "stupid" while public speaking) to the implementation of the safety behavior (e.g., avoidance of eye contact with audience members). Such behaviors may prevent or weaken the ability to gain corrective and disconfirming evidence regarding beliefs about feared behaviors and their outcomes (e.g., appearing "stupid" and it leading to negative evaluation; Salkovskis, 1991; Wells et al., 1995). Simply, they will be unable to learn that their feared outcomes will not come true even if they refrain from utilizing the behavior.

A number of studies have detailed the detrimental effects of safety behaviors. Experimental studies tend to compare the use of safety behaviors to a no safety behavior, exposure-only control condition, though treatment protocols differ to what extent safety behaviors are instructed versus eliminated.

Wells and colleagues (1995) found that social phobics, who were discouraged to use safety behaviors during exposure, had greater reductions in anxiety and belief in feared consequences in comparison to exposure-only. Extension of this study compared socially anxious individuals across three conditions: (a) exposure with decreased safety behaviors using a cognitive rationale, (b) exposure with decreased safety behaviors using an extinction rationale, and (c) exposure only (Kim, 2005). Results were similar to Wells et al. (1995): discouraged use of safety behaviors with a cognitive rationale evidenced greater decreases in anxiety and belief ratings for feared outcomes than the other two

conditions (Kim, 2005). This is consistent with the notion that safety behaviors do not allow for disconfirmation of threat beliefs. It further suggests exposure alone is not as effective as a rationale given to discontinue use of safety behaviors as Kim (2005) found that both discouraged safety behaviors conditions did significantly better than exposure-only. Compared to waitlist control, an intervention designed to target decreases in safety behaviors among individuals with panic, social anxiety, and generalized anxiety disorder led to clinically significant improvement and better treatment gain maintenance (Schmidt, Buckner, Pusser, Woolaway-Bickel, Preston, & Norr, 2012).

Safety behaviors have also been examined with emphasis on instructing participants to utilize the behaviors, rather than discouraging or eliminating their use. It is argued that safety behaviors may allow an individual to feel less distressed in the short-term but maintain anxiety in the long-term. Individuals with panic disorder and agoraphobia were randomly assigned to either distract themselves or focus on their own internal bodily cues during exposure therapy. Those assigned to the distraction group reported better results at post-treatment than the internal cues group. However, greater fear was found in the distraction group at follow-up, suggesting that gains made in the short-term were not maintained over long-term follow-up (Craske, Street, & Barlow, 1989). Deacon and Maack (2008) observed similar findings using an A/B/A design where the ‘B’ phase consisted of daily safety behaviors (e.g., washing/disinfecting hands after and before eating) over a one-week period. Use of the contamination safety behaviors led to increases in fear of contamination and threat overestimation among individuals with both high and low contamination fearfulness. A related study demonstrated that use of health-related safety behaviors led to increases in health anxiety and hypochondriacal

beliefs compared to no safety behaviors (Olatunji, Etzel, Tomarken, Ciesielski, & Deacon, 2011). Taken together, the findings indicate that safety behaviors are strategies that contribute to maintaining or exacerbating anxiety symptoms.

Sloan and Telch (2002) assigned claustrophobics to one of three exposure-based treatment protocols: guided threat focus and reappraisal (i.e., focus on the perceived threat and gain evidence to weaken the threatening beliefs), safety behavior utilization, or exposure-only. Individuals in the safety behavior utilization condition were able to open a small window in the claustrophobia chamber and/or talk with the experimenter through an intercom, among other safety strategies. Those in this condition evidenced more return of fear at post- and follow-up treatment assessments than the other conditions. Powers, Smits, and Telch (2004) replicated and extended this study by examining whether the *perceived availability* of safety behaviors versus their *actual use* would lead to similar adverse outcomes. Individuals in the availability group were told that safety aids were available to them, but to only use them if they felt they must. Indeed, the researchers found that safety behaviors do not necessarily need to be utilized to lead to worse outcomes. The authors recommend to clinicians that they should not only encourage clients to refrain from safety behaviors but to also discard their perceived availability (e.g., carrying benzodiazepine medication for fear of panic attack). Furthermore, the instructed use of safety behaviors led to decreases in memory confidence (Radomsky, Gilchrist, & Dussault, 2006) and interference with reductions in anxiety (Mohlman & Zinbarg, 2000; Telch, Valentiner, & Bolte, 1994; Salkovskis et al., 1999; Schmidt-Leuz, Elsesser, Lohrmann, Johren, & Sartory, 2007) among animal phobics (Sartory, Rachman,

& Grey, 1982) and claustrophobics (Kamphuis & Telch, 2000; Sloan & Telch, 2002; Powers et al., 2004).

In a counter-balanced design, Grayson and his colleagues (1982) randomly assigned individuals with OCD to exposure and attention focusing (i.e., observing and discussing contaminants) on day one and exposure with distraction (i.e., playing a video game) on the second day of treatment, or the reverse order. Comparable declines were found for both conditions on self-reported anxiety but greater between-session habituation was found for those who underwent exposure and attention-focusing first (Grayson, Foa, & Steketee, 1982). Grayson et al. further found that safety behaviors (e.g., distraction) impact physiological arousal. Heart rate decreased following exposure with attention focusing but remained elevated in those who underwent the distraction task first (Grayson et al., 1986). The researchers argue that safety behaviors during exposure interfere with reductions in physiological arousal.

There are many reasons why safety behaviors may interfere with meaningful treatment outcomes. First, safety behaviors may directly increase fear and lead to the development of clinical levels of anxiety. Research has demonstrated that engagement in safety behaviors may lead to increases in fear of contamination (Deacon & Maack, 2008), health anxiety (Olatunji et al., 2011), and social anxiety (McManus et al., 2008). One thought is that the repetitive behavioral efforts employed during safety behavior use may increase the salience of perceived threats. In other words, the more attentional focus given to the threatening stimulus, the more prominent the threat. Thus, safety behaviors may exert a potentially causal role in increasing contamination fear, health anxiety, and social anxiety (Deacon & Maack, 2008; Olatunji et al., 2011; McManus et al., 2008). The

allocation of attention may also distract from gaining disconfirming evidence. Second, safety behaviors may initially reduce anxiety although eventually interfere with long-term therapeutic gain. Higher rates of fear return have been demonstrated among claustrophobics (Kamphius & Telch, 2000; Sloan & Telch, 2002), spider (Haw & Dickerson, 1998) and animal phobics (Sartory et al., 1982). Furthermore, immediate gains (i.e., initial fear reduction) may not be maintained in the long run.

Although the entrenched view has been to drop safety behaviors in the context of therapy, growing evidence suggests that safety behaviors may not be detrimental or preclude cognitive change and fear reduction, prompting Rachman et al. (2008) to call for "a reconsideration" of their use (p. 163). As stated earlier, experimental research has typically compared a set of instructed or discouraged safety behaviors to a no safety behavior exposure-only control condition. The following demonstrates equivalence between groups for safety behaviors utilized in exposure therapy protocols.

Snake phobics who used safety behaviors experienced comparable decreases in fear, anxiety, and behavioral avoidance to those who did not use safety behaviors (Hood, Antony, Koerner, & Monson, 2010; Milosevic & Radomsky, 2008). Likewise, agoraphobics who were given the opportunity to leave fear-provoking situations during exposure demonstrated equivalent decreases in behavioral avoidance and fear to those unable to escape (de Silva & Rachman, 1984). The study was replicated and included a 3-month follow-up period and both conditions (i.e., escape and no-escape) showed improvements on measures of agoraphobic concerns with gains maintained at follow-up (Rachman, Craske, Tallman, & Solyom, 1986). Moreover, the escape group reported a greater sense of control and less fearfulness in comparison to those in the no-escape

condition (Rachman et al., 1986), suggesting that escape does not increase behavioral avoidance and instead may aid in enhancing an individual's sense of control during the course of treatment.

Although early research has found that use of safety behaviors impedes reductions in physiological arousal compared to no safety behaviors (Grayson et al., 1986), Levitt and her colleagues (2004) found no differences in physiological arousal (i.e., heart rate and skin temperature) when comparing individuals with panic disorder who accepted versus suppressed their emotions during a carbon dioxide inhalation challenge. This finding suggests that safety behaviors may not interfere with physiological reduction during exposure as was previously argued.

Addressed thus far are efforts by researchers to demonstrate equivalence in outcomes. Some research has even suggested that safety behavior utilization leads to *better* outcomes than exposure only. Snake phobics who were given "response induction aids" displayed better treatment outcomes including greater behavioral approach and larger reductions in fear, relative to minimally aided conditions (Bandura, Jeffrey, & Wright, 1974). Additionally, negative beliefs were lower among individuals who utilized safety behaviors during spider exposure (Milosevic & Radomsky, 2013a), suggesting safety seeking behaviors do not preclude corrective learning. A replication of Powers et al. (2004) found that safety behavior utilization led to greater improvements in self-efficacy and claustrophobia-related cognitions than conventional exposure or exposure with safety behavior availability (Sy, Dixon, Lickel, Nelson, & Deacon, 2011). Moreover, two independent research groups found that individuals given the opportunity to use hand-wipes following exposure to potential contaminants had greater reductions in

contamination fear than those who did not use safety behaviors (Rachman, Shafran, Radomsky, & Zysk, 2011; van den Hout, Engelhard, Toffolo, & van Uijen, 2011). The individuals who used safety behaviors also felt a greater sense of control over their emotions during exposure (van den Hout et al., 2011).

In Rachman et al.'s (2008) reconsideration of safety behaviors, a call for research that examined the "judicious use of safety behaviors" was placed. Per Rachman, judicious use means "the careful use of safety behaviour, with an emphasis on the early stages of treatment" (p. 169) with safety behaviors gradually faded out during the course of exposure therapy. Safety behaviors may facilitate treatment via a number of different avenues. Exposure therapy for anxiety disorders can be quite aversive, distressing, and demanding for clients. Safety behavior utilization in early treatment sessions may allow clients to feel a greater sense of control over therapy without sacrificing treatment gains. However, few studies have yet to examine the "judicious use" of safety behaviors though the results of one study are promising. Comparable reductions in fear and improvement in claustrophobia-related cognitions were found for those who were and were not able to use safety behaviors during a claustrophobia chamber exposure (Deacon, Sy, Lickel, & Nelson, 2010). Safety behaviors were withdrawn during exposure to examine their *judicious use* and declines in negative beliefs were found. And owing to greater levels of satisfaction, Milosevic and Radomsky (2013b) found that anxious and non-anxious individuals, who rated cognitive-behavioral therapy for anxiety vignettes, found those vignettes that depicted judicious safety behaviors to be the most acceptable.

Currently, there are two opposing views on the role of safety behaviors in the treatment of anxiety disorders (Helbig-Lang & Petermann, 2010). The entrenched view is

that safety behaviors are simply "anti-therapeutic" and lead to negative outcomes. Alternatively, safety behaviors may be facilitative of treatment gains and lead to comparable or greater treatment outcomes. However, safety behaviors remain poorly defined and very little is known regarding which behaviors are helpful versus harmful. Distinguishing different types of safety behaviors may hold some benefit for determining whether specific behaviors may be beneficial for clients to utilize in the early stages of treatment. Helbig-Lang and Petermann (2010) suggest that classifying safety behaviors based on functional value may be one possible solution.

Preventative safety behaviors are attempts to reduce the strength or intensity of contact with potential experiences and situations (Helbig-Lang & Petermann, 2010). In OCD, actions can include compulsive behaviors such as repeated checking, mental neutralizing (e.g., thought stopping) carried out to prevent an increase in anxiety, distraction, and situational avoidance (e.g., avoiding public restrooms for fear of becoming contaminated). On the other hand, *restorative safety behaviors* are those used to "remedy" a situation back to its desired state or to correct a behavior (Helbig-Lang & Petermann, 2010). These behaviors are often thought of in the washing subtype of OCD and can include washing and cleaning rituals. Restorative behaviors may also include mental neutralizing used to reduce anxiety (e.g., counting, praying), thought suppression, and other compulsive behaviors to decrease anxiety (e.g., escape from anxiety-sustaining situations).

Table 1 summarizes studies across the anxiety disorder spectrum using clinical and nonclinical samples, with the majority of studies comparing the efficacy of preventative or restorative safety behaviors to no safety behaviors. In the studies

compiled, we have classified the safety behaviors as either: (1) primarily preventative, (2) primarily restorative, or (3) mixed (i.e., elements of preventative and restorative). Although this is not an exhaustive list of studies examining safety behaviors in an experimental or clinical context, relevant studies were identified through literature search and scanning reference lists of relevant manuscripts. We included all anxiety disorders as search terms and some anxiety-related spectrum conditions (e.g., chronic back pain and health anxiety). Studies excluded from the table included those that compared two safety behavior conditions against each other with no exposure-only control condition and those studies where safety behaviors could not be easily divided into preventative, restorative, or mixed subtypes.

Out of the 16 studies compiled, 7 (=44%) are described as primarily preventative, 4 (=25%) as primarily restorative, and 5 (=31%) as combination. Studies with only preventative safety behaviors evidenced an overwhelming amount of unfavorable outcomes (=58%). Only two studies demonstrated favorable outcomes compared to no safety behaviors and one found no difference between preventative and exposure only. Three quarters of the studies representative of restorative safety behaviors found equivalent performance between safety behavior and exposure-only conditions. The findings for those studies which utilized both preventative and restorative (i.e., mixed) are placed in between the two other categories: a slightly larger number of null and positive outcomes than negative outcomes. This may reflect the combination of deleterious effects of preventative safety behaviors and benign/ beneficial effects of restorative safety behaviors. Overall, out of the six studies (of 16) demonstrating adverse effects, none of the studies examined only restorative safety behaviors, and out of the six

studies with no difference in outcomes between groups, almost all were either restorative safety behaviors or a combination. These findings suggest that preventative safety behaviors are likely to impede the effects of exposure-based treatment for anxiety disorders, whereas the addition of restorative safety behavior potentially yields no such interference effects.

It is unknown why the preventative type of safety behavior demonstrates more negative effects on exposure therapy, though emotional processing theory may provide a theoretical account for why differential effects exist. Emotional processing theory explains the processes of and guides the use of exposure in anxiety disorder treatment. According to the theory, activation of the fear structure is a necessary component for anxiety reduction to occur, a prominent goal of disorder-specific exposure procedures. Fear structures are cognitive networks of maladaptive thoughts that become activated when fear or anxiety are experienced. For example, an individual with panic disorder may think 'I'm going to die' when they notice internal cues such as shortness of breath or rapid heart beat. When the individual begins to notice these cues, they may rely on safety-seeking behavior such as use of benzodiazepine medication. When they use the medication, they are unable to remain in contact with their anxiety to disconfirm maladaptive thought patterns (e.g., 'I'm going to die without this benzodiazepine'). Thus, a major goal of emotional processing is to modify the fear structure. For this modification to occur, two conditions are necessary: (1) elicitation of fear and (2) the provision of corrective information. Foa and Kozak (1986) maintain that there are three indicators to look for to infer emotional processing is occurring: (a) initial fear activation, (b) within-session habituation (i.e., fear gradually decreases during exposure session), and (c)

between-session habituation (i.e., fear gradually diminishes across exposure sessions). Fear activation and between-session habituation are consistently associated with more favorable treatment outcomes.

Within emotional processing theory, clinicians focus on fear activation followed by between and within-session reduction of fear. Michelle Craske and her colleagues (2008, 2012) have found that evidence is mixed regarding whether within-session habituation is a necessary indicator of treatment success (Kozak, Foa, & Steketee, 1988). Instead, it is now thought that inhibitory learning may be central to fear learning and extinction (Bouton, 1993). Inhibitory learning suggests that the original pairing of conditioned stimulus and unconditioned stimulus during fear conditioning is not simply 'forgotten' or erased during extinction learning; instead, it is left intact as secondary learning. The new inhibitory association disrupts the inherent Pavlovian conditioned stimulus-unconditioned stimulus responses and is optimized when individuals learn that fear is tolerable (Craske et al., 2008) and exposure is maximized when clients encounter exposure exercises where they may learn that feared outcomes are less likely or less severe than previously expected. In relation to both emotional processing theory and inhibitory learning, it is thought that the use of safety behaviors (e.g., avoidance) impedes fear activation and distracts an individual from gaining corrective information.

Preventative safety behaviors may interfere with initial fear activation as individuals who utilize such behaviors will not adequately contact feared objects, situations, or experiences. On the other hand, restorative safety behaviors may allow for initial fear activation given contact with a situation will occur and fear will become activated to the same degree as exposure without safety behaviors. The only difference

between restorative safety behaviors and conventional exposure is the remedy that occurs following exposure.

Previous findings regarding safety behaviors may be mixed and leave researchers with inconsistent results for a number of reasons. First, the definition of safety behaviors is poorly understand and may circumvent a number of different behaviors or mental strategies depending on the disorder, including: escape, avoidance, mental neutralizing, and compulsions. Although distinguishing between behavioral and cognitive strategies of safety behaviors may be helpful in some cases, classifying safety behaviors based on functional value (i.e., preventative versus restorative) may prove more useful. And as discussed previously, Rachman (1984), Salkovskis et al. (1996), and Barlow and colleagues (2004) have all devised their own conceptualizations of safety behaviors. These inconsistencies will undoubtedly lead to critical methodological differences in the way safety behaviors are operationalized and measured in the context of experimental psychopathology research. Second, favorable outcomes regarding safety behaviors may differ by anxiety disorder; however, when safety behaviors are denounced, it is often broadly stated for all anxiety problems to drop safety behaviors in treatment. This is problematic and experimental research should examine each anxious condition specifically rather than broadly generalizing findings across the anxiety disorder spectrum.

The current investigation used a non-clinical student sample to examine preventative and restorative safety behaviors as compared with an exposure-only control condition. Although the use of a non-clinical student sample may limit the generalizability and clinical relevance of our findings (and a sample of clinical hand-

washers would be optimal), one review stated that symptoms and cognitions are comparable amongst OCD and non-clinical samples (Gibbs, 1996). Likewise, taxometric analysis indicated that OCD symptoms and related cognitions are dimensional in nature (Olatunji, Williams, Haslam, Abramowitz, & Tolin, 2008). Participants in the current study were randomly assigned to one of three conditions during a single-session experimental study using an ideographic exposure stimulus: (1) exposure with no safety behaviors (NSB), (2) exposure with preventative safety behaviors (PSB), or (3) exposure with restorative safety behaviors (RSB). Participants completed 15 trials of exposure instructed to use either preventative or restorative safety behaviors, or no safety behaviors.

Overall, we predict that NSB and RSB will evidence greater reductions in fear, disgust, and behavioral avoidance, relative to PSB. This is based on our conceptualization that PSB will preclude initial fear activation – which is central for subsequent fear reduction (Foa & Kozak, 1986) - and that activation of the fear-based arousal system is important for treatment outcomes (Kozak, Foa, & Steketee, 1988). Further, given that remedy should follow each stimulus contact per exposure trial in RSB, we predict that this condition will have greater treatment outcomes compared to PSB, though we hypothesize that those in RSB will demonstrate comparable outcomes to NSB.

Method

Participants

Fifty-one non-clinical students at a large, mid-western university participated in the current study in exchange for course credit. The mean age of participants was 21.69 years (SD = 4.82) and participants were predominately female (74.5%). They reported a

variety of ethnic and racial characteristics (with multiple selections allowed): 72.5% White, 19.6% Black, 9.8% Hispanic, 7.8% Asian or Pacific Islander.

Measures

The following measures were administered to participants:

The *Depression Anxiety and Stress Scale* (Lovibond and Lovibond, 1995) is composed of 21 self-rated items assessing state depressive, anxiety, and stress symptoms.

The *Obsessive-Compulsive Inventory-Revised* (OCI-R; Foa et al., 2002) is an 18-item measure of OCD symptoms. Participants rate the degree to which they have been bothered by symptoms in the past month on a 5-point scale from 0 ("Not at all") to 4 ("Extremely"). The measure assesses six types of symptoms: (1) Washing, (2) Checking, (3) Obsessing, (4) Mental neutralizing, (5) Ordering, and (6) Hoarding. The current study utilized the washing subscale.

The reduced item *Disgust Propensity and Sensitivity Scale-Revised* (Fergus & Valentiner, 2009) is a 12-item measure designed to assess the tendency to respond with disgust (Disgust Propensity) and the negative impact of experiencing disgust (Disgust Sensitivity).

The *Acceptance and Action Questionnaire-II* (AAQ-II; Bond et al., 2011) is a measure of experiential avoidance, or an attempt to avoid unwanted and negative private events (e.g., thoughts, feelings, sensations).

Treatment Feasibility (Hunsley, 1992; Kelley, Heffer, Gresham, & Elliott, 1989). Participants' level of treatment acceptability and satisfaction was assessed following completion of the 15 trials of exposure. Participants rated four statements on a scale from 0 to 7, with higher ratings suggestive of greater overall satisfaction. Questions assessed

how acceptable, tolerable, effective, and distressing individuals found the exposure procedure.

Treatment Credibility (e.g., Kim, 2005). Treatment credibility was rated immediately following the exposure condition rationale. This was designed to ensure that observed group differences were not simply reflective of potentially different expectations about the procedures. Participants rated a single-item on a scale from 0 "not at all helpful" to 100 "extremely helpful": "How helpful do you think this procedure will be in overcoming your fears?"

Safety Behavior Checklist (author-constructed; see Appendix E). The Safety Behavior Checklist is a 30-item experimenter-administered measure developed by the author of the thesis to assess participants' use of a broad range of covert safety behaviors during exposure. Respondents answered 'yes' or 'no' to the use of each behavior. This measure was utilized to ensure group equivalence with regard to non-washing-related safety behaviors.

Psychophysiology Assessment

Psychophysiological arousal (i.e., heart rate and respiration rate) were measured using a portable psychophysiology monitor (Zephir Bioharness garment and device, Biopac Systems, Inc.). Physiological data were obtained during each of the 15 trials of exposure, with baseline and recovery data obtained before and after exposure, respectively. A five-minute baseline period was established prior to the start of exposure and a 5-minute recovery period following the post- exposure assessment. From the 15 exposure trials as well as baseline and recovery periods, peak heart and respiration rate were assessed. Data were acquired at a sampling rate of 250 MHz and Bioharness

respiration sensors in the garment detected breathing rates for up to 70 breaths per minute. All actions required throughout the exposure trials involved a minimal range of movement at a slow-pace; thus, movement and motion effects were not expected to increase heart or respiration rate in a significant way.

Exposure Task

Ideographic Exposure Stimulus Selection

Participants were presented with four contamination-related exposure stimuli including: (1) a dirty toilet, (2) a basket of soiled laundry that "may or may not have been touched with bodily fluids," (3) a mixture of dirt, dead insects, and dog hair, and (4) a dirty wastebasket. These stimuli have been used in previous work (Cougle, Wolitzky-Taylor, Lee, & Taylor, 2007; Najmi, Tobin, & Amir, 2012). After being shown the four stimuli, subjects were presented with the Behavioral Approach Task Rating Form (BATRF; see Appendix D) where they rated their anticipated fear ("Estimate the highest level of fear you expect to experience while touching the mixture") in response to each of the four items on a scale from 0-100, with 0 being "no fear at all" and 100 "extremely fearful." The stimulus with the highest fear ratings was chosen for the assessment and exposure tasks ("target exposure stimulus"). If all stimuli were rated highly, the experimenter asked the participant to identify the stimulus that provoked more discomfort than the others. Participants also rated the following indices on the BATRF for each stimulus: Estimated Disgust ("Estimate the highest level of disgust you expect to experience while touching the mixture"), Illness Likelihood ("How likely is it that you would become ill as a result of touching this mixture?") and Illness Severity ("If you became ill as a result of touching the mixture, how severe would your illness be?"). The

three items were also rated on the aforementioned 0-100 scale, with higher ratings indicating greater disgust, illness likelihood and illness severity, respectively. Upon selection of the target exposure stimulus, the baseline assessment took place.

Baseline Assessment

Prior to exposure condition completion, participants completed an assessment trial composed of 16-steps that increased in contact intensity with the ideographic target exposure stimulus (see Appendix A). The steps ranged from "touch with one finger" to "touch stimulus with both hands, and then lick one hand." Each step consisted of the participant being asked to touch the target exposure stimulus and then rate their level of fear and disgust. Similar procedures have been used in previous work examining contamination concerns (Cougle et al., 2007; Najmi et al., 2012). If the participant was unable to complete a step, anticipated level of fear and disgust was assessed instead (e.g., "Estimate your anticipated level of fear/disgust if you were to touch this with both hands and then lick one hand"). Both current and anticipatory fear/disgust were rated using 0-100 visual analogue scales. At the end of the baseline assessment, a target exposure step was derived. *This step is the last step actually performed by the participant* ("target exposure step"), and is the behavior that exposure is conducted on. Following the baseline assessment, randomization to one of the three conditions occurred. Participants were randomized by gender.

Condition

Participants were randomly assigned to one of three conditions: (1) exposure with no safety behaviors (NSB), (2) exposure with preventative safety behaviors (PSB), or (3)

exposure with restorative safety behaviors (RSB). Participants were instructed to touch the target exposure stimulus with the target exposure step across 15 repeated trials.

Exposure with No Safety Behaviors (NSB). The exposure rationale detailed to participants that they should not use safety behaviors during exposure trials and that they will eventually habituate to their anxiety. By doing this, they are told they will learn that their catastrophic fears about touching the potentially contaminated object are untrue. The experimenter says to the participant:

Say: We need to explore how we can reduce fear and discomfort about dirty objects. In order to overcome your fear, you have to go into the situation and experience the fear you are afraid of. To do this you should try to avoid doing things which you normally do to prevent something bad from happening, like using hand sanitizer or using a tissue to prevent contact with something potentially contaminating. For example, when you are in the situation, and have come into direct contact with a contaminating object, don't try to save yourself, do not use behaviors like washing or cleansing yourself after touching something that is potentially contaminating. By staying in the situation, your fear will go away quickly and you will become more confident.

Exposure with Preventative Safety Behaviors (PSB). The preventative rationale details the importance of using protective aids and barriers to contact to help overcome anxiety when coming into contact with a potentially contaminated object. By using preventative safety behaviors and reducing direct contact, they are told their fear will quickly decline. Participants are instructed to use a tissue each time they are to touch the contaminated stimulus. The experimenter says to the participant:

Say: We need to explore how we can reduce fear and discomfort about dirty objects. In order to overcome your fear, you have to go into the situation and use behaviors that will aid in reducing your fear by minimizing direct contact with the contaminating object. To do this you should avoid directly contacting contaminating things, for example, by using tissues or gloves. For example, when you are in the situation and have come into direct contact with a contaminating object, please use this tissue to minimize contact. By reducing direct contact, your fear will go away quickly and you will become more confident.

Exposure with Restorative Safety Behaviors (RSB). Participants in this condition were encouraged to use restorative behaviors (e.g., hand sanitizer) following immediate contact with the potentially contaminated object. They were instructed to cleanse their hands with Purell hand sanitizer after each stimulus contact. By using restorative safety behaviors, they are told their fear will quickly decrease following exposure. The experimenter says to the participant:

Say: We need to explore how we can reduce fear and discomfort about dirty objects. In order to overcome your fear, you have to go into the situation and try to restore your feelings of cleanliness immediately to decrease your fear. To do this you should try to do things like use hand sanitizer after coming into contact with contaminating objects. For example, when you are in the situation and have come into direct contact with a contaminating object, please use hand sanitizer. After staying in the situation this way, you will feel better quickly so that the exposure will be easier the next time you do it. By using hand-sanitizer, your fear will go away quickly and you will become more confident and ready for the next task.

Exposure Trials and Post-Exposure Assessment

Participants proceeded through 15 trials of exposure commensurate with the randomly assigned condition (see Trials 1-15 of Exposure in Appendix C). At each trial, participants rated a number of indices before, during, and after stimulus contact. During the trial, participants touched the stimulus for 20-sec and were asked to rate their Peak Fear and Disgust. Following touching, they rated Urge to Wash, Illness Likelihood, and Illness Severity. This was conducted repeatedly for the 15 trials. Moreover, to minimize carryover effects between trials, experimenters waited for participants' fear to drop below 30 or drop 20 points below their peak fear from the previous trial. For example, if a participants' peak fear on Trial 6 was a 60, the experimenter would wait for their fear to drop to at least 40 before initiating Trial 7.

After completion of the 15 trials, the post-exposure assessment was conducted (see Appendix B). This was identical to the baseline assessment such that no safety behaviors were permitted. Mean fear/disgust and number of steps completed as reported on the baseline and post-exposure assessments served as the primary outcome indices.

Generalization

After the post-exposure assessment, all participants were asked to rate the BATRF for a second time (see Appendix D). They rated Estimated Fear, Estimated Disgust, Illness Likelihood, and Illness Severity for the three unselected stimulus (i.e., the non-target exposure stimuli). In other words, we conducted this second administration to examine between-group differences in the degree to which decreases across conditions generalized to other contaminants. The three unselected items for each participant were averaged together to obtain mean pre-post generalization scores. Similar analyses were

conducted by van den Hout et al. (2011) to examine stimulus generalization in a sample of unselected participants who engaged in contamination-related safety behaviors versus those who did not after touching a contaminant.

Procedure

Participants arrived to the laboratory and underwent the informed consent procedure. Following this, the participant was instructed by the experimenter to place the psychophysiology monitor around their chest. To ensure proper placement and adequate habituation to the device, the participant wore the monitor throughout the course of the 3-hr study. Following completion of several self-report measures (see Measures), a 5-min baseline psychophysiology recording was obtained whereby the participant was instructed to sit in a room alone and make few movements other than those required for range of motion (see Figures 1 and 2). After the 5-mins, participants rated all four BAT stimuli on the BATRF, and the ideographic, target exposure stimulus was selected. Following selection of the target exposure stimulus, participants completed the baseline assessment whereby they proceeded through a series of 16 steps and the last step completed served as the target exposure step. Subsequently, subjects were randomly assigned to one of three conditions based on their gender: (1) exposure with no safety behaviors (NSB), (2) exposure with preventative safety behaviors (PSB), or (3) exposure with restorative safety behaviors (RSB). After the condition rationale was given, treatment credibility ratings were obtained and participants next completed 15-trials of exposure. Following the 15 trials of exposure, in which physiological arousal was recorded per trial, participants completed the post-exposure assessment, the second administration of the BATRF, and the Safety Behaviors Checklist. Treatment Feasibility

was assessed and the 5-minute recovery psychophysiology recording obtained. Partial course credit was exchanged for participation in the current study.

Results

Demographic and Baseline Variables

Participants in the NSB, PSB, and RSB conditions did not significantly differ with respect to age, $F(2, 48) = 2.61$, $p > .09$ or gender $X^2 (2) = 1.45$, $p = .49$. We also examined whether between-group differences existed on the OCI-R, DASS, AAQ-II, DPSS, and baseline assessment variables (fear, disgust, behavioral approach). None of the tests were significant, indicating that randomization was successful. The makeup of target exposure stimulus selection was as follows: 31% selected the Dirt, Dead Insects, and Dog Hair; 51% Dirty Toilet; 18% Soiled Laundry. No participant chose the Dirty Wastebasket. The mean target exposure step that was used for exposure trials was between steps 11 and 12.

Treatment expectancy

Mean expectancy ratings for participants in NSB (M= 67.65, SD= 26.38), PSB (M = 77.00, SD= 23.37), and RSB (M=78.41, SD=28.81) did not differ, $F(2,48) = 0.84$, $p = .44$. This suggests that there were no between-group differences regarding procedural expectations based on the condition rationale.

Covert safety behavior utilization

To evaluate whether there were between-group differences in participants' use of covert safety behaviors, a one-way analysis of variance was conducted using the Safety Behaviors Checklist. The total number of *other* safety behaviors was summed. There were no significant between-group differences in use of covert safety behaviors, $F(2, 30) = 0.51$, $p = .61$.

Primary hypotheses

Fear. We hypothesized that NSB and RSB will evidence greater reductions in fear at post-exposure assessment in comparison to PSB. A 3 (cond) x 2 (time) mixed factor ANOVA was conducted to compare between-group changes in self-reported fear pre-to-post assessment. This analysis yielded a significant main effect of time, $F(1,48) = 51.25$, $p < .001$, $\eta_p^2 = .52$, indicating a substantial improvement in fear throughout the study assessments. A significant condition x time interaction was also found, $F(2,48) = 5.77$, $p < .01$, $\eta_p^2 = .19$. The interaction was subsequently followed up with orthogonal interaction contrast tests. Results showed that RSB exhibited a significantly greater amount of fear reduction compared to NSB [$F(1,48) = 4.40$, $p < .05$, $\omega^2 = .02$] and PSB, $F(1,48) = 11.31$, $p < .01$, $\omega^2 = .05$. NSB and PSB conditions were not significantly different, $p > .05$.

Additionally, after controlling for the baseline level of peak fear, condition significantly predicted post-assessment fear level, $F(2,47) = 4.86$, $p < .05$ $\eta_p^2 = .17$ (see Figure 3). Follow up tests were conducted to evaluate pairwise differences among the adjusted means. The results showed that NSB and PSB were marginally different F (1, 47) = 2.95, p =.09, $\eta_p^2 = .06$, although NSB was not significantly different from RSB, p = .18. NSB showed greater reductions in fear at post-assessment when compared to PSB, though this was only at trend level. RSB and PSB were significantly different such that when controlling for baseline fear, RSB resulted in significantly lower fear at post-assessment, F (1, 47) = 9.63, $p < .01$, $\eta_p^2 = .17$

Behavioral approach. Similar to the prior hypothesis, we predicted that NSB and RSB would evidence more pronounced reductions in behavioral avoidance (i.e., a greater

number of behavioral approach task steps completed) than PSB baseline-to-post exposure. A 3 x 2 mixed factor ANOVA was conducted to compare between-group changes in behavioral approach, yielding a significant main effect of time, $F(1,48) = 5.81$, $p < .05$, $\eta_p^2 = .11$, and condition x time interaction, $F(2,48) = 5.28$, $p < .01$, $\eta_p^2 = .18$. Interaction contrast tests demonstrated a similar pattern of findings such that changes in RSB significantly differed from NSB [$F(1,48) = 9.48$, $p < .01$] and PSB, $F(1,48) = 5.94$, $p < .01$. RSB demonstrated the greatest amount of change in number of steps completed. Furthermore, PSB and NSB did not significantly differ.

An ANCOVA was also conducted to control for baseline behavioral approach and was found to be significant, $F(2,47) = 5.58$, $p < .01$, $\eta_p^2 = .19$. Follow-up tests were conducted to evaluate all pairwise comparisons among the adjusted means (see Figure 4). Results showed that RSB significantly differed from NSB [$F(1,47)= 9.06$, $p <.01$, $\eta_p^2 = .16$] and PSB [$F(1,47)= 7.53$, $p < .01$, $\eta_p^2 = .14$]. RSB evidenced greater behavioral approach after controlling for numbers of steps completed at the baseline assessment. NSB did not significantly differ from PSB.

Disgust. We hypothesized that NSB and RSB would evidence greater reductions in disgust at post-exposure assessment in comparison to PSB. An additional 3 x 2 mixed factor ANOVA was conducted to compare between-group changes in disgust. A significant main effect of time was found, $F(1,48) = 45.60$, $p < .001$, $\eta_p^2 = .49$, which was qualified by a significant condition x time interaction, $F(2,48) = 3.32$, $p < .05$, $\eta_p^2 = .12$, indicating improvements in disgust specific to condition. Follow-up tests indicated only RSB and PSB demonstrated significant differences in amount of change pre-to-post assessment, $F(1,48) = 6.50$, $p < .01$.

Next, an ANCOVA controlling for baseline disgust ratings was found to be marginally significant, $F(2,47) = 2.80$, $p = .07$, $\eta_p^2 = .11$. Follow-up tests were conducted to evaluate all pairwise comparisons (see Figure 5). Results showed that NSB did not differ from PSB or RSB, but PSB and RSB were significantly different, $F(1,47)= 5.58$, $p <.05$, $\eta_p^2 = .11$. RSB evidenced significantly lower disgust at post-exposure assessment compared to PSB.

Change in peak fear during exposure trials. It was hypothesized that NSB and RSB would show a steeper decrease in peak fear across 15-trials of exposure (i.e., more rapid declines in fear) relative to PSB. Multilevel modeling (MLM) analyses were conducted to obtain the overall decline slopes for peak fear across the 15 trials using SPSS for Windows (IBM version 20.0). MLM holds advantages over traditional repeated measures ANOVA as there is no requirement for complete data for repeated assessments, nor is there a requirement for equal intervals of measurement per case. Sphericity (uncorrelated errors over time) is also not a problem in MLM as it tests trends for individuals over time.

The current multilevel model is composed of two levels. At Level 1, repeated measures (i.e., the 15 trials) are nested within individuals (Level 1) and are entered to examine the individual growth curve in peak fear as a function of Time (i.e., rate of linear peak fear reduction) and $Time^2$ (i.e., a quadratic function; change in rate of fear reduction). At Level 2, the variance in random intercept (i.e., initial status) and random slope (i.e., growth rate) were examined with the inclusion of individual-level covariates (i.e., condition variables, Gender, OCI-R Washing, DPSS Total, DASS Total, AAQ-II Total). We modeled condition using dummy-coded variables so that condition status

could be added as a predictor (the two dummy-coded variables compared NSB to RSB and PSB to RSB, respectively, thus RSB served as the reference group) to examine Condition x Time interactions. The covariance structure was defined as Diagonal for repeated measures and Variance Component for random effects of the model. Covariance parameters showed significant variance in random intercept and slope, which supports the relevance and utility of MLM for the current data. However, the current results section will only focus on describing the significance of fixed effects in the model (i.e., the effect of Time and Time^2 and the effect of Time X dummy-coded Condition1 and Time X dummy-coded Condition2).

A significant Time effect was found such that linear reductions in fear were shown regardless of condition membership ($\beta = -7.34$, $t(102.01) = -10.09$, $p < .001$). Further, there was a significant change in the rate of fear reduction across individuals as indicated by a quadratic Time^2 effect ($\beta = 0.32$, $t(88.45) = 8.85$, $p < .001$). This indicates that the symptom reduction rate was greater at earlier trials than at later trials. With respect to the overall linear pattern of fear reduction, RSB evidenced a significantly greater decline slope in peak fear compared to NSB ($\beta = 5.74$, $t(100.31) = 5.52$, $p < .001$) and PSB ($\beta = 5.36$, $t(101.12) = 5.13$, $p < .001$). Moreover, significant quadratic Time^2 effects were found for RSB and NSB ($\beta = -0.27$, $t(89.71) = -5.35$, $p < .001$) as well as RSB and PSB ($\beta = -0.24$, $t(89.63) = -4.64$, $p < .001$). Figures 6 and 7 demonstrate the pattern of linear and quadratic slope across condition. Taken together, these findings show that the overall rate of fear reduction was greater and fear reduction at initial exposure trials was achieved faster for RSB. Further, these changes were maintained after controlling for a host of covariates. None of the covariates uniquely predicted variance in

peak fear. The same pattern emerged when covariates were removed from the model. An identical pattern of findings was shown for peak disgust.

Changes in physiological arousal during exposure trials. Similar to the aforementioned findings, we predicted that NSB and RSB would demonstrate reductions in heart rate and respiration rates baseline-to-post exposure that would be more pronounced when compared to PSB. MLM was again utilized to examine the overall decline in heart and respiration rate across exposure trials. Level 1 predictors were 17 repeated measures (baseline, 15 trials of exposure, and recovery trials) which were nested within individuals. The repeated measures were utilized to examine individual growth curve in peak heart and respiration rate as a function of Time (rate of linear heart/respiration reduction) and Time^2 (i.e., change in the rate of heart/respiration reduction). At Level 2, the variance in random intercept and random slope were examined with the inclusion of individual level covariates (i.e., condition variables, Gender, OCI-R Washing, DPSS Total, DASS Total, AAQ-II Total). The parameters were identical to the previous MLM analysis. The condition variables were dummy-coded in the same fashion with RSB used as the reference group.

The linear Time effect was marginally significant indicating reductions in heart rate across individuals, (β = -1.34, t(62.53) = -1.82, p = .07) whereas no quadratic Time^2 effect was found across individuals, p > .05. Marginally significant Time X Condition1 and Time X Condition2 interactions were also found. RSB evidenced a greater magnitude of decline in peak heart rate when compared to NSB (β = 1.66, t(32.71) = 1.89, p = .07). This was similarly found for RSB when compared to PSB (β = 1.51, t(33.15) = 1.82, p = .08). Overall, RSB demonstrated faster reduction in peak heart rate (i.e., greater slope)

and also showed greater physiological arousal to begin the trials, potentially due to greater threat salience; however, these were both marginally significant. None of the covariates predicted variance in peak heart rate.

As for peak respiration rate, linear and quadratic main effects of Time were not found, suggesting that decreases in and changes in the rate of respiration did not differ by individuals. None of the Time X Condition interactions or covariates were significant.

Treatment acceptability. We predicted that exposure with safety behaviors would be experienced as more tolerable than exposure without safety behaviors (NSB). We hypothesized that PSB would evidence the highest levels of acceptability and satisfaction given those in PSB experienced less contact with exposure stimuli and, in turn, less fear activation. RSB would experience comparable fear activation, similar to NSB, but given the expectation remedy (i.e., hand sanitizer) would immediately follow exposure, we expected treatment feasibility to be greater for RSB.

These data were submitted to a MANOVA to examine whether variables related to treatment (i.e., acceptability, tolerability, effectiveness, and distress) differed by condition. Items were rated on a 7-point scale with higher ratings indicating better outcomes. The multivariate tests were not significant, $F(8,54) = 0.13$, $p > .05$, Wilks' $\Lambda = 0.96$, suggesting the groups did not differ in regard to treatment palatability; thus, one-way ANOVAs were not interpreted. We also examined whether the safety behaviors conditions (PSB and RSB) significantly differed from NSB and whether the two safety behaviors conditions differed from each other. We failed to find evidence for either hypothesis, $p > .05$. Overall, the conditions were comparable to the extent to which they experienced procedures as acceptable (NSB: M= 5.42, SD=1.00; PSB: M= 5.18,

SD=0.98; RSB: M=5.30, SD=1.89), tolerable (NSB: M= 5.25, SD=1.14; PSB: M= 5.00, SD=1.34; RSB: M=5.30, SD=1.49), effective (NSB: M= 5.08, SD=1.56; PSB: M= 4.91, SD=1.36; RSB: M=4.90, SD=1.52), and non-distressing (NSB: M= 4.58, SD=1.38; PSB: M= 4.45, SD=1.44; RSB: M=5.00, SD=1.63). Furthermore, contrary to prediction, the use of safety behaviors did not make the exposure procedure more tolerable or acceptable, though the lack of findings may be due in-part to the sensitivity of the instrument.

Secondary hypotheses

Initial fear activation. We hypothesized that initial fear (as assessed by peak fear on Trial 1 of 15 trials of exposure) would be lower in PSB than NSB or RSB. We predicted that PSB would prevent initial fear activation, as individuals in this condition would not experience the same level of contact with exposure stimuli, compared to NSB or RSB. RSB and NSB would evidence greater initial fear activation by experiencing the full range of contact with exposure stimuli.

A one-way ANOVA was conducted to determine whether the three conditions differed in their level of initial fear activation, and it was found that the three conditions differed in self-reported fear at Trial 1, $F(2,48)=9.76$, $p < .001$. Those in PSB experienced the lowest fear activation (M=21.17, SD = 26.89) when compared to NSB (M=44.12, SD=31.83) and RSB (M=64.12, SD=25.99). Simple contrast tests indicated that all conditions significantly differed: NSB and PSB, $t(48) = 2.36$, $p = .02$; NSB and RSB, $t(48) = -2.06$, $p = .05$; and PSB and RSB, $t(48) = -4.42$, $p < .001$.

Generalization effects. We tested the generalization of therapeutic outcome by examining participants' fear and disgust responses to other non-target exposure stimuli

items on the Behavioral Approach Task Rating Form (BATRF). This was a form rated both before and after exposure. For feasibility reasons, we did not conduct an *in vivo* assessment to examine whether treatment gains would translate to a more naturalistic setting.

We predicted that because procedural integrity of exposure would be compromised in PSB, generalization of treatment effects would also be disrupted in this condition. We expected that within PSB, fear ratings in response to the other three contaminated stimuli would be comparable (i.e., there will be no change) to such self-report ratings obtained *prior to* exposure during the assessment of the target exposure stimulus. We predicted that NSB and RSB would demonstrate decreases in fear for the other contaminated stimuli from pre-to post-.

Ratings across the three unselected stimuli (i.e., the one's not chosen as most bothersome/fearful stimulus and which exposure was conducted upon) were summed and averaged to create four variables: (1) Estimated Fear, (2) Estimated Disgust, (3) Illness Likelihood, and (4) Illness Severity. These variables were assessed at time 1 and time 2. At time 1, no differences existed across the three conditions, all *p's* > .05, such that all stimuli were rated equally across condition.

We conducted 3 (cond) x 2 (time: time 1, time 2) ANOVAs for all four BATRF variables. We found a marginal time x condition interaction for Estimated Fear, $F(2, 30) = 2.79$, $p = .08$, $\eta_p^2 = .16$, though no main effect of time, $p = .41$. Probing the set of pairwise comparisons, we found that none of the conditions significantly differed, $p > .05$. This was also tested using ANCOVA (see Figure 8) to control for baseline fear on the three unselected stimuli, and was again found to be at trend level, $F(2, 29) = 2.55$, p

= .09, η_p^2 = .15, demonstrating a medium effect. Follow-up contrast tests were conducted to examine the set of pairwise comparisons. Results showed that NSB did not significantly differ from PSB, but RSB marginally differed from PSB [F (1, 29) = 3.72, p = .06, η_p^2 = .11] and NSB [F (1, 29) = 4.00, p = .06, η_p^2 = .12]. The results suggest that, controlling for baseline fear scores on the BATRF, RSB evidenced the greatest reduction on the BATRF at post-assessment.

No main effect of time was found for Estimated Disgust. However, a marginally significant main effect of time was found for Illness Likelihood such that all conditions evidenced decreases in the degree to which they feared illness occurrence, F(1, 30) = 3.44, p = .07, η_p^2 =.10. Illness Severity also demonstrated a main effect of time, F(1, 30) = 10.14, p < .01, η_p^2 =.25. No condition x time interaction was found for Estimated Disgust, Illness Likelihood, or Illness Severity. Furthermore, when controlling for baseline levels, condition did not predict time 2 assessment variables of Estimated Disgust, Illness Likelihood, or Illness Severity.

We also sought to examine the associations between gains made during the 15 exposure trials (i.e., the amount of therapeutic change during the trials) to gains made during the test of generalizability (i.e., the amount of pre-post change on the BATRF). To examine this, we obtained the residual gain scores of the assessment fear and disgust indices and examined the correlations between residual gain scores on the BATRF estimated fear and disgust measures by condition. We found significant correlations for both NSB and RSB only. For NSB: fear and disgust gains made during the assessments (i.e., reductions in fear and disgust pre-to-post NSB exposure completion) correlated strongly with those gains made during the generalizability test [Fear assessment and

BATRG, $r(12) = .73$, $p < .01$; Disgust assessment and BATRG, $r(12) = .82$, $p < .001$]. As for RSB, only changes in disgust at the assessments (i.e., reductions in disgust pre-to-post RSB exposure completion) significantly correlated with changes in disgust generalizability scores on the non-target exposure stimuli, $r(10) = .65$, $p < .05$. In other words, only RSB and NSB evidenced correlations between gains within the exposure trials to gains made "outside" of the exposure context.

Discussion

The judicious use of safety behaviors in the therapeutic process has received much research attention in recent years as researchers propose that safety behaviors enhance the acceptability and tolerability of exposure-based therapies (Rachman et al., 2008). Notably, this tends to be at odds with cognitive models of anxiety disorders. In fact, it is argued that safety behaviors are a factor in maintaining anxiety (Salkovskis, 1991; Clark, 1999; Clark & Wells, 1995). In contrast to such prevailing views, the current study sought to examine the impact of safety behaviors on a single session of exposure therapy for contamination fear. Overall, the findings indicate that restorative safety behaviors may be facilitative of treatment gains, while other types (i.e., preventative safety behaviors) may be harmful to the therapeutic process and outcomes. In fact, in the current study, exposure with restorative safety behaviors led to better outcomes. The findings further support the notion that the unqualified rejection of such behaviors may be a stiff statement that does not capture the usefulness of safety behaviors in specific instances (e.g., as a facilitative agent used within the context of therapy). Overall, for washing problems, specific types of safety behaviors may not be deleterious.

Consistent with prediction, RSB resulted in greater reductions in behavioral avoidance, disgust and fear, compared to preventative safety behaviors, with medium-to-large effect sizes. Moreover, our hypotheses also sought to test whether NSB would evidence greater reductions compared to PSB: No differences were found for behavioral approach or disgust and only trend-level differences were found for fear. Although our hypotheses did not explicitly seek to examine differences between RSB and NSB, findings were mixed such that RSB was at least comparable to NSB, though RSB was better on some indices such as behavioral approach. NSB and RSB were not different when examining fear and disgust pre-to-post exposure. Taken together, the first three hypotheses support the notion that restorative behaviors facilitate therapeutic progress compared to preventative safety behaviors; however, results are mixed regarding whether NSB and PSB or NSB and RSB meaningfully differ on clinical outcomes.

RSB resulted in lower fear, disgust, and behavioral avoidance at post-exposure assessment compared to the other conditions, and NSB and PSB were generally similar in amount of pre-post change. This is consistent with substantial reductions in fear and avoidance found by two independent research groups (Rachman et al., 2011; van den Hout et al., 2011) who examined conventional exposure and exposure with restorative safety behaviors (i.e., use of a hand-wipe) for washing symptoms. Moreover, safety behavior use led to closer and more rapid approach to a live snake (Milosevic & Radomsky, 2008; 2013a) and reductions in negative beliefs about spiders (Hood et al., 2010; Milosevic & Radomsky, 2013a). The improvements shown by RSB in the current study were further generalizable to a self-report measure of other potential contaminants. RSB evidenced greater decreases in fear towards unselected, contaminated stimuli during

the generalizability task, compared to NSB and PSB. Moreover, decreases in disgust baseline-to-post-exposure assessment were significantly correlated with decreases in disgust "outside" of the exposure context on the generalizability questionnaire.

The current study also sought to examine decreases in peak fear across the 15-exposure trials using multilevel modeling techniques. Compared to NSB and PSB, RSB demonstrated greater reductions in fear and a greater rate of fear reduction during the repeated trials. Fear reduction at initial exposure trials was achieved faster (i.e., larger gains at the beginning trials) for RSB, though there were no differences that resulted at later exposure trials (i.e., all conditions ended the 15 trials of exposure at approximately the same fear level). Moreover, initial fear activation, as assessed by peak fear on Trial 1, differed significantly between the three conditions and PSB demonstrated the lowest initial arousal. Commensurate with hypotheses and emotional processing theory, this may have been due to PSB not gaining full contact intensity with the contaminated stimulus as participants were given a tissue with which to touch, creating a contact barrier. Heightened initial arousal is predictive of superior treatment outcome (Kozak, Foa, & Steketee, 1988) and RSB and NSB evidenced greater fear activation, as the groups experienced the full range of stimulus contact. Additionally, the multilevel modeling finding that RSB achieved the greatest rate of fear reduction during the exposure trials is particularly compelling as RSB also began the trials with the greatest degree of fear activation.

Reductions in heart rate and respiration rate were examined during the exposure trials. Linear, and not quadratic (i.e., change in the rate of heart rate reduction), decreases in heart rate were found per condition such that RSB evidenced greater heart rate decline

and even greater physiological arousal at early trials, compared to NSB and PSB. These results are at odds with Grayson et al. (1986) who demonstrated that heart rate remained elevated when using safety behaviors (i.e., distraction: playing video games while holding contaminated object in other hand). Heart rate declined in the attention focusing condition whereby conversation was centered on the contaminated object. The heart and respiration rate findings are more consistent with Levitt et al. (2004). Her group found no differences in skin temperature and heart rate among participants who were instructed to accept or suppress their emotions during a carbon dioxide panic challenge.

Overall, the use of RSB did not diminish the efficacy of exposure therapy; indeed, it potentially facilitated clinical improvement. RSB demonstrated greater physiological arousal, specifically with fear activation and peak heart rate, whereas NSB and PSB did not. Potentially, instructing participants in this condition to use hand-sanitizer may have sensitized individuals to fear. For example, the sight of hand-sanitizer may have increased the perceived potency or severity of the contaminating stimuli (e.g., the presence of unhealthy bacteria). Thus, participants may have perceived a greater threat when compared to individuals in NSB, though the two groups underwent virtually the same exposure procedure - the only difference being the use of hand-sanitizer.

For RSB, each exposure trial was akin to a new exposure task i.e., 15 *separate* exposure tasks as opposed to 15 repeated trials of touching a contaminated stimulus. Individuals randomized to RSB were instructed to use hand sanitizer immediately following each stimulus contact, in a way creating a new exposure context per trial. After stimulus contact, participants "spoil the exposure" by cleaning themselves and then must "re-contaminate" on the next trial. One thought is that this may have led to a more intense

exposure than what NSB experienced. Participants in NSB were “contaminated” for the duration of the 15 trials whereas RSB was “contaminated and subsequently re-contaminated” 15 times. For NSB, it may have been that “once contaminated, always contaminated” and perhaps touching the stimulus again would not be an insurmountable step. However, individuals in RSB received the opportunity to become clean and then were asked to fully re-contaminate themselves and “ruin” that cleanness. Perhaps, this may be a more therapeutic task compared to NSB and warrants further study.

As a secondary hypothesis, we predicted that safety behaviors would be rated as more acceptable and tolerable than NSB. This hypothesis was unsupported, as none of the three conditions differed. Moreover, the two safety behaviors conditions did not differ from one another or from NSB. Research groups are mixed regarding whether safety behaviors evidence reliable benefits in improving satisfaction within exposure. For example, Deacon and colleagues (2010) found no effect of treatment condition (exposure only versus exposure plus safety behaviors) for changes in acceptability or aversion in a single-session exposure intervention for claustrophobia. However, others have found evidence for the effects of safety behaviors as more acceptable (Milosevic & Radomsky, 2008, 2013b; Hood et al., 2010). It may be that the measure used in the current study was not sensitive enough to adequately capture group-differences.

Limitations

The current study is not without limitations. The use of a non-clinical sample of healthy undergraduate students at a large, mid-western university does limit the generalizability of results, though one review argues that non-clinical and clinical samples demonstrate comparable OCD-related cognitions (Gibbs, 1996). It remains to be

examined how the findings would generalize to a treatment seeking sample with contamination fears. Additionally, control over the pacing and timing of exposure was kept constant, though differences did exist between participants responses per trial. Participants' level of fear had to reach a certain threshold to continue to the next exposure trial to minimize carryover effects. However, this is similar to a treatment context as a clinician will typically wait for a reduction in distress prior to re-introducing contact with the exposure stimulus. Additionally, exposure was conducted with only one step in the hierarchy, and participants were unable to proceed to the next step if they felt as though they "mastered" the step they were on. The current study attempted to balance individualizing exposure versus studying key elements of preventative and restorative safety behaviors. For example, an ideographic target exposure stimulus was arrived at, but we were limited to the extent of individualizing exposure in other areas. Moreover, the study's generalizability assessment was a limitation as it was conducted via self-report measure and the long term effects of the exposure interventions were not examined.

Future Directions

It is important to note that this study did not examine the *judicious* use of safety behaviors per Rachman et al.'s (2008) definition as safety behaviors were not faded out during exposure trials. However, an alternative definition of *judicious use* may mean identifying and utilizing helpful and productive (i.e., restorative) versus harmful and non-productive (i.e., preventative) safety behaviors.

An important future direction would be to examine restorative safety behaviors versus no safety behaviors in a treatment-seeking clinical population with contamination-related OCD, in addition to whether safety behaviors lead to lower attrition rates. Future

research should seek to replicate and extend the findings of the deleterious preventative safety behaviors and the facilitative restorative behaviors. Future investigation should also follow-up on the nature of RSB. For each of the 15 trials, each exposure trial was akin to a new clinical context as participants were instructed to "cleanse" themselves and then re-initiate exposure. This may be a more effective means of conducting exposure than one long "contamination" single exposure duration of gradually increasing intensity. Perhaps, the intentional violation of ritual prevention or "breaking cleanliness" should be part of exposure protocols for contamination fearful persons. It remains to be examined whether the ability to get contaminated, cleansed, and subsequently re-initiate contamination is a more important experience for clients than maintaining or tolerating contamination for a prolonged period, as is done in typical exposure-based protocols.

It would also be informative to utilize novel, potentially contaminated stimuli to examine generalizability of treatment gains, rather than self-report measure as was used in the current study. For example, in this study, the majority of individuals selected the most distressing stimulus as the dirty toilet. Placing a second contaminated toilet in a separate room to examine generalizability would be a substantial improvement over the current study. Moreover, follow-up to examine the long-term effects of safety behaviors would be valuable as few studies have employed such assessments.

Summary

The findings from the current study add to the extant literature on the nature of safety behaviors. The association between restorative safety behaviors and better therapeutic outcomes adds support to the growing literature that not all safety behaviors

are deleterious, although some behaviors should likely be avoided in therapy, specifically, those that are preventative and avoidant.

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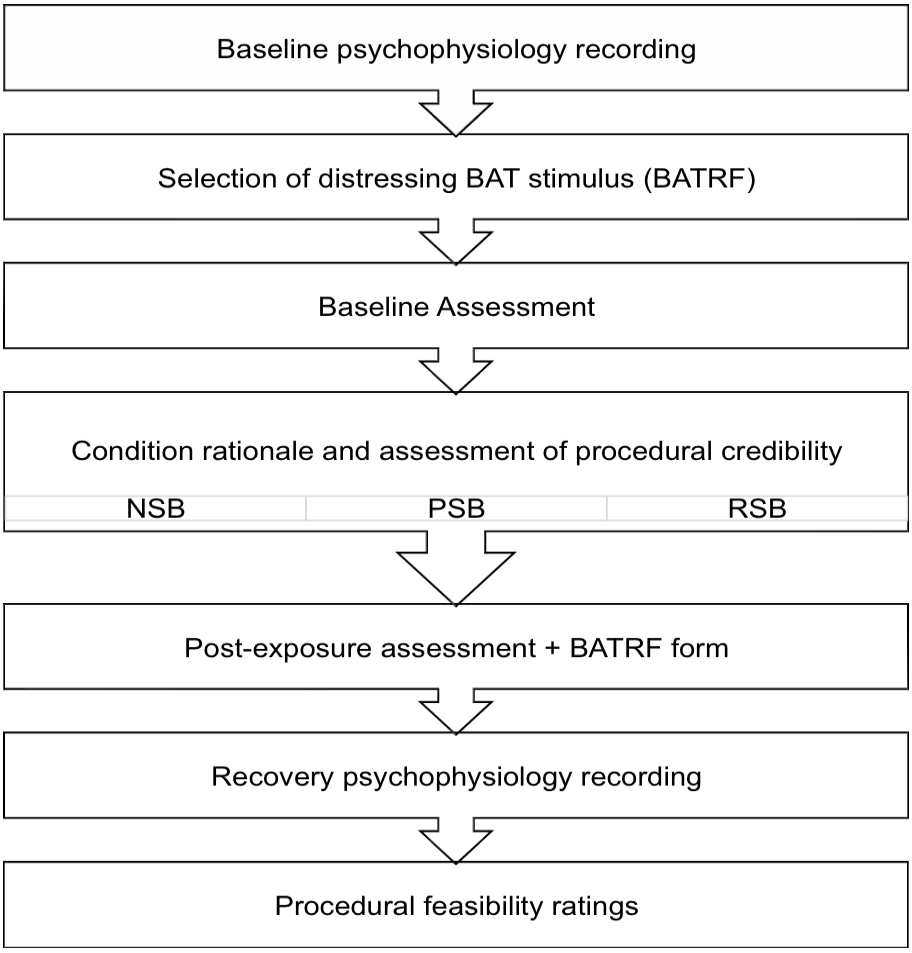

Figure 1. Flowchart showing exposure procedure.

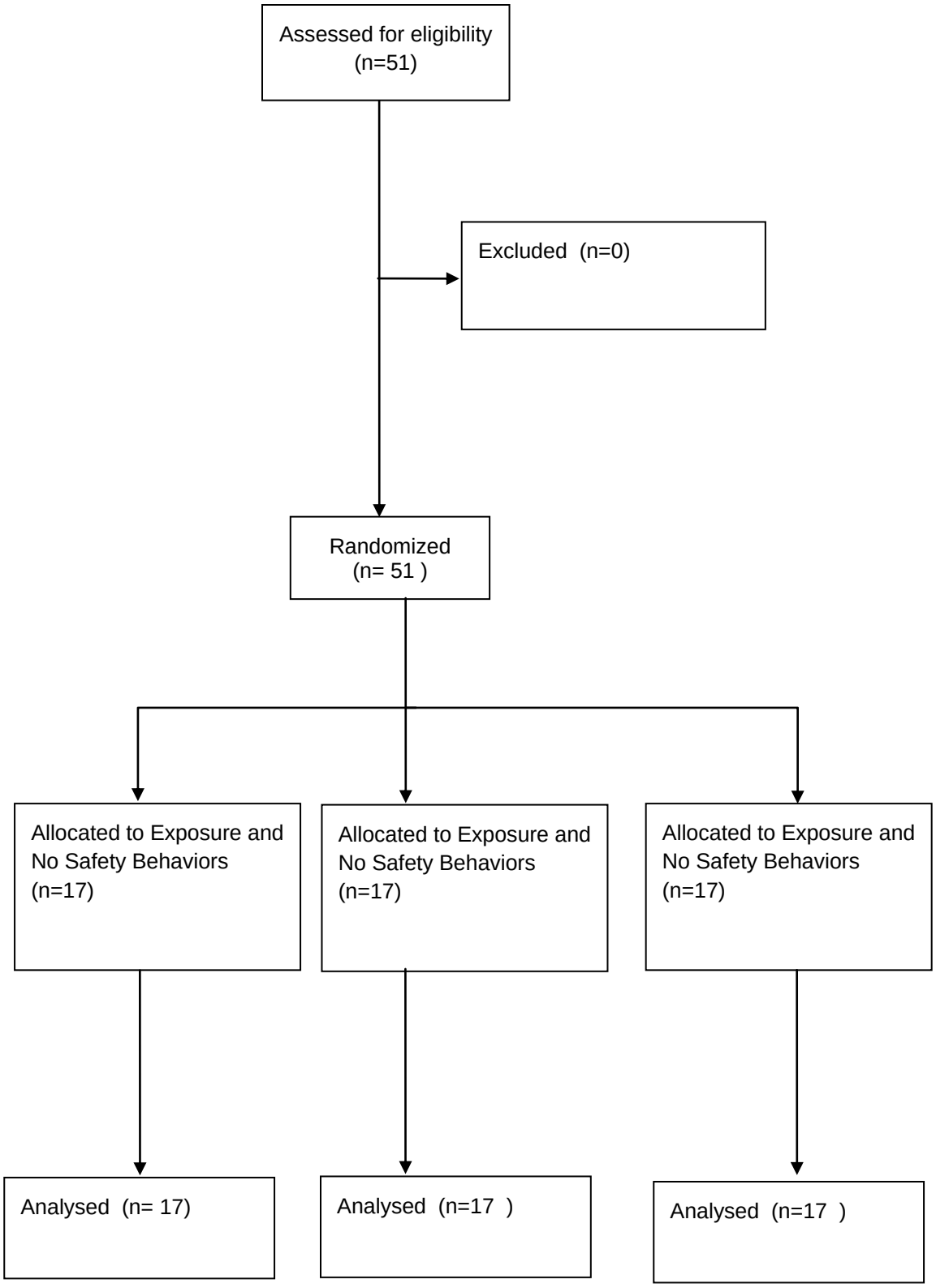

Figure 2: Consort chart showing participant flow and assignment.

Source	Sample	N	Conditions	Preventative, Restorative, or Mixed	Finding	Effect
Radomsky et al. (2006)	Non-Clinical student sample	50	Compulsive checking vs no checking	Preventative	Checking decreased memory confidence and vividness	-
Deacon & Maack (2008)	High vs Low Contamination Fear	56	Contamination-related safety behaviors	Preventative	Increases in contamination fears, threat estimation, and avoidance	-
Kamphuis & Telch (2000)	Claustrophobia	58	Distraction vs exposure only and exposure with guided threat appraisal	Preventative	Distraction led to higher rates of return of fear	-
Haw & Dickerson (1998)	Spider phobia	72	Distraction vs exposure only while looking at spider images	Preventative	Higher rates of fear return for distraction group	-
Oliver & Page (2003)	Blood-injection phobia	51	Distraction vs exposure with focusing or exposure only	Preventative	Distraction associated with greater between and within session habituation	+
de Silva & Rachman (1984)	Agoraphobic patients	18	Exposure only vs Exposure and Escape	Restorative	No differences in the two groups for behavioral avoidance	0
Deacon et al. (2010)	Claustrophobia	33	Exposure only vs exposure with judicious safety behaviors	Mixed	Both groups demonstrated comparable improvement in claustrophobic change and catastrophic cognitions	0

Grayson et al. (1986)	Obsessive-Compulsive washers	17	Exposure only vs Exposure and distraction	Preventative	Greater reductions in anxiety during distraction condition	+
Hood et al. (2010)	Spider phobia	43	Safety behavior use vs no safety behavior use	Mixed	Comparable reductions in anxiety and negative spider-related beliefs	0
Milosevic & Radomsky (2008)	Spider phobia	62	Exposure with or without safety gear	Preventative	Comparable reductions in fearful cognitions, anxiety, and improvement in approach distance	0
Olatunji et al. (2011)	Health Anxiety	60	Engaging in health-related safety behaviors or no safety behaviors	Mixed	Safety behaviors led to increases in health anxiety, hypochondriacal beliefs, and contamination fear	-
Powers et al. (2004)	Claustrophobia	72	Exposure only vs Exposure with safety behavior availability vs safety behavior utilization	Mixed	Safety behavior availability and utilization resulted in poorer ended state functioning than exposure only	-
Rachman et al. (1986)	Agoraphobic patients	14	Exposure only vs Exposure and Escape	Restorative	The escape condition showed less fear and more control than the no-escape condition	+
Rachman et al. (2011)	Nonclinical	80	Exposure plus safety behaviors vs exposure and response prevention	Restorative	Comparable reductions in contamination, fear, disgust and danger found for both conditions	0
Sy et al. (2011)	High claustrophobic fear	58	Exposure only vs exposure with safety behavior availability and exposure with safety behavior utilization	Mixed	Safety behavior utilization led to greater improvements in self-efficacy and claustrophobic cognitions than exposure only.	+
van den Hout et al. (2011)	Nonclinical	44	Exposure plus safety behaviors vs exposure and response prevention	Restorative	Comparable reductions in contamination, fear, disgust and danger found for both conditions	0

Table 1. Experimental studies examining the effects of safety behaviors on anxiety symptoms.

Note: + ‘‘favorable results when safety behaviors were used,’’ – “adverse effects when safety behaviors were used,” 0 “no differences between safety behaviors versus no safety behaviors”

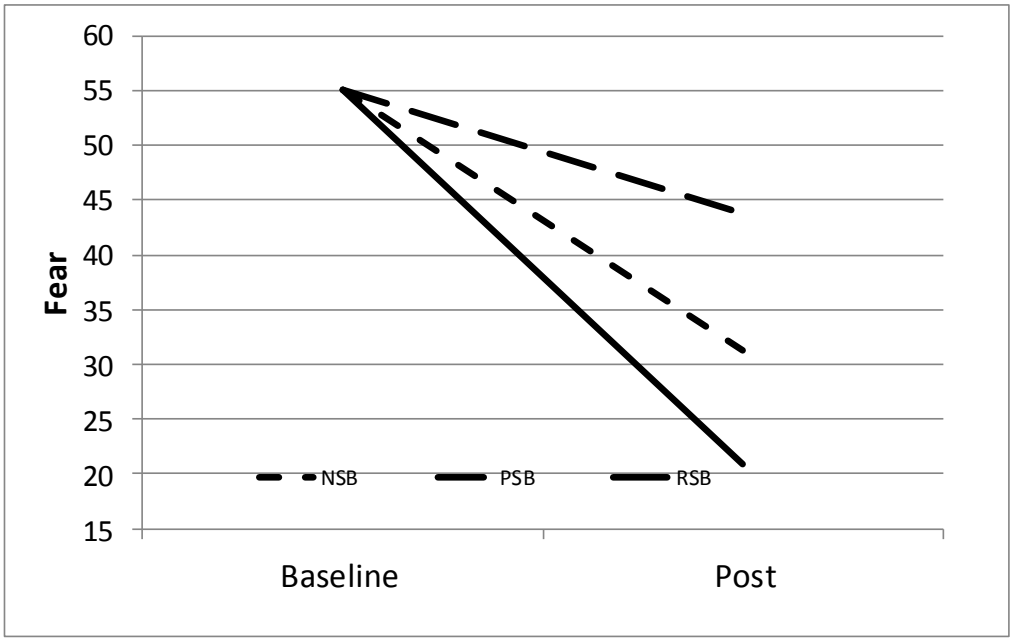

Figure 3. Post-exposure assessment fear ratings after controlling for baseline fear.

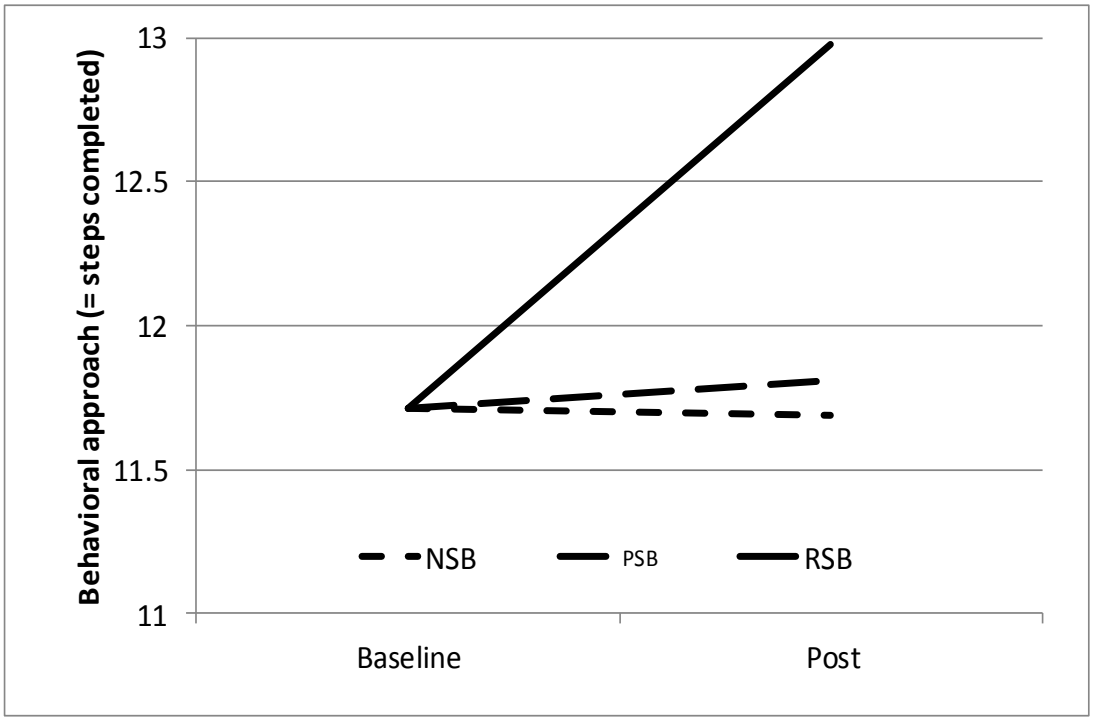

Figure 4. Post-exposure assessment behavioral approach (=number of steps completed) after controlling for baseline behavioral approach.

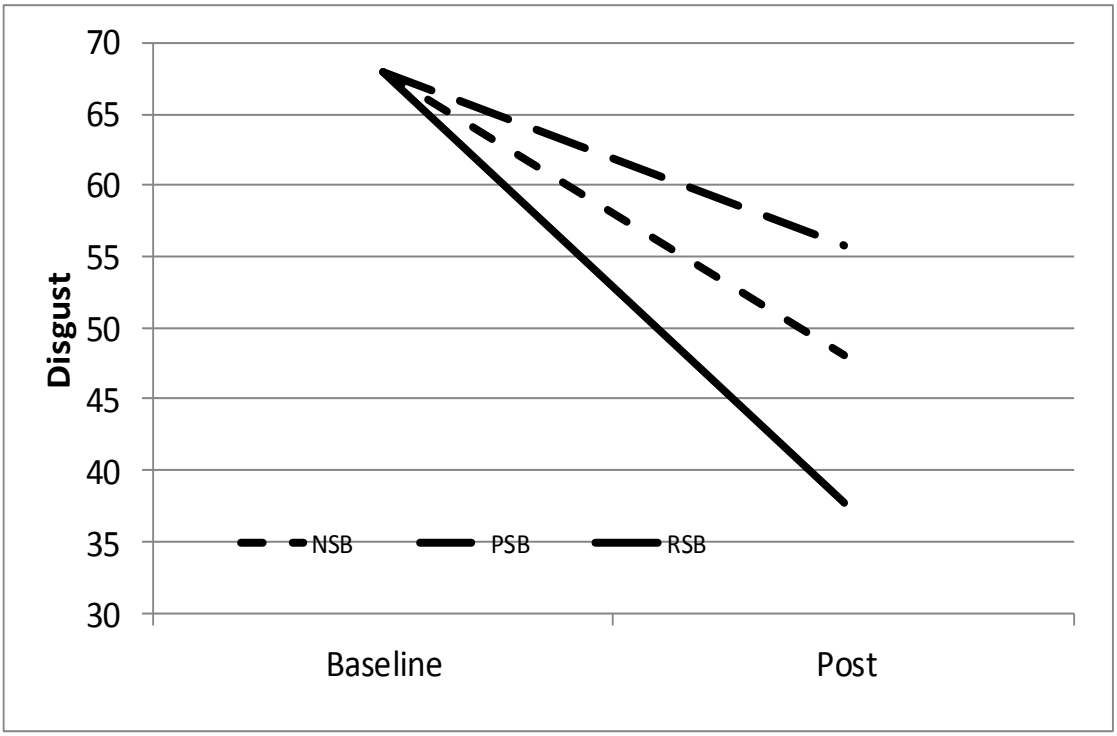

Figure 5. Post-exposure assessment disgust ratings after controlling for baseline disgust.

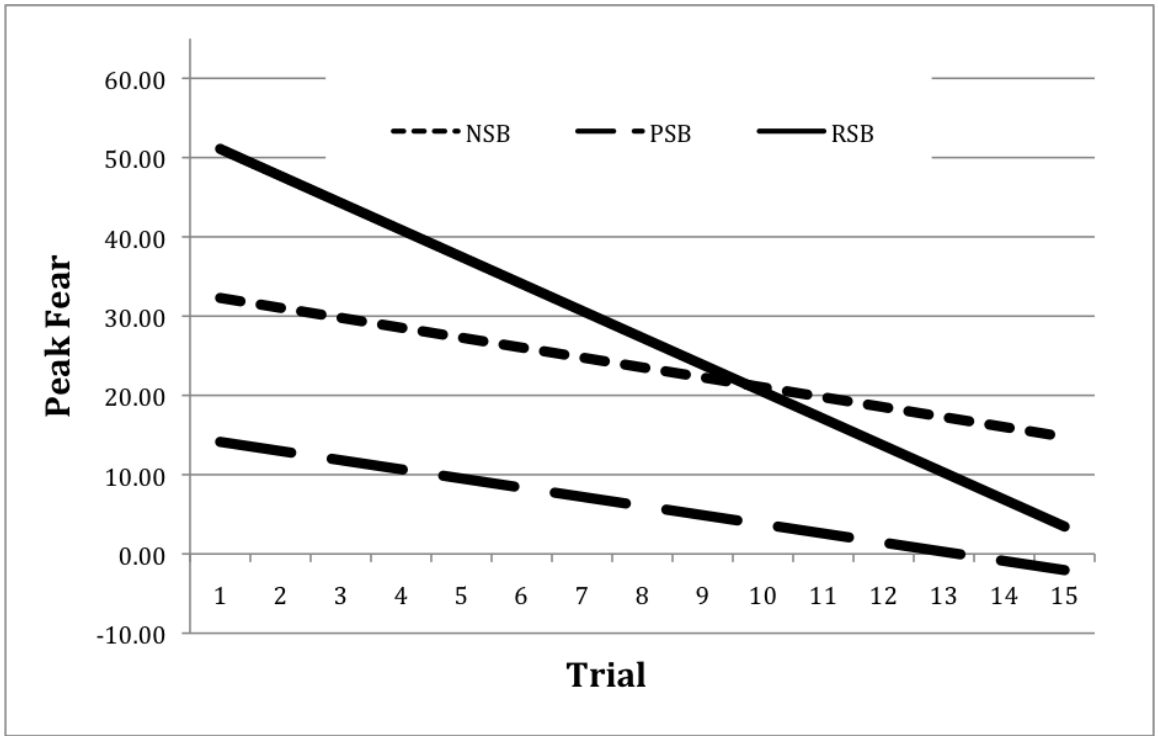

Figure 6. Linear decreases in peak fear as a function of condition.

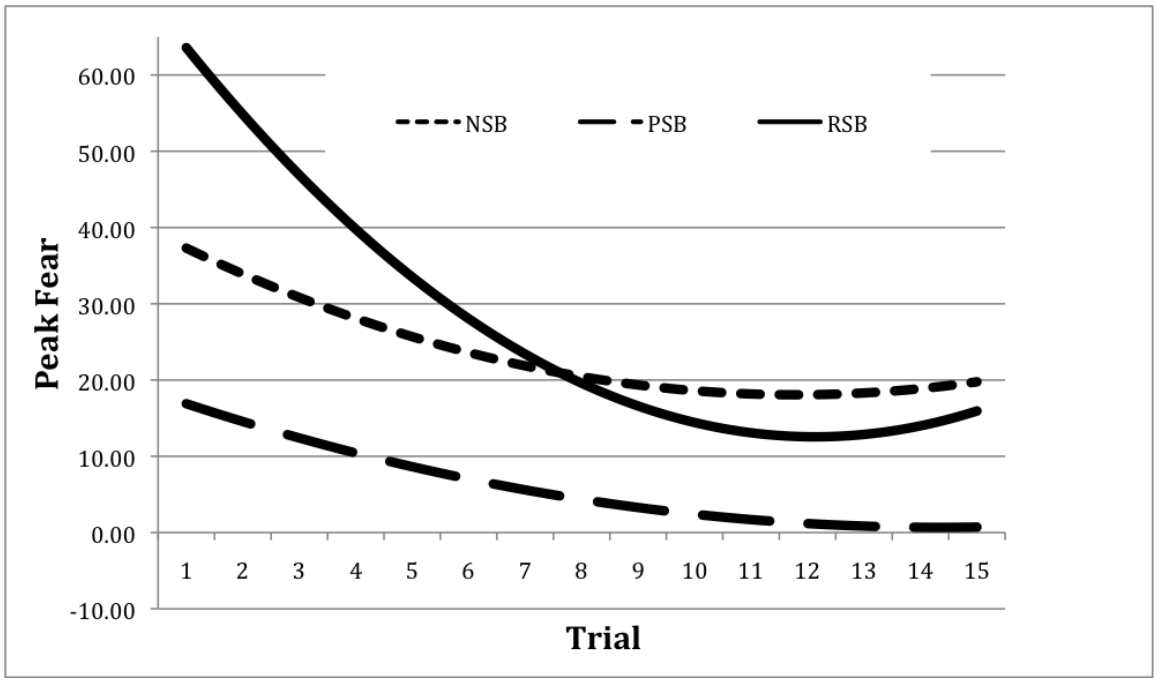

Figure 7. Quadratic decreases in peak fear as a function of condition.

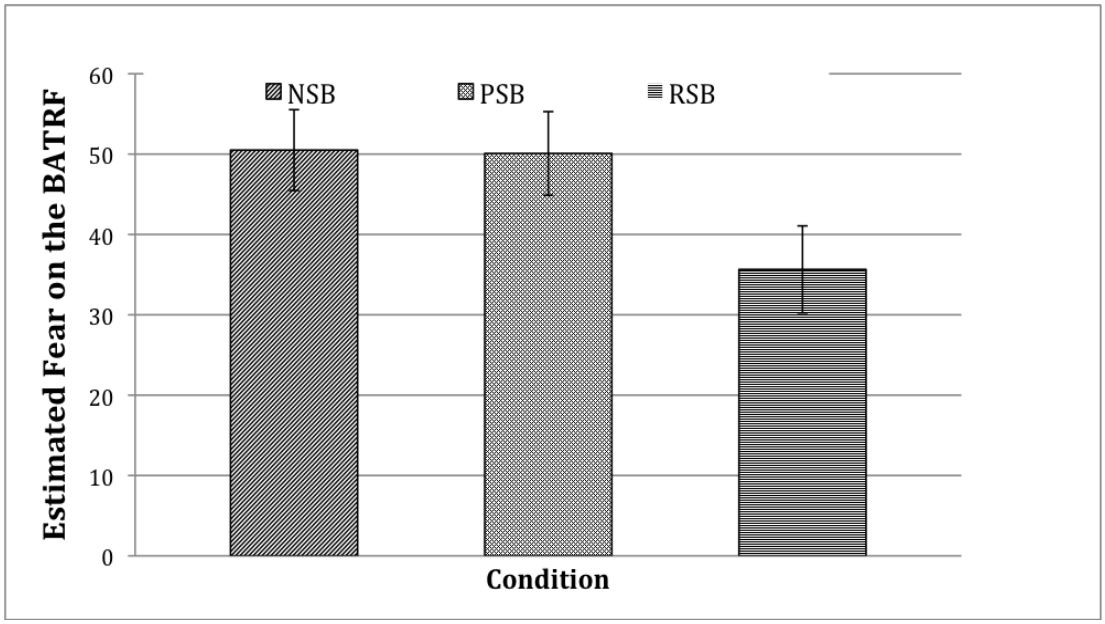

Figure 8. Fear generalizability of treatment gains for the three unselected BAT stimuli after controlling for baseline fear on the BATRF.
Note: BATRF = Behavioral Approach Task Rating Form

Appendices

Appendix A: Baseline Assessment

Subject ID:_____ Date (MM/DD/YYYY):_____

Stimulus used (circle): DDH Trash bin Toilet Soiled Laundry

While touching:
CF- What is your current level of fear?
If refuse to touch:
AF- Estimate your anticipated level of fear if you were to touch this with _____?

Behavior	**Touch? Y/N**	**CF**	**AF**
1. Touch with one finger	_____Yes _____No		
2. Touch with one hand	_____Yes _____No		
3. Touch with both hands	_____Yes _____No		
4. Touch with both hands, and then touch pants (on thighs)	_____Yes _____No		
5. Touch with both hands, and then touch chest	_____Yes _____No		
6. Touch with both hands, and then rub hands together	_____Yes _____No		
7. Touch with both hands, and then rub wrists with opposite hands.	_____Yes _____No		
8. Touch with both hands, and then touch upper arms (skin to skin contact)	_____Yes _____No		
9. Touch with both hands, and then touch hair	_____Yes _____No		
10. Touch with both hands, and then push hair back with hands	_____Yes _____No		
11. Touch with both hands, and then smell both hands	_____Yes _____No		
12. Touch with both hands, and then touch neck	_____Yes _____No		
13 Touch with both hands, and then touch face	_____Yes _____No		
14. Touch with both hands, and then use hands to cover eyes	_____Yes _____No		
15. Touch with both hands, and then touch lips.	_____Yes _____No		
16. Touch with both hands, and then lick one hand	_____Yes _____No		

Last Behavior Performed:_____

Appendix B: Post-Exposure Assessment

Subject ID:_____ Date (MM/DD/YYYY):_____

While touching:
CF- What is your current level of fear?
If refuse to touch:
AF- Estimate your anticipated level of fear if you were to touch this with _____?

Behavior	**Touch? Y/N**	**CF**	**AF**
1. Touch with one finger	_____Yes _____No		
2. Touch with one hand	_____Yes _____No		
3. Touch with both hands	_____Yes _____No		
4. Touch with both hands, and then touch pants (on thighs)	_____Yes _____No		
5. Touch with both hands, and then touch chest	_____Yes _____No		
6. Touch with both hands, and then rub hands together	_____Yes _____No		
7. Touch with both hands, and then rub wrists with opposite hands.	_____Yes _____No		
8. Touch with both hands, and then touch upper arms (skin to skin contact)	_____Yes _____No		
9. Touch with both hands, and then touch hair	_____Yes _____No		
10. Touch with both hands, and then push hair back with hands	_____Yes _____No		
11. Touch with both hands, and then smell both hands	_____Yes _____No		
12. Touch with both hands, and then touch neck	_____Yes _____No		
13 Touch with both hands, and then touch face	_____Yes _____No		
14. Touch with both hands, and then use hands to cover eyes	_____Yes _____No		
15. Touch with both hands, and then touch lips.	_____Yes _____No		
16. Touch with both hands, and then lick one hand	_____Yes _____No		

Appendix C:
Trials 1-15 of Exposure

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ANTICIPATORY															
1. Estimate the highest level of FEAR you expect to experience while touching the mixture.															
2. Estimate the highest level of DISGUST you expect to experience while touching the mixture.															
3. How confident are you to in touching the stimulus with _____?															
TOUCH STIMULUS AND WHILE TOUCHING															
4. What is your highest level of FEAR during this trial?															
5. What is your highest level of DISGUST during this trial?															
AFTER TOUCHING															
6. How great is your urge to wash right now?															
7. How likely is it that you would become ill as a result of touching this? 0- not at all likely – 100- extremely likely															
8. If you became ill as a result of touching this, how severe would your illness be? 0- no noticeable symptoms, minor illness – 100-terminal illness, death certain															

Appendix D:
Behavioral Approach Task Rating Form (BATRF)

1. Estimate the highest level of fear you expect to experience while touching the mixture.

No fear at all									Extremely fearful	
0	10	20	30	40	50	60	70	80	90	100

2. Estimate the highest level of disgust you expect to experience while touching the mixture.

No disgust at all								Extremely disgusting	
0	10	20	30	40	50	60	70	80	90	100

3. How likely is it that you would become ill as a result of touching this mixture?

Not at all likely								Very likely – Illness certain	
0	10	20	30	40	50	60	70	80	90	100

4. If you became ill as a result of touching the dirt mixture, how severe would your illness be?

Not ill at all								Extremely ill	
0	10	20	30	40	50	60	70	80	90	100

Appendix E: Safety Behavior Checklist

Use tissue to touch?	**YES NO**
Avoid touching?	**YES NO**
Avoid eye contact with stimulus?	**YES NO**
Take medication before exposure has started?	**YES NO**
Check for exits?	**YES NO**
Relaxation exercises before touching?	**YES NO**
Relaxation exercises while touching?	**YES NO**
Breathing exercises while touching?	**YES NO**
Breathing exercises before touching?	**YES NO**
Distract self while touching?	**YES NO**
Suppress thoughts of contamination while touching?	**YES NO**
Try to think of something else before touching?	**YES NO**
Praying before touching?	**YES NO**
Praying while touching?	**YES NO**
Counting before touching?	**YES NO**
Counting while touching?	**YES NO**
Use anti-bacterial hand sanitizer after touching?	**YES NO**
Wash hands after touching?	**YES NO**
Escape or try to leave session early?	**YES NO**
Take medication after exposure is over?	**YES NO**
Relaxation exercises after touching?	**YES NO**
Breathing exercises after touching?	**YES NO**
Sit down to avoid fainting after exposure?	**YES NO**
Reassurance seeking from therapist?	**YES NO**
Distract self after touching?	**YES NO**
Focus on something else after touching?	**YES NO**
Talk to therapist to distract self while touching?	**YES NO**
Neutralize act of touching by thinking of something else?	**YES NO**
Praying after touching?	**YES NO**
Counting after touching?	**YES NO**