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# Freeze! The Impact of a Guided Imagery Intervention on Looming Vulnerability and Subclinical Contamination-OCD Symptoms

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# ABSTRACT

## Freeze! The Impact of a Guided Imagery Intervention on Looming Vulnerability and Subclinical Contamination-OCD Symptoms

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Looming vulnerability (LV) refers to the tendency to appraise and perceive potential threats as dynamic and increasing in risk. Research suggests that contamination-fearful individuals may have an increased tendency to interpret contamination as growing or spreading (i.e., "looming"), which may hinder habituation to contamination and play a role in the maintenance of contamination-OCD symptoms. Studies have shown that engaging in imagery in which one mentally freezes contamination in place decreases state levels of fear, though little is known about its longer-term effects (e.g., after one week). The present study aimed to experimentally manipulate LV using freeze imagery in a subclinical contamination-OCD sample and test the effects of this intervention on contamination fear-related symptoms over time.

In sessions one (baseline) and two (24-hours later), participants ($N$ = 127) completed self-report measures of 1) LV, including the tendency to interpret both contamination and threat in general as looming; and 2) contamination fear, disgust sensitivity and propensity, and OCD symptoms. Additionally, participants completed a "chain of contagion" task in which they provided contamination ratings of objects over a series of removals from an initial contaminant. At the end of session one, participants were randomized to one of three conditions in which they completed a guided imagery intervention: freeze imagery (i.e., imagining germs as frozen in place), loom imagery (i.e., imagining germs as moving and spreading), or a no-task control condition (i.e., no imagery intervention). Participants completed their same assigned intervention at the end of session two. One-week later (session three), participants completed the same self-report measures and chain of contagion task.

As expected, participants in the freeze imagery condition (but not other conditions) demonstrated significant reductions over time (i.e., from sessions one to three) in contamination fear, OCD symptoms, and in their tendency to interpret contamination and threat in general as looming. Further, participants in the freeze condition demonstrated decreased average chain of contagion contamination ratings from sessions two to three, whereas those in the loom and control conditions demonstrated increased contamination ratings over time (i.e., from sessions one to three). Condition did not affect disgust sensitivity or propensity. Finally, results revealed that changes in looming of contamination cognitions mediated the relationship between condition and changes in contamination fear and OCD symptoms. Findings suggest that engaging in freeze imagery may effectively modify LV in a subclinical contamination-OCD sample and be an adaptive strategy to reduce related symptoms over time. Overall, this study provides meaningful information about the role of LV in contamination-OCD and provides support for LV as an important target for intervention.

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# Freeze! The impact of a guided imagery intervention on looming vulnerability and subclinical contamination-OCD symptoms

Within the past half century, cognitive models have become an increasingly common theoretical approach to describe the relationship between cognitive, emotional, and behavioral responses in psychopathology. Cognitive models of anxiety suggest that an individual's appraisal of a situation, not the situation itself, leads to anxiety (Beck et al., 2005). The looming vulnerability (LV) model was formulated to expand upon existing cognitive models of anxiety by integrating research and theory that emphasizes the importance of dynamically changing threats (Riskind, 1997; Riskind et al., 2006). Specifically, it draws from evolutionary psychology theories suggesting that humans have an innate ability to quickly and easily distinguish between threats that are changing and increasing in risk versus those that are decreasing in risk or remaining static (Riskind & Rector, 2018), theorizing that anxiety is caused not only by exaggerated threat appraisals, but also by perceptions of threat as dynamic, approaching, and increasing in risk over time (Riskind, 1997). Thus, the LV model extends current cognitive conceptualizations of anxiety by incorporating a spatiotemporal component and attending to the *progression* of threat rather than only static threat appraisals (e.g., "point in time" estimates of the probability of harm; Riskind, 1997; Riskind et al., 2000).

From an evolutionary perspective, there are clear advantages to being more sensitive to dynamic, changing stimuli, as this may be indicative of a growing threat to which individuals need to respond to increase survival. However, pathological anxiety and maladaptive coping strategies may result when these dynamic perceptions and appraisals of threat exceed their evolutionary purpose. The LV model theorizes that a key contributor to the etiology and maintenance of anxiety disorders is a more generalized (i.e., nonspecific) and *increased* sense of

LV (Riskind, 1997). This enduring cognitive pattern is referred to as the looming cognitive style (LCS) and is a cognitive vulnerability to anxiety (Riskind et al., 2006; Riskind & Rector, 2018).

**Schematic Processing Biases in the Looming Cognitive Style**

Similar to other contemporary cognitive models of anxiety (Beck & Haigh, 2014), the LV model suggests that faulty information processing is at the core of maladaptive cognitive, affective, and behavioral functioning in anxiety disorders. Specifically, the LCS is thought to function as a "danger schema" and is associated with a schematic processing bias in interpretation, attention, and memory for "looming" threat-related information (Riskind et al., 2000; Riskind & Williams, 2006; Riskind & Rector, 2018). As a result, individuals who have an increased sense of LV may experience more distress and become reliant upon maladaptive coping strategies, ultimately creating a feedback loop in which these behaviors are reinforced and one's sense of LV continues to grow (Riskind et al., 2006).

Functioning as a danger schema, the LCS may lead to exaggerated or erroneous appraisals of threat (Mathews & MacLeod, 2005), and as a result, anxious individuals may have an increased tendency to overestimate the severity of threats and subsequently underestimate their ability to handle them (Beck & Clark, 1997; Riskind & Williams, 2005). Further, the activation of this schematic processing bias can sensitize individuals to movement in their environment, thereby leading to increased hypervigilance (Basanovic et al., 2017), and can bias memory for threat-related information such that threatening stimuli is falsely remembered as approaching rather than receding (Riskind et al., 2000; Riskind & Rector, 2018). Lastly, this danger schema creates heightened perceptions of LV, further fueling perceptual biases that approaching threats are closer (Cole et al., 2013) and moving faster (Riskind et al., 1995; Riskind et al., 2014) than reality.

Importantly, the schematic processing biases resulting from the LCS are thought to play a major role in the maintenance of anxiety. Specifically, the LV model postulates that these biases—which ultimately lead one to mentally generate and attend to scenarios in which threats are depicted as dynamic and increasing in risk —may maintain fear, impede fear reduction, and block the habituation process. Whereas individuals tend to easily habituate to stimuli that are static and predictable (Katz & Wykes, 1985; Paterson & Neufeld, 1987), some studies suggest that individuals do not habituate and may in fact become sensitized to dynamic threatening stimuli (Dorfan & Woody, 2006). As such, Riskind and Rector (2018) suggest that the use of strategies to reduce the perceived dynamism of threats—thereby reducing LV-related distortions—may decrease distress, facilitate the habituation process, and decrease one's sense of behavioral urgency, which may ultimately promote more adaptive coping strategies over time.

**Implications of the Looming Cognitive Style on Anxiety**

The body of literature on LV suggests that the LCS is a common feature across anxiety disorders. For example, Williams and colleagues (2005) found that the LCS predicted shared variance in anxiety disorder symptoms, including obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), generalized anxiety disorder (GAD), social anxiety disorder, and specific phobia. In another study, the LCS demonstrated specificity in predicting anxiety disorder symptoms, including symptoms of OCD, panic disorder, GAD, and PTSD (Reardon & Williams, 2007). Further research exploring cognitive vulnerabilities found that the LCS predicted incidence of past anxiety disorder diagnoses (Black et al., 2010).

Whereas the LCS is considered a transdiagnostic factor underlying anxiety disorders in general, the specific LV content may differ across anxiety disorders (Riskind et al., 2011; Riskind et al., 2006; Riskind & Rector, 2018). For example, an individual with social anxiety

may perceive the threat of negative evaluation or embarrassment as quickly progressing over the course of a social interaction (Brown & Stopa, 2008; Riskind et al., 2006). Increased LV in GAD may lead an individual to mentally generate catastrophically evolving scenarios of threat, leading to worry about even relatively innocuous situations (Riskind & Williams, 2005). Lastly, those with panic disorder who are hypervigilant to their bodily sensations may imagine rapidly progressing scenarios of their bodily sensations worsening and becoming more dangerous, possibly leading to a heart attack (Riskind et al., 2006).

**Obsessive-Compulsive Disorder**

Obsessive-compulsive disorder (OCD) is characterized by obsessions and compulsions that cause marked distress and/or functional impairment (American Psychiatric Association, 2013). Obsessions are recurrent and intrusive thoughts, urges, or images that cause anxiety, while compulsions are defined as repetitive behaviors that an individual performs to reduce anxiety or prevent a feared outcome (American Psychiatric Association, 2013). A common theme of OCD, and the one most studied in relation to LV, pertains to the fear of contamination (Rasmussen & Eisen, 1992; Riskind & Rector, 2018). Individuals with contamination-OCD experience intense distress when thinking about coming into contact with contaminants (e.g., blood, urine, dirt, or other germs) and may engage in a variety of compulsive behaviors to de-contaminate themselves or decrease anxiety, such as excessive handwashing or cleaning (American Psychiatric Association, 2013).

In addition to fear, disgust is thought to play a prominent role in the etiology and maintenance of contamination-OCD. In fact, patients with contamination-OCD often describe contaminated stimuli as more disgusting than anxiety-provoking (Tallis, 1996; Tolin et al., 2004). While disgust responses are thought to be evolutionarily advantageous through their

disease-avoidance function (Curtis & Biran, 2001; Curtis et al., 2004; Matchett & Davey, 1991; Ware et al., 1994), they may become excessive in contamination-OCD, thus exacerbating obsessional fears and increasing washing and cleaning compulsions. For example, research has demonstrated that disgust predicts contamination-related OCD symptoms, including contamination obsessions, distress, and washing compulsions (Moretz & McKay, 2008; Olatunji et al., 2010), and mediates the relationship between contamination fear and avoidant responding to contaminated stimuli (Deacon & Olatunji, 2007; Olatunji et al., 2007). Importantly, disgust responses have been shown to be more treatment-resistant than fear-based responses (Mason & Richardson, 2012; McKay, 2006), suggesting that novel strategies should be explored to better target disgust in the treatment of contamination-OCD.

Exposure and response prevention (ERP), a type of cognitive behavioral therapy (CBT), is considered the gold standard treatment for OCD (NICE, 2006; Olatunji et al., 2013). In a course of ERP, patients with OCD are instructed to gradually approach their feared stimuli (i.e., the exposure component) while refraining from engaging in compulsive rituals that serve to decrease anxiety or escape feared outcomes (i.e., the response prevention component). While this intervention has strong empirical support and has been shown to be more effective than other psychological and pharmacological interventions for OCD (Foa & McLean, 2016; Olatunji et al., 2013), a sizeable percentage of patients do not respond to treatment, do not maintain long-term therapy gains, or remain symptomatic (Eisen et al., 2013; Foa et a., 2005; Foa & McLean, 2016; Norberg et al., 2008; Springer et al., 2018). As such, more research is needed to evaluate novel approaches to improve the efficacy of OCD treatment and to identify factors that may contribute to insufficient treatment response, remission, or relapse.

**Looming Vulnerability in Contamination Fear and OCD**

The LV model posits that an increased tendency to perceive contamination as rapidly growing and spreading and as more imminent and uncontrollable plays a significant role in contamination fear and OCD (Riskind et al., 1997a; Riskind & Rector, 2007; Riskind & Rector, 2018). In fact, looming of contamination cognitions—in combination with other explicit measures of threat overestimation—predict contamination fear symptoms, as well as fear and disgust ratings when contamination-fearful individuals are asked to touch a contaminated object (i.e., a toilet; Green & Teachman, 2013); this suggests that LV may be a contributor to the heightened distress contamination-fearful individuals experience when encountering feared stimuli.

Research has also demonstrated that LV predicts contamination fear and OCD symptoms beyond other vulnerabilities. Specifically, OCD-related looming cognitions account for significant variance in OCD symptom severity in a diagnosed sample, even after controlling for variance shared with static beliefs and appraisals (e.g., intolerance of uncertainty, over-importance of thoughts), such that higher contamination related-LV predicted more severe OCD symptoms (Riskind & Rector, 2007). Additionally, both the LCS and looming of contamination cognitions incrementally predicted contamination fear after controlling for anxiety sensitivity, negative affect, and the perceived potential for harm from contamination (Elwood et al., 2011).

Despite the prominent role of disgust in contamination-OCD, few studies have directly explored the contribution of disgust to LV. “Looming of disgust” refers to one’s tendency to appraise potentially disgusting stimuli or scenarios as dynamic, approaching, and increasing in risk; this concept is similar to other looming threat appraisals, but it places additional focus on the implications of disgust itself. For example, looming of disgust may be assessed through questions such as, “To what extent is your level of disgust increasing as the scene unfolds?” “To

what extent is the threat of your becoming nauseous or sick increasing as the scene unfolds?" and "How quickly is [the disgust stimulus] approaching, spreading, or moving in the scene that you imagine?" (Williams et al., 2006).

Given that the threat of contamination is a central theme in disgust appraisals (Woody & Teachman, 2000) and contaminants that are perceived as looming are associated with increased contamination fears (Riskind & Rector, 2007), it is likely that appraising disgusting stimuli as looming would be associated with increased disgust responses. In one study that tested this hypothesis, results revealed that those who were higher in disgust sensitivity were more likely to perceive disgusting stimuli as rapidly approaching, spreading, and escalating in risk (Williams et al., 2006). Additionally, looming of disgust discriminated between individuals with high contamination fear, anxious controls, and non-anxious controls (Williams et al., 2006). As such, it is possible that individuals with contamination-OCD may generate dynamic mental scenarios that include themes of both fear and disgust when confronted with contaminated stimuli.

### *Looming Vulnerability in Chain of Contagion Beliefs*

Although higher contamination fear is associated with greater disgust across a variety of disgust domains (e.g., food, animals, death; Olatunji et al., 2004), research suggests that the domain of "sympathetic magic" may be particularly relevant to contamination-OCD (McKay, 2006; McKay & Tsao, 2005). This disgust domain is based on the "laws of sympathetic magic" proposed by Rozin and Nemeroff (1990) that posit that appraisals of disgust and contamination threat are guided by certain implicit rules. Specifically, when a neutral object comes into contact with or appears visually similar to a disgusting or contaminated object (i.e., the laws of contagion and similarity, respectively), the neutral object then takes on these properties and becomes

disgusting and contaminated itself (Nemeroff & Rozin, 1994; Rozin et al., 1986; Rozin & Nemeroff, 1990).

Patients with contamination-OCD appear to follow these implicit rules (Tolin et al., 2004; Woody & Teachman, 2000) and may endorse irrational beliefs about the spread of contamination. For example, they may believe that once-contaminated objects retain their contamination indefinitely and that contamination can transfer its full contagious properties in a "chain-like" manner (Tolin et al., 2004; Nemeroff & Rozin, 1994; Rozin et al., 1986). This leads to a "chain of contagion" in which contamination is perceived to persist across sequential points of removal from an initial contaminant. LV may also play a role in sympathetic magic beliefs, as contamination that is thought to quickly grow and spread may be perceived as moving in a relatively indefinite manner (Tolin et al., 2004).

Tolin and colleagues (2004) sought to examine these sympathetic magic beliefs in a chain of contagion task across three diagnostic groups: contamination-OCD, anxious controls, and non-anxious controls. First, researchers opened a new box of twelve pencils and wiped the first pencil on an ideographically-selected contaminated object (in most cases, a toilet or trash can). They then took a new pencil from the box and wiped it on the first pencil. This process was continued until they had gone through all the pencils in the box. After each pencil had been "contaminated," participants were asked to rate the degree of contamination. While both anxious and non-anxious controls rated the pencils as less contaminated the more degrees of removal they were from the original contaminant, the contamination-OCD group continued to report a persisting chain of contagion in which they rated the last pencil as still highly contaminated. Notably, results demonstrated that the relationship between diagnostic group and chain of contagion was mediated by looming of contamination cognitions, suggesting that LV may be an

underlying cognitive mechanism in OCD that drives implausible beliefs about the spread of contamination (e.g., Tolin et al., 2004).

**Looming Manipulations Using Mental Imagery**

Despite the theorized importance of LV in maintaining symptoms of contamination-OCD, only two studies have tested the impact of experimentally manipulating LV on contamination fear and related symptoms. In the first of these studies, Riskind and colleagues (1997b) randomly assigned participants to watch videos of contaminated scenes while engaging in different types of mental imagery: freeze imagery, loom imagery, and control imagery. In the freeze imagery condition, participants were asked to imagine that the contamination could not move from its present location. In the loom imagery condition, participants were asked to imagine that the contamination could rapidly spread. In the control condition, participants were asked to simply imagine themselves in the scene.

Results of this study revealed a main effect of loom imagery on worry and urges to wash, such that those in the loom condition reported more worry and stronger urges to wash immediately after watching the videos than those in the control condition. In most of the remaining analyses assessing differences between imagery conditions, participants were split into additional sub-groups: low vs. high contamination fear and low vs. high "imagination" (i.e., the ability to fantasize and the vividness of their imagination). Amongst the high contamination-fearful participants, Riskind and colleagues (1997b) reported a "near significant" effect of freeze imagery on anxiety and worry such that—compared to the control condition—those in the freeze condition reported less anxiety and worry while watching the videos. Additionally, amongst high contamination-fearful participants, there was a significant effect for freeze imagery on the "accessibility of anxiety-related constructs," such that those in the freeze condition—compared

to the control—circled fewer words in a task in which they were to identify "fear-related" words from a paragraph written in a foreign language and unfamiliar alphabet. Amongst low contamination-fearful participants, those in the loom condition—compared to the control—circled more words as "fear-related." Lastly, amongst high-imagination participants, those in the freeze condition indicated more willingness to approach contaminated objects than those in the control condition immediately after watching the videos.

Although these findings provide some support for the efficacy of freeze imagery in reducing anxiety and avoidance in a high contamination fearful sample, there are several notable issues that preclude any firm conclusions from being made. First, the results were analyzed by separately comparing each active imagery condition to the control condition (i.e., freeze vs. control and loom vs. control) but never to each other (i.e., freeze vs. loom), which precludes any direct comparisons between types of imagery. It is therefore unclear whether there were any statistically significant differences between these conditions. Additionally, the over-interpretation of null findings (e.g., interpreting non-significant interactions), under-reporting of statistical analyses (e.g., not providing data for all group comparisons), methodological flaws (e.g., unequal and small group sizes, lack of pre-imagery data), and questionable statistical approaches (e.g., using a median split to dichotomize continuous variables, lack of important covariates) further limits conclusions that can be drawn.

In a similar study that addresses some of these limitations, Dorfan and Woody (2006) assigned participants to one of three imagery conditions while undergoing a 30-minute exposure involving urine on their hand: moving harm imagery, static harm imagery, and safety imagery. Participants in the moving harm imagery condition imagined the germs were moving (similar to the loom condition in Riskind et al., 1997b), and those in the static harm imagery condition

imagined that the germs were contained but still toxic (similar to the freeze condition; Riskind et al., 1997b). Participants in the safety imagery condition were asked to imagine that the urine was sterile and contained no germs. Participants were asked to rate their distress level ("How disgusted, anxious, or contaminated do you feel?") every minute during the 30-minute exposure. Results demonstrated that those in the moving harm condition endorsed higher static threat appraisals immediately post-exposure and more lingering distress approximately ten minutes post-exposure than those in the static harm and safety imagery conditions. Additionally, whereas both the static harm and safety imagery conditions led to a decrease in distress ratings across the exposure, the moving harm imagery condition appeared to sensitize participants to distress, increasing their distress ratings over the 30-minute exposure.

Although these studies found only modest support for the use of freeze imagery to reduce contamination-related distress, Riskind and colleagues (2012) suggested that this strategy may be incorporated into standard CBT practices, such as exposures, to facilitate fear reduction. However, the studies by Riskind et al. (1997b) and Dorfan and Woody (2006) do not provide sufficient evidence to determine whether freeze imagery leads to symptom improvement beyond short-term fear reduction when in the immediate presence of a contaminant. Thus, whereas modifying LV using freeze imagery may reduce short-term contamination-related distress, it is unclear whether it may maintain long-term anxiety and/or disrupt emotional processing of feared stimuli.

### *Benefits of Adjunctive Mental Imagery Strategies for OCD*

Recently, a growing number of studies have suggested that certain types of mental imagery may be effective for OCD and may be successfully used as an adjunctive intervention for patients who have not responded to standard treatments, such as ERP. Specifically, imagery

rescripting—an intervention that targets aversive memories by imagining a more a positive sequence of events—is effective for reducing OCD symptoms in treatment-resistant patients who previously completed trials of ERP (Maloney et al., 2019; Veale et al., 2015). Of relevance to this project, some research has examined the effects of mental imagery strategies on contamination-related symptoms. For example, imagery rescripting reduced short-term disgust in a contamination-OCD sample (Fink et al., 2018) and using mental imagery to manipulate the visual perspective (i.e., towards the observer, or third-person perspective) of obsessional images related to contamination reduced distress, urges to mentally suppress the image, and threat appraisals related to the likelihood of the image occurring (Wong et al., 2020). Given these findings, research should explore whether other types of mental imagery—such as freeze imagery—are beneficial for contamination-OCD and may effectively be used as an adjunctive intervention to existing treatments.

**Safety Behavior or Adaptive Strategy?**

Although Riskind et al. (1997b) cite a case example from Foa and Kozak (1986) as reasoning for why freeze imagery may reduce contamination fear, further review of the original case example highlights the possible negative effects of this strategy. Specifically, Foa and Kozak (1986) described an exposure in which several drops of urine were placed on the arm of a contamination-fearful patient. Despite regularly exhibiting a sharp reduction in fear during the exposures, there was no evidence of between-session habituation. Upon discussion of this pattern, the patient revealed that he was using his imagination to “freeze” the urine in place to prevent its spread; then, after gaining control of the contamination, he stopped attending to it. When this strategy was discontinued, he exhibited a gradual within-session reduction of anxiety,

suggesting that his initial sharp reduction in fear was not due to successful emotional processing, but rather due to avoidance.

Thus, as suggested in this case example, some contamination-fearful patients may use freeze imagery as a form of cognitive avoidance, ultimately impeding habituation to a feared stimuli and functioning as a safety behavior. Safety behaviors, defined as overt or covert actions that are performed to prevent, minimize, or escape a feared outcome (Salkovskis, 1991), are thought to be major contributors to the maintenance of anxiety (Abramowitz et al., 2019; Salkovskis et al., 1999; Wells et al., 2016). Further, while these behaviors may reduce short-term anxiety, it is thought that they preclude longer-term cognitive change by preventing the occurrence of disconfirming experiences and causing misattributions of safety (Salkovskis, 1991). In fact, cognitive behavioral theories have long emphasized the maintaining effects of avoidance and safety behaviors in anxiety-related disorders and, as such, it is generally recommended that these be eliminated from patients' behavioral repertoire over the course of exposure therapy (Abramowitz et al., 2019; Barlow et al., 2016). However, research in this area is mixed and controversial (see the following articles arguing for the judicious use of safety behavior within exposure treatment: Deacon et al., 2010; Levy et al., 2014; Milosevic & Radomsky, 2013; Rachman et al., 2008; Rachman et al., 2011; Taylor & Alden, 2011; Telch & Lancaster, 2012), and of note, a recent meta-analysis found that there was not compelling evidence supporting either the addition or removal of safety behaviors during exposures (Meulders et al., 2016).

Adaptive coping strategies, on the other hand, are more difficult to define, and in fact, clinicians may have difficulty distinguishing between adaptive coping strategies and safety behaviors. While safety behaviors are intended to prevent or minimize a feared outcome,

adaptive coping strategies are performed to reduce anxiety "but do not seek to prevent an 'imagined' catastrophe and therefore do not prevent disconfirmation of unhelpful beliefs" (Thwaites & Freeston, 2005). Further, adaptive coping strategies can be identified in part by their longer-term consequences as these strategies, unlike safety behaviors, do not maintain anxiety or worsen one's responses to a feared stimulus over time. More research is therefore needed to examine whether freeze imagery may function as a safety behavior or adaptive coping strategy when used for contamination-OCD symptoms.

**Relevance of Looming Threats and Contamination Fear During COVID-19**

To our knowledge, this is the first study to examine looming of contamination cognitions and the relationship between LV and contamination fear during COVID-19. As suggested in a separate study by Dorfan and Woody (2011), studying threat appraisals of looming contamination may be more pertinent during disease outbreaks when there is much uncertainty about disease spread and transmission. In fact, research collected during the 2003 SARS epidemic showed that population anxiety levels were closely related to the incidence of new cases (Leung et al., 2005) and that anxious individuals adopted significantly more preventive measures against SARS (Leung et al., 2003), suggesting that public anxiety may have been partially driven by obtaining information about the rapid spread of the virus and therefore the increased risk of infection (Dorfan & Woody, 2011).

It is plausible that the ongoing threat of COVID-19 may have exacerbated looming of contamination cognitions in OCD populations as well as in the general public. Early public health guidelines may have also contributed to this, particularly in the early stages of the pandemic when little was known about COVID-19 transmission. For example, it was initially believed that a primary method of coronavirus spread was through fomite transmission (i.e., the

spread of infectious agents via contaminated objects or surfaces), which resulted in many people wiping down groceries and packages with disinfectant wipes, and then disinfecting the countertop that groceries or outside objects came into contact with (NPR, 2020a,b). These behaviors are suggestive of a perceived chain of contagion, which may be driven by LV (Tolin et al., 2004). Thus, although pre-pandemic data was not collected—precluding conclusions about the influence of COVID-19 on LV or contamination fear-related symptoms—this research may be particularly relevant in the current context of COVID-19.

**Current Study and Hypotheses**

Although recently published literature on LV continues to suggest the use of looming reduction strategies such as "freeze frame" imagery to expedite habituation to feared stimuli (Riskind & Rector, 2018), only two studies to date have tested the effects of experimentally manipulating LV on distress ratings during exposure to a real or imagined contaminant (Dorfan & Woody, 2006; Riskind et al., 1997b). Additionally, given the ongoing COVID-19 pandemic, it may be especially important to study the impact of LV on contamination fear and to identify effective strategies to manage contamination-related distress.

The current study aims to address several limitations of past research on the use of freeze imagery to decrease LV and contamination-related distress. Specifically, research on LV has not thoroughly examined longer-term symptom change beyond change in state distress following LV imagery manipulations or tested whether LV mediates symptom change over time. Relatedly, despite using imagery as a looming manipulation strategy, the studies by Riskind and colleagues (1997b) and Dorfan and Woody (2006) did not assess changes in LV beyond immediate, short-term effects nor did they assess changes in other relevant symptoms (e.g., OCD symptoms)

besides state distress levels. Lastly, both former studies only presented the imagery strategies to participants once, so the impact of multiple repetitions of freeze imagery is unknown.

Thus, the primary purpose of the current study was to examine the impact of freeze and loom guided imagery interventions designed to target LV on LV-related constructs (i.e., the LCS and looming of contamination cognitions), contamination fear, OCD symptoms, disgust sensitivity and propensity, and the chain of contagion across three sessions. Participants with high contamination fear were randomly assigned to one of three conditions: freeze imagery, loom imagery, or a no-task control condition. Following the first session in which participants in the two active conditions received their assigned imagery interventions, symptoms were assessed at two additional time points: 1) 24-hours later, at which point they received the imagery intervention a second time, and 2) one-week later, at which point they only completed self-report questionnaires. The second session was included to reveal shorter-term, temporary changes in symptoms that may not be detectable at a later follow-up period and to provide a second iteration of the imagery interventions. Since research has demonstrated that the LCS can predict changes in OCD symptoms over a one-week interval (Riskind et al., 2007), the final session was scheduled to take place one week after the baseline session to assess for any lasting effects of the interventions.

For Aim 1 of this study, we assessed whether there were changes in the LV-related constructs by condition over time. For Aim 2, we assessed whether OCD symptoms, disgust sensitivity and propensity, contamination fear, and the chain of contagion differed by condition over time. Since we were primarily interested in the longer-term effects of the imagery interventions, we were most interested in changes occurring from sessions one to three and two to three, though we also examined changes occurring from sessions one to two to identify any

transient changes that may be lost to follow-up. We hypothesized that both LV-related constructs, contamination fear, disgust sensitivity and propensity, OCD symptoms, and chain of contagion beliefs would significantly decrease over time (i.e., from sessions one to three, and two to three) in the freeze imagery condition, increase over time in the loom imagery condition, and remain unchanged in the control condition.

Lastly, we planned to run mediation models to assess whether change in LV mediated the relationship between condition and change in outcome variables. We anticipated that changes in looming of contamination cognitions—but not necessarily LCS, as this was not directly targeted via the imagery interventions—would mediate the relationship between condition and change in symptoms.

## Methods

### Participants

Participants consisted of contamination-fearful adults aged 18 years and older located in the United States. To be eligible for the study, all interested participants were pre-screened with the Padua Inventory-Washington State University Revision, Contamination Subscale (PI-C; Burns et al., 1996). Participants received $0.25 for completing the pre-screening questionnaire. Those who scored 12 or above on the PI-C (i.e., one *SD* or more above the mean score for a normative sample; $M = 6.54$, $SD = 5.53$; Burns et al., 1996) were eligible to participate in this study. A total of 558 participants completed the pre-screening questionnaire; of these 558 participants, a total of 256 participants met eligibility criteria on the PI-C. Of the eligible participants, a randomly selected sample of 200 participants were invited to complete the full study.

A total of 127 participants completed the full study, which took place entirely online (control, $n$ = 45; freeze, $n$ = 42; loom, $n$ = 40; see Figure 1 for a flowchart of participant recruitment and retention). Attention checks were embedded in all three sessions; everyone in the final sample passed all attention checks. Participants received $3.00 for session one, $3.00 for session two, and $9.00 for session three; compensation was provided at study completion. The mean age of the sample was 40.93 years old (*SD* = 12.93, range = 19 – 73) and participants primarily identified as cisgender female (70.1%). See Table 1 for detailed demographic information of the sample.

## Measures

The following measures were administered throughout the course of this study. All self-report questionnaires were presented in a randomized order.

### *Contamination Fear Measure*

The Padua Inventory-Washington State University Revision (PI; Burns et al., 1996) is a 39-item self-report questionnaire that includes five subscales, including contamination obsessions and washing compulsions, dressing/grooming compulsions, checking compulsions, obsessional thoughts of harm to self or others, and obsessional impulses to harm self or others. The contamination obsessions and washing subscale (PI-C), which is commonly administered to assess contamination fear, consists of 10 items that assess how much an individual experiences contamination concerns and the degree of disturbance that these concerns cause (e.g., “I find it difficult to touch garbage or dirty things”). Items are rated on a 5-point scale ranging from 0 (*not at all*) to 4 (*very much*), and the total score is obtained by summing the items. The PI has demonstrated good psychometric properties. Each subscale demonstrated discriminant validity from a measure of worry and from the other subscales within the PI (Burns et al., 1996) and

showed high internal consistency reliability and stability over a 6-month period (contamination subscale α = 0.85; Burns et al, 1996). In the present sample, the internal consistency reliability ranged from good to excellent in all three sessions (α = .88 - .90). The PI-C was administered to assess participants' contamination fear over time between conditions.

***OCD Symptom Measures***

The Dimensional Obsessive-Compulsive Scale (DOCS; Abramowitz et al., 2010) is a 20-item self-report questionnaire that assesses OCD symptom severity across four common symptom dimensions, including concerns about germs and contamination; concerns about being responsible for harm, injury, or bad luck; unacceptable thoughts; and concerns about symmetry, completeness, and the need for things to be "just right." Each symptom dimension consists of five items assessing time spent on obsessions, avoidance, distress, functional impairment, and difficulty ignoring obsessions and compulsions. Each item is rated on a five-point scale ranging from 0 to 4 with scale anchors differing depending upon the question asked, and scores for each subscale are obtained by summing these five items. Only the contamination subscale (DOCS-C) was administered in the current study. The DOCS has good psychometric properties, including good to excellent internal consistency reliability (contamination subscale, α = 0.96 in an OCD sample and 0.83 in a student sample) and good construct validity (Abramowitz et al., 2010). Further, the DOCS has demonstrated good treatment change sensitivity (Abramowitz et al., 2010). In the present sample, internal consistency reliability was good in all three sessions (α = .84 - .88). The DOCS-C was used in the present study to assess change in contamination-related OCD symptoms over time between conditions.

The 12-Item Obsessive-Compulsive Inventory (OCI-12; Abramovitch et al., 2021) is a 12-item self-report questionnaire that assesses how much individuals are bothered by four

domains of OCD symptoms, including checking ("I check things more often than necessary"), ordering ("I get upset if objects are not arranged properly"), washing ("I wash my hands more often and longer than necessary"), and obsessing ("I find it difficult to control my own thoughts"). Items are rated on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*extremely*). Scores are generated by summing all the items. The OCI-12 demonstrates good to very good internal consistency reliability (OCD group, $\alpha = .79$; anxiety-related disorders group, $\alpha = .89$; non-clinical community sample, $\alpha = .71$) and good test-retest reliability (Abramovitch et al., 2021). Further, it demonstrates good convergent and discriminant validity (Abramovitch et al., 2021). In the present sample, internal consistency reliability was excellent ($\alpha = .91$) The OCI-12 was used in the present study to characterize the sample and assess for baseline differences between conditions.

***Disgust Measure***

The Disgust Propensity and Sensitivity Scale-Revised, Reduced-Item Version (DPSS-R; Fergus & Valentiner, 2009) is a 12-item self-report questionnaire that can be split into two subscales to assesses the frequency of disgust experiences (propensity; e.g., "I experience disgust") and the degree to which disgust is experienced as aversive (sensitivity; e.g., "I think feeling disgust is bad for me"). Items are rated on a 5-point scale ranging from 1 (*never*) to 5 (*always*). The DPSS-R has acceptable psychometric properties, including good internal consistency reliability (propensity, $\alpha = 0.83$; sensitivity, $\alpha = 0.80$; Fergus & Valentiner, 2009). In the present sample, internal consistency reliability was good in all three sessions ($\alpha = .85$ - $.87$). The DPSS-R has demonstrated convergent validity with other commonly used and validated disgust measures (Olatunji et al., 2007). Total scores for each subscale are determined by summing the respective items; a total score for the full measure is determined by summing the

subscale totals. The DPSS-R was used in the present study to assess changes in disgust propensity and sensitivity over time between conditions.

***Looming Vulnerability Measures***

The Looming Maladaptive Style Questionnaire (LMSQ; Riskind et al., 2000) is a self-report questionnaire that assesses an individual's tendency to perceive potentially threatening situations as dynamic and increasingly dangerous (i.e., it is intended as a measure of the LCS). This instrument consists of six vignettes about potentially anxiety-provoking situations and asks participants to answer four questions about each vignette. The four questions include worry while imagining the scene, whether the chances of them having difficulty with the scene are increasing, whether the level of threat is growing, and how much they visualize the scene as progressively worsening. Each item is rated on a four-point scale ranging from 1 to 4 with scale anchors differing depending upon the question asked. The questionnaire is scored by obtaining a mean rating for all items, except for the item pertaining to worry. Past research has demonstrated the incremental validity of the LMSQ and shown that this instrument can predict anxiety even after taking into account other relevant factors such as uncontrollability, unpredictability, likelihood, and imminence of threat (Riskind et al, 2000; Riskind & Rector, 2018). Further, the LMSQ has adequate predictive, convergent, and discriminant validity, including excellent internal consistency reliability ($\alpha = 0.91$) and one-week test-retest reliability ($r = 0.88$; Riskind et al., 2000). In the present sample, internal consistency reliability ranged from good to excellent in all three sessions ($\alpha = .89$ - $.95$). The LMSQ was used to assess changes in one's general LCS over time between conditions.

The Looming of Contamination Questionnaire (LOC; Riskind et al., 1997a) is a self-report measure that assesses the degree to which individuals view contamination as spreading,

approaching, and accelerating. This measure uses five vignettes related to contamination: 1) using a dirty restroom at a gas station; 2) sitting next to a man on a subway who smells of urine and is wearing dirty clothes; 3) shaking hands with someone after they empty the trash; 4) shopping in the produce section next to a man who coughed on produce; and 5) talking to a person at a party who spits while they speak. Following the vignettes, participants respond to three items assessing their sense of LV to contamination (e.g., "How quickly does it seem that the germs or contamination is spreading towards you?") and one item assessing their anxiety while imagining the situation. The questionnaire is scored by obtaining a mean rating for all items, except for the item pertaining to anxiety. Items are rated on a scale of 1 (*not at all*) to 5 (*very much*). The LOC has high internal consistency reliability ($\alpha = 0.93$) and adequate convergent validity (Riskind et al., 1997a). In the present sample, internal consistency reliability was excellent in all three sessions ($\alpha = .94$ - .97). The LOC was used in the present study to assess changes in looming cognitions over time between conditions.

***Negative Affect Measure***

The Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report instrument that assesses the severity of symptoms of depression, anxiety, and stress and is commonly used as a measure of general negative affect. Participants are asked to rate the extent to which different symptoms of depression (e.g. "I couldn't seem to experience any positive feeling at all"), anxiety (e.g. "I was worried about situations in which I might panic and make a fool of myself"), and stress (e.g. "I found it hard to wind down") applied to them over the past two weeks. Items are rated on a 5-point scale ranging from 0 (*did not apply to me at all*) to 4 (*applied to me very much or most of the time*) and total scores are obtained by summing all items and doubling the score. The DASS-21 has excellent psychometric properties, and

internal consistency reliabilities for each of the subscales are in the good to excellent range (depression, α = 0.94; anxiety, α = 0.87; stress, α = 0.91; Antony et al., 1998). The DASS-21 demonstrates concurrent validity with other commonly used and validated measures of depression and anxiety (Antony et al., 1998). In the present sample, internal consistency reliability was excellent (α = .95). The DASS-21 was used to characterize the sample and assess for baseline group differences in general negative affect.

***Imagery Measure***

The Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973) is a 16-item self-report questionnaire that assesses an individual's ability to engage in mental imagery and the vividness of these mental scenes. Participants are asked to read about and imagine four different scenes (a rising sun, a relative/friend, a shop they have been to, and a landscape). Each scene is divided into four specific aspects that participants must visualize[1], which differ depending on the scene (e.g., in the landscape scene, participants must visualize the contours of the landscape, the shape and color of the trees, etc.). Participants are asked to rate how vividly they were able to imagine each of these four aspects on a 5-point scale ranging from 1 (*no image at all, you only 'know' that you are thinking of an object*) to 5 (*perfectly clear and as vivid as normal vision*). Scores are obtained by calculating a mean rating for all the items, and higher scores indicate higher levels of vividness. The VVIQ demonstrates adequate psychometric properties, including acceptable test-retest reliability ($r$ = 0.74; Marks, 1973) and good internal consistency reliability (α = 0.89; Nelis et al., 2019). In the present sample, internal consistency reliability was good (α = .89) The VVIQ was used in the present study as a covariate to control for levels of vividness during the guided imagery interventions. Further, it was used to characterize the sample and assess for baseline group differences in vividness.

[1]In the original instructions for this measure, participants are instructed to visualize the scene once with their eyes open and once with their eyes closed, though due to time constraints of the study and limits of online administration, participants were only asked to visualize the scene once. They were not provided with specific instructions regarding whether their eyes should be open or closed (see Appendix for full instructions).

### *COVID-19 Measure*

The COVID-Related Thoughts and Behavioral Symptoms Adult Self-Report (COV-TaBS; Schneider et al., 2020) is a 10-item self-report questionnaire that assesses one's thoughts and behaviors related to the novel coronavirus that causes the disease COVID-19. Participants are asked to rate how much they have had various experiences over the past two weeks related to COVID-19 (e.g., "I was worried a lot about COVID-19;" "I did everything I could in order to avoid exposure to COVID-19"). Items are rated on a 5-point scale ranging from 0 (*not at all*) to 4 (*all the time*). The total score is obtained by summing the items. The COV-TaBS is a new measure and psychometric data is not yet available; in the present sample, internal consistency reliability was excellent ($\alpha = .91$). The COV-TaBS was used to characterize the sample and to assess for differences between conditions at baseline.

### *Chain of Contagion Task*

The chain of contagion task was designed by Tolin and colleagues (2004) to assess the degree to which contamination is perceived to be transferred between objects. The chain of contagion task in the present study was based off the version by Tolin et al. (2004) described in the introduction, with several important modifications. First, although the version by Tolin and colleagues (2004) was completed in person, the version in the present study was modified for an online format. Further, although Tolin et al. (2004) suggested using an idiographic approach to select contaminated stimuli for the task, only a single stimulus was used to simplify online adminstration. Given these modifications, participants instead watched a video of this process using a toilet as the contaminated stimulus and provided contamination ratings after each pencil. This task was included in the present study to assess whether the imagery intervention affects the

chain of contagion, as it is thought that LV may be the cognitive mechanism underlying chain of contagion beliefs (Tolin et al., 2004).

### *Guided Imagery Intervention*

Participants were randomly assigned to one of three conditions: a no-task control condition, a freeze imagery condition, or a loom imagery condition. In both guided imagery conditions, participants listened to a 10-minute audio-recording of a guided imagery intervention and were encouraged to either close their eyes or focus their gaze on a fixed spot. While the guided imagery script played, a reminder to pay attention to the audio was shown on the screen.

The different guided imagery conditions were based on the scripts provided by Dorfan and Woody (2006) and Riskind et al. (1997b). Participants in the two guided imagery conditions were asked to imagine themselves in a scene of a dirty bathroom. After creating a mental picture of the dirty bathroom, participants were asked to imagine that they touched urine as they put down a toilet seat. Participants in the freeze imagery condition were asked to visualize that the contamination from the urine was contained within the area that they initially touched and could not spread beyond this, despite the contamination still being "alive and toxic." Participants in the loom imagery condition were asked to visualize that the contamination from the urine was moving and spreading. For both imagery conditions, participants were instructed to maintain their attention on the contamination throughout the duration of the imagery exercise. Participants in the no-task control condition did not complete any type of guided imagery intervention. See the Appendix for the full imagery scripts.

## Procedures

This study was approved by the West Virginia University Institutional Review Board and was hosted on the online participant-sourcing platform CloudResearch, which recruits

participants from Amazon Mechanical Turk. To enhance data quality, the study was only open to "CloudResearch Approved Participants" (i.e., participants who have been vetted by CloudResearch for attention and engagement). Prior to study enrollment, interested participants were screened using the PI-C to assess levels of contamination fear. Those who met eligibility criteria and passed attention check items (described above under the Participants section) were invited to participate in the full three-session study.

***Session One***

After completing the informed consent form, participants provided basic demographic information and completed the following self-report measures in a randomized order: PI-C, DOCS-C, OCI-12, DPSS-R, LMSQ, LOC, DASS-21, VVIQ, and COV-TaBS. Following questionnaires, participants completed a computerized version of the chain of contagion task.

Next, participants in the two guided imagery conditions rated their pre-guided imagery feelings of disgust and anxiety on a visual analogue scale from 0 (*not at all disgusted or anxious*) to 100 (*the most disgusted or anxious imaginable*). Participants then began their assigned guided imagery intervention, as described above. Following the guided imagery intervention, participants used the same 0-100 scales to report their highest (i.e., peak) anxiety and disgust at any point during the task and their post-intervention levels of anxiety and disgust. Using the 1 (*perfectly clear and as vivid as normal vision*) to 5 (*no image at all, you only 'know' that you are thinking of an object*) scale from the VVIQ, participants rated how vividly they engaged in mental imagery during the intervention. Those in the no-task control condition only reported their current anxiety and disgust and did not complete any imagery intervention.

To ensure participants in the freeze and loom conditions were paying attention to the audio, they completed comprehension questions about the intervention content. Specifically,

participants in the imagery conditions responded to four multiple-choice questions that asked what scene they were in (i.e., a bathroom), what substance they got on their hand (i.e., urine), whether the germs were moving or were frozen in place, and the cleanliness of the bathroom (i.e., was the bathroom clean or dirty?). All participants in the final sample correctly responded to these comprehension/attention check questions. At the end of session one, participants in the two guided imagery conditions were instructed to practice the guided imagery intervention at least once per day when encountering any type of potential contamination.

***Session Two***

The second session occurred approximately 24-hours after session one. Participants completed the same computerized version of the chain of contagion task described above before completing the following questionnaires in a randomized order: PI-C, DOCS-C, DPSS-R, LMSQ, and LOC. Instructions were modified for the DOCS-C so that participants were asked about their symptoms since session one. To assess whether participants in the freeze and loom conditions used their respective guided imagery interventions since session one, they were asked to self-report how many times they practiced the exercise[2]. Next, participants in the freeze and loom conditions completed the guided imagery intervention for a second time, again providing scores for their pre-, peak, and post-intervention anxiety and disgust ratings as well as their vividness of imagery during the task. Attention check questions regarding the content of the imagery exercises were re-administered and participants were again reminded to practice the intervention at least once daily.

***Session Three***

The third session occurred approximately one week after session one. Like session two, participants completed the chain of contagion task and the following questionnaires in a

[2]Additionally, participants were asked what percentage of this practice was related to COVID-19 contamination concerns. Due to inconsistencies in the way that this COVID-19 data was reported by participants, this data will not be presented.

randomized order: PI-C, DOCS-C, DPSS-R, LMSQ, and LOC. Again, instructions were modified for the DOCS-C so that participants were asked about their symptoms over the past week since their last session. Participants in the freeze and loom conditions self-reported how many times they used their respective imagery exercise since their second session[3]. Upon completion of the study, participants were provided with a debriefing form which included contact information for the researcher as well as a list of mental health resources. Participants were then compensated for their time.

## Results

### Checking Assumptions

Prior to conducting statistical analyses, the data were checked for missingness and examined for adherence to statistical assumptions. Missingness was negligible as there were only 41 missing data points on self-report questionnaires across the entire database (out of 34,544 self-report questionnaire data points). There was no missingness on any other variables (i.e., demographics, the chain of contagion task). Further, missingness was completely at random (Little's MCAR test, $X^2(12,451) = 3438.68$, $p = 1.00$). As such, it was appropriate to use mean imputation to correct missing data.

Data were assessed for normality, and scores for the primary outcome variables (PI-C, DOCS-C, DPSS-R, LOC, and LMSQ) were approximately normally distributed for all conditions, as assessed by visual inspection of Normal Q-Q Plots, skew, and kurtosis. One variable for the control condition at session three (LOC) was mildly negatively skewed with a standardized skew value greater than ±3.2 ($z$-score = -3.45). Analyses were run with transformed and non-transformed LOC variables; given that the pattern of results did not change, we present data using the non-transformed variables. Two baseline variables (DASS-21 and OCI-12) had

[3]Again, participants were also asked what percentage of this use was related to COVID-19 concerns, though this data is not reported due to inconsistencies in data collection.

standardized skew values greater than ±3.2 (respectively, *z*-scores = 4.42, 3.37). Given that these variables were only used to characterize the sample and there were no significant group differences (see Group Differences at Baseline section below), transformations were not necessary.

There were several univariate outliers in the data for all three administrations of the LOC and LMSQ, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. However, removing these data points did not change the pattern of results; as a result, final analyses included these data points. There were two multivariate outliers in the data as assessed by Mahalanobis distance ($p < .001$): one multivariate outlier on the combination of Aim 1 variables and one on the combination of Aim 2 variables. The removal of these multivariate outliers did not change the pattern of results, so final analyses included these data points as well. An examination of Pearson bivariate correlations amongst baseline variables revealed no evidence of multicollinearity (see Table 2 for correlations). Lastly, the assumption of linearity was met for all Aim 1 and Aim 2 variables, as assessed by scatterplot.

**Sample Characteristics at Baseline (Pre-Intervention)**

Table 3 lists the descriptive data for all covariates and Aim 1 and Aim 2 variables for each time point. At baseline, participants in the present sample reported higher contamination fear and disgust sensitivity and propensity compared to nonclinical samples (Burns et al., 1996; Fergus and Valentiner, 2009), and similar OCD symptom severity to that of a diagnosed OCD sample across different domains and on contamination-related subscales (Abramovitch et al., 2021; Abramowitz et al., 2010). Overall, participants in the present study appeared to experience heightened symptoms compared to nonclinical samples, and in some cases, reported symptoms comparable to those of a clinical population.

**Group Differences at Baseline (Pre-Intervention)**

A one-way ANOVA was conducted to test for group differences on questionnaires administered at session one (i.e., baseline; PI-C, DOCS-C, OCI-12, DPSS-R, LMSQ, LOC, DASS-21, VVIQ, and COV-TaBS). There were no significant group differences between the three conditions (freeze, loom, control) on PI-C ($F(2, 124) = 2.25$, $p = .11$, $\eta^2 = .04$); DOCS-C ($F(2, 124) = .81$, $p = .45$, $\eta^2 = .01$); OCI-12 ($F(2, 124) = .30$, $p = .74$, $\eta^2 = .01$); DPSS-R ($F(2, 124) = .66$, $p = .52$, $\eta^2 = .01$); LMSQ ($F(2, 124) = .003$, $p = 1.0$, $\eta^2 < .001$); LOC ($F(2, 124) = .13$, $p = .88$; $\eta^2 = .002$); DASS-21 ($F(2, 124) = 1.0$, $p = .37$, $\eta^2 = .02$); VVIQ ($F(2, 124) = 1.19$, $p = .31$, $\eta^2 = .02$); or COV-TaBS ($F(2, 124) = .20$, $p = .82$, $\eta^2 = .003$). See Table 3 for the means and standard deviations of each questionnaire score across sessions.

A one-way ANOVA revealed no group differences by age ($F(2, 124) = 1.95$, $p = .15$, $\eta^2 = .03$). Additionally, the proportions within conditions did not appear to differ by gender identity, sexual orientation, race/ethnicity, or education. See Table 1 for the demographic breakdown of the sample.

**Effects of Freeze and Loom Imagery Interventions**

Analyses were conducted to examine whether the guided imagery interventions induced feelings of disgust and anxiety in the freeze and loom conditions and whether there were differences in these variables at pre, peak, and post-intervention. Overall, participants in both conditions found the interventions at least moderately (i.e., > 50 out of 100) anxiety-provoking and disgusting at peak ratings (see Table 4); thus, as planned, we were successful at creating emotionally salient interventions. Importantly, given research demonstrating that imagery vividness may lead to differential distress ratings immediately after imaginal exposures (Hoppe et al., 2022), a one-way ANOVA revealed that there were no group differences on how vividly

participants imagined the scenarios (session one: ($F(1, 80) = .82$, $p = .37$, $\eta^2 = .01$; session 2: ($F(1, 80) = .19$, $p = .67$, $\eta^2 = .002$).

A series of two (condition: freeze, loom) by three (time: pre, peak, and post ratings) mixed model repeated measures ANOVAs were conducted to examine changes in disgust and anxiety ratings during the guided imagery interventions during sessions one and two. Anxiety and disgust were analyzed separately because disgust responses in contamination-OCD have been shown to be more resistant and slower to respond to treatment compared to anxiety (Mason & Richardson, 2012; McKay, 2006).

***Session One***

First, session one anxiety ratings were examined. Mauchly's test indicated that the assumption of sphericity had been violated, ($X^2(2) = 11.74$, $p = .003$); therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .88$). Results revealed a significant time by condition interaction for anxiety ($F(1.76, 140.58) = 3.24$, $p = .049$, partial $\eta^2 = .04$). As expected, univariate *F*-tests with Bonferroni correction revealed no significant differences on mean pre-anxiety ($F(1, 80) = .02$, $p = .88$, partial $\eta^2 < .001$) or peak-anxiety ($F(1, 80) = 2.71$, $p = .10$, partial $\eta^2 = .03$) ratings between conditions. Consistent with predictions, there were differences on post-anxiety ratings ($F(1, 80) = 4.51$, $p = .04$, partial $\eta^2 = .05$) such that participants in the freeze condition demonstrated significantly lower anxiety ratings than those in the loom condition at the end of the intervention.

Next, disgust ratings were examined in session one. Mauchly's test indicated that the assumption of sphericity had not been violated, ($X^2(2) = 5.58$, $p = .06$). There was a significant time by condition interaction for disgust, ($F(2, 160) = 3.11$, $p = .048$, partial $\eta^2 = .04$). Univariate *F*-tests with Bonferroni correction revealed no significant group differences on mean pre-disgust

($F(1, 80) = .14$, $p = .71$, partial $\eta^2 = .002$) or peak-disgust ratings ($F(1, 80) = 2.49$, $p = .12$, partial $\eta^2 = .03$). There was a trend toward a group difference on post-disgust ratings such that those in the freeze condition demonstrated lower post-intervention disgust ratings ($F(1, 80) = 3.80$, $p = .055$, $\eta^2 = .05$); however, this was nonsignificant.

***Session Two***

The same analyses were then conducted for session two. First, anxiety ratings were examined. Mauchly's test indicated that the assumption of sphericity had been violated, ($X^2(2) = 34.18$, $p < .001$); therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .74$). As expected, there was a significant main effect of time, ($F(1.48, 118.41) = 60.47$, $p < .001$, partial $\eta^2 = .43$), such that anxiety ratings increased from pre- to peak and decreased from peak to post-intervention. Further, results revealed a significant main effect of condition, ($F(1, 80) = 4.3$, $p = .04$, partial $\eta^2 = .05$), such that those in the freeze condition reported significantly lower anxiety ratings overall compared to the loom condition. There was not a significant time by condition interaction for anxiety, ($F(1.48, 118.41) = 2.00$, $p = .15$, $\eta^2 = .02$).

Next, session two disgust ratings were examined. Again, Mauchly's test indicated that the assumption of sphericity had been violated, ($X^2(2) = 6.27$, $p = .04$); therefore, degrees of freedom were again corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .93$). There was a significant main effect of time ($F(1.86, 148.65) = 141.60$, $p < .001$, partial $\eta^2 = .64$) such that disgust ratings changed across the interventions in the expected direction (i.e., increased from pre to peak and decreased from peak to post). Further, in line with expectations, there was a significant main effect of condition ($F(1, 80) = 4.2$, $p = .04$, partial $\eta^2 = .05$) such that those in the freeze condition reported significantly lower disgust ratings overall compared to the loom

condition. There was not a significant time by condition interaction for disgust, ($F$(1.86, 148.65) = 1.82, $p$ = .17, partial $\eta^2$ = .02).

***Practice Frequency***

A one-way ANOVA was conducted to test for group differences on the number of times that participants in the two imagery conditions used their respective guided imagery interventions outside of study sessions; this data was self-reported by participants at sessions two (i.e., how many times they used it since session one) and three (i.e., how many times they used it since session two). There were no significant group differences between the two imagery conditions (freeze and loom) on the frequency of imagery use at session two ($F$(1, 81) = .14, $p$ = .71, $\eta^2$ = .002) or three ($F$(1, 80) = .32, $p$ = .58, $\eta^2$ = .04). Additionally, participants adhered to study instructions to practice their respective interventions at least once per day at sessions two (freeze: $M$ = 2.83, $SD$ = 2.42; loom: $M$ = 3.08, $SD$ = 3.39) and three (freeze: $M$ = 7.98, $SD$ = 5.43; loom: $M$ = 7.33, $SD$ = 4.81).

**Aim 1 Analysis**

A three (condition: control, freeze, loom) by three (session one [T1]; session two [T2]; session three [T3]) mixed model repeated measures MANOVA was conducted to evaluate the extent to which condition influenced changes in looming cognitions (LOC and LMSQ) over time. Mauchly's test indicated that the assumption of sphericity had been violated for both variables (LOC: $X^2$(2) = 22.29, $p$ < .001; LMSQ: $X^2$(2) = 36.34, $p$ < .001), therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity (LOC: ε = .86; LMSQ: ε = .80). The assumption of homogeneity of variance-covariance matrices was violated, as assessed by Box's test of equality of covariance matrices ($p$ < .001). As such, Pillai's Trace

criterion was applied, as this test is more robust for protection against departures from homogeneity of variance-covariance matrices (Tabachnick & Fidell, 2013).

As expected, the omnibus test revealed a significant time by condition interaction (Pillai's Trace = .16; $F(8, 496) = 5.27$, $p < .001$, partial $\eta^2 = .08$). To protect against risk of Type I errors, a Bonferroni correction was applied. Follow-up univariate *F*-tests revealed a significant time by condition interaction for LOC ($F(3.43, 212.75) = 7.58$, $p < .001$, partial $\eta^2 = .11$) such that participants in the freeze condition—but not other conditions ($p$'s $\geq .31$)—demonstrated significant reductions in their tendency to interpret contamination as looming over time (T1 to T2, $p = .002$; T2 to T3, $p = .001$; T1 to T3, $p < .001$). Further, participants in the freeze condition had significantly lower LOC scores at session two compared to the loom condition ($p = .046$) and significantly lower scores at session three than both the loom ($p = .002$) and the control conditions ( $p = .005$). There were no differences between any groups at session one ($p$'s = 1.00), no differences between the control and freeze or control and loom groups at session two ($p$'s $\geq$ .34), and no differences between the control and loom groups at session three ($p = 1.00$). See Tables 5 and 6 and Figure 2 for additional information on LOC results.

Similarly, there was a significant time by condition interaction for LMSQ ($F(3.19, 197.48) = 5.06$, $p = .002$, partial $\eta^2 = .08$) such that participants in the freeze condition—but not the other conditions ($p$'s $\geq .10$)—showed a decreased tendency to interpret general threat as looming over time. Although there was not a significant change in LMSQ for the freeze condition from session one to two ($p = .18$), there was a significant decrease in LMSQ scores for this group from session two to three ($p < .001$) and expectedly, from session one to three ($p < .001$). At session three, participants in the freeze condition demonstrated significantly decreased LMSQ scores compared to those in the control condition ($p = .04$; see Figure 3). There were no

differences between any groups at sessions one or two ($p$'s = 1.00), and no differences between the control and loom or freeze and loom groups at session three ($p$'s ≥ .19). See Tables 7 and 8 and Figure 3 for additional information on LMSQ results.

**Aim 2 Analysis**

A three (condition: control, freeze, loom) by three (session one [T1]; session two [T2]; session three [T3]) mixed model repeated measures MANOVA was conducted to evaluate the extent to which condition influences changes in disgust sensitivity and propensity (DPSS-R), contamination fear (PI-C), and OCD symptoms (DOCS-C) over time. Mauchly's test indicated that the assumption of sphericity had been violated for all three variables (DPSS-R: $X^2(2) = 9.14$, $p = .01$; PI-C: $X^2(2) = 15.58$, $p < .001$; DOCS-C: $X^2(2) = 8.94$, $p = .01$); therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity (DPSS-R: ε = .93; PI-C: ε = .89; DOCS-C: ε = .93). Box's test of equality of covariance matrices indicated that the assumption of homogeneity of variance-covariance matrices was not violated ($p = .92$). As such, Wilks' Lambda criterion was applied.

As hypothesized, there was a significant time by condition interaction (Wilks' Lambda = .90; $F(12, 651.15) = 2.12$, $p = .01$, partial $\eta^2 = .03$). Post-hoc univariate $F$-tests with a Bonferroni correction were conducted to parse apart the interaction, which revealed a significant time by condition interaction for PI-C and DOCS-C (PI-C: $F(3.58, 221.63) = 3.16$, $p = .02$, partial $\eta^2 = .05$; DOCS-C: $F(3.74, 231.76) = 4.68$, $p < .01$, partial $\eta^2 = .07$), but not for DPSS-R ($F(3.73, 231.42) = 1.30$, $p = .27$, $\eta^2 = .02$)[4]. See Tables 9 and 10 and Figure 4 for additional information on DPSS-R results.

Participants in the freeze condition—but not other conditions ($p$'s ≥ .79)—demonstrated significant reductions in contamination fear over time. Although there was not a significant

[4]Although there was not a significant time by condition interaction for DPSS-R, there was a main effect of time ($F(1.87, 231.42) = 4.69$, $p = .01$, partial $\eta^2 = .04$) such that scores decreased across conditions from T1 to T2 (see Figure 4).

reduction in PI-C for the freeze condition from session one to two ($p$ = 1.00), there was a significant decrease in PI-C scores for this group from session two to three ($p$ = .008) and expectedly, from session one to three ($p$ = .03). Those in the freeze condition had significantly lower contamination fear than the loom condition at session three ($p$ = .001; see Figure 5). There were no differences between any groups at sessions one or two ($p$'s ≥ .06), and no differences between the control and freeze or control and loom conditions at session three ($p$'s ≥ .19; also see Tables 11 and 12) Further, participants in the freeze condition—but not the other conditions ($p$'s ≥ .34)—demonstrated significantly less severe OCD symptoms (DOCS-C) over time (T1 to T2, $p$ = .02; T2 to T3, $p$ = .047; T1 to T3, $p$ < .001; see Figure 6). However, there were no differences between groups at sessions one, two, or three ($p$'s ≥ .056; see Tables 13 and 14).

To assess if condition affected contamination ratings during the chain of contagion task, we conducted a three-way (time, pencils, condition) mixed model ANOVA. There was not a statistically significant three-way interaction between time, pencils, and condition ($F$(7.74, 480.14) = .78, $p$ = .61; partial $\eta^2$ = .01). However, there was a significant time by condition interaction ($F$(2.84, 176.08) = 4.97, $p$ = .003, partial $\eta^2$ = .07; see Figure 10 and Tables 15 and 16). Post-hoc univariate $F$-tests with a Bonferroni correction were conducted to parse apart the interaction. Although there was not a significant change in contamination ratings for the freeze condition from sessions one to two ($p$ = .49), there was a significant decrease in contamination ratings for this group from sessions two to three ($p$ = .01). Participants in the control and loom conditions rated the pencils as significantly more contaminated from sessions one to two (control, $p$ = .008; loom, $p$ < .001) and sessions one to three (control, $p$ = .02; loom, $p$ < .001), though there was no significant change in ratings from sessions two to three (control, $p$ = 1.00;

loom, $p = .84$; see Figures 7 to 10 and Tables 15 and 16). There were no differences between groups at sessions one, two, or three ($p$'s $\geq .69$)

Additionally, given some research demonstrating that the immediate effects of LV-related imagery may differ based on varying levels of "imagination" (Riskind et al., 1997b), we tested whether controlling for baseline levels of trait-like vividness of mental imagery would impact the pattern of results by conducting two repeated measures MANCOVAs with VVIQ scores as a covariate for Aim 1 and Aim 2. Given that there were no baseline differences on this variable between conditions in this study or in the one by Dorfan and Woody (2006), it was not expected to significantly impact the relationship between condition and Aim 1 or 2 variables, and as expected, the pattern of results did not appreciably change.

For Aims 1 and 2, a post-hoc power analysis revealed that there was more than adequate power to detect a medium (observed power = .90) to large (observed power = .99) effect given the sample size.

**Aim 3 Analysis**

Given that there was a significant time by condition interaction for LOC and LMSQ (Aim 1) and time by condition interaction for PI-C, DOCS-C, and average contamination ratings in the chain of contagion task (Aim 2), additional analyses were conducted to determine whether change in LV mediated the relationship between condition and change in Aim 2 variables. Three parallel mediation analyses (one for each of the significant Aim 2 interactions) were run using PROCESS, an SPSS plug-in (Preacher & Hayes, 2008). No major assumptions were violated. Given the repeated measures nature of the study, later measurements of the mediators and dependent variables were modeled while using earlier measurements as covariates (Hayes, 2017). Thus, LOC and LMSQ scores at session two were entered as the mediators and PI-C,

DOCS-C, and average contamination ratings at session three were entered into separate analyses as the dependent variables, fulfilling the mediation requirement of temporal precedence. Condition was entered as a multicategorical independent variable such that two separate comparisons could be made: freeze vs. control ($X_1$) and freeze vs. loom ($X_2$). Baseline measurements of the mediators and dependent variables were entered as covariates (i.e., session one measurements of LOC and LMSQ and session one measurements of either PI-C, DOCS-C, or average contamination ratings dependent upon the analysis). Bootstrapping was set to 10,000 samples (Hayes, 2017).

First, a parallel mediation analysis was conducted using PI-C as the dependent variable. Those in the freeze group reported lower LOC scores compared to those in the control ($X_1$) and loom ($X_2$) conditions (path *a*, see Figure 11), and those with lower LOC scores reported lower contamination fear (path *b*, see Figure 11). A 95% confidence interval based on 10,000 bootstrap samples revealed that the indirect effect through changes in LOC, holding all mediators constant, was statistically different from zero ($X_1$: Indirect = -1.03, *SE* = .62, 95% *CI* [ -2.47, -.05]; $X_2$: Indirect = 1.81, *SE* = 1.05, 95% *CI* [.30, 4.31]), suggesting that the relationships between $X_1$ (freeze vs. control) and contamination fear and between $X_2$ (freeze vs. loom) and contamination fear were mediated by changes in looming of contamination cognitions (LOC). These relationships were not mediated through changes in the general looming cognitive style (LMSQ; see Figure 11 for these statistics).

Next, a parallel mediation analysis was conducted using DOCS-C as the dependent variable. Those in the freeze group reported lower LOC scores compared to those in the control ($X_1$) and loom ($X_2$) conditions (path *a*, see Figure 12), and those with lower LOC scores reported less OCD symptoms (path *b*, see Figure 12). A 95% confidence interval based on 10,000

bootstrap samples revealed that the indirect effect through changes in LOC, holding all mediators constant, was statistically different from zero ($X_1$: Indirect = -.35, *SE* = .19, 95% *CI* [ -.77, -.03]; $X_2$: Indirect = .65, *SE* = .34, 95% *CI* [.14, 1.44]), suggesting that the relationship between $X_1$ (freeze vs. control) and OCD symptoms and between $X_2$ (freeze vs. loom) and OCD symptoms were mediated by changes in looming of contamination cognitions (LOC). These relationships were not mediated through changes in the general looming cognitive style (LMSQ; see Figure 12 for these statistics).

Lastly, a final parallel mediation analysis was conducted using average contamination ratings in the chain of contagion task as the dependent variable. Results revealed that those in the freeze group reported lower LOC scores compared to those in the control ($X_1$) and loom ($X_2$) conditions (path *a*, see Figure 13); those with lower LOC scores reported lower average contamination ratings (path *b*, see Figure 13); and there was a direct effect of group on contamination ratings for $X_2$ and a total effect of both group comparisons on contamination ratings (path c', see Figure 13). However, despite these findings, a 95% confidence interval based on 10,000 bootstrap samples revealed that the indirect effect through changes in LOC or LMSQ, holding all mediators constant, was not statistically different from zero (LOC, $X_1$: Indirect = -1.93, *SE* = 1.56, 95% *CI* [ -5.62, .22]; LOC, $X_2$: Indirect = 3.69, *SE* = 2.92, 95% *CI* [-.26, 10.77]; LMSQ, $X_1$: Indirect = .07, *SE* = .55, 95% *CI* [ -1.00, 1.40]; LMSQ, $X_2$: Indirect = .01, *SE* = .44, 95% *CI* [-.74, 1.16]), suggesting that the relationship between group and average contamination ratings in the chain of contagion task was not mediated by changes in LOC or LMSQ (see Figure 13 for these statistics).

## Discussion

The purpose of the current study was to examine the effectiveness of an online guided imagery intervention in decreasing LV-related cognitions and contamination fear-related symptoms in a subclinical contamination-OCD sample. The effectiveness of this novel intervention—which instructed participants to imagine germs as frozen in place—was compared after 24-hours and one-week to two conditions: a second imagery condition in which participants were instructed to instead imagine contamination as looming and a no-task control condition.

Our research questions were examined via three separate aims. First, we tested whether participants in the freeze condition endorsed decreased LV-related cognitions over time, including looming of contamination cognitions and LCS. Second, we examined whether participants in the freeze condition reported decreased contamination fear, disgust propensity and sensitivity, OCD symptoms, and chain of contagion beliefs. Third, we tested if changes in LV-related cognitions, particularly looming of contamination cognitions, mediated the relationship between condition and changes in symptoms. Our hypotheses were generally supported. The results of this study suggest that those in the freeze condition—but not the control or loom conditions—reported decreased LV-related cognitions (LOC and LMSQ), contamination fear (PI-C), OCD symptoms (DOCS-C), and overall chain of contagion contamination ratings over time; the pattern of these results did not differ when controlling for baseline levels of the vividness of mental imagery. Lastly, changes in contamination fear and OCD symptoms were mediated by changes in looming of contamination cognitions, as expected.

The findings of this study provide additional support for the LV model and its theory that dynamic perceptions of threat play a significant role in the maintenance of anxiety. It is notable that freeze imagery led to significant reductions in both of our LV-related constructs, particularly

because the LCS is thought to be a *trait*-like cognitive vulnerability to anxiety (Riskind et al., 2006; Riskind & Rector, 2018). Thereore, the LCS may be more malleable than previously thought. Additionally, it is plausible that the benefits of interventions targeting specific LV content may generalize to other types of anxiety.

Given that previous studies that tested freeze imagery did not collect follow-up data on symptoms beyond state distress levels (Dorfan & Woody, 2006; Riskind et al., 1997b), it was previously unknown whether freeze imagery led to any lasting changes in symptoms beyond an immediate reduction in distress. This study provides a novel contribution to the current body of literature on LV by being the first to test whether the impact of freeze imagery on different symptoms can be detected over a longer follow-up period beyond changes in state distress levels. Our finding that freeze imagery led to significant reductions in contamination fear, OCD symptoms, and chain of contagion contamination ratings provides further evidence of the role of LV in contamination-OCD and suggests that this intervention has the power to influence symptoms that affect one's daily functioning (e.g., OCD symptoms) in addition to decreasing state distress levels (e.g., anxiety and disgust).

The finding that changes in LV-related cognitions mediated the relationship between freeze imagery and symptom reductions is especially notable and provides some initial evidence that LV may be an underlying mechanism maintaining contamination fear and OCD symptoms. As such, LV may be an important target for intervention, and changes in LV-related distortions—whether targeted directly through freeze imagery or indirectly through other CBT practices—may represent an important treatment outcome in their own right (Riskind & Rector, 2018). Overall, the results of this study provide preliminary support for the beneficial use of

freeze imagery, and further highlight the need to continue studying the role of LV in the etiology and maintenance of anxiety disorders.

Lastly, although the capacity to produce vivid (i.e., "clear and lively;" Marks, 1973) mental images is thought to be important for the success of mental imagery-based interventions, our pattern of results remained the same when controlling for baseline levels of vividness of mental imagery. It is possible that only a certain level of imagery vividness is needed for the freeze imagery intervention to be effective and that vividness above this level may not have added benefit (Hoppe et al., 2022; Rauch et al., 2004). Given recent findings that varying levels of imagery vividness do not lead to differences in fear ratings 24 hours after an imaginal exposure exercise (Hoppe et al., 2022), it may not be necessary to generate extremely clear and vivid mental images to experience lasting benefits from freeze imagery, possibly allowing this intervention to be successfully used by individuals with lower levels of vividness.

**Freeze Imagery: Safety Behavior or Adaptive Strategy?**

Despite the possible deleterious effects of freeze imagery noted by Foa and Kozak (1986), the freeze guided imagery intervention did not appear to function as merely a safety behavior in the present study, and instead, may be an adaptive strategy to manage contamination-OCD. First, if the use of the freeze intervention functioned as a safety behavior, it would be expected that contamination fear-related symptoms worsen over the one-week period from when participants first received the intervention (session one) to the final follow-up session (session three). Safety behaviors are known to have deleterious effects on anxiety after only brief usage, and in fact, a previous study demonstrated that purposefully engaging in health-related safety behaviors led to increases in contamination fear, health anxiety, and avoidant responses on health-related behavioral tasks at a one-week follow-up (Olatunji et al., 2011). However,

participants in the freeze condition in the present study exhibited decreased contamination fear and OCD symptoms over a one-week period, suggesting that this intervention does not function similarly to unhelpful safety behaviors and may instead be adaptive.

Second, since safety behaviors are thought to maintain anxiety by increasing the perceived likelihood and importance of threat (Abramowitz et al., 2019; Blakey & Abramowitz, 2016; Helbig-Lang & Petermann, 2010; Salkovskis, 1991), it would be expected that participants in the freeze condition perceive contamination to be more threatening and looming if the freeze intervention functioned as a safety behavior. Importantly, safety behaviors are thought to disrupt therapeutic information processing via three routes: 1) by signaling danger; 2) by increasing the perception of threatening stimuli; and 3) by directing attention away from disconfirming information (i.e., directing attention towards the safety behavior and possibility of threat and away from evidence that the feared outcome did not occur and/or that the individual was able to tolerate the distress; Blakey & Abramowitz, 2016). However, those who received the freeze intervention endorsed decreased looming of contamination cognitions compared to the other conditions, such that they reported the threat was not growing as large and contamination was spreading more slowly and approaching to a lesser extent. This suggests that the intervention may have deemphasized the perceived likelihood and importance of threat and disconfirmed the unhelpful and irrational belief that contamination spreads in a "looming" manner. Thus, the freeze intervention led to more adaptive and accurate cognitions about the spread of contamination, contrary to what may be expected if the intervention functioned as a safety behavior.

Overall, the results of this study support the theory that freeze imagery—if completed in a specific manner—may function as an adaptive strategy, rather than a safety behavior, to

manage contamination fear-related symptoms. However, if someone were to use freeze imagery only as a means of avoiding their immediate feelings of anxiety without further processing and challenging their LV-related beliefs or if it were to develop into a compulsion on its own, this strategy may have little to no benefit (Riskind et al., 2012); the goal of freeze imagery is not to distract from anxiety, but rather to focus on contamination and modify LV-related distortions. Thus, in future studies that further explore this strategy, symptoms should be closely monitored and the risk of this intervention inadvertently becoming a safety behavior must be carefully considered. To optimize the use of freeze imagery in treatment, it may be beneficial to gradually decrease the use of this strategy once decreased looming appraisals of contamination have been achieved; this is similar to recommendations regarding the adaptive use of safety behaviors during the course of exposure therapy (Hofmann & Hay, 2018; Telch & Lancaster, 2012).

**Freeze Imagery Through an Inhibitory Learning Lens**

While hypotheses regarding the freeze condition were generally supported and in line with the LV model of anxiety, the findings of this study may feel counterintuitive to theoretical models that posit habituation as the mechanism through which fear reduction occurs. However, results may be explained by the inhibitory learning theory (ILT; Craske et al., 2008), which was introduced to address the limitations of habituation models. The ILT posits that fear associations are not "broken" during exposure therapy but rather remain intact while new non-threat associations are created that compete with (i.e., "inhibit") the older threat associations. Thus, this theoretical model emphasizes the importance of fear tolerance over fear reduction and suggests that inhibitory learning is optimized by maximizing expectancy violations. Specifically, exposures should be designed to highlight discrepancies between feared and actual outcomes and

should additionally aim to disprove the expectancy that distress will be intolerable or last indefinitely (Craske et al., 2008; Jacoby & Abramowitz, 2016).

The ILT provides several possible explanations in support of the finding that freeze imagery led to significant reductions in contamination fear, OCD symptoms, and overall chain of contagion contamination ratings. First, the freeze intervention may have taught participants to tolerate, rather than extinguish, fear by encouraging approach behaviors and discouraging either behavioral or cognitive avoidance towards contamination. To practice the freeze intervention, participants were encouraged to encounter contamination at least once daily and to focus their attention on the contamination for the duration of the exercise. Further, participants were never encouraged to engage in "safety imagery" (i.e., imagining that they were safe and that the germs could not harm them) and were instead reminded that the contamination they encountered was alive, toxic, and may have contained diseases that were harmful to them. Additionally, the freeze intervention may have helped participants regain a sense of control over their environment, thus violating uncontrollability expectations. As a result of regaining control, they may experience less distress, which may violate an expectancy that remaining in prolonged contact with a contaminant would be intolerable.

Second, the freeze intervention may have led to the development of new beliefs regarding the movement of germs (i.e., germs are frozen in place), which competed with participants' original LV-related beliefs (i.e., germs quickly move and spread), thus decreasing contamination-related distress over time. Importantly, this new belief regarding the speed of the spread of germs is more scientifically accurate than the original LV-related threat association, as although germs are capable of movement, they travel at microscopic speeds and do not rapidly "crawl" across skin to infect large areas of the body. It is possible that receiving this potentially

corrective information may lead to more realistic cognitions about the spread of contamination in the future. Relatedly, the lack of significant symptom change in the loom condition is also in line with the ILT because engaging in loom imagery likely reinforced old LV-related beliefs rather than creating new beliefs. Future research should aim to clarify whether the observed benefits of freeze imagery in this study can be attributed to exposure effects and habituation, changing beliefs related to the movement and threat of germs, or a combination of both.

**Effects of Freeze Imagery on Disgust and the Chain of Contagion**

Although most of our hypotheses regarding the freeze condition were generally supported, there were several unexpected findings. First, contrary to expectations, there were no significant group differences in disgust sensitivity and propensity over time. It is possible that the duration of the study was not long enough to detect changes in disgust sensitivity and propensity, as it is well-documented that disgust responses in contamination-OCD are slower to respond to treatment compared to fear-based responses (Mason & Richardson, 2012; McKay, 2006). Second, it is possible that the freeze intervention did not adequately target looming of disgust in addition to looming of contamination appraisals. Future research should continue to explore ways to better target disgust responses in contamination-OCD, such as including additional language regarding looming of disgust in the freeze intervention by instructing participants to imagine their feelings of disgust and their risk of becoming nauseous as remaining stable.

Second, hypotheses regarding the chain of contagion task were only partially supported. Unexpectedly, there was not a significant time by condition by pencil interaction in the chain of contagion task such that, contrary to hypotheses, contamination ratings in the freeze condition did not degrade *faster* than the other conditions such that they would perceive the contamination to quickly become diluted over successive points of removal. However, there was a significant

time by condition interaction such that participants in the control and loom conditions rated the pencils overall as *more* contaminated from sessions one to two whereas those in the freeze condition rated the pencils overall as *less* contaminated from sessions two to three. Thus, while the freeze intervention appeared successful at reducing overall contamination ratings—which was in line with hypotheses—it did not lead to appreciably faster reductions.

One explanation for these mixed findings may be related to participants' overall symptom severity at session three. While participants in the freeze condition demonstrated a significant reduction in symptom severity over time on several variables, the severity of their contamination fear and OCD symptoms were still similar to that of a clinical sample at the end of the study. As a result, they were likely still responding similarly on this task to an OCD sample. It is possible that the pattern of responding for participants in the freeze condition would better align with that of non-OCD samples if the intervention was administered over a longer period of time (e.g., for 30 minutes instead of 10 minutes), for more repetitions, and if longer-term follow-up data was collected (e.g., 6 months post-intervention).

**Effects of Loom Imagery**

Although our hypotheses for the freeze and control conditions were mostly supported—such that symptoms generally decreased in the freeze condition and remained unchanged in the control condition—results for the loom condition were not in line with expectations. Consistent with previous studies utilizing loom imagery (Dorfan & Woody, 2006; Riskind et al., 1997b), individuals in the loom condition generally endorsed higher post-intervention levels of state anxiety and state disgust than those in the freeze condition. However, this increased post-intervention distress did not translate to symptom changes for the loom condition, as they did not

demonstrate any statistically significant changes over time on LV-related constructs, contamination fear, OCD symptoms, or disgust sensitivity and propensity.

Given that LV-related constructs decreased over the course of the study in the freeze condition, it is somewhat surprising that LV-related constructs—particularly looming of contamination cognitions—did not significantly increase in the loom condition. Moreover, since loom imagery did not affect LV, it is then unsurprising that those in the loom condition did not report changes in contamination fear, OCD symptoms, or disgust sensitivity and propensity. Since LV is theorized to sensitize individuals to threat and elicit anxiety (Riskind, 1997), one may infer that frequently and intentionally engaging in loom imagery regarding contamination may enhance—or at least maintain—fear over time. Given our finding that there were no differences in performance between those in the loom condition and those in the no-task control condition, it is feasible that loom imagery simply maintained pre-existing levels of LV rather than providing a new, "worsened" threat appraisal, providing further evidence of the LV model of anxiety.

Provided that higher contamination fear is associated with a greater sense of contamination-related LV (Riskind, 1997), it is possible that restricting the study to only high contamination-fearful individuals constrained variability across LV measures as well. The present sample endorsed elevated LV at baseline, and it is possible that this near-ceiling effect limited our ability to detect increases in LV. We may have detected an effect of the loom intervention on LV-related constructs if the study were open to individuals with varying levels of contamination fear and LV.

Lastly, since the loom intervention partially imitates an imaginal exposure, it is possible that engaging in loom imagery for a longer duration of time may eventually prove to be

therapeutic by desensitizing participants to the the threat of looming contamination. It may be the case that discontinuing the intervention after ten minutes did not allow for sufficient time for habituation to occur or enough opportunity for participants to learn that they could tolerate the distress or that a feared outcome (e.g., getting sick) would not transpire. As such, it is possible that a lengthier intervention would have allowed inhibitory learning to occur (by violating expectancies regarding distress tolerance or predicted negative outcomes), thereby decreasing distress. However, Dorfan and Woody (2006) found that participants engaging in loom imagery did not habituate over a 30-minute exposure, and in fact became sensitized to distress. Future studies should examine whether engaging in loom imagery for a lengthier period of time (e.g., 60 minutes) or completing several iterations of the intervention over multiple sessions eventually leads to a reduction in distress or continues to maintain anxiety.

**Clinical Implications**

To our knowledge, this study is the first to test the effectiveness of an intervention designed to modify LV and other symptoms in a contamination-fearful sample. These findings may have clinical implications for the treatment of contamination-OCD, as they suggest that improvements in LV may be one mechanism through which contamination fear and OCD symptoms improve over the course of therapy, further highlighting the potential importance of targeting LV-related distortions in treatment. Thus, it may be beneficial to incorporate more content pertaining to LV into existing evidence-based psychotherapies. For example, clinicians may consider providing psychoeducation to patients about LV to increase their awareness of when they engage in these maladaptive thoughts, similar to how patients may be instructed to identify their cognitive distortions during a course of CBT. Relatedly, providing patients with accurate, scientific information regarding their fears is common in treatment, such as informing

patients with panic disorder of the science behind their physiological responses during a panic attack. Thus, patients with contamination-OCD may find it helpful to learn information that may counter their LV-related distortions such as the speed of germ movement, the skin's function as a protective barrier, and how long certain bacteria or viruses can survive on different surfaces.

While the freeze guided imagery intervention led to statistically significant reductions in contamination fear-related symptoms, it is important to note that participants still endorsed relatively high symptom severity at the end of the study, and it is unclear to what extent participants personally found these symptom reductions helpful, noticeable, or meaningful. As such, although this study does not provide sufficient support that freeze imagery could function as a standalone intervention, it does provide a foundation for future work on the use of freeze imagery during treatment to target LV. Future research should aim to replicate these findings, assess even longer-term effects (e.g., at a 6-month follow-up), and examine other strategies to strengthen the effects of freeze imagery. If additional support is found that freeze imagery is helpful, this looming-reduction strategy may eventually be adjunctively integrated into the protocols of existing, empirically supported treatments for contamination-OCD to improve clinical outcomes. Further, since this intervention was successfully delivered via an entirely-online format—a particular strength of this study—it is possible that freeze imagery could be easily taught and quickly disseminated via the Internet as a potentially adaptive coping strategy to manage contamination fear.

Given that the LCS is considered a transdiagnostic factor across the spectrum of anxiety disorders (Reardon & Williams, 2007; Williams et al., 2005), our finding that freeze imagery led to reductions in LCS scores has potential implications for patients with multiple anxiety-related comorbities, and it is therefore plausible that the benefits of interventions targeting specific LV

content may generalize to other types of anxiety. Further, given that the freeze imagery intervention successfully decreased contamination-related LV in a subclinical contamination-OCD sample, it is likely that freeze imagery interventions targeting other specific LV content will also effectively reduce disorder-specific LV in other anxious populations. In addition to replicating our findings, future research should explore whether engaging in imagery in which, for example, the threat of embarrassment or negative evaluation is "frozen" in time leads to reductions in social anxiety-related LV.

Finally, it is possible that LV may mediate symptom change across different evidence-based psychotherapies and, as such, future treatment studies should consider administering a measure of LV alongside other symptom measures to determine if LV shifts over the course of therapy and whether it is a mechanism of symptom change. Although recent research found that CBT leads to reductions in LV distortions which predict post-treatment anxiety symptoms, possible mediating effects of LV were not tested (Katz et al., 2017); thus, it is unclear to what extent, if at all, these changes in anxiety symptoms can be attributed to LV versus other mechanisms of change. Finally, since elevated LV is theorized to impede habituation and maintain fear, future studies should examine differences between treatment responders and non-responders to assess whether LV may play a role in predicting who benefits from treatment.

**Limitations**

While the results of this study are promising, they should be interpreted in light of several limitations. First, no information is known about the diagnostic status of the present sample (i.e., whether they meet diagnostic criteria for OCD), their psychiatric comorbidities, or their history of pharmacological or psychological interventions for mental health concerns. Although that information was not available, the sample used in the present study endorsed contamination fear

and OCD symptoms on self-report measures to a similar degree to diagnosed OCD samples. Further, research has repeatedly demonstrated the relevance of utilizing analogue samples to understand obsessive-compulsive symptoms (Abramowitz et al., 2014). Regardless, caution should be used when generalizing the results of this study to clinical populations. Future research should consider utilizing clinician-administered assessment instruments and structured clinical interviews rather than relying fully on self-report data.

Second, the sample was predominantly White, cisgender female, heterosexual, and highly educated. As a result, caution should be used when generalizing the results of this study to racial, ethnic, gender, and sexual minority populations; future studies should aim to assess the efficacy of the freeze intervention in these populations. In addition, there were no participants in the present study who did not have at least a high school diploma (or GED equivalent), so generalizability of these results to lower education levels is unknown. The highly educated nature of the present sample also poses a barrier to interpreting the overall success of the freeze intervention as most participants likely have some preexisting knowledge about the spread of germs given their educational background, and certain aspects of both imagery interventions may have been more or less believable given their basic knowledge.

Relatedly, it is possible that demand effects related to the information that participants were told about the freeze and loom interventions (i.e., that they were going to learn a strategy that may help reduce their fear of germs) impacted symptom change over time via confirmation bias (Nickerson, 1998). While the possibility of a confirmation bias significantly influencing results cannot be entirely ruled out, this is an unlikely explanation because results differed between the imagery conditions despite them receiving the same information about how the intervention may be helpful.

Similarly, it is possible that outcomes varied between the freeze and loom conditions due to perceived credibility of the interventions. For instance, participants in the loom condition may have found the idea of the intervention to be counterintuitive and therefore may have been less motivated to practice the intervention outside of study sessions. Further, participants in the loom condition reported more distress during the intervention, which may have also discouraged daily practice. On the other hand, participants in the freeze condition may have found the intervention to be more intuitive and been more likely to utilize it when encountering contamination. However, results revealed that there was no significant difference between the two conditions on frequency of intervention use, and importantly, results did not differ when controlling for the frequency of intervention use[5]. Future studies should collect data on the credibility, acceptability, and feasibility of the freeze intervention and test whether these impact the efficacy of the intervention and how often participants utilize it.

Although results did not differ when controlling for the frequency of practice, participants practiced the guided imagery interventions varying numbers of times between sessions. In addition, the interventions in the present study were brief (approximately 10 minutes) and were only formally presented twice. It is unknown whether the participants used the interventions correctly or for a sufficient length of time outside of the study sessions, and it is possible that a different pattern of results would have emerged if the interventions were lengthier or practiced more often. Future research in this area should aim to increase the effectiveness of this intervention by identifying the correct "dosage" of freeze imagery and providing more structure around the frequency and accuracy of use, such as by sending daily reminders to practice and providing participants with the guided audio to follow along with outside of sessions.

[5]As a post-hoc exploratory analysis, the frequency of imagery use was entered as a covariate into Aim 1 and Aim 2 analyses. Inclusion of this covariate did not impact the pattern of results.

Lastly, there is somewhat limited psychometric data on the LV-related measures and no psychometric data available regarding our chain of contagion task. Further, since the original chain of contagion task was completed in-person whereas the one utilized in the present study was a newly created computerized version, these results should be interpreted with caution.

### *Contamination-OCD and LV in the Age of COVID-19*

Given this study's focus on contamination fear, the findings should be discussed in the context of the ongoing COVID-19 pandemic. While research targeting contamination fear may be particularly relevant in the age of COVID-19, it also poses special considerations for data interpretation as participants in the present study may not be representative of "pre-pandemic" analogue contamination-OCD samples. In fact, a recent systematic review found that COVID-19 became a central theme for many individuals who had OCD prior to the pandemic, particularly for those who had pre-existing contamination fears (Guzick et al., 2021). Further, obsessive-compulsive symptoms increased in the early stages of the pandemic in OCD samples as well as in the general population (Guzick et al., 2021), and as such, it is likely that some participants in the present study were experiencing a new onset (or increase) of contamination fear and OCD symptoms.

Relatedly, a recent study found that obsessive-compulsive washing symptoms significantly increased in a non-clinical sample in the early stages of the COVID-19 pandemic (Knowles & Olatunji, 2021), suggesting that participants in the present study may have also been engaging in more washing behaviors than they did previously. It is unclear what proportion of the present sample's compulsion-like behaviors were due to contamination fear and what proportion were attributable to following public health guidelines, which have quickly changed over the course of the pandemic (Harvard T.H. Chan School of Public Health, 2022).

Of note, all data—including prescreening—were collected between October 29, 2021, and November 20, 2021, which was shortly before the identification of the Omicron variant and at a point when COVID-19 vaccines were readily available to adults in the United States (Centers for Disease Control and Prevention, 2021a). Though it is now known that the risk of fomite transmission is relatively low compared to other routes of transmission, such as droplet or airborne transmission (Centers for Disease Control and Prevention, 2021b), it is possible that individuals with contamination-OCD may still interpret contamination as spreading in this chain-like, looming manner, which may have influenced the results of the present study.

**Conclusion**

The purpose of this study was to test the feasibility of a freeze guided imagery intervention as a means of reducing 1) LV, including LCS and looming of contamination cognitions, and 2) contamination fear, OCD symptoms, disgust propensity and sensitivity, and chain of contagion beliefs. Those in the freeze condition—but not the other conditions—demonstrated reductions in LCS, looming of contamination cognitions, contamination fear, OCD symptoms, and overall contamination ratings in a computerized chain of contagion task. Further, changes in looming of contamination cognitions mediated the relationship between condition and contamination fear and OCD symptoms. Unexpectedly, LV did not mediate the relationship between condition and overall contamination ratings in the chain of contagion task.

Although much longer-term follow-up data is needed to determine whether this intervention leads to lasting changes in symptoms and functional impairment, this study provides meaningful information about the role of LV in contamination-OCD. Overall, results suggest that freeze imagery may modify LV, which in turn, may lead to improvements in contamination fear and OCD symptoms. Further, this research provides support for LV as an important target in the

treatment of contamination-OCD and—given that LV is implicated across anxiety disorders—in the transdiagnostic treatment of anxiety more broadly.

## References

Abramovitch, A., Abramowitz, J. S., & McKay, D. (2021). The OCI-12: A syndromally valid modification of the obsessive-compulsive inventory-revised. *Psychiatry Research, 298*, 113808. https://doi.org/10.1016/j.psychres.2021.113808

Abramowitz, J. S., Deacon, B. J., Olatunji, B. O., Wheaton, M. G., Berman, N. C., Losardo, D., Hale, L. R. (2010). Assessment of obsessive-compulsive symptom dimensions: development and evaluation of the dimensional obsessive-compulsive scale. *Psychological Assessment*, *22*(1), 180–98. https://doi.org/10.1037/a0018260

Abramowitz, J. S., Deacon, B. J., & Whiteside, S. P. (2019). *Exposure therapy for anxiety: Principles and practice* (2nd ed.). Guilford Publications.

Abramowitz, J. S., Fabricant, L. E., Taylor, S., Deacon, B. J., McKay, D., & Storch, E. A. (2014). The relevance of analogue studies for understanding obsessions and compulsions. *Clinical Psychology Review*, *34*(3), 206-217. https://doi.org/10.1016/j.cpr.2014.01.004

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the depression anxiety stress scales in clinical groups and a community sample. *Psychological Assessment*, *10*(2), 176–181. https://doi.org/10.1037//1040-3590.10.2.176

Barlow, D. H., Allen, L. B., & Choate, M. L. (2016). Toward a unified treatment for emotional disorders–republished article. *Behavior Therapy*, *47*(6), 838-853. https://doi.org/10.1016/j.beth.2016.11.005

Basanovic, J., Dean, L., Riskind, J. H., & MacLeod, C. (2017). Direction of stimulus movement alters fear-linked individual differences in attentional vigilance to spider stimuli. *Behaviour Research and Therapy, 99*, 117-123. https://doi.org/10.1016/j.brat.2017.10.004

Beck, A. T., & Clark, D. A. (1997). An information processing model of anxiety: Automatic and strategic processes. *Behaviour Research and Therapy, 35*(1), 49-58. https://doi.org/10.1016/S0005-7967(96)00069-1

Beck, A. T., Emery, G., & Greenberg, R. L. (2005). *Anxiety disorders and phobias: A cognitive perspective* ([15th anniversary ed.], rev. pbk.). Basic Books.

Beck, A. T., & Haigh, E. A. (2014). Advances in cognitive theory and therapy: The generic cognitive model. *Annual review of clinical psychology, 10*, 1-24. https://doi.org/10.1146/annurev-clinpsy-032813-153734

Black, D., Riskind, J. H., & Kleiman, E. M. (2010). Lifetime history of anxiety and mood disorders predicted by cognitive vulnerability to anxiety. *International Journal of Cognitive Therapy, 3*(3), 215–227. https://doi.org/10.1521/ijct.2010.3.3.215

Blakey, S. M., & Abramowitz, J. S. (2016). The effects of safety behaviors during exposure therapy for anxiety: Critical analysis from an inhibitory learning perspective. *Clinical Psychology Review, 49*, 1–15. https://doi.org/10.1016/j. cpr.2016.07.002

Brown, M. A., & Stopa, L. (2008). The looming maladaptive style in social anxiety. *Behavior Therapy*, *39*(1), 57–64. https://doi.org/10.1016/j.beth.2007.04.004

Burns, G. L., Keortge, S. G., Formea, G. M., & Sternberger, L. G. (1996). Revision of the Padua Inventory of obsessive compulsive disorder symptoms: Distinctions between worry,

obsessions, and compulsions. *Behaviour Research and Therapy*, *34*(2), 163-173. https://doi.org/10.1016/0005-7967(95)00035-6

Centers for Disease Control and Prevention. (2021a). *COVID-19 timeline.* https://www.cdc.gov/museum/timeline/covid19.html

Centers for Disease Control and Prevention. (2021b, April 5). *SARS-CoV-2 and surface (fomite) transmission for indoor community environments* . https://www.cdc.gov/coronavirus/2019-ncov/more/science-and-research/surface-transmission.html

Cole, S., Balcetis, E., & Dunning, D. (2013). Affective signals of threat increase perceived proximity. *Psychological Science*, *24*(1), 34-40. https://doi.org/10.1177/0956797612446953

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, *46*(1), 5–27. https://doi.org/10.1016/j.brat.2007.10.003

Curtis, V., Aunger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, *271*(suppl_4), S131-S133. https://doi.org/10.1098/rsbl.2003.0144

Curtis, V., & Biran, A. (2001). Dirt, disgust, and disease: Is hygiene in our genes?. *Perspectives in biology and medicine*, *44*(1), 17-31. https://doi.org/10.1353/pbm.2001.0001

Deacon, B., & Olatunji, B. O. (2007). Specificity of disgust sensitivity in the prediction of behavioral avoidance in contamination fear. *Behaviour research and therapy*, *45*(9), 2110-2120. https://doi.org/10.1016/j.brat.2007.03.008

Deacon, B. J., Sy, J. T., Lickel, J. J., & Nelson, E. A. (2010). Does the judicious use of safety behaviors improve the efficacy and acceptability of exposure therapy for claustrophobic fear? *Journal of Behavior Therapy and Experimental Psychiatry, 41,* 71–80. http://dx.doi.org/10.1016/j.jbtep.2009.10.004

Dorfan, N. M., & Woody, S. R. (2006). Does threatening imagery sensitize distress during contaminant exposure? *Behaviour Research and Therapy*, *44*(3), 395–413. https://doi.org/10.1016/j.brat.2005.02.006

Dorfan, N. M., & Woody, S. R. (2011). Danger appraisals as prospective predictors of disgust and avoidance of contaminants. *Journal of Social and Clinical Psychology*, *30*(2), 105-132. https://doi.org/10.1521/jscp.2011.30.2.105

Eisen, J. L., Sibrava, N. J., Boisseau, C. L., Mancebo, M. C., Stout, R. L., Pinto, A., & Rasmussen, S. A. (2013). Five-year course of obsessive-compulsive disorder: predictors of remission and relapse. *The Journal of Clinical Psychiatry*, *74*(3), 7286. https://doi.org/10.4088/JCP.12m07657

Elwood, L. S., Riskind, J. H., & Olatunji, B. O. (2011). Looming vulnerability: Incremental validity of a fearful cognitive distortion in contamination fears. *Cognitive Therapy and Research*, *35*(1), 40-47. https://doi.org/10.1007/s10608-009-9277-3

Fergus, T. A., & Valentiner, D. P. (2009). The Disgust Propensity and Sensitivity Scale–Revised: An examination of a reduced-item version. *Journal of Anxiety Disorders, 23*(5), 703-710. https://doi.org/10.1016/j.janxdis.2009.02.009

Fink, J., Pflugradt, E., Stierle, C., & Exner, C. (2018). Changing disgust through imagery rescripting and cognitive reappraisal in contamination-based obsessive-compulsive

disorder. *Journal of Anxiety Disorders*, *54*, 36–48. https://doi.org/10.1016/j.janxdis.2018.01.002

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: exposure to corrective information. *Psychological Bulletin*, *99*(1), 20–35. https://doi.org/10.1037//0033-2909.99.1.20

Foa, E. B., Liebowitz, M. R., Kozak, M. J., Davies, S., Campeas, R., Franklin, M. E., ... Tu, X. (2005). Randomized, placebo-controlled trial of exposure and ritual prevention, clomipramine, and their combination in the treatment of obsessive-compulsive disorder. *The American Journal of Psychiatry*, *162*(1), 151–161. https://doi.org/10.1176/appi.ajp.162.1.151

Foa, E. B., & McLean, C. P. (2016). The efficacy of exposure therapy for anxiety-related disorders and its underlying mechanisms: The case of OCD and PTSD. *Annual Review of Clinical Psychology*, *12*, 1-28. https://doi.org/10.1146/annurev-clinpsy-021815-093533

Green, J. S., & Teachman, B. A. (2013). Predictive validity of explicit and implicit threat overestimation in contamination fear. *Journal of Obsessive-Compulsive and Related Disorders*, *2*(1), 1–8. https://doi.org/10.1016/j.jocrd.2012.09.002

Guzick, A. G., Candelari, A., Wiese, A. D., Schneider, S. C., Goodman, W. K., & Storch, E. A. (2021). Obsessive–Compulsive Disorder During the COVID-19 Pandemic: A Systematic Review. *Current Psychiatry Reports*, *23*(11), 1-10. https://doi.org/10.1007/s11920-021-01284-2

Harvard T.H. Chan School of Public Health. (2022). *The latest on the coronavirus.* https://www.hsph.harvard.edu/news/hsph-in-the-news/the-latest-on-the-coronavirus/

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis, second edition: A regression-based approach*. Guilford Publications.

Helbig-Lang, S., & Petermann, F. (2010). Tolerate or eliminate? a systematic review on the effects of safety behavior across anxiety disorders. *Clinical Psychology: Science and Practice*, *17*(3), 218–233. https://doi.org/10.1111/j.1468-2850.2010.01213.x

Hofmann, S. G., & Hay, A. C. (2018). Rethinking avoidance: Toward a balanced approach to avoidance in treating anxiety disorders. *Journal of Anxiety Disorders*, *55*, 14-21. https://doi.org/10.1016/j.janxdis.2018.03.004

Hoppe, J. M., Holmes, E. A., & Agren, T. (2022). Imaginal extinction and the vividness of mental imagery: Exploring the reduction of fear within the mind's eye. *Behavioural Brain Research*, *418*, 113632. https://doi.org/10.1016/j.bbr.2021.113632

Jacoby, R. J., & Abramowitz, J. S. (2016). Inhibitory learning approaches to exposure therapy: A critical review and translation to obsessive-compulsive disorder. *Clinical Psychology Review*, *49*, 28-40. https://doi.org/10.1016/j.cpr.2016.07.001

Katz, D., Rector, N. A., & Riskind, J. (2017). Reduction in looming cognitive style in cognitive-behavioral therapy: Effect on post-treatment symptoms across anxiety disorders and within generalized anxiety disorder. *International Journal of Cognitive Therapy*, *10*(4), 346-358. https://doi.org/10.1521/ijct.2017.10.4.346

Katz, R., & Wykes, T. (1985). The psychological difference between temporally predictable and unpredictable stressful events: evidence for information control theories. *Journal of Personality and Social Psychology*, *48*(3), 781–790. https://doi.org/10.1037//0022-3514.48.3.781

Knowles, K. A., & Olatunji, B. O. (2021). Anxiety and safety behavior usage during the COVID-19 pandemic: The prospective role of contamination fear. *Journal of Anxiety Disorders*, *77*, 102323. https://doi.org/10.1016/j.janxdis.2020.102323

Leung, G. M., Lam, T. H., Ho, L. M., Ho, S. Y., Chan, B. H. Y., Wong, I. O. L., & Hedley, A. J. (2003). The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. *Journal of Epidemiology & Community Health*, *57*(11), 857-863. http://dx.doi.org/10.1136/jech.57.11.857

Leung, G. M., Ho, L. M., Chan, S. K., Ho, S. Y., Bacon-Shone, J., Choy, R. Y., ... & Fielding, R. (2005). Longitudinal assessment of community psychobehavioral responses during and after the 2003 outbreak of severe acute respiratory syndrome in Hong Kong. *Clinical Infectious Diseases*, *40*(12), 1713-1720. https://doi.org/10.1086/429923

Levy, H. C., Senn, J. M., & Radomsky, A. S. (2014). Further support for the acceptability-enhancing roles of safety behavior and a cognitive rationale in cognitive behavioral therapy for anxiety disorders. *Journal of Cognitive Psychotherapy*, *28*(4), 303-316. https://doi.org/10.1891/0889-8391.28.4.303

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the depression anxiety stress scales.* Sydney: Psychology Foundation.

Maloney, G., Koh, G., Roberts, S., & Pittenger, C. (2019). Imagery rescripting as an adjunct clinical intervention for obsessive compulsive disorder. *Journal of Anxiety Disorders*, *66*, 102110. https://doi.org/10.1016/j.janxdis.2019.102110

Marks, D. F. (1973). Visual imagery differences in the recall of pictures. *British Journal of Psychology*, *64*(1), 17-24. https://doi.org/10.1111/j.2044-8295.1973.tb01322.x

Mason, E. C. & Richardson, R. (2012). Treating disgust in anxiety disorders. *Clinical Psychology: Science and Practice, 19*(2), 180. https://doi.org/10.1111/j.1468-2850.2012.01282.x

Matchett, G., & Davey, G. C. (1991). A test of a disease-avoidance model of animal phobias. *Behaviour Research and Therapy, 29*(1), 91-94. https://doi.org/10.1016/S0005-7967(09)80011-9

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual. Review of Clinical Psychology., 1*, 167-195. https://doi.org/10.1146/annurev.clinpsy.1.102803.143916

McKay, D., & Tsao, S. D. (2005). A treatment most foul: Handling disgust in cognitive-behavior therapy. *Journal of Cognitive Psychotherapy, 19*(4), 355-367. https://psycnet.apa.org/doi/10.1891/jcop.2005.19.4.355

McKay, D. (2006). Treating disgust reactions in contamination-based obsessive–compulsive disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 37*(1), 53-59. https://doi.org/10.1016/j.jbtep.2005.09.005

McKelvie, S. J. (1995). The VVIQ as a psychometric test of individual differences in visual imagery vividness: A critical quantitative review and plea for direction. *Journal of Mental Imagery, 19,* 3 & 4, 1-106.

Meulders, A., van Daele, T., Volders, S., & Vlaeyen, J.W. S. (2016). The use of safety-seeking behavior in exposure-based treatments for fear and anxiety: Benefit or burden? A meta-analytic review. *Clinical Psychology Review, 45,* 144–156. https://doi.org/10.1016/j.cpr.2016.02.002

Milosevic, I., & Radomsky, A. S. (2013). Incorporating the judicious use of safety behavior into exposure-based treatments for anxiety disorders: A study of treatment acceptability. *Journal of Cognitive Psychotherapy, 27*(2), 155-174. https://doi.org/10.1891/0889-8391.27.2.155

Moretz, M. W., & McKay, D. (2008). Disgust sensitivity as a predictor of obsessive-compulsive contamination symptoms and associated cognitions. *Journal of Anxiety Disorders, 22*(4), 707–715. https://doi.org/10.1016/j.janxdis.2007.07.004

Nelis, S., Holmes, E. A., Griffith, J. W., & Raes, F. (2019). Mental imagery during daily life: Psychometric evaluation of the Spontaneous Use of Imagery Scale (SUIS). *Psychologica Belgica*, *54*(1), 19-32. https://doi.org/10.5334/pb.ag

Nemeroff, C., & Rozin, P. (1994). The contagion concept in adult thinking in the United States: Transmission of germs and of interpersonal influence. *Ethos*, *22*(2), 158-186. https://doi.org/10.1525/eth.1994.22.2.02a00020

National Collaborating Centre for Mental Health (UK. (2006). Obsessive-compulsive disorder: core interventions in the treatment of obsessive-compulsive disorder and body dysmorphic disorder. British Psychological Society.

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology, 2*(2), 175-220. https://doi.org/10.1037/1089-2680.2.2.175

Norberg, M. M., Calamari, J. E., Cohen, R. J., & Riemann, B. C. (2008). Quality of life in obsessive-compulsive disorder: an evaluation of impairment and a preliminary analysis of the ameliorating effects of treatment. *Depression and Anxiety*, *25*(3), 248-259. https://doi.org/10.1002/da.20298

NPR. (2020a, April 12). *No, you don't need to disinfect your groceries. But here's how to shop safely.* https://www.npr.org/sections/health-shots/2020/04/12/832269202/no-you-dont-need-to-disinfect-your-groceries-but-here-s-to-shop-safely

NPR. (2020b, December 28). *Still disinfecting surfaces? It might not be worth it.* https://www.npr.org/sections/health-shots/2020/12/28/948936133/still-disinfecting-surfaces-it-might-not-be-worth-it

Olatunji, B. O., Cisler, J. M., Deacon, B. J., Connolly, K., & Lohr, J. M. (2007). The Disgust Propensity and Sensitivity Scale-Revised: Psychometric properties and specificity in relation to anxiety disorder symptoms. *Journal of Anxiety Disorders*, *21*(7), 918-930. https://doi.org/10.1016/j.janxdis.2006.12.005

Olatunji, B. O., Davis, M. L., Powers, M. B., & Smits, J. A. (2013). Cognitive-behavioral therapy for obsessive-compulsive disorder: A meta-analysis of treatment outcome and moderators. *Journal of Psychiatric Research*, *47*(1), 33-41. https://doi.org/10.1016/j.jpsychires.2012.08.020

Olatunji, B. O., Etzel, E. N., Tomarken, A. J., Ciesielski, B. G., & Deacon, B. (2011). The effects of safety behaviors on health anxiety: An experimental investigation. *Behaviour Research and Therapy*, *49*(11), 719-728. https://doi.org/10.1016/j.brat.2011.07.008

Olatunji, B. O., Lohr, J. M., Sawchuk, C. N., & Tolin, D. F. (2007). Multimodal assessment of disgust in contamination-related obsessive-compulsive disorder. *Behaviour Research and Therapy*, *45*(2), 263-276. https://doi.org/10.1016/j.brat.2006.03.004

Olatunji, B. O., Moretz, M. W., Wolitzky-Taylor, K. B., McKay, D., McGrath, P. B., & Ciesielski, B. G. (2010). Disgust vulnerability and symptoms of contamination-based

OCD: Descriptive tests of incremental specificity. *Behavior Therapy*, *41*(4), 475-490. https://doi.org/10.1016/j.beth.2009.11.005

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*(1), 93-104. https://doi.org/10.1016/S0005-7967(03)00102-5

Paterson, R. J., & Neufeld, R. W. (1987). Clear danger: Situational determinants of the appraisal of threat. *Psychological Bulletin*, *101*(3), 404. https://doi.org/10.1037/0033-2909.101.3.404

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*(3), 879-891. https://doi.org/10.3758/BRM.40.3.879

Rachman, S., Radomsky, A. S., & Shafran, R. (2008). Safety behaviour: A reconsideration. *Behaviour Research and Therapy*, *46*(2), 163–173 https://doi.org/10.1016/j.brat.2007.11.008

Rachman, S., Shafran, R., Radomsky, A. S., & Zysk, E. (2011). Reducing contamination by exposure plus safety behaviour. *Journal of Behavior Therapy and Experimental Psychiatry*, *42*(3), 397-404. https://doi.org/10.1016/j.jbtep.2011.02.010

Rasmussen, S. A., & Eisen, J. L. (1992). The epidemiology and clinical features of obsessive compulsive disorder. *The Psychiatric Clinics of North America*, *15*, 743–758.

Rauch, S. A., Foa, E. B., Furr, J. M., & Filip, J. C. (2004). Imagery vividness and perceived anxious arousal in prolonged exposure treatment for PTSD. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, *17*(6), 461-465. https://doi.org/10.1007/s10960-004-5794-8

Reardon, J. M., & Williams, N. L. (2007). The specificity of cognitive vulnerabilities to emotional disorders: Anxiety sensitivity, looming vulnerability and explanatory style. *Journal of Anxiety Disorders*, *21*(5), 625-643. https://doi.org/10.1016/j.janxdis.2006.09.013

Riskind, J. H. (1997). Looming vulnerability to threat: A cognitive paradigm for anxiety. *Behaviour Research and Therapy*, *35*(8), 685-702. https://doi.org/10.1016/S0005-7967(97)00011-9

Riskind, J. H., Abreu, K., Strauss, M., & Holt, R. (1997a). Looming vulnerability to spreading contamination in subclinical OCD. *Behaviour Research and Therapy*, *35*(5), 405-414. https://doi.org/10.1016/S0005-7967(96)00113-1

Riskind, J. H., Kleiman, E. M., Seifritz, E., & Neuhoff, J. (2014). Influence of anxiety, depression and looming cognitive style on auditory looming perception. *Journal of anxiety disorders*, *28*(1), 45-50. https://doi.org/10.1016/j.janxdis.2013.11.005

Riskind, J. H., Moore, R., & Bowley, L. (1995). The looming of spiders: The fearful perceptual distortion of movement and menace. *Behaviour Research and Therapy*, *33*(2), 171-178. https://doi.org/10.1016/0005-7967(94)E0023-C

Riskind, J. H. & Rector, N. A. (2007). Beyond belief: Incremental prediction of obsessive-compulsive disorder by looming vulnerability illusions. *Journal of Cognitive Psychotherapy*, *21*(3), 243-256. https://doi.org/10.1891/088983907781494564

Riskind, J. H. & Rector, N. A. (2018). *Looming vulnerability: Theory, research, and practice in anxiety.* Springer. https://doi.org/10.1007/978-1-4939-8782-5

Riskind, J. H., Rector, N. A., & Cassin, S. E. (2011). Examination of the convergent validity of looming vulnerability in the anxiety disorders. *Journal of Anxiety Disorders*, *25*(8), 989-993. https://doi.org/10.1016/j.janxdis.2011.06.004

Riskind, J. H., Rector, N. A., & Taylor, S. (2012). Looming cognitive vulnerability to anxiety and its reduction in psychotherapy. *Journal of Psychotherapy Integration*, *22*(2), 137. https://psycnet.apa.org/doi/10.1037/a0028011

Riskind, J. H., Tzur, D., Williams, N. L., Mann, B., & Shahar, G. (2007). Short-term predictive effects of the looming cognitive style on anxiety disorder symptoms under restrictive methodological conditions. *Behaviour Research and Therapy*, *45*(8), 1765-1777. https://doi.org/10.1016/j.brat.2006.12.007

Riskind, J. H., Wheeler, D. J., & Picerno, M. R. (1997b). Using mental imagery with subclinical OCD to 'freeze' contamination in its place: Evidence for looming vulnerability theory. *Behaviour Research and Therapy*, *35*(8), 757-768. https://doi.org/10.1016/S0005-7967(97)00023-5

Riskind, J. H., & Williams, N. L. (2005). The looming cognitive style and generalized anxiety disorder: Distinctive danger schemas and cognitive phenomenology. *Cognitive Therapy and Research*, *29*(1), 7-27. https://doi.org/10.1007/s10608-005-1645-z

Riskind, J. H., & Williams, N. L. (2006). A unique vulnerability common to all anxiety disorders: The looming maladaptive style. In *Cognitive Vulnerability to Emotional Disorders* (pp. 185-216). Routledge.

Riskind, J. H., Williams, N. L., Gessner, T. L., Chrosniak, L. D., & Cortina, J. M. (2000). The looming maladaptive style: Anxiety, danger, and schematic processing. *Journal of*

*Personality and Social Psychology*, *79*(5), 837-852. https://doi.org/10.1037//0022-3514.79.5.837

Riskind, J. H., Williams, N. L., & Joiner Jr, T. E. (2006). The looming cognitive style: A cognitive vulnerability for anxiety disorders. *Journal of Social and Clinical Psychology*, *25*(7), 779-801. https://doi.org/10.1521/jscp.2006.25.7.779

Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology*, *50*(4), 703. https://doi.org/10.1037/0022-3514.50.4.703

Rozin, P., & Nemeroff, C. (1990). The laws of sympathetic magic: A psychological analysis of similarity and contagion. In J. W. Stigler, R. A. Shweder, & G. Herdt (Eds.), *Cultural psychology: Essays on comparative human development* (pp. 205–232). Cambridge University Press. https://doi.org/10.1017/CBO9781139173728.006

Salkovskis, P. M. (1991). The importance of behaviour in the maintenance of anxiety and panic: A cognitive account. *Behavioural Psychotherapy, 19*(1), 6–19. https://doi.org/10.1017/S0141347300011472

Salkovskis, P. M., Clark, D. M., Hackmann, A., Wells, A., & Gelder, M. G. (1999). An experimental investigation of the role of safety-seeking behaviours in the maintenance of panic disorder with agoraphobia. *Behaviour Research and Therapy, 37*, 559–574. http://dx.doi.org/10.1016/S0005-7967(98)00153-3.

Schneider, S. C., Weinzimmer, S., Amos Nwankwo, G. N., Cepeda, S., & Storch, E. A. (2020). *COVID-Related Thoughts and Behavioral Symptoms (COV-TaBS) Adult Self-Report.* Unpublished manuscript. Retrieved from

https://www.researchgate.net/publication/340870744_COVID-Related_Thoughts_and_Behavioral_Symptoms_COV-TaBS_Adult_Self-Report.

Sinclair, S. J., Siefert, C. J., Slavin-Mulford, J. M., Stein, M. B., Renna, M., & Blais, M. A. (2012). Psychometric evaluation and normative data for the depression, anxiety, and stress scales-21 (DASS-21) in a nonclinical sample of US adults. *Evaluation & the Health Professions*, *35*(3), 259-279. https://doi.org/10.1177%2F0163278711424282

Springer, K. S., Levy, H. C., & Tolin, D. F. (2018). Remission in CBT for adult anxiety disorders: a meta-analysis. *Clinical Psychology Review*, *61*, 1-8. https://doi.org/10.1016/j.cpr.2018.03.002

Tabachnick, B. G. & Fidell, L. S. (Eds.). (2013). *Using multivariate statistics.* Pearson.

Tallis, F. (1996). Compulsive washing in the absence of phobic and illness anxiety. *Behaviour Research and Therapy, 34,* 361–362. https://doi.org/10.1016/0005-7967(95)00079-8

Taylor, C. T., & Alden, L. E. (2011). To see ourselves as others see us: An experimental integration of the intra and interpersonal consequences of self-protection in social anxiety disorder. *Journal of Abnormal Psychology, 120*(1), 129–141. https://doi.org/10.1037/a0022127

Telch, M. J., & Lancaster, C. L. (2012). Is there room for safety behaviors in exposure therapy for anxiety disorders? In P. Neudeck, & H. U. Wittchen (Eds.). *Exposure therapy: Rethinking the model, refining the method* (pp. 313–334). New York: Springer.

Thwaites, R., & Freeston, M. H. (2005). Safety-seeking behaviours: Fact or function? How can we clinically differentiate between safety behaviours and adaptive coping strategies across anxiety disorders? *Behavioural and Cognitive Psychotherapy*, *33*(2), 177-188. https://doi.org/10.1017/S1352465804001985

Tolin, D. F., Worhunsky, P., & Maltby, N. (2004). Sympathetic magic in contamination-related OCD. *Journal of Behavior Therapy and Experimental Psychiatry*, *35*(2), 193-205. https://doi.org/10.1016/j.jbtep.2004.04.009

Veale, D., Page, N., Woodward, E., & Salkovskis, P. (2015). Imagery Rescripting for Obsessive Compulsive Disorder: A single case experimental design in 12 cases. *Journal of Behavior Therapy and Experimental Psychiatry*, *49*, 230-236. https://doi.org/10.1016/j.jbtep.2015.03.003

Ware, J., Jain, K., Burgess, I., & Davey, G. C. (1994). Disease-avoidance model: Factor analysis of common animal fears. *Behaviour Research and Therapy*, *32*(1), 57-63. https://doi.org/10.1016/0005-7967(94)90084-1

Wells, A., Clark, D. M., Salkovskis, P., Ludgate, J., Hackmann, A., & Gelder, M. (2016). Social phobia: the role of in-situation safety behaviors in maintaining anxiety and negative beliefs–Republished Article. *Behavior Therapy*, *47*(5), 669-674. https://doi.org/10.1016/j.beth.2016.08.010

Williams, N. L., Olatunji, B. O., Elwood, L. S., Connolly, K. M., & Lohr, J. M. (2006). Cognitive vulnerability to disgust: Development and validation of the Looming of Disgust Questionnaire. *Anxiety, Stress, and Coping*, *19*(4), 365-382. https://doi.org/10.1080/10615800601053910

Williams, N. L., Shahar, G., Riskind, J. H., & Joiner Jr, T. E. (2005). The looming maladaptive style predicts shared variance in anxiety disorder symptoms: Further support for a cognitive model of vulnerability to anxiety. *Journal of Anxiety Disorders*, *19*(2), 157-175. https://doi.org/10.1016/j.janxdis.2004.01.003

Wong, S. F., Hu, D. A. P., & Grisham, J. R. (2020). Manipulating visual perspective for obsessional imagery and its impact on obsessive-compulsive symptoms in an analogue sample. *Journal of Anxiety Disorders*, *72*. https://doi.org/10.1016/j.janxdis.2020.102227

Woody, S. R., & Teachman, B. A. (2000). Intersection of disgust and fear: Normative and pathological views. *Clinical Psychology: Science and Practice*, *7*(3), 291. https://psycnet.apa.org/doi/10.1093/clipsy.7.3.291

**Table 1**

*Demographic Data*

| | | Condition | | | Total | % |
|---|---|---|---|---|---|---|
| | | Control ($n$ = 45) | Freeze ($n$ = 42) | Loom ($n$ = 40) | | |
| Gender Identity | | | | | | |
| | Cisgender male | 15 | 8 | 10 | 33 | 26.0 |
| | Cisgender female | 29 | 33 | 27 | 89 | 70.1 |
| | Transgender male | 0 | 1 | 1 | 2 | 1.6 |
| | Transgender female | 1 | 0 | 0 | 1 | 0.8 |
| | Non-binary | 0 | 0 | 2 | 2 | 1.6 |
| Sexual Orientation | | | | | | |
| | Heterosexual | 36 | 37 | 33 | 106 | 83.5 |
| | Gay or lesbian | 4 | 2 | 1 | 7 | 5.5 |
| | Bisexual | 3 | 2 | 3 | 8 | 6.3 |
| | Pansexual | 0 | 1 | 1 | 2 | 1.6 |
| | Asexual | 2 | 0 | 0 | 2 | 1.6 |
| | Other | 0 | 0 | 1 | 1 | 0.8 |
| | Prefer not to say | 0 | 0 | 1 | 1 | 0.8 |
| Race/ Ethnicity | | | | | | |
| | White | 30 | 34 | 32 | 96 | 75.6 |
| | Hispanic or Latino | 2 | 1 | 1 | 4 | 3.1 |
| | Black or African American | 5 | 4 | 2 | 11 | 8.7 |
| | Native American or American Indian | 0 | 0 | 1 | 1 | 0.8 |
| | Asian or Pacific Islander | 2 | 1 | 3 | 6 | 4.7 |
| | Multiracial | 6 | 2 | 1 | 9 | 7.1 |
| Education | | | | | | |
| | High school diploma or GED | 2 | 4 | 1 | 7 | 5.5 |
| | Some college but no degree | 15 | 13 | 8 | 36 | 28.3 |
| | Associate degree (2-year) | 8 | 2 | 8 | 18 | 14.2 |
| | Bachelor’s degree (4-year) | 15 | 12 | 14 | 41 | 32.3 |
| | Master’s degree | 4 | 7 | 8 | 19 | 15.0 |
| | Doctoral degree | 1 | 3 | 0 | 4 | 3.1 |
| | Professional degree (JD, MD) | 0 | 1 | 1 | 2 | 1.6 |

**Table 2**

*Bivariate Correlations Between Baseline (Pre-Intervention) Variables*

| | Correlation Coefficients | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. DASS-21 | 1 | | | | | | | | |
| 2. COV-TaBS | .31** | 1 | | | | | | | |
| 3. VVIQ | -.09 | .16 | 1 | | | | | | |
| 4. OCI-12 | .67** | .50** | -.03 | 1 | | | | | |
| 5. LOC | .07 | .12 | .13 | .17 | 1 | | | | |
| 6. LMSQ | .25** | .11 | .14 | .20* | .44** | 1 | | | |
| 7. DPSS-R | .58** | .27** | -.05 | .64** | .27** | .33* | 1 | | |
| 8. PI-C | .31** | .42** | .14 | .56** | .49** | .27** | .43** | 1 | |
| 9. DOCS-C | .41** | .43** | .04 | .66** | .33** | .32** | .50** | .63** | 1 |

Note. ** $p < 0.01$; * $p < 0.05$. DASS-21 = Depression Anxiety Stress Scales; COV-TaBS = COVID-Related Thoughts and Behavioral Symptoms Adult Self-Report; VVIQ = Vividness of Visual Imagery Questionnaire; OCI-12 = 12-Item Obsessive Compulsive Inventory; LOC = Looming of Contamination Questionnaire; LMSQ = Looming Maladaptive Style Questionnaire; DPSS-R = Disgust Propensity and Sensitivity Scale-Revised; PI-C = Padua Inventory-Contamination Subscale; DOCS-C = Dimensional Obsessive-Compulsive Scale, Contamination Fear Subscale.

**Table 3**

*Descriptive Data on Outcome Variables*

| | | Condition | | | | | |
|---|---|---|---|---|---|---|---|
| | | Control ($n$ = 45) | | Freeze ($n$ = 42) | | Loom ($n$ = 40) | |
| Measure | Session | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| COV-TaBS | 1 | 15.47 | 9.72 | 15.33 | 9.17 | 16.54 | 9.50 |
| DASS-21 | 1 | 30.66 | 25.94 | 29.00 | 24.60 | 36.71 | 27.04 |
| OCI-12 | 1 | 15.71 | 10.45 | 15.88 | 10.14 | 17.28 | 9.77 |
| VVIQ | 1 | 3.66 | .65 | 3.60 | .66 | 3.43 | .81 |
| LOC | 1 | 3.86 | .88 | 3.79 | .94 | 3.76 | .85 |
| | 2 | 3.75 | .93 | 3.42 | 1.01 | 3.94 | .89 |
| | 3 | 3.76 | .89 | 3.09 | 1.08 | 3.86 | .99 |
| LMSQ | 1 | 3.85 | .49 | 3.86 | .60 | 3.86 | .66 |
| | 2 | 3.81 | .49 | 3.76 | .69 | 3.74 | .74 |
| | 3 | 3.86 | .57 | 3.45 | .86 | 3.77 | .80 |
| DOCS-C | 1 | 6.71 | 3.56 | 7.71 | 4.16 | 7.33 | 3.34 |
| | 2 | 6.38 | 3.71 | 6.57 | 4.07 | 7.03 | 3.53 |
| | 3 | 6.62 | 3.37 | 5.71 | 3.59 | 7.60 | 3.80 |
| PI-C | 1 | 19.46 | 7.69 | 18.69 | 9.28 | 22.58 | 9.32 |
| | 2 | 19.67 | 7.90 | 18.47 | 9.16 | 23.08 | 9.47 |
| | 3 | 19.93 | 8.35 | 16.45 | 8.84 | 23.55 | 9.33 |
| DPSS-R | 1 | 32.24 | 7.96 | 33.45 | 8.68 | 34.17 | 6.55 |
| | 2 | 31.18 | 7.46 | 32.05 | 9.10 | 33.05 | 7.30 |
| | 3 | 32.16 | 7.69 | 31.27 | 8.66 | 33.47 | 7.02 |

Note. DASS-21 = Depression Anxiety Stress Scales; COV-TaBS = COVID-Related Thoughts and Behavioral Symptoms Adult Self-Report; VVIQ = Vividness of Visual Imagery Questionnaire; OCI-12 = 12-Item Obsessive Compulsive Inventory; LOC = Looming of Contamination Questionnaire; LMSQ = Looming Maladaptive Style Questionnaire; DPSS-R = Disgust Propensity and Sensitivity Scale-Revised; PI-C = Padua Inventory-Contamination Subscale; DOCS-C = Dimensional Obsessive-Compulsive Scale, Contamination Fear Subscale.

**Table 4**

*Descriptive Data on Anxiety And Disgust During Imagery Interventions*

| | | Condition | | | |
|---|---|---|---|---|---|
| | | Freeze ($n$ = 42) | | Loom ($n$ = 40) | |
| Session | Variable | *M* | *SD* | *M* | *SD* |
| 1 | Pre-Anxiety | 37.67 | 31.10 | 38.65 | 27.78 |
| | Peak-Anxiety | 65.86 | 31.64 | 76.48 | 26.45 |
| | Post-Anxiety | 48.14 | 34.63 | 63.45 | 30.39 |
| | Pre-Disgust | 26.24 | 27.80 | 23.98 | 27.61 |
| | Peak-Disgust | 81.31 | 22.73 | 88.53 | 18.28 |
| | Post-Disgust | 54.33 | 33.92 | 67.95 | 29.02 |
| 2 | Pre-Anxiety | 30.88 | 29.67 | 39.05 | 31.07 |
| | Peak-Anxiety | 55.50 | 33.80 | 69.60 | 31.93 |
| | Post-Anxiety | 45.43 | 34.52 | 63.90 | 34.14 |
| | Pre-Disgust | 22.38 | 26.73 | 33.05 | 29.31 |
| | Peak-Disgust | 75.79 | 27.13 | 81.78 | 24.56 |
| | Post-Disgust | 51.33 | 35.79 | 68.95 | 33.73 |

**Table 5**

*Pairwise Comparisons for Looming of Contamination Cognitions: Group Differences at Each Timepoint*

| Measure | Time | Condition (A) | Condition (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| LOC | 1 | Control | Freeze | .070 | .192 | 1.00 | -.395 | .536 |
| | | | Loom | .095 | .194 | 1.00 | -.376 | .566 |
| | | Freeze | Control | -.070 | .192 | 1.00 | -.536 | .395 |
| | | | Loom | .025 | .197 | 1.00 | -.454 | .504 |
| | | Loom | Control | -.095 | .194 | 1.00 | -.566 | .376 |
| | | | Freeze | -.025 | .197 | 1.00 | -.504 | .454 |
| | 2 | Control | Freeze | .324 | .203 | .336 | -.168 | .816 |
| | | | Loom | -.188 | .205 | 1.00 | -.687 | .31 |
| | | Freeze | Control | -.324 | .203 | .336 | -.816 | .168 |
| | | | Loom | -.513 | .209 | .046 | -1.019 | -.006 |
| | | Loom | Control | .188 | .205 | 1.00 | -.31 | .687 |
| | | | Freeze | .513 | .209 | .046 | .006 | 1.019 |
| | 3 | Control | Freeze | .677 | .212 | .005 | .162 | 1.191 |
| | | | Loom | -.094 | .215 | 1.00 | -.615 | .427 |
| | | Freeze | Control | -.677 | .212 | .005 | -1.191 | -.162 |
| | | | Loom | -.771 | .218 | .002 | -1.30 | -.241 |
| | | Loom | Control | .094 | .215 | 1.00 | -.427 | .615 |
| | | | Freeze | .771 | .218 | .002 | .241 | 1.30 |

*Note.* LOC = Looming of Contamination Cognitions; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 6**

*Pairwise Comparisons for Looming of Contamination Cognitions: Assessing Changes Over Time in Each Condition*

| Measure | Condition | Time (A) | Time (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| LOC | Control | 1 | 2 | .109 | .101 | .85 | -.136 | .353 |
| | | | 3 | .093 | .125 | 1.00 | -.211 | .397 |
| | | 2 | 1 | -.109 | .101 | .85 | -.353 | .136 |
| | | | 3 | -.016 | .090 | 1.00 | -.233 | .202 |
| | | 3 | 1 | -.093 | .125 | 1.00 | -.397 | .211 |
| | | | 2 | .016 | .090 | 1.00 | -.202 | .233 |
| | Freeze | 1 | 2 | .363* | .104 | .002 | .109 | .616 |
| | | | 3 | .700* | .130 | <.001 | .385 | 1.015 |
| | | 2 | 1 | -.363* | .104 | .002 | -.616 | -.109 |
| | | | 3 | .337* | .093 | .001 | .112 | .562 |
| | | 3 | 1 | -.700* | .130 | <.001 | -1.015 | -.385 |
| | | | 2 | -.337* | .093 | .001 | -.562 | -.112 |
| | Loom | 1 | 2 | -.175 | .107 | .314 | -.434 | .085 |
| | | | 3 | -.096 | .133 | 1.00 | -.419 | .227 |
| | | 2 | 1 | .175 | .107 | .314 | -.085 | .434 |
| | | | 3 | .079 | .095 | 1.00 | -.151 | .309 |
| | | 3 | 1 | .096 | .133 | 1.00 | -.227 | .419 |
| | | | 2 | -.079 | .095 | 1.00 | -.309 | .151 |

*Note.* LOC = Looming of Contamination Cognitions; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 7**

*Pairwise Comparisons for the Looming Cognitive Style: Group Differences at Each Timepoint*

| Measure | Time | Condition (A) | Condition (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| LMSQ | 1 | Control | Freeze | -.009 | .126 | 1.00 | -.313 | .296 |
| | | | Loom | -.008 | .127 | 1.00 | -.317 | .301 |
| | | Freeze | Control | .009 | .126 | 1.00 | -.296 | .313 |
| | | | Loom | .001 | .129 | 1.00 | -.313 | .315 |
| | | Loom | Control | .008 | .127 | 1.00 | -.301 | .317 |
| | | | Freeze | -.001 | .129 | 1.00 | -.315 | .313 |
| | 2 | Control | Freeze | .058 | .138 | 1.00 | -.277 | .394 |
| | | | Loom | .075 | .140 | 1.00 | -.265 | .415 |
| | | Freeze | Control | -.058 | .138 | 1.00 | -.394 | .277 |
| | | | Loom | .017 | .142 | 1.00 | -.328 | .362 |
| | | Loom | Control | -.075 | .140 | 1.00 | -.415 | .265 |
| | | | Freeze | -.017 | .142 | 1.00 | -.362 | .328 |
| | 3 | Control | Freeze | .409 | .161 | .037 | .018 | .80 |
| | | | Loom | .097 | .163 | 1.00 | -.299 | .493 |
| | | Freeze | Control | -.409 | .161 | .037 | -.80 | -.018 |
| | | | Loom | -.311 | .166 | .189 | -.714 | .091 |
| | | Loom | Control | -.097 | .163 | 1.00 | -.493 | .299 |
| | | | Freeze | .311 | .166 | .189 | -.091 | .714 |

*Note.* LMSQ = Looming Maladaptive Style Questionnaire; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 8**

*Pairwise Comparisons for the Looming Cognitive Style: Assessing Changes Over Time in Each Condition*

| Measure | Condition | Time (A) | Time (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| LMSQ | Control | 1 | 2 | .038 | .053 | 1.00 | -.091 | .167 |
| | | | 3 | -.010 | .087 | 1.00 | -.221 | .20 |
| | | 2 | 1 | -.038 | .053 | 1.00 | -.167 | .091 |
| | | | 3 | -.049 | .078 | 1.00 | -.237 | .14 |
| | | 3 | 1 | .010 | .087 | 1.00 | -.20 | .221 |
| | | | 2 | .049 | .078 | 1.00 | -.14 | .237 |
| | Freeze | 1 | 2 | .105 | .055 | .176 | -.029 | .239 |
| | | | 3 | .407* | .090 | <.001 | .189 | .624 |
| | | 2 | 1 | -.105 | .055 | .176 | -.239 | .029 |
| | | | 3 | .302* | .080 | <.001 | .107 | .497 |
| | | 3 | 1 | -.407* | .090 | <.001 | -.624 | -.189 |
| | | | 2 | -.302* | .080 | <.001 | -.497 | -.107 |
| | Loom | 1 | 2 | .121 | .056 | .101 | -.016 | .258 |
| | | | 3 | .095 | .092 | .916 | -.128 | .318 |
| | | 2 | 1 | -.121 | .056 | .101 | -.258 | .016 |
| | | | 3 | -.027 | .082 | 1.00 | -.227 | .173 |
| | | 3 | 1 | -.095 | .092 | .916 | -.318 | .128 |
| | | | 2 | .027 | .082 | 1.00 | -.173 | .227 |

*Note.* LMSQ = Looming Maladaptive Style Questionnaire; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 9**

*Pairwise Comparisons for Disgust Sensitivity and Propensity: Group Differences at Each Timepoint*

| Measure | Time | Condition (A) | Condition (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| DPSS-R | 1 | Control | Freeze | -1.208 | 1.674 | 1.00 | -5.27 | 2.855 |
| | | | Loom | -1.921 | 1.695 | .778 | -6.036 | 2.193 |
| | | Freeze | Control | 1.208 | 1.674 | 1.00 | -2.855 | 5.27 |
| | | | Loom | -.714 | 1.724 | 1.000 | -4.897 | 3.47 |
| | | Loom | Control | 1.921 | 1.695 | .778 | -2.193 | 6.036 |
| | | | Freeze | .714 | 1.724 | 1.00 | -3.47 | 4.897 |
| | 2 | Control | Freeze | -.870 | 1.715 | 1.00 | -5.032 | 3.292 |
| | | | Loom | -1.872 | 1.737 | .850 | -6.088 | 2.343 |
| | | Freeze | Control | .870 | 1.715 | 1.00 | -3.292 | 5.032 |
| | | | Loom | -1.002 | 1.766 | 1.00 | -5.288 | 3.283 |
| | | Loom | Control | 1.872 | 1.737 | .850 | -2.343 | 6.088 |
| | | | Freeze | 1.002 | 1.766 | 1.00 | -3.283 | 5.288 |
| | 3 | Control | Freeze | .889 | 1.680 | 1.00 | -3.188 | 4.966 |
| | | | Loom | -1.308 | 1.701 | 1.00 | -5.438 | 2.821 |
| | | Freeze | Control | -.889 | 1.680 | 1.00 | -4.966 | 3.188 |
| | | | Loom | -2.198 | 1.730 | .619 | -6.396 | 2.001 |
| | | Loom | Control | 1.308 | 1.701 | 1.00 | -2.821 | 5.438 |
| | | | Freeze | 2.198 | 1.730 | .619 | -2.001 | 6.396 |

*Note.* DPSS-R = Disgust Propensity and Sensitivity Scale-Revised; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 10**

*Pairwise Comparisons for Disgust Sensitivity and Propensity: Assessing Changes Over Time in Each Condition*

| Measure | Condition | Time (A) | Time (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| DPSS-R | Control | 1 | 2 | 1.067 | .738 | .453 | -.725 | 2.858 |
| | | | 3 | .087 | .753 | 1.00 | -1.742 | 1.915 |
| | | 2 | 1 | -1.067 | .738 | .453 | -2.858 | .725 |
| | | | 3 | -.980 | .600 | .315 | -2.436 | .477 |
| | | 3 | 1 | -.087 | .753 | 1.00 | -1.915 | 1.742 |
| | | | 2 | .980 | .600 | .315 | -.477 | 2.436 |
| | Freeze | 1 | 2 | 1.405 | .764 | .205 | -.45 | 3.259 |
| | | | 3 | 2.184 | .780 | .018 | .291 | 4.077 |
| | | 2 | 1 | -1.405 | .764 | .205 | -3.259 | .45 |
| | | | 3 | .779 | .621 | .636 | -.728 | 2.287 |
| | | 3 | 1 | -2.184 | .780 | .018 | -4.077 | -.291 |
| | | | 2 | -.779 | .621 | .636 | -2.287 | .728 |
| | Loom | 1 | 2 | 1.116 | .783 | .470 | -.784 | 3.016 |
| | | | 3 | .700 | .799 | 1.00 | -1.239 | 2.639 |
| | | 2 | 1 | -1.116 | .783 | .470 | -3.016 | .784 |
| | | | 3 | -.416 | .637 | 1.00 | -1.961 | 1.129 |
| | | 3 | 1 | -.700 | .799 | 1.00 | -2.639 | 1.239 |
| | | | 2 | .416 | .637 | 1.00 | -1.129 | 1.961 |

*Note.* DPSS-R = Disgust Propensity and Sensitivity Scale-Revised; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 11**

*Pairwise Comparisons for Contamination Fear: Group Differences at Each Timepoint*

| Measure | Time | Condition (A) | Condition (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| PI-C | 1 | Control | Freeze | .769 | 1.880 | 1.00 | -3.793 | 5.331 |
| | | | Loom | -3.116 | 1.904 | .313 | -7.737 | 1.505 |
| | | Freeze | Control | -.769 | 1.880 | 1.00 | -5.331 | 3.793 |
| | | | Loom | -3.885 | 1.936 | .141 | -8.582 | .813 |
| | | Loom | Control | 3.116 | 1.904 | .313 | -1.505 | 7.737 |
| | | | Freeze | 3.885 | 1.936 | .141 | -.813 | 8.582 |
| | 2 | Control | Freeze | 1.193 | 1.896 | 1.00 | -3.408 | 5.794 |
| | | | Loom | -3.408 | 1.920 | .235 | -8.068 | 1.252 |
| | | Freeze | Control | -1.193 | 1.896 | 1.00 | -5.794 | 3.408 |
| | | | Loom | -4.601 | 1.952 | .060 | -9.339 | .136 |
| | | Loom | Control | 3.408 | 1.920 | .235 | -1.252 | 8.068 |
| | | | Freeze | 4.601 | 1.952 | .060 | -.136 | 9.339 |
| | 3 | Control | Freeze | 3.481 | 1.895 | .206 | -1.118 | 8.08 |
| | | | Loom | -3.617 | 1.919 | .186 | -8.275 | 1.041 |
| | | Freeze | Control | -3.481 | 1.895 | .206 | -8.08 | 1.118 |
| | | | Loom | -7.098 | 1.951 | .001 | -11.833 | -2.362 |
| | | Loom | Control | 3.617 | 1.919 | .186 | -1.041 | 8.275 |
| | | | Freeze | 7.098 | 1.951 | .001 | 2.362 | 11.833 |

*Note.* PI-C = Padua Inventory-Contamination Subscale; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 12**

*Pairwise Comparisons for Contamination Fear: Assessing Changes Over Time in Each Condition*

| Measure | Condition | Time (A) | Time (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| PI-C | Control | 1 | 2 | -.207 | .645 | 1.00 | -1.773 | 1.358 |
| | | | 3 | -.474 | .815 | 1.00 | -2.452 | 1.504 |
| | | 2 | 1 | .207 | .645 | 1.00 | -1.358 | 1.773 |
| | | | 3 | -.267 | .634 | 1.00 | -1.805 | 1.272 |
| | | 3 | 1 | .474 | .815 | 1.00 | -1.504 | 2.452 |
| | | | 2 | .267 | .634 | 1.00 | -1.272 | 1.805 |
| | Freeze | 1 | 2 | .217 | .668 | 1.00 | -1.403 | 1.837 |
| | | | 3 | 2.238 | .844 | .027 | .191 | 4.286 |
| | | 2 | 1 | -.217 | .668 | 1.00 | -1.837 | 1.403 |
| | | | 3 | 2.021 | .656 | .008 | .429 | 3.614 |
| | | 3 | 1 | -2.238 | .844 | .027 | -4.286 | -.191 |
| | | | 2 | -2.021 | .656 | .008 | -3.614 | -.429 |
| | Loom | 1 | 2 | -.500 | .684 | 1.00 | -2.16 | 1.16 |
| | | | 3 | -.975 | .864 | .785 | -3.073 | 1.123 |
| | | 2 | 1 | .500 | .684 | 1.00 | -1.16 | 2.16 |
| | | | 3 | -.475 | .672 | 1.00 | -2.107 | 1.157 |
| | | 3 | 1 | .975 | .864 | .785 | -1.123 | 3.073 |
| | | | 2 | .475 | .672 | 1.00 | -1.157 | 2.107 |

*Note.* PI-C = Padua Inventory-Contamination Subscale; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 13**

*Pairwise Comparisons for OCD Symptoms: Group Differences at Each Timepoint*

| Measure | Time | Condition (A) | Condition (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| DOCS-C | 1 | Control | Freeze | -1.003 | .795 | .628 | -2.933 | .926 |
| | | | Loom | -.614 | .805 | 1.00 | -2.568 | 1.34 |
| | | Freeze | Control | 1.003 | .795 | .628 | -.926 | 2.933 |
| | | | Loom | .389 | .819 | 1.00 | -1.597 | 2.376 |
| | | Loom | Control | .614 | .805 | 1.00 | -1.34 | 2.568 |
| | | | Freeze | -.389 | .819 | 1.00 | -2.376 | 1.597 |
| | 2 | Control | Freeze | -.194 | .810 | 1.00 | -2.16 | 1.772 |
| | | | Loom | -.647 | .821 | 1.00 | -2.639 | 1.344 |
| | | Freeze | Control | .194 | .810 | 1.00 | -1.772 | 2.16 |
| | | | Loom | -.454 | .834 | 1.00 | -2.478 | 1.571 |
| | | Loom | Control | .647 | .821 | 1.00 | -1.344 | 2.639 |
| | | | Freeze | .454 | .834 | 1.00 | -1.571 | 2.478 |
| | 3 | Control | Freeze | .908 | .769 | .720 | -.958 | 2.774 |
| | | | Loom | -.978 | .779 | .635 | -2.868 | .912 |
| | | Freeze | Control | -.908 | .769 | .720 | -2.774 | .958 |
| | | | Loom | -1.886 | .792 | .056 | -3.807 | .036 |
| | | Loom | Control | .978 | .779 | .635 | -.912 | 2.868 |
| | | | Freeze | 1.886 | .792 | .056 | -.036 | 3.807 |

*Note.* DOCS-C = Dimensional Obsessive-Compulsive Scale-Contamination Subscale; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 14**

*Pairwise Comparisons for OCD Symptoms: Assessing Changes Over Time in Each Condition*

| Measure | Condition | Time (A) | Time (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| DOCS-C | Control | 1 | 2 | .333 | .393 | 1.00 | -.621 | 1.288 |
| | | | 3 | .089 | .428 | 1.00 | -.951 | 1.128 |
| | | 2 | 1 | -.333 | .393 | 1.00 | -1.288 | .621 |
| | | | 3 | -.244 | .338 | 1.00 | -1.066 | .577 |
| | | 3 | 1 | -.089 | .428 | 1.00 | -1.128 | .951 |
| | | | 2 | .244 | .338 | 1.00 | -.577 | 1.066 |
| | Freeze | 1 | 2 | 1.143 | .407 | .017 | .155 | 2.131 |
| | | | 3 | 2.000 | .443 | <.001 | .924 | 3.076 |
| | | 2 | 1 | -1.143 | .407 | .017 | -2.131 | -.155 |
| | | | 3 | .857 | .350 | .047 | .007 | 1.707 |
| | | 3 | 1 | -2.000 | .443 | <.001 | -3.076 | -.924 |
| | | | 2 | -.857 | .350 | .047 | -1.707 | -.007 |
| | Loom | 1 | 2 | .300 | .417 | 1.00 | -.713 | 1.313 |
| | | | 3 | -.275 | .454 | 1.00 | -1.378 | .828 |
| | | 2 | 1 | -.300 | .417 | 1.00 | -1.313 | .713 |
| | | | 3 | -.575 | .359 | .335 | -1.446 | .296 |
| | | 3 | 1 | .275 | .454 | 1.00 | -.828 | 1.378 |
| | | | 2 | .575 | .359 | .335 | -.296 | 1.446 |

*Note.* DOCS-C = Dimensional Obsessive-Compulsive Scale-Contamination Subscale; *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 15**

*Pairwise Comparisons for Chain of Contagion Task: Group Differences at Each Timepoint*

| Measure | Time | Condition (A) | Condition (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| Mean Contamination Ratings | 1 | Control | Freeze | -2.053 | 7.009 | 1.00 | -19.063 | 14.956 |
| | | | Loom | 5.523 | 7.099 | 1.00 | -11.705 | 22.751 |
| | | Freeze | Control | 2.053 | 7.009 | 1.00 | -14.956 | 19.063 |
| | | | Loom | 7.576 | 7.217 | .888 | -9.939 | 25.091 |
| | | Loom | Control | -5.523 | 7.099 | 1.00 | -22.751 | 11.705 |
| | | | Freeze | -7.576 | 7.217 | .888 | -25.091 | 9.939 |
| | 2 | Control | Freeze | 1.534 | 6.440 | 1.00 | -14.096 | 17.164 |
| | | | Loom | 1.026 | 6.523 | 1.00 | -14.805 | 16.857 |
| | | Freeze | Control | -1.534 | 6.440 | 1.00 | -17.164 | 14.096 |
| | | | Loom | -.508 | 6.632 | 1.00 | -16.603 | 15.587 |
| | | Loom | Control | -1.026 | 6.523 | 1.00 | -16.857 | 14.805 |
| | | | Freeze | .508 | 6.632 | 1.00 | -15.587 | 16.603 |
| | 3 | Control | Freeze | 7.904 | 6.532 | .686 | -7.95 | 23.757 |
| | | | Loom | .417 | 6.616 | 1.00 | -15.641 | 16.474 |
| | | Freeze | Control | -7.904 | 6.532 | .686 | -23.757 | 7.95 |
| | | | Loom | -7.487 | 6.727 | .804 | -23.812 | 8.838 |
| | | Loom | Control | -.417 | 6.616 | 1.00 | -16.474 | 15.641 |
| | | | Freeze | 7.487 | 6.727 | .804 | -8.838 | 23.812 |

*Note. SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Table 16**

*Pairwise Comparisons for Chain of Contagion Task: Assessing Changes Over Time in Each Condition*

| Measure | Condition | Time (A) | Time (B) | Mean Difference (A-B) | *SE* | *p* | 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *LL* | *UL* |
| Mean Contamination Ratings | Control | 1 | 2 | -6.809 | 2.217 | .008 | -12.191 | -1.428 |
| | | | 3 | -8.133 | 2.980 | .022 | -15.366 | -.901 |
| | | 2 | 1 | 6.809 | 2.217 | .008 | 1.428 | 12.191 |
| | | | 3 | -1.324 | 1.685 | 1.00 | -5.414 | 2.765 |
| | | 3 | 1 | 8.133 | 2.980 | .022 | .901 | 15.366 |
| | | | 2 | 1.324 | 1.685 | 1.00 | -2.765 | 5.414 |
| | Freeze | 1 | 2 | -3.222 | 2.295 | .489 | -8.792 | 2.348 |
| | | | 3 | 1.823 | 3.085 | 1.00 | -5.663 | 9.31 |
| | | 2 | 1 | 3.222 | 2.295 | .489 | -2.348 | 8.792 |
| | | | 3 | 5.046 | 1.744 | .014 | .813 | 9.279 |
| | | 3 | 1 | -1.823 | 3.085 | 1.00 | -9.31 | 5.663 |
| | | | 2 | -5.046 | 1.744 | .014 | -9.279 | -.813 |
| | Loom | 1 | 2 | -11.306 | 2.352 | <.001 | -17.014 | -5.598 |
| | | | 3 | -13.240 | 3.161 | <.001 | -20.911 | -5.569 |
| | | 2 | 1 | 11.306 | 2.352 | <.001 | 5.598 | 17.014 |
| | | | 3 | -1.933 | 1.787 | .844 | -6.271 | 2.404 |
| | | 3 | 1 | 13.240 | 3.161 | <.001 | 5.569 | 20.911 |
| | | | 2 | 1.933 | 1.787 | .844 | -2.404 | 6.271 |

*Note*. *SE* = standard error; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

**Figure 1**

*Participant Flow-Chart From Pre-Screening to Study Completion*

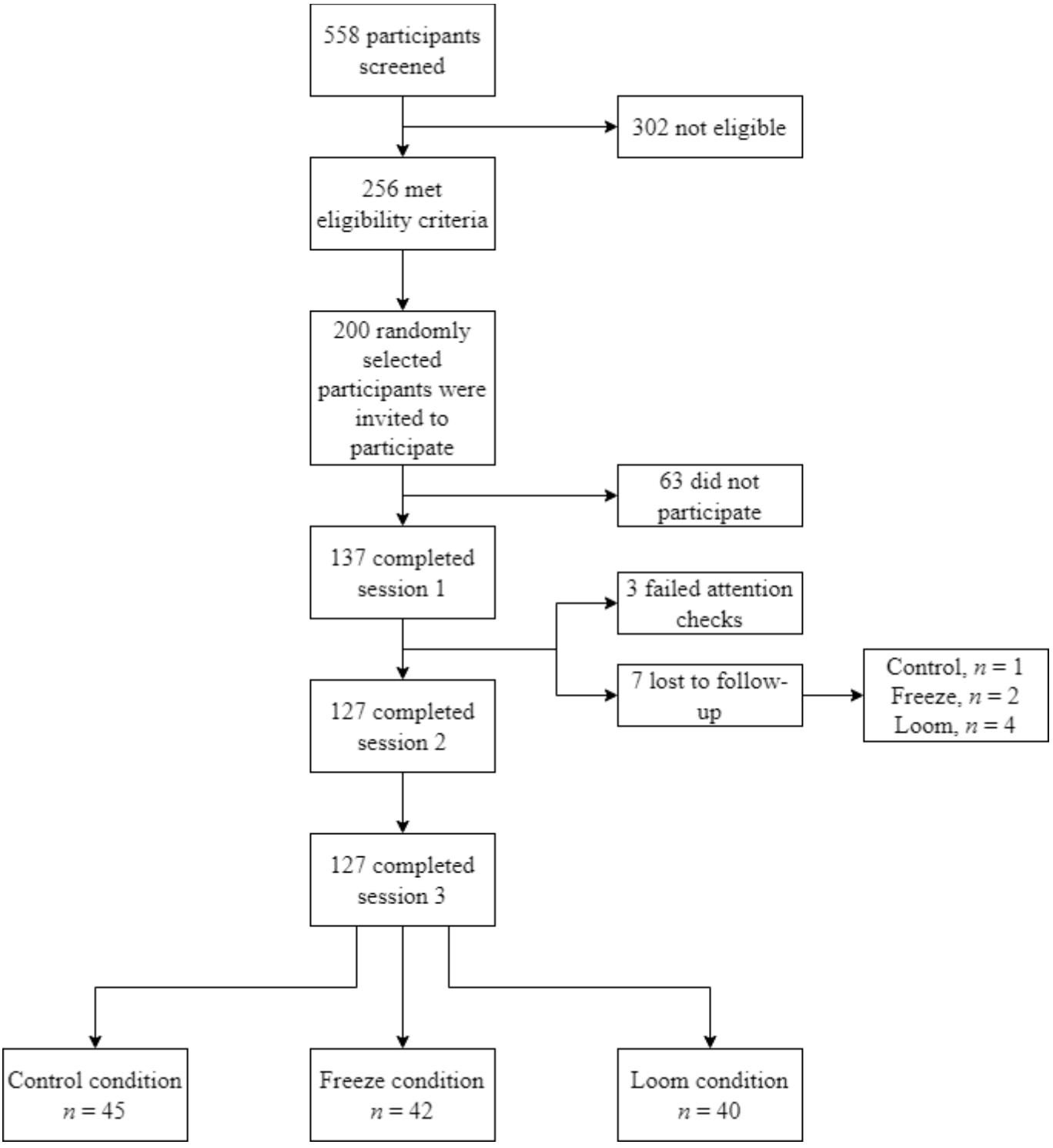
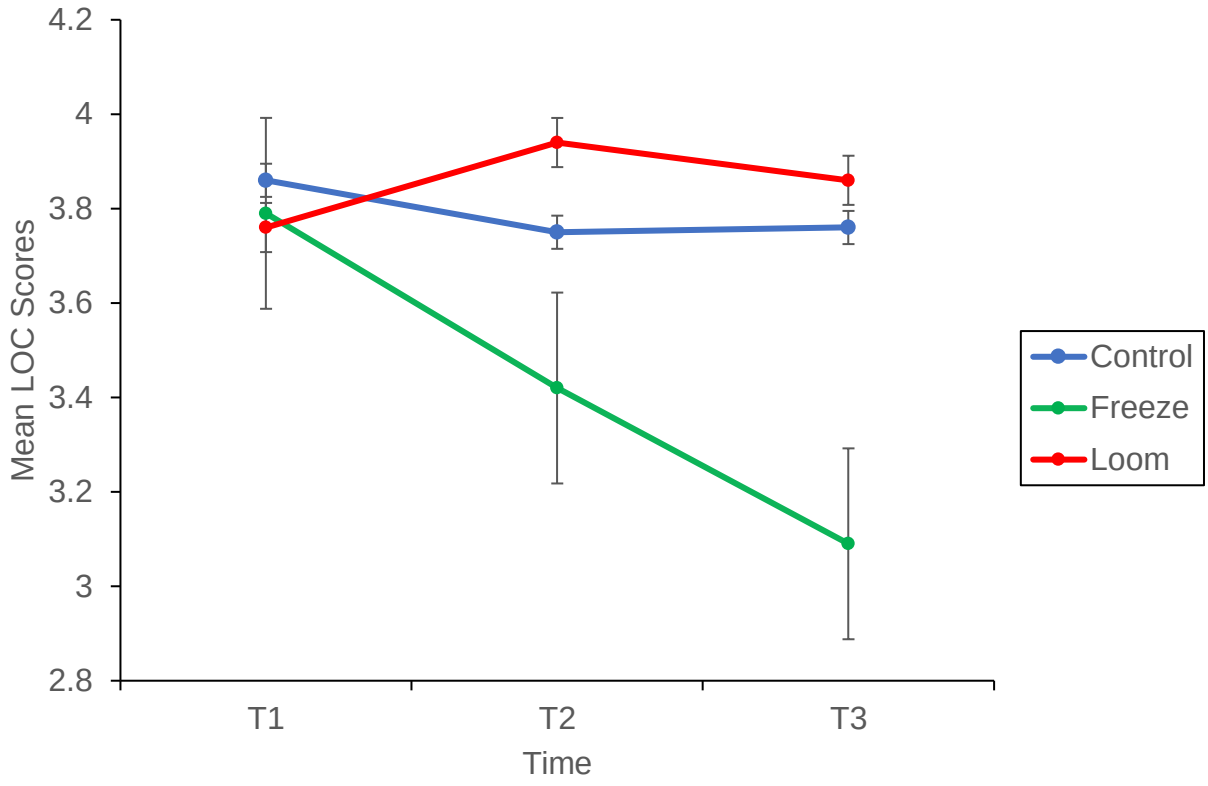


**Figure 2**

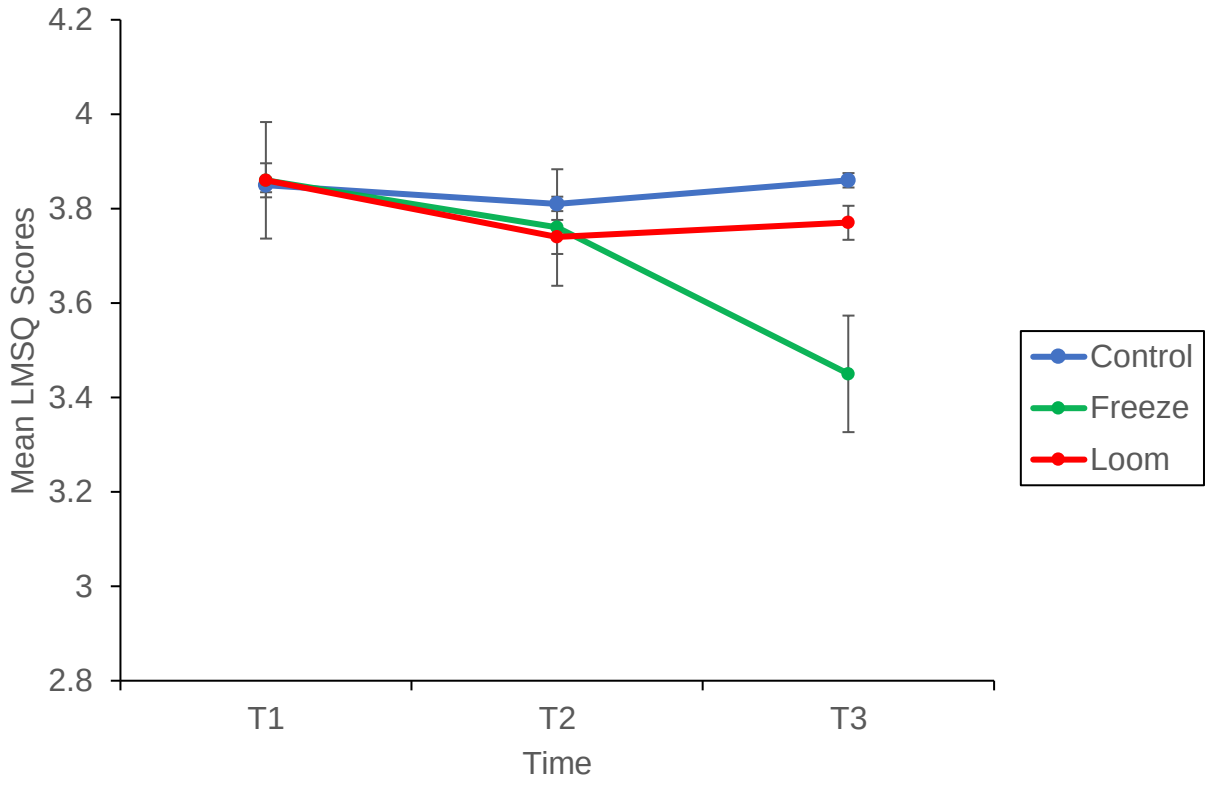
*Change in Looming of Contamination Cognitions by Condition Across Sessions*




*Note.* LOC = Looming of Contamination Cognitions; T1 = session one; T2 = session two; T3 = session three. Interpretation: The freeze condition decreased from T1 to T2, $p = .002$; T2 to T3, $p = .001$; and T1 to T3, $p < .001$. The control and loom conditions did not change over time ($p$'s $\geq .31$). There were no differences between any groups at T1 ($p$'s = 1.00). At T2, the freeze condition was lower than the loom condition (p = .046). At T3, the freeze condition was lower than both the loom ($p = .002$) and the control conditions ($p = .005$). There were no differences between the control and freeze or control and loom groups at T2 ($p$'s $\geq .34$) and no differences between the control and loom groups at T3 ($p = 1.00$).

**Figure 3**

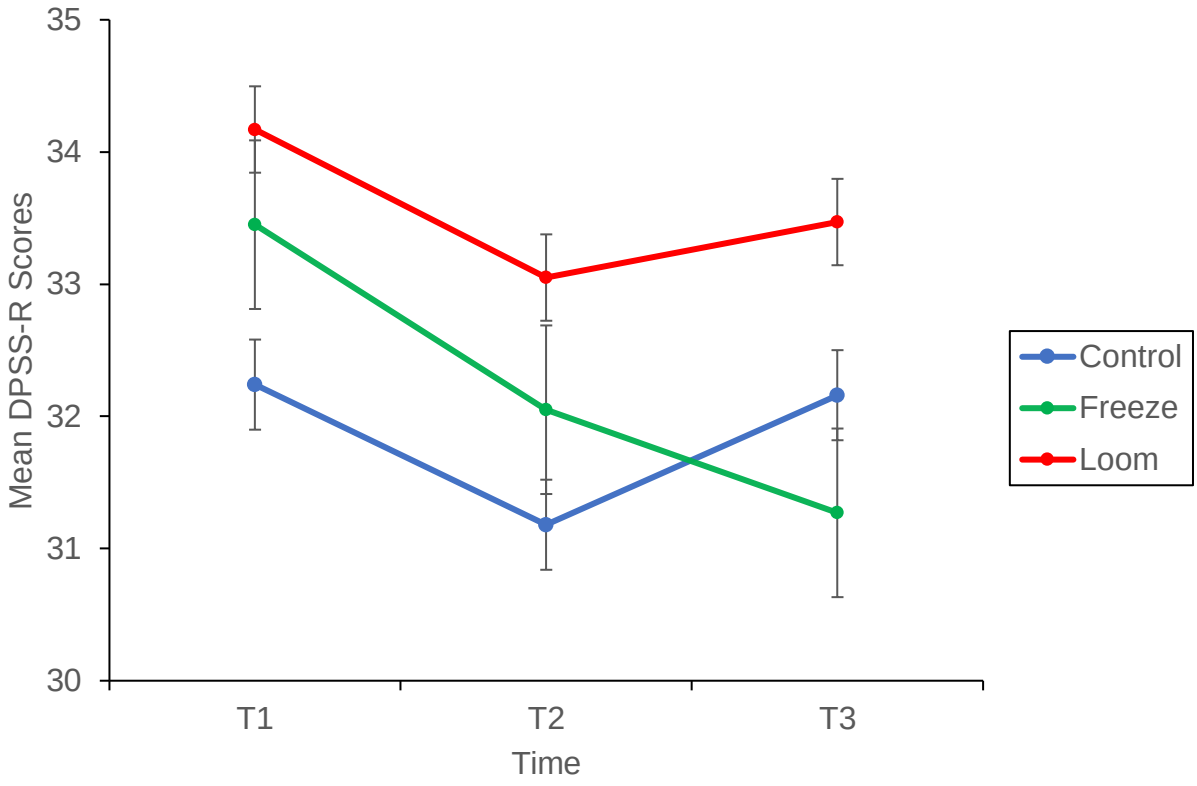
*Change in the Looming Cognitive Style by Condition Across Sessions*




*Note.* LMSQ = Looming Maladaptive Style Questionnaire; T1 = session one; T2 = session two; T3 = session three. Interpretation: The freeze condition decreased from T2 to T3 ($p < .001$) and from T1 to T3 ($p < .001$); there was no change from T1 to T2 ($p = .18$). The control and loom conditions did not change over time ($p$'s $\geq .10$). There were no differences between any groups at T1 or T2 ($p$'s = 1.00). At T3, the freeze condition was lower than the control condition ($p = .04$). There were no differences between the control and loom or freeze and loom groups at T3 ($p$'s $\geq .19$).

**Figure 4**

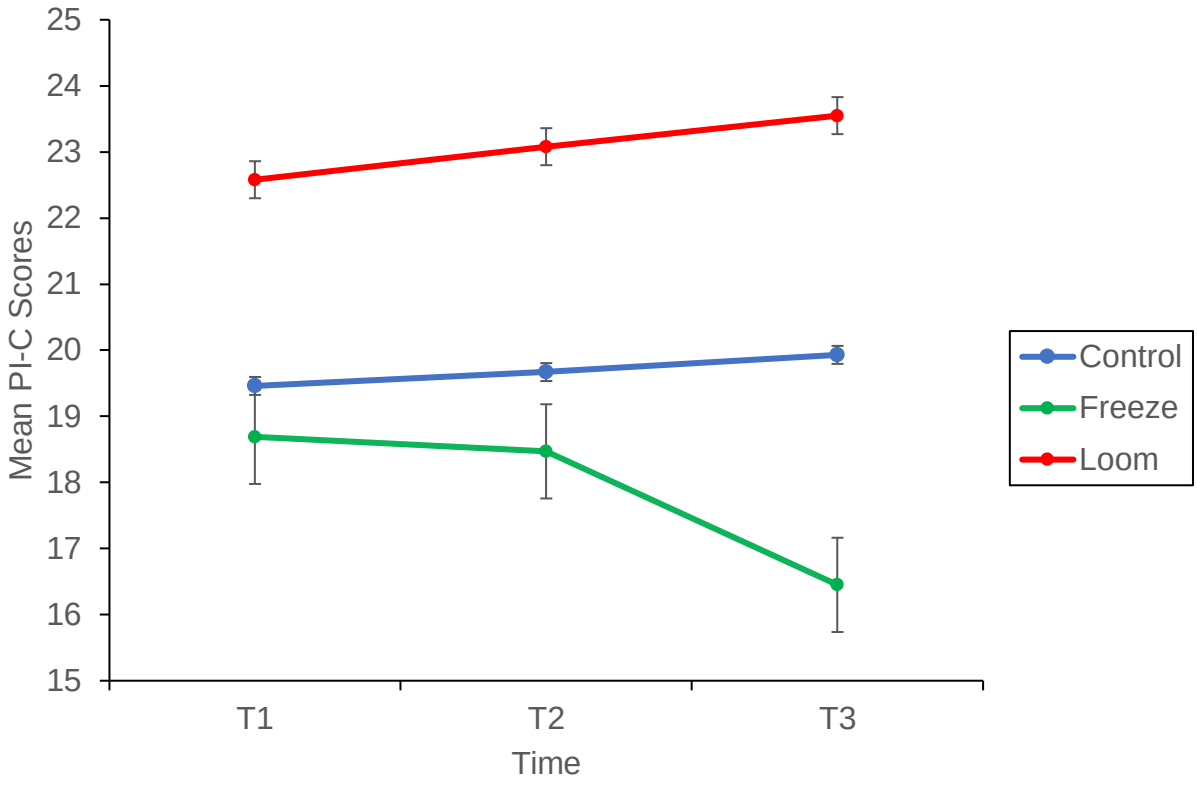
*Change in Disgust Propensity and Sensitivity by Condition Across Sessions*




*Note.* DPSS-R = Disgust Propensity and Sensitivity Scale-Revised; T1 = session one; T2 = session two; T3 = session three. Interpretation: There were no significant differences within or between groups.

**Figure 5**

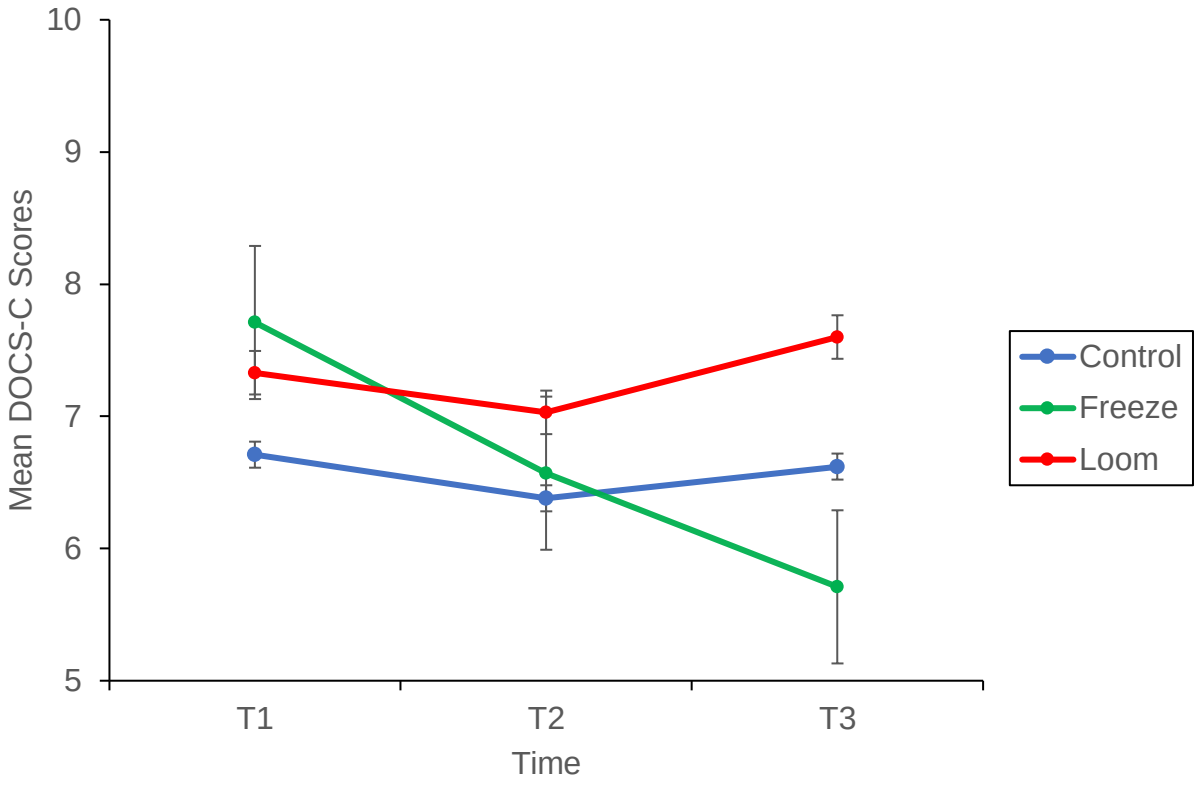
*Change in Contamination Fear by Condition Across Sessions*




*Note.* PI-C = Padua Inventory-Contamination Subscale; T1 = session one; T2 = session two; T3 = session three. Interpretation: The freeze condition decreased from T2 to T3 ($p$ = .008) and T1 to T3 ($p$ = .03); there was no change from T1 to T2 ($p$ = 1.00). The control and loom conditions did not change over time ($p$'s ≥ .79). There were no differences between any groups at T1 or T2 ($p$'s ≥ .06). At T3, the freeze condition was lower than the loom condition ($p$ = .001). There were no differences between the control and freeze or control and loom conditions at T3 ($p$'s ≥ .19).

**Figure 6**

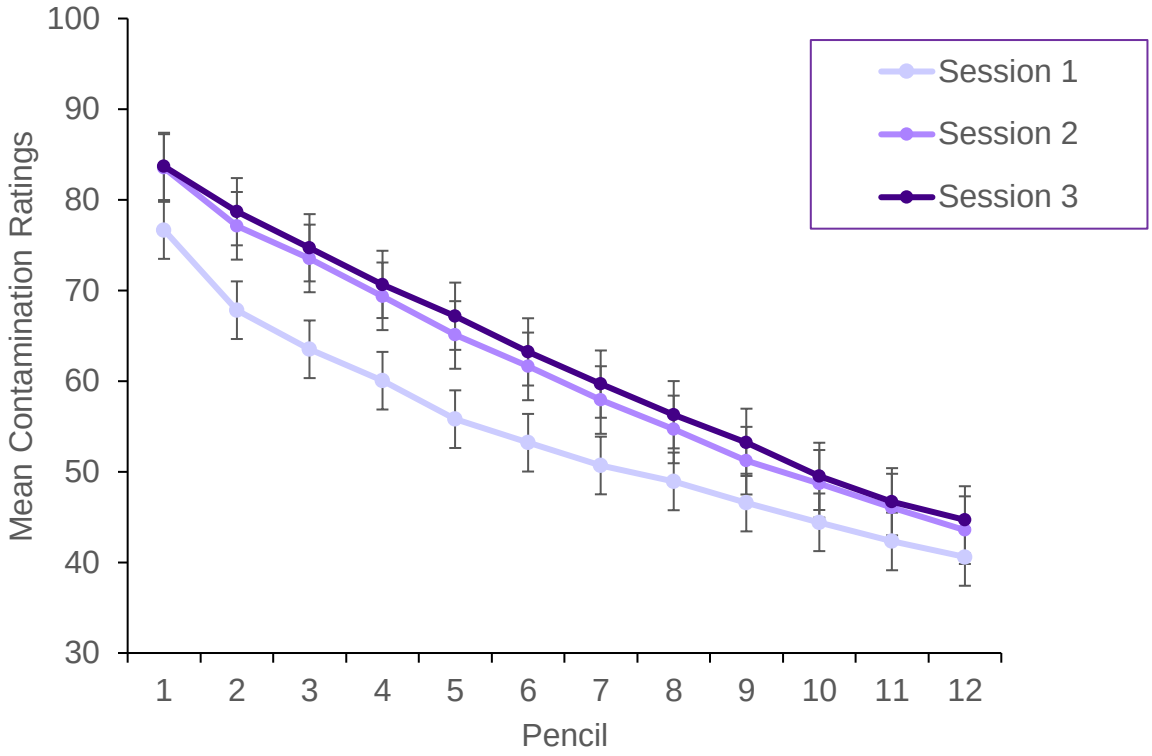
*Change in OCD Symptoms by Condition Across Sessions*




*Note.* DOCS-C = Dimensional Obsessive-Compulsive Scale-Contamination Subscale; T1 = session one; T2 = session two; T3 = session three. Interpretation: The freeze condition decreased from T1 to T2, $p = .02$; T2 to T3, $p = .047$; and T1 to T3, $p < .001$. The control and loom conditions did not change over time ($p$'s $\geq .34$). There were no differences between any groups at T1, T2, or T3 ($p$'s $\geq .056$).

**Figure 7**

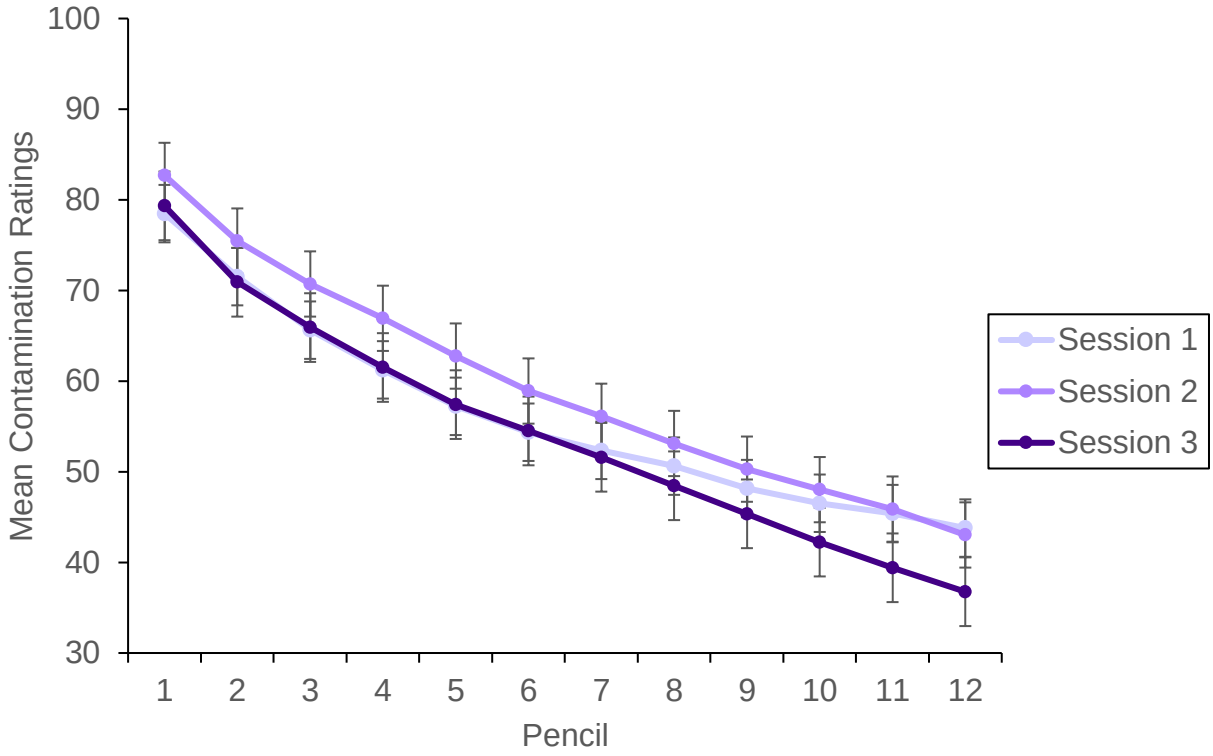
*Change in Pencil Contamination Ratings for Control Condition*




*Note.* This graph shows the contamination ratings per pencil for each session of the Control condition. Interpretation: The control condition increased from session 1 to session 2 ($p$ = .008) and session 1 to session 3 ($p$ = .02); there was no change from session 2 to session 3 ($p$ = 1.00).

**Figure 8**

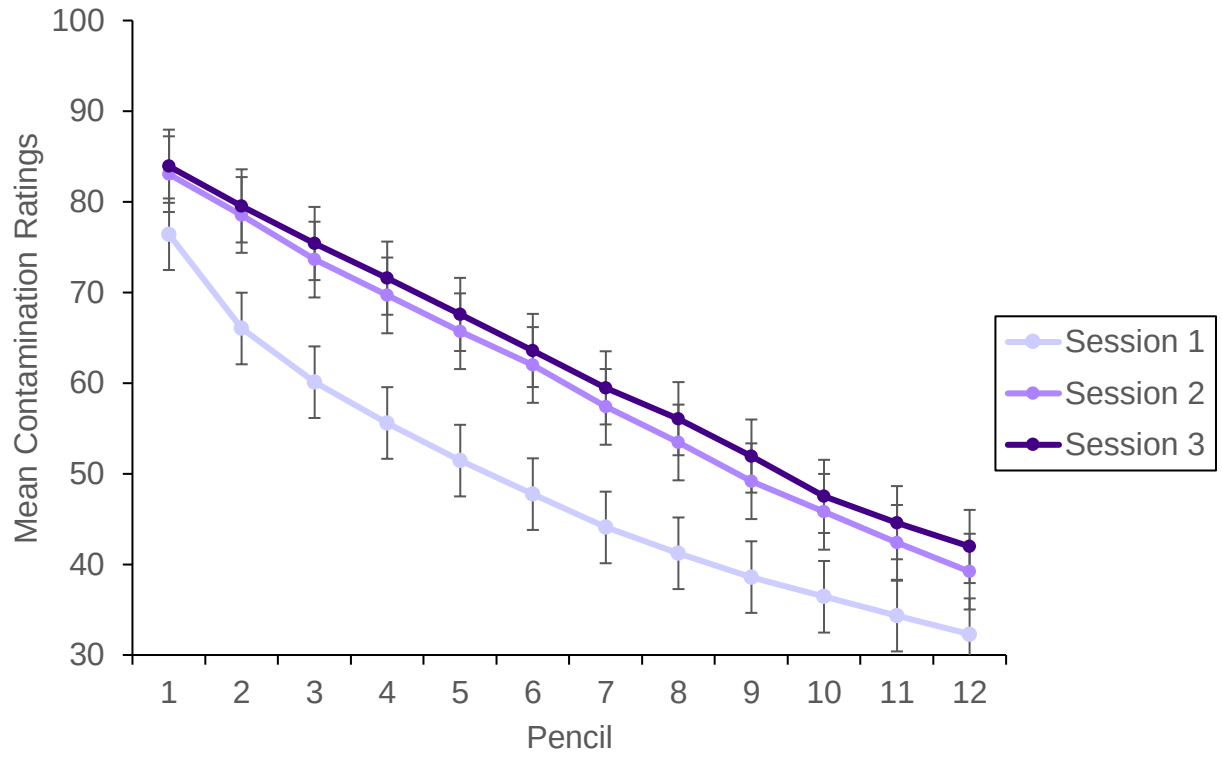
*Change in Pencil Contamination Ratings for Freeze Condition*




*Note.* This graph shows the contamination ratings per pencil for each session of the Freeze condition. Interpretation: The freeze condition decreased from session 2 to session 3 ($p$ = .01); there was no change from session 1 to session 2 ($p$ = .49) or session 1 to session 3 ($p$ = 1.00).

**Figure 9**

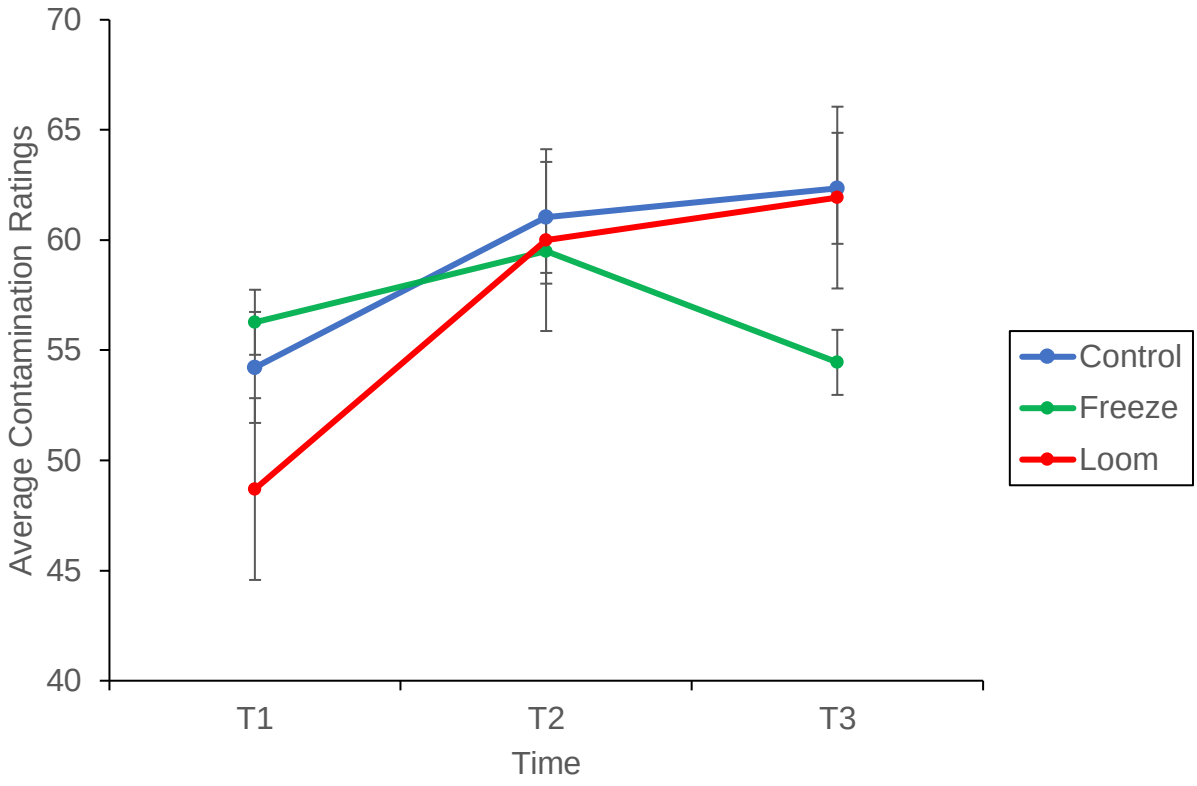
*Change in Pencil Contamination Ratings for Loom Condition*




*Note.* This graph shows the mean contamination ratings per pencil for each session of the Loom condition. Interpretation: The loom condition increased from session 1 to session 2 ($p < .001$) and session 1 to session 3 ($p < .001$); there was no change from session 2 to session 3 ($p = .84$).

**Figure 10**

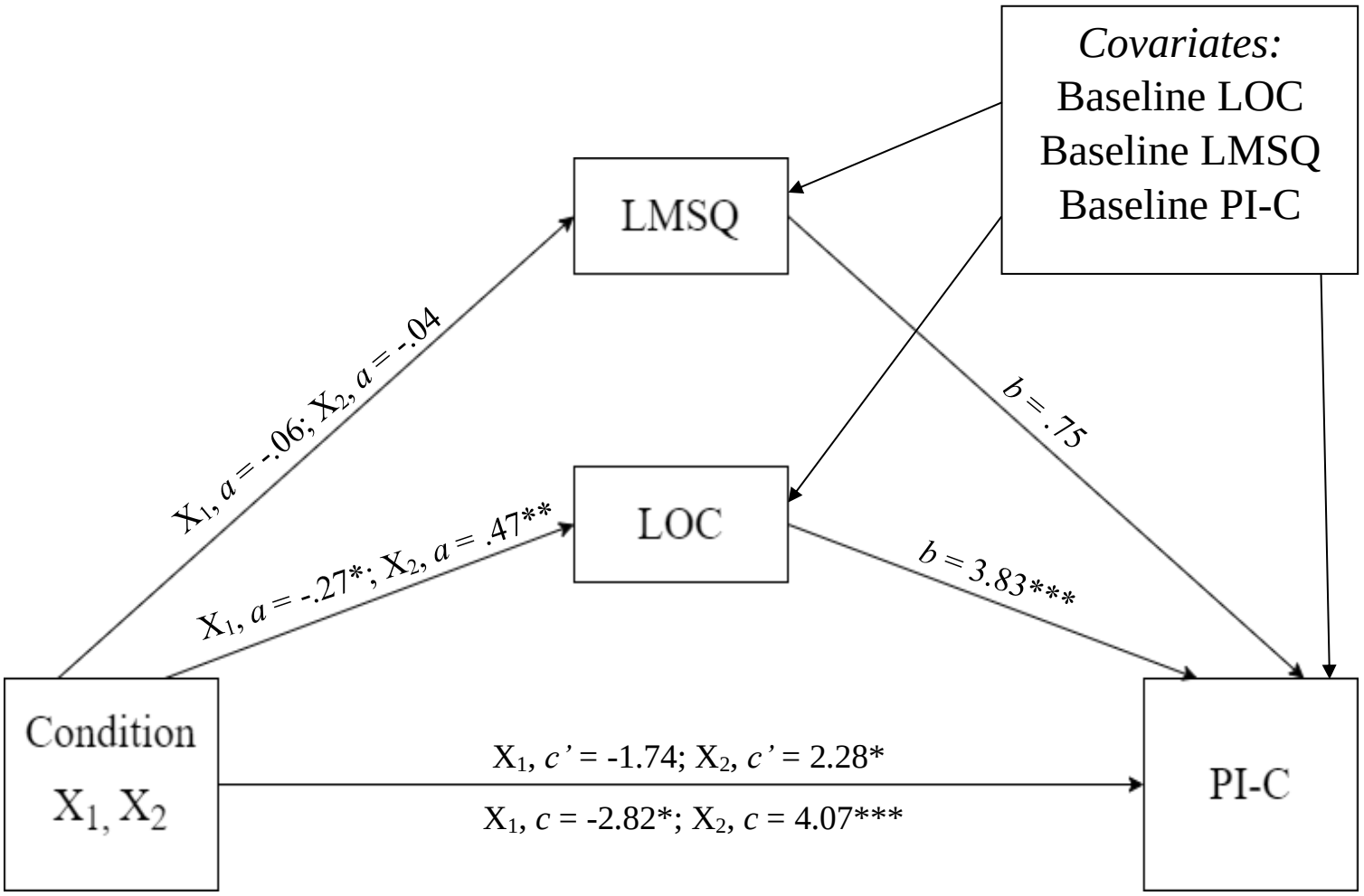
*Change in Overall Contamination Ratings by Condition Across Sessions*




*Note.* Average contamination ratings refers to the mean contamination rating of all 12 pencils per session; T1 = session one; T2 = session two; T3 = session three. Interpretation: The freeze condition decreased from T2 to T3 ($p$ = .01); there was no change from T1 to T2 ($p$ = .49) or T1 to T3 ($p$ = 1.00). The control condition increased from T1 to T2 ($p$ = .008) and T1 to T3 ($p$ = .02); there was no change from T2 to T3 ($p$ = 1.00). The loom condition increased from T1 to T2 ($p$ < .001) and T1 to T3 ($p$ < .001); there was no change from T2 to T3 ($p$ = .84). There were no differences between groups at T1, T2, or T3 ($p$'s ≥ .69).

**Figure 11**

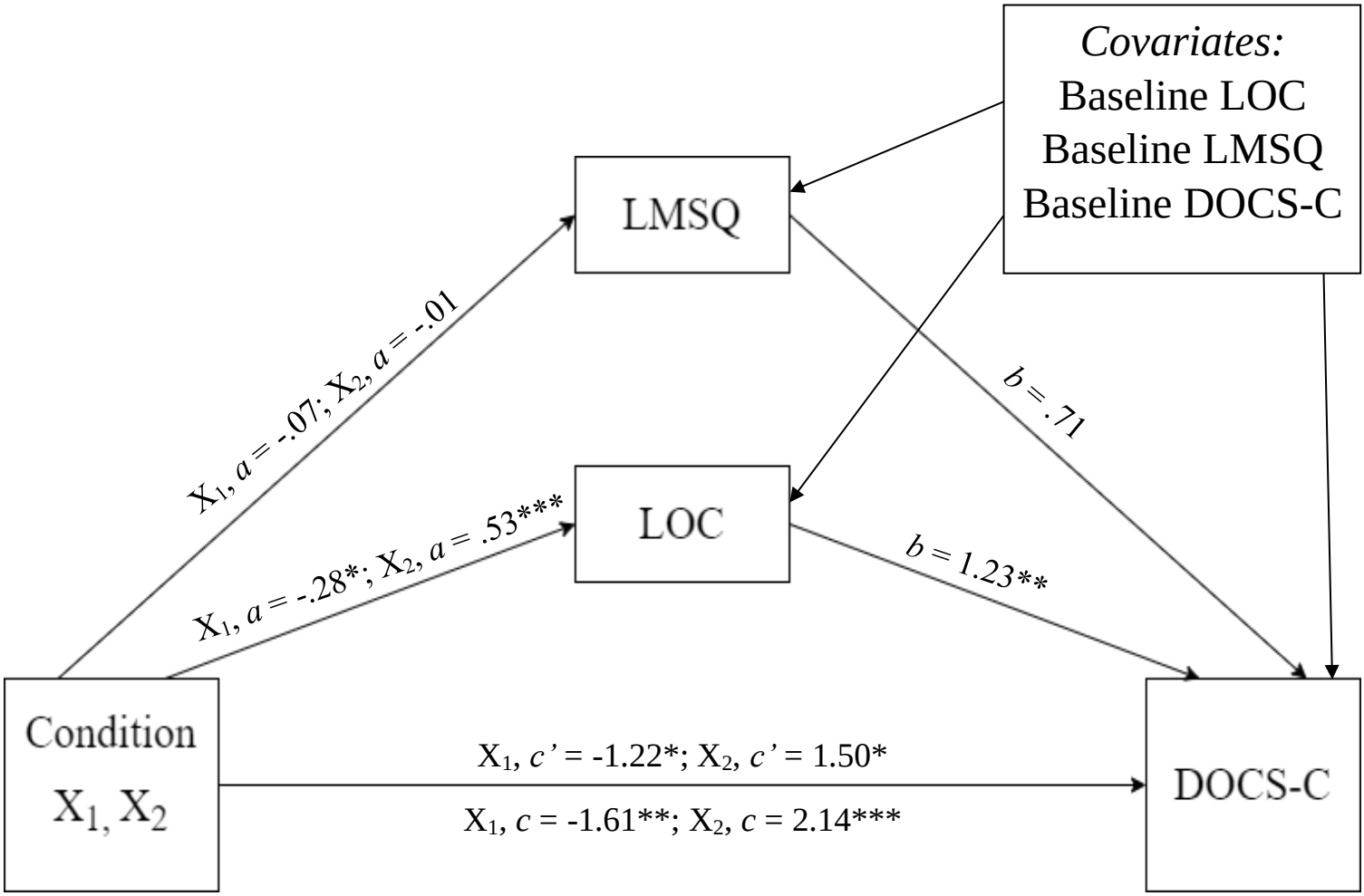
*Mediation Of LOC And LMSQ In The Relationship Between Condition And PI-C.*




Note. *** p < .001; ** p < 0.01; * p < 0.05. $X_1$ = Freeze vs. Control; $X_2$ = Freeze vs. Loom. LOC = Looming of Contamination Questionnaire; LMSQ = Looming Maladaptive Style Questionnaire; PI-C = Padua Inventory-Contamination Subscale. All presented effects are unstandardized; *a* is effect of condition on LOC and LMSQ; *b* is effect of LOC and LMSQ on PI-C; *c'* is direct effect of condition on PI-C; *c* is total effect of condition on PI-C.

**Figure 12**

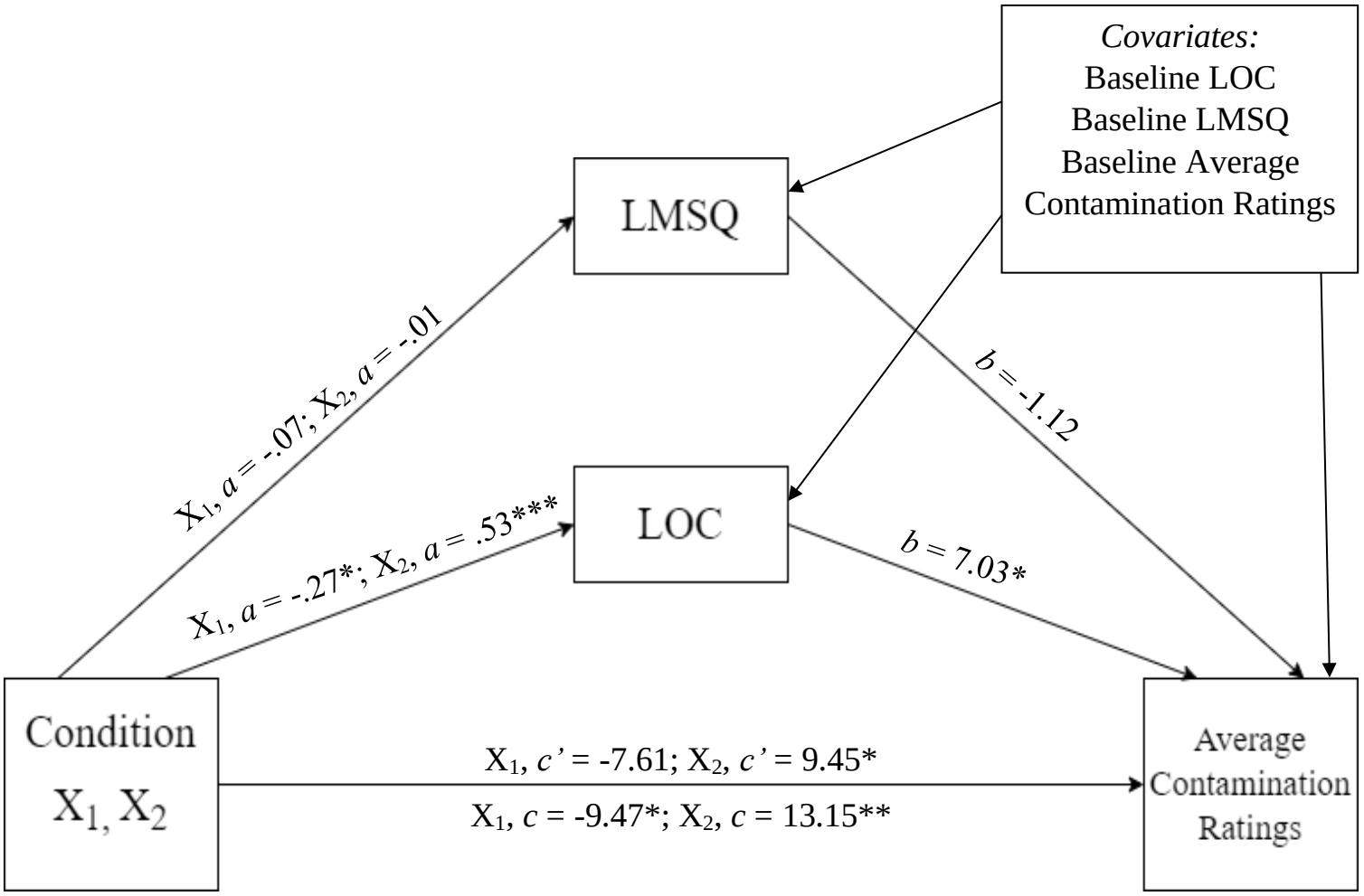
*Mediation Of LOC And LMSQ In The Relationship Between Condition And DOCS-C.*




Note. *** p < .001; ** p < 0.01; * p < 0.05. $X_1$ = Freeze vs. Control; $X_2$ = Freeze vs. Loom. LOC = Looming of Contamination Questionnaire; LMSQ = Looming Maladaptive Style Questionnaire; DOCS-C = Dimensional Obsessive-Compulsive Scale, Contamination Fear Subscale. All presented effects are unstandardized; *a* is effect of condition on LOC and LMSQ; *b* is effect of LOC and LMSQ on DOCS-C; *c'* is direct effect of condition on DOCS-C; *c* is total effect of condition on DOCS-C.

**Figure 1**3

*Mediation Of LOC And LMSQ In The Relationship Between Condition And Average Contamination Ratings In The Chain Of Contagion Task*




Note. *** p < .001; ** p < 0.01; * p < 0.05. $X_1$ = Freeze vs. Control; $X_2$ = Freeze vs. Loom. LOC = Looming of Contamination Questionnaire; LMSQ = Looming Maladaptive Style Questionnaire; Average Contamination Ratings = Average contamination ratings across the 12 pencils. All presented effects are unstandardized; *a* is effect of condition on LOC and LMSQ; *b* is effect of LOC and LMSQ on average contamination ratings; *c'* is direct effect of condition on average contamination ratings; *c* is total effect of condition on average contamination ratings.

# Appendix

## Scripts for the Guided Imagery Interventions

Note: Participants in both imagery conditions heard the same scenario at the beginning of the audio and the same wrap-up instructions at the end of the intervention. The middle portion of the audio in which they received the intervention differed, as described below.

### Scenario

You will now learn a new strategy that may help you reduce your fear of germs. [Pause 3 seconds] This new strategy consists of a mental imagery exercise, or listening to and imagining a scenario about germs. [Pause 3 seconds] After you learn this strategy, you should plan to practice it at least once per day. [Pause 3 seconds] At the end of this exercise, I will talk about ways that you can practice this strategy in your day-to-day life.

[Pause 3 seconds]

Over the next 10 minutes, you will be asked to listen to a scenario and to imagine it as vividly and in as much detail as possible… [Pause 3 seconds] At times, the audio will pause to allow you to focus on imagining the scenario. [Pause 3 seconds] When this happens, just continue focusing on the scenario until the audio begins to play again…

[Pause 3 seconds]

To start, sit in a comfortable position and either close your eyes or rest them gently on a fixed spot in the room. [Pause 3 seconds] Allow your imagination to take over as you listen, picturing yourself within the scenario being described.

[Pause 3 seconds]

You have just walked into a public bathroom. [Pause 3 seconds] As you walk inside, you notice that the bathroom has not been cleaned in quite some time. [Pause 3 seconds] The smell of urine is thick in the air. [Pause 3 seconds] There are small puddles of liquid surrounding the toilet and all around the room. [Pause 3 seconds] The puddles are a murky brown color. [Pause 3 seconds] As you look around, you notice that there are paper towels and toilet paper scattered throughout the room, some dampened from the liquid on the floor.

[Pause 10 seconds]

As you walk towards the toilet, you notice that the walls behind it have been splattered with a brownish substance which has since dried. [Pause 3 seconds] The floor is stained from a build-up of grime over the years. [Pause 3 seconds] You look at the toilet behind the stall door and see yellow stains that stretch from the outside of the toilet bowl down to the floor, as if drops of liquid had run down the outside of the bowl.

[Pause 10 seconds]

You approach the toilet and see that its seat is up, which allows you to see into the toilet bowl more clearly. [Pause 3 seconds] The inside of the toilet bowl appears to be splattered with the same brown substance that is on the wall and it appears that someone used the toilet without flushing, as there is yellow liquid in the bowl. [Pause 3 seconds] Further, you notice several rust-colored rings inside the bowl. [Pause 3 seconds] There is a slight sewage smell coming from a nearby drain on the floor.

[Pause 10 seconds]

You reach out and grab the toilet seat from its upright position to put it down. [Pause 3 seconds] Suddenly, you feel a liquid cover your fingertips. [Pause 3 seconds] You drop the seat with a loud clatter. [Pause 3 seconds] You realize that the toilet seat had drops of urine on it, which are now on your hands. [Pause 3 seconds] You stare at your hands.

**Freeze Condition**

Now, focus on the area of your hand where the urine is sitting right now. [Pause 3 seconds] Any germs or contamination from the urine are contained within this area alone. [Pause 3 seconds] Germs and bacteria can cause diseases that are harmful to you, and the urine on your hand feels gross and dirty. [Pause 3 seconds] However, the contamination is restricted to the spots where it sits on your skin right now.

[Pause 10 seconds]

Mentally picture any contamination from the urine as unable to move or spread from its current location. [Pause 3 seconds] Because your skin is multi-layered, it forms a natural surface barrier that keeps contamination on the surface of your skin. [Pause 3 seconds] Therefore, think about the implications of the germs sitting stationary on your skin's surface. [Pause 3 seconds] Any dangerous bacteria are confined to this area alone and cannot move or spread from their current location.

[Pause 30 seconds]

Remember, your task when imagining this scene is to imagine that the germs, disease, or contamination in this situation cannot move or spread beyond where it already is. [Pause 3 seconds] While the contamination is still alive and toxic, you can visualize it as unable to move or spread by itself from where it is. [Pause 3 seconds] You can move, but the contamination cannot.

[Pause 30 seconds]

Keep focusing on the urine on your hand and imagining the germs and contamination as frozen in place.

[Pause 45 seconds]

**Loom Condition**

Now, visualize that any germs or contamination from the urine are moving across your skin and spreading through the air as they evaporate. [Pause 3 seconds] Germs and bacteria can cause diseases that are harmful to you, and the urine on your hand feels gross and dirty. [Pause 3 seconds] Any germs or contamination can spread readily, as some bacteria are capable of movement. [Pause 3 seconds] Picture any contamination from the urine as spreading across your skin. [Pause 3 seconds] Germs can seep through tiny invisible tears in your skin. [Pause 3 seconds] Some bacteria are able to bypass natural surface barriers and spread through thick substances. [Pause 3 seconds] Therefore, think about the implications of the germs moving and spreading on your skin. [Pause 3 seconds] Remember that the contamination is not confined to any one spot; any dangerous germs can move across your skin and spread through the air at all times.

[Pause 30 seconds]

Remember, your task when imagining this scene is to imagine that the germs, disease, or contamination is airborne and mobile. [Pause 3 seconds] You can visualize it as able to move or rapidly spread by itself from where it is. [Pause 3 seconds] Both you and the contamination can move.

[Pause 30 seconds]

Keep focusing on the urine on your hand and imagining the germs and contamination as spreading and moving.

[Pause 45 seconds]

Wrap-Up

Take a few more seconds to finish visualizing whatever image you have in your mind now, then come back to the present…

[Pause 10 seconds]

Now that you have practiced imagining this scene and what happens to the germs, please practice imagining it at least once per day. [Pause 3 seconds] You can use this strategy when you encounter any type of potential contamination in your life. [Pause 3 seconds] For example, if you touch something that you think is contaminated, such as a door handle or the lid of a trashcan, focus on the part of your hand that touched the object and imagine the germs on your hand as [frozen in place/moving and spreading], just like you did in this exercise. [Pause 3 seconds] If you feel that a different part of your body is contaminated, such as your face or arm, you should focus on that area of your body instead. [Pause 3 seconds] Focus on this and visualize the germs as [frozen in place/moving and spreading] for 10 minutes, if possible. [Pause 3 seconds] If you

don't have 10 minutes to do this, just practice the exercise for as long as you can, aiming to focus on and visualize the germs as [frozen in place/moving and spreading] for at least several minutes.

[Pause 3 seconds]

Remember, you can use this strategy in *any* situation in which you feel contaminated. [Pause 3 seconds] For example, you can practice this exercise if you encounter bodily fluids, garbage, sticky substances, spoiled foods, dirty laundry, pets, or anything else that makes you feel dirty or contaminated.

[Pause 3 seconds]

Please keep track of approximately how many times you use this strategy over the next week because we will ask you to estimate how often you used it at your session tomorrow and your session next week.

## Demographics

This section will ask you to fill out demographic information.

1. Age: _____
2. Gender:
    a. Cisgender male (assigned male at birth and identifies as male)
    b. Cisgender female (assigned female at birth and identifies as female)
    c. Transgender male (assigned female at birth but identifies as male)
    d. Transgender female (assigned male at birth but identifies as female)
    e. Non-binary (does not identify as either male or female or blends elements of both male and female)
    f. Other
    g. Prefer not to say
3. Which of the following best describes your sexual orientation?
    a. Heterosexual (straight)
    b. Gay or lesbian
    c. Bisexual
    d. Pansexual
    e. Asexual
    f. Other
    g. Prefer not to say
4. Race/Ethnicity: Select all that apply
    a. White
    b. Hispanic or Latino
    c. Black or African American
    d. Native American or American Indian
    e. Asian / Pacific Islander
    f. Other
    g. Prefer not to say
5. What is the highest level of school you have completed or the highest degree you have received?
    a. Less than high school degree
    b. High school graduate (high school diploma or equivalent including GED)
    c. Some college but no degree
    d. Associate degree in college (2-year)
    e. Bachelor's degree in college (4-year)
    f. Master's degree
    g. Doctoral degree
    h. Professional degree (JD, MD)
    i. Prefer not to say

**Looming of Contamination Questionnaire (LOC)**

*Instructions:* In these questions, we are interested in your immediate thoughts and reactions to a number of different scenes. Put down whatever comes to mind in response to each of these scenes immediately, rather than thinking about your answer for a long time.

After you read each scene, try to imagine it as vividly as possible. What comes to mind as you bring that scene to mind and think about it? Imagine it in as much vivid detail as possible.

**You're on a road trip and you have been looking for a bathroom for the last two hours. You finally find one at a gas station. It looks as though it hasn't been cleaned for quite some time and there's no soap. As you imagine yourself in this scene:**

1. How worried or anxious does your imagining this scene make you feel?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

2. How quickly does it seem that the germs or contamination is spreading towards you?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

3. To what extent does the contamination seem to be approaching moment-by-moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

4. To what extent do you imagine the threat as growing larger with each moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

**You are at a cocktail party engaging in conversation with a man who spits a little while he speaks. As you are talking to him can feel this man's spit landing on and around your face. Imagine your thoughts and your perceptions.**

1. How worried or anxious does your imagining this scene make you feel?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

2. How quickly does it seem that the germs or contamination is spreading towards you?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

3. To what extent does the contamination seem to be approaching moment-by-moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

4. To what extent do you imagine the threat as growing larger with each moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

**You are taking a subway to avoid weekend traffic. After you've sat down, a man wearing layers of dirty, ragged clothing sits down next to you. There is a strong odor of urine about him. Imagine your thoughts and perceptions.**

1. How worried or anxious does your imagining this scene make you feel?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

2. How quickly does it seem that the germs or contamination is spreading towards you?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

3. To what extent does the contamination seem to be approaching moment-by-moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

4. To what extent do you imagine the threat as growing larger with each moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

**You are shopping for produce at the grocery store. As you see some produce that you want to select, a man next to you being coughing on it. Imagine your thoughts and perceptions.**

1. How worried or anxious does your imagining this scene make you feel?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

2. How quickly does it seem that the germs or contamination is spreading towards you?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

3. To what extent does the contamination seem to be approaching moment-by-moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

4. To what extent do you imagine the threat as growing larger with each moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

**You are shaking hands with someone you just met. As you do this, you realize that they have just emptied the trashcan with garbage. Imagine your thoughts and perceptions.**

1. How worried or anxious does your imagining this scene make you feel?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

2. How quickly does it seem that the germs or contamination is spreading towards you?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

3. To what extent does the contamination seem to be approaching moment-by-moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

4. To what extent do you imagine the threat as growing larger with each moment?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

**Looming Maladaptive Style Questionnaire (LMSQ)**

*Instructions:* In these questions, we are interested in your immediate thoughts and reactions to a number of different scenes. Put down whatever comes to mind in response to each of these scenes immediately, rather than thinking about your answer for a long time.
After you read each scene, try to **vividly** imagine it. What comes to mind as you bring that scene to mind and think about it? Concentrate on it and imagine it in as much vivid detail as possible.

After you have finished concentrating on the scene, answer the questions about what you were imagining was happening. Please do not leave out any questions if possible.

To summarize:

1. Vividly imagine yourself in each scene.
2. Answer all the questions about your own immediate thoughts and feelings.

---

**Suppose that you were to hear a strange engine noise from your car as you were driving on the expressway in heavy rush hour traffic. There are rushing cars and trucks on both sides of you and your car sounds as if it the engine could be cracking or the engine is developing a serious problem.**

1. How worried or anxious does your imagining this scene make you feel?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

2. In this scene, are the chances of your having a difficulty with the car's engine decreasing, or increasing and expanding with each moment?

| **Chances are decreasing with time** | 1 | 2 | 3 | 4 | 5 | **Chances are expanding** |
|---|---|---|---|---|---|---|

3. Is the level of threat to you from the car's engine staying fairly constant, or is it growing rapidly larger with each passing moment?

| **Threat is staying fairly constant** | 1 | 2 | 3 | 4 | 5 | **Threat is growing rapidly larger** |
|---|---|---|---|---|---|---|

4. How much do you visualize your car's engine as in the act of progressively worsening?

| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |
|---|---|---|---|---|---|---|

**Suppose that a person you have been romantically involved with is behaving oddly. They were late to meet you and there are long moments of silence when they don't speak and don't give you eye contact. It seems your relationship could be breaking up.**

1. How worried or anxious does your imagining this scene make you feel?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

2. In this scene, are the chances of your having a difficulty with the relationship decreasing, or increasing and expanding with each moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Chances are decreasing with time** | 1 | 2 | 3 | 4 | 5 | **Chances are expanding** |

3. Is the level of threat of losing your relationship staying fairly constant, or is it growing rapidly larger with each passing moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Threat is staying fairly constant** | 1 | 2 | 3 | 4 | 5 | **Threat is growing rapidly larger** |

4. How much do you visualize your relationship as in the act of progressively breaking up?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

**Suppose that you get odd heart palpitations while talking to someone about a financial problem. You have never had palpitations where your heart skipped around like this and you could be developing a heart murmur.**

1. How worried or anxious does your imagining this scene make you feel?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

2. In this scene, are the chances of your having a difficulty with your heart seem to be decreasing, or increasing and expanding with each moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Chances are decreasing with time** | 1 | 2 | 3 | 4 | 5 | **Chances are expanding** |

3. Is the level of threat of a heart condition staying fairly constant, or is it growing rapidly larger with each passing moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Threat is staying fairly constant** | 1 | 2 | 3 | 4 | 5 | **Threat is growing rapidly larger** |

4. How much do you visualize your heart problem as in the act of becoming progressively worse?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

**Suppose you walk up to an extremely popular, self-centered person in a group of people. The person looks a little bored when first glancing at you and many of the people in the group are looking in your direction. You want to extend an invitation to a party to the person but the person could reject your invitation.**

1. How worried or anxious does your imagining this scene make you feel?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

2. In this scene, are the chances of your having a difficulty decreasing, or increasing and expanding with each moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Chances are decreasing with time** | 1 | 2 | 3 | 4 | 5 | **Chances are expanding** |

3. Is the level of threat of your being rejected staying fairly constant, or is it growing rapidly larger with each passing moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Threat is staying fairly constant** | 1 | 2 | 3 | 4 | 5 | **Threat is growing rapidly larger** |

4. How much do you visualize the risk of being rejected as in the act of becoming progressively worse?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

**Suppose that you are in front of a large audience of strangers. You are speaking about a topic on which you do not know a lot. Some of the people look bored or disinterested, while others look upset. It seems that you could get a very negative audience reaction.**

1. How worried or anxious does your imagining this scene make you feel?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

2. In this scene, are the chances of your having a difficulty with the audience decreasing, or increasing and expanding with each moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Chances are decreasing with time** | 1 | 2 | 3 | 4 | 5 | **Chances are expanding** |

3. Is the level of threat from the audience staying fairly constant, or is it growing rapidly larger with each passing moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Threat is staying fairly constant** | 1 | 2 | 3 | 4 | 5 | **Threat is growing rapidly larger** |

4. How much do you visualize the audience reaction as in the act of becoming progressively worse?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

**Suppose that it is 6:00 in the evening-- the height of the rush hour and you are heading home on the expressway in your car. A red truck is speeding aggressively in and out of traffic behind you without seeming to notice your position. It seems that there is a definite risk of getting into an accident.**

1. How worried or anxious does your imagining this scene make you feel?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

2. In this scene, are the chances of your having difficulty with the red truck decreasing, or increasing and expanding with each moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Chances are decreasing with time** | 1 | 2 | 3 | 4 | 5 | **Chances are expanding** |

3. Is the level of threat of an accident staying fairly constant, or is it growing rapidly larger with each passing moment?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Threat is staying fairly constant** | 1 | 2 | 3 | 4 | 5 | **Threat is growing rapidly larger** |

4. How much do you visualize the risk of an accident as in the act of becoming progressively worse?

| | | | | | | |
|---|---|---|---|---|---|---|
| **Not at all** | 1 | 2 | 3 | 4 | 5 | **Very Much** |

**The Disgust Propensity and Sensitivity Scale - Revised (DPSS-R)**

*Instructions:* This questionnaire consists of 12 statements about disgust. Please read each statement and think how often it is true for you, then place a 'X' in the box that is closest to this.

| | | **Never** | **Rarely** | **Sometimes** | **Often** | **Always** |
|---|---|---|---|---|---|---|
| **1** | I avoid disgusting things. | 1 | 2 | 3 | 4 | 5 |
| **2** | When I feel disgusted, I worry that I might pass out. | 1 | 2 | 3 | 4 | 5 |
| **3** | It scares me when I feel nauseous. | 1 | 2 | 3 | 4 | 5 |
| **4** | I feel repulsed. | 1 | 2 | 3 | 4 | 5 |
| **5** | Disgusting things make my stomach turn. | 1 | 2 | 3 | 4 | 5 |
| **6** | I screw up my face in disgust. | 1 | 2 | 3 | 4 | 5 |
| **7** | When I notice that I feel nauseous, I worry about vomiting. | 1 | 2 | 3 | 4 | 5 |
| **8** | I experience disgust. | 1 | 2 | 3 | 4 | 5 |
| **9** | It scares me when I feel faint. | 1 | 2 | 3 | 4 | 5 |
| **10** | I find something disgusting. | 1 | 2 | 3 | 4 | 5 |
| **11** | It embarrasses me when I feel disgusted. | 1 | 2 | 3 | 4 | 5 |
| **12** | I think feeling disgust is bad for me. | 1 | 2 | 3 | 4 | 5 |

**Padua Inventory – Washington State University Revision- Contamination Subscale**

*Instructions:* The following statements refer to thoughts and behaviors which may occur to everyone in everyday life. For each statement, choose the reply which best seems to fit you and the degree of disturbance which such thoughts or behaviors may create.

| | | Not at All | A Little | Quite A Lot | A Lot | Very Much |
|---|---|---|---|---|---|---|
| **1** | I feel my hands are dirty when I touch money. | 0 | 1 | 2 | 3 | 4 |
| **2** | I think even slight contact with bodily secretions (perspiration, saliva urine, etc.) may contaminate my clothes or somehow harm me. | 0 | 1 | 2 | 3 | 4 |
| **3** | I find it difficult to touch an object when I know it has been touched by strangers or by certain people. | 0 | 1 | 2 | 3 | 4 |
| **4** | I find it difficult to touch garbage or dirty things. | 0 | 1 | 2 | 3 | 4 |
| **5** | I avoid using public toilets because I am afraid of disease and contamination. | 0 | 1 | 2 | 3 | 4 |
| **6** | I avoid using public telephones because I am afraid of contagion and disease. | 0 | 1 | 2 | 3 | 4 |
| **7** | I wash my hands more often and longer than necessary. | 0 | 1 | 2 | 3 | 4 |
| **8** | I sometimes have to wash or clean myself simply because I think I may be dirty or “contaminated”. | 0 | 1 | 2 | 3 | 4 |
| **9** | If I touch something I think is “contaminated”, I immediately have to wash or clean myself. | 0 | 1 | 2 | 3 | 4 |
| **10** | If an animal touches me, I feel dirty and immediately have to wash myself or change my clothing. | 0 | 1 | 2 | 3 | 4 |

**Dimensional Obsessive-Compulsive Scale (DOCS)- Contamination Fear Subscale**

*Instructions:* This questionnaire asks you about different types of concerns that you might or might not experience. There is a description of the kinds of thoughts (sometimes called *obsessions*) and behaviors (sometimes called *rituals* or *compulsions*) that are typical of that particular concern, followed by 5 questions about your experiences with these thoughts and behaviors. Please read the description carefully and answer the questions for the category based on your experiences in the last month.

**Category 1: Concerns about Germs and Contamination**
*Examples…*

- Thoughts or feelings that you are contaminated because you came into contact with (or were nearby) a certain object or person.
- The feeling of being contaminated because you were in a certain place (such as a bathroom).
- Thoughts about germs, sickness, or the possibility of spreading contamination.
- Washing your hands, using hand sanitizer gels, showering, changing your clothes, or cleaning objects because of concerns about contamination.
- Following a certain routine (e.g., in the bathroom, getting dressed) because of contamination
- Avoiding certain people, objects, or places because of contamination.

The next questions ask about your experiences with thoughts and behaviors related to contamination over the last month. Keep in mind that your experiences might be different than the examples listed above. Please circle the number next to your answer:

1. About how much time have you spent each day thinking about contamination and engaging in washing or cleaning behaviors because of contamination?
   0 None at all
   1 Less than 1 hour each day
   2 Between 1 and 3 hours each day
   3 Between 3 and 8 hours each day
   4 8 hours or more each day

2. To what extent have you avoided situations in order to prevent concerns with contamination or having to spend time washing, cleaning, or showering?
   0 None at all
   1 A little avoidance
   2 A moderate amount of avoidance
   3 A great deal of avoidance
   4 Extreme avoidance of nearly all things

3. If you had thoughts about contamination but could not wash, clean, or shower (or otherwise remove the contamination), how distressed or anxious did you become?
   0 Not at all distressed/anxious
   1 Mildly distressed/anxious
   2 Moderately distressed/anxious

3 Severely distressed/anxious
4 Extremely distressed/anxious

4. To what extent has your daily routine (work, school, self-care, social life) been disrupted by contamination concerns and excessive washing, showering, cleaning, or avoidance behaviors?
0 No disruption at all.
1 A little disruption, but I mostly function well.
2 Many things are disrupted, but I can still manage.
3 My life is disrupted in many ways and I have trouble managing.
4 My life is completely disrupted and I cannot function at all.

5. How difficult is it for you to disregard thoughts about contamination and refrain from behaviors such as washing, showering, cleaning, and other decontamination routines when you try to do so?
0 Not at all difficult
1 A little difficult
2 Moderately difficult
3 Very difficult
4 Extremely difficult

**Depression Anxiety Stress Scales (DASS-21)**

*Instructions:* Please read each statement and circle a number 0, 1, 2, or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

| | | **Did not apply to me at all- NEVER** | **Applied to me to some degree, or some of the time- SOMETIMES** | **Applied to me to a considerable degree, or a good part of time- OFTEN** | **Applied to me very much, or most of the time- ALMOST ALWAYS** |
|---|---|---|---|---|---|
| **1** | I found it hard to wind down. | 0 | 1 | 2 | 3 |
| **2** | I was aware of dryness of my mouth | 0 | 1 | 2 | 3 |
| **3** | I couldn't seem to experience any positive feeling at all | 0 | 1 | 2 | 3 |
| **4** | I experienced difficulty breathing (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion) | 0 | 1 | 2 | 3 |
| **5** | I found it difficult to work up the initiative to do things | 0 | 1 | 2 | 3 |
| **6** | I tended to over-react to situations | 0 | 1 | 2 | 3 |
| **7** | I experienced trembling (eg. in the hands) | 0 | 1 | 2 | 3 |
| **8** | I felt that I was using a lot of energy | 0 | 1 | 2 | 3 |
| **9** | I was worried about situations in which I might panic and make a fool of myself | 0 | 1 | 2 | 3 |
| **10** | I felt I had nothing to look forward to | 0 | 1 | 2 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| **11** | I found myself getting agitated | 0 | 1 | 2 | 3 |
| **12** | I found it difficult to relax | 0 | 1 | 2 | 3 |
| **13** | I felt down-hearted and blue | 0 | 1 | 2 | 3 |
| **14** | I was intolerant of anything that kept me from getting on with what I was doing | 0 | 1 | 2 | 3 |
| **15** | I felt I was close to panic | 0 | 1 | 2 | 3 |
| **16** | I was unable to become unenthusiastic about anything | 0 | 1 | 2 | 3 |
| **17** | I felt I wasn't worth much as a person | 0 | 1 | 2 | 3 |
| **18** | I felt that I was rather touchy | 0 | 1 | 2 | 3 |
| **19** | I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat) | 0 | 1 | 2 | 3 |
| **20** | I felt scared without any good reason | 0 | 1 | 2 | 3 |
| **21** | I felt that life was meaningless | 0 | 1 | 2 | 3 |

**COVID-Related Thoughts and Behavioral Symptoms (COV-TaBS)**

*Instructions:* The following questions are about your thoughts and behaviors relating to the novel coronavirus SARS-CoV-2 that causes the disease known as COVID-19.

| | **Over the past two weeks….** | **Not at all** | **A little** | **Sometimes** | **A lot** | **All the time** |
|---|---|---|---|---|---|---|
| **1** | I worried a lot about COVID-19 | 0 | 1 | 2 | 3 | 4 |
| **2** | It was hard to sleep because of COVID-19 | 0 | 1 | 2 | 3 | 4 |
| **3** | I could not stop thinking about terrible things that might happen because of COVID-19 | 0 | 1 | 2 | 3 | 4 |
| **4** | I felt irritable or angry because of COVID-19 | 0 | 1 | 2 | 3 | 4 |
| **5** | I felt isolated or lonely because of COVID-19 | 0 | 1 | 2 | 3 | 4 |
| **6** | I was more distressed about COVID-19 than other people | 0 | 1 | 2 | 3 | 4 |
| **7** | I was very diligent about cleaning my hands and surfaces to avoid COVID-19 | 0 | 1 | 2 | 3 | 4 |
| **8** | I wanted to know a lot about COVID-19, such as frequently checking the news, social media, or discussing it with others | 0 | 1 | 2 | 3 | 4 |
| **9** | I was very concerned about having enough food and supplies | 0 | 1 | 2 | 3 | 4 |
| **10** | I did everything I could in order to avoid exposure to COVID-19 | 0 | 1 | 2 | 3 | 4 |

## Vividness of Visual Imagery Questionnaire (VVIQ)

*Instructions:* For each item on this questionnaire, try to form a visual image, and consider your experience carefully. For any image that you do experience, rate how vivid it is using the five-point scale described below. If you do not have a visual image, rate vividness as '1'. Only use '5' for images that are truly as lively and vivid as real seeing. Please note that there are no right or wrong answers to the questions, and that it is not necessarily desirable to experience imagery or, if you do, to have more vivid imagery.

| **No image at all, you only "know" that you are thinking of the object** | **Vague and dim** | **Moderately clear and lively** | **Clear and reasonably vivid** | **Perfectly clear and vivid as real seeing** |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

For items 1-4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye.

1. The exact contour of face, head, shoulders and body _____
2. Characteristic poses of head, attitudes of body, etc. _____
3. The precise carriage, length of step etc., in walking _____
4. The different colours worn in some familiar clothes _____

Visualise a rising sun. Consider carefully the picture that comes before your mind's eye.

5. The sun rising above the horizon into a hazy sky _____
6. The sky clears and surrounds the sun with blueness _____
7. Clouds. A storm blows up with flashes of lightning _____
8. A rainbow appears _____

Think of the front of a shop which you often go to. Consider the picture that comes before your mind's eye.

9. The overall appearance of the shop from the opposite side of the road _____
10. A window display including colours, shapes and details of individual items for sale_____
11. You are near the entrance. The colour, shape and details of the door. _____
12. You enter the shop and go to the counter. The counter assistant serves you. Money changes hands _____

Finally, think of a country scene which involves trees, mountains and a lake. Consider the picture that comes before your mind's eye.

13. The contours of the landscape _____
14. The colour and shape of the trees _____
15. The colour and shape of the lake _____
16. A strong wind blows on the trees and on the lake causing waves in the water._____

**The 12-Item Obsessive-Compulsive Inventory (OCI-12)**

*Instructions:* The following statements refer to experiences that many people have in their everyday lives. Circle the number that best describes HOW MUCH that experience has DISTRESSED or BOTHERED you during the PAST MONTH. The numbers refer to the following verbal labels:

| | | Not at all | A little | Moderately | A lot | Extremely |
|---|---|---|---|---|---|---|
| **1** | I check things more often than necessary. | 0 | 1 | 2 | 3 | 4 |
| **2** | I get upset if objects are not arranged properly. | 0 | 1 | 2 | 3 | 4 |
| **3** | I find it difficult to touch an object when I know it has been touched by strangers or certain people. | 0 | 1 | 2 | 3 | 4 |
| **4** | I find it difficult to control my own thoughts. | 0 | 1 | 2 | 3 | 4 |
| **5** | I repeatedly check doors, windows, drawers, etc. | 0 | 1 | 2 | 3 | 4 |
| **6** | I get upset if others change the way I have arranged things. | 0 | 1 | 2 | 3 | 4 |
| **7** | I sometimes have to wash or clean myself simply because I feel contaminated. | 0 | 1 | 2 | 3 | 4 |
| **8** | I am upset by unpleasant thoughts that come into my mind against my will. | 0 | 1 | 2 | 3 | 4 |
| **9** | I repeatedly check gas and water taps and light switches after turning them off. | 0 | 1 | 2 | 3 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **10** | I need things to be arranged in a particular way. | 0 | 1 | 2 | 3 | 4 |
| **11** | I wash my hands more often and longer than necessary. | 0 | 1 | 2 | 3 | 4 |
| **12** | I frequently get nasty thoughts and have difficulty in getting rid of them. | 0 | 1 | 2 | 3 | 4 |