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Developing Interpretation Training for Modifying Thought-Action-Fusion Associated with Obsessive-Compulsive Symptoms

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DEVELOPING INTERPRETATION TRAINING FOR MODIFYING THOUGHT-ACTION-FUSION ASSOCIATED WITH OBSESSIVE-COMPULSIVE SYMPTOMS

by

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ABSTRACT

DEVELOPING INTERPRETATION TRAINING FOR MODIFYING THOUGHT-ACTION-FUSION ASSOCIATED WITH OBSESSIVE-COMPULSIVE SYMPTOMS

by

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In obsessive-compulsive disorder (OCD), obsessions are in part caused by the belief that simply having a thought can increase the chance of an event occurring or represents a person's morality. This phenomenon is Thought-Action-Fusion (TAF) and is common in OCD. Challenging these beliefs through Interpretation Training (IT) has been used in past research to modify negative interpretations, and lessen the distress and grief associated with them. The current study examined whether three sessions of computerized IT, challenging TAF obsessional thoughts, can impact TAF strength and OC symptoms. Thirty-nine non-clinical students were randomized to either: (1) an active condition (TAFMOD), where participants are presented with a sentence reducing the impact of the obsessional thoughts, or (2) a neutral condition (TAFMAN), in which a non-disconfirming sentence is provided. Among the primary outcomes, an interaction of group (TAFMOD vs TAFMAN) by time (pre-training to post-training) was non-significant, but there were significant reductions by time alone in TAF scores, OC symptoms, primary obsessions, and general anxiety and distress. Overall, the findings from the current study do not support a difference between groups as a result of training, but there did appear to be a general reduction of symptoms over time. Results of the study are discussed in terms of the cognitive theory of obsessional thoughts, and future research directions are suggested.

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Obsessive-Compulsive Symptoms

Obsessive Compulsive Disorder (OCD) is a devastating anxiety disorder characterized by recurrent and intrusive obsessions (i.e. thoughts, images, or impulses) that lead to significant levels of anxiety. The disorder also involves compulsive behavior, which is characterized as any behavior, mental or physical, the sufferer feels driven to perform in a ritualistic manner, and/or used to reduce distress or avoid a feared outcome. A paramount aspect the disorder is that the obsessions and/or compulsions cause a significant increase in distress, cause social/occupational impairment (Salkovskis & Kirk, 1999), and/or are time consuming (>1hour/day). Another distinguishing feature of the disorder is that the bizarre thoughts associated with OCD are heterogeneous and relative to the individual's lifestyle and situation, thus two OCD sufferers may have very different obsessions and compulsions from each other.

Prevalence and Course of OCD

Without treatment a typical course of OCD involves symptoms waxing and waning over time, particularly during periods of increased stress, but without total remission of symptoms (Ambramowitz, 2006; Steketee, Eisen & Dyck, 1999). It is estimated that approximately 2–2.5% of the adult population suffers or will suffer from OCD during their lifetime (Kessler et al., 2005; Ruscio, Stein, Chiu & Kessler, 2008), and an additional 21% to 25% of the general population will experience subclinical symptoms (Fullana et al., 2009). The mean onset of the disorder is 19.5 years of age, with 25% experiencing the disorder by age 14, and epidemiological data suggests onset typically spans from early adolescence to young adulthood (Antony, Downie & Swinson, 1998; Swedo, Rapoport & Leonard, 1992) , with the disorder tending to affect males

and females equally (Kolada, Bland & Newman, 1994; Karno, Golding, Sorenson & Burnam, 1988; Rasmussen & Tsuang, 1986) .

Impairment

Individuals with OCD often experience difficulties with interpersonal relationships (Riggs, Hiss & Foa 1992), marital distress in 50% of patients seeking treatment (Emmelkamp, Haan & Hoogduin 1990; Riggs, Hiss & Foa 1992), 1 in 3 patients with OCD are unable to maintain employment, and of these individuals nearly 50% receive disability payments principally related to their OCD (Koran, 2000; Leon, Portera, & Weissman, 1995; Mancebo et al., 2008). Moreover, about 24% of individuals with OCD are thought to live at a substandard socioeconomic status (Regier, Narrow, Rae & Manderschied, 1993). Not surprisingly, quality of life is significantly lower among OCD sufferers when compared with published community norms (Eisen et al., 2006).

Cognitive Theory of OCD

In the cognitive-behavioral model of anxiety disorders the experience of obsessive thoughts (e.g. repulsive, horrific, aggressive, or even dangerous) are a normative experience and not necessarily pathological symptoms of OCD (Rachman & De Silva, 1978). In fact, in a study conducted by Rachman & de Silva (1978) around 90% of their non-clinical sample reported experiencing obsessional thoughts. When obsessive thoughts occur in a non-clinical population they are most often considered odd and random, but are not given more significance. What differentiates those who develop OCD from those who do not is not the content of the obsessive thought but how the thought is interpreted and coped with (Rachman & De Silva, 1978; Rassin, Cougle & Muris, 2007). Similarly, Rachman (1997) suggests that individuals with OCD engage in cognitive errors and misinterpret the presence and/or meaning of these thoughts as significant,

threatening, and revealing of their hidden dark nature. Additionally, the more frequent obsessional thoughts occur, the more proof to the OCD sufferer they must be significant and not just random (Rachman, 1997). Moreover, OCD sufferers experience inflated responsibility about their obsessional intrusions and any potential harm which may occur from them, thus they are motivated to engage in various rituals to prevent any potential harm (Salkovskis, 1985). In sum, the obsessive thoughts should be thought of as a triggering stimulus, and in a person with OCD their cognitive error to ascribe significance to these thoughts is considered to be an important process in forming and maintaining the disorder.

Thought Action Fusion

One of the most studied cognitive errors involving biased interpretations in OCD is Thought-Action Fusion (TAF). TAF is currently viewed as one of a few cognitive errors by which individuals with obsessional difficulties place undue significance and meaning to their thoughts (e.g. magical thinking, over-responsibility), and believe their thoughts can influence reality (Frost & Steketee, 2002; OCCWG, 1997; Shafran, 2004). The dysfunctional interpretation that thoughts are equivalent of acts or thoughts can cause real life outcomes, tied with a personal responsibility for the thoughts occurring, motivates the individual to strive to stop any feared outcome associated with the thoughts (Shafran et al, 1996). This motivation compels the individual to engage in behaviors which are typically intended to (a) actively resist the thoughts (i.e. thought suppression), and (b) rituals that are utilized to decrease the anxiety or prevent anticipated harm associated with the thought (i.e. contacting and warning their friend of a possible car crash) (Abramowitz, Whiteside, Lynam, & Kalsy, 2003).

There are two subtypes of TAF (Rassin, Diepstraten, Merckelback & Muris, 2001): Moral and Likelihood TAF. Moral TAF (TAF-M) refers to an individual's belief that experiencing an unacceptable thought is as bad as carrying out the action (Shafran et al., 1996)

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(e.g. "*Thinking of sleeping with my brother's wife is as bad as actually sleeping with her*").
Likelihood TAF (TAF-L) refers to the belief that having an intrusive and distressing thought
about an event increases the chances this event will come true (i.e. *Thinking about a car accident*
involving my best friend will actually increase the likelihood that it will come true) (Berle &
Starcevic, 2005; Rachman, 1997; Shafran, 2004; Shafran, Thordarson, & Rachman, 1996). These
definitions clearly indicate that both TAF-M and TAF-L are interpretations that occur in
response to obsessional intrusions. TAF-M and TAF-L are conceptually distinguished but are
inter-related constructs (Berle & Starcevic, 2005) as existing findings by Shafran et al. (1996)
and Rassin, Merkelbach et al. (2001) demonstrated that the two factors are moderately correlated
(r=0.44 and r=0.32 respectively). This makes sense as many obsessional intrusions may be
capable of resulting in both TAF-M and TAF-L, but the individual's belief in TAF-M and TAF-
L may differ depending on their idiographic interpretation processes. For example, an individual
might have a distressing thought wishing their mother dead, and may be perceive this thought as
both immoral and increasing the likelihood their mother will die. Yet another individual with the
same thought may perceive the though as immoral but they do not believe there is an increase in
the chances their mother will die.

　　Research shows that TAF-L can be further divided into TAF-Likelihood Others (TAF-
LO) and TAF-Likelihood Self (TAF-LS). TAF-LO refers to the increase in chance of a negative
event occurring to *someone else* because of the thought, while TAF-LS refers to thoughts which
increases the chance of a negative event occurring to *the individual* with the thought. TAF-LO
and TAF-LS have both been shown to associate with pathology, but TAF-LO seems particularly
tied to high OC symptoms in non-clinical populations (Rassin et al., 2000). Thus, when looking
at student or community samples it is important to sufficiently represent the TAF-LO subtype in

a non-clinical study when TAF-L is addressed. In contrast, in clinical OCD populations a two

factor model of TAF (TAF-M and TAF-L) has been supported better (Meyer & Brown, 2013).

How does TAF contribute to OCD?

From the current cognitive-behavioral perspectives of OCD (Rachman and De Silva,

1978; Rassin, Diepstraten, et al., 2001; Salkovskis, 1985; Safran et al., 1996), there are at least

two well-known theories that attempt to explain how TAF may contribute to obsessional

symptoms. The first is a cognitive model that expresses those high in TAF tend to make

attributions of inflated responsibility or an evil nature to their obsessional thoughts (Salkovskis,

1985; Shafran et al., 1996). Thus, individuals who believe the thoughts are representations of

their true thoughts and nature are likely to experience increased distress as TAF amplifies the

negative meanings attached to the presence of the thoughts. Further, this increased emotional

salience of the thoughts is likely to increase its frequency of occurrence.

The second theory stresses the role of thought suppression in OCD (Rassin, Diepstraten,

et al., 2001). According to this theory, *cognitive avoidance* in the form of thought suppression is

often used as a coping mechanism to escape the anxiety triggered by the intrusive thought.

Attempts at suppressing these thoughts, could however, results in more frequent intrusions, and

even escalation into pathological obsessions (Wegner, 1989; Wegner, Schneider, Carter, &

White, 1987). As Wegner (1989) explained, "an obsession can grow from nothing but the desire

to suppress a thought" (p. 167). This phenomenon is termed the "white bear effect" and it is

premised on the basic behavioral principle that posits that avoidance of a feared stimulus

prevents a reduction of the fear from occurring (i.e., habituation). Berle and Starcevic (2005)

argue that those high in TAF believe they are morally responsible for their thoughts, and because

of the great importance and individual attributes to these thoughts occurring, actions such as

thought suppression enacted by the individual are understandable. Rassin, Diepstraten, et al., (2001) emphasized that thought suppression can be conceptualized as a form of neutralization activity used to ease or nullify the distress brought on by an intrusive thoughts (e.g. praying, confessing, superstitious rituals, reassurance seeking, etc.). It has been hypothesized that utilizing this method of harm avoidance is an extension of the tendency to fuse thoughts with real-life events (Amir, Freshman, Ramsey, Neary, & Brigidi, 2001), thus tying it directly to TAF.

Strength of TAF association with OCD

The importance of an individual's interpretation and meaning ascribed to their obsessional thought in OCD is not a new concept. There is growing evidence to suggest that both TAF and thought suppression interact and contribute in the development of obsessional problems (Rachman, 1997; Rassin, Muris, Schmidt & Murkelback, 2000). In their comprehensive study on TAF, Rassin et al., (2000) used a structural modeling approach to conclude directionality in the development and maintenance of TAF among 173 undergraduate psychology students. The results supported a model in which TAF leads to attempts at neutralization via thought suppression, which in turn predicts more OC symptoms. When the data were analyzed with TAF broken down into TAF-M and TAF-L, the model remained intact, indicating both TAF-M and TAF-L are distinct contributing factors in OC symptoms. However, the data also suggested that it is more plausible that it is the likelihood component specifically which directly influences OC symptoms. These results support those found by Rassin, Merckelbach, Muris, and Spaan (1999) that suggested TAF may play a causal role in the development of intrusive thoughts.

Yet, recent research has not provided robust support for the specificity of TAF to OCD, as TAF occurs in subclinical samples for OCD (Amir et al., 2001; Muris et al., 2001), but also

generalized anxiety disorder (GAD; Muris et al., 2001), schizotypy (Lee et al., 2005, Muris and Merckelbach, 2003), and depression (Abramowitz et al., 2003; Muris et al., 2001; Rachman et al, 1995, Rassin et al., 2001; Shafran and Rachman, 2004). Likewise, the specificity of TAF to OCD in clinical populations has not been supported as TAF has displayed associations to GAD (Thompson-Hollands et al., 2013), major depressive disorder (Hossein et al., 2012), and schizophrenia (Kabakci, Demir, Demirel, & Sevik, 2008).

Research findings have consistently indicated that TAF displays influence in many different disorders, yet its strongest influence is with OCD and OC symptoms (Muris et al., 2001). In a study by Muris et al. (2001) 427 non-clinical adolescents were assessed and TAF was found to be associated with a broad range of anxiety disorder symptoms. However, when correlational analysis was used to control for trait anxiety TAF was still found to be significantly related to OCD. Supporting this finding, in a recent study by Meyer and Brown (2013) of the psychometric properties of the Though-Action-Fusion Scale (TAFS; Shafran, Thordarson, & Rachman, 1996), a validated measure of TAF, the authors found in a clinical outpatient sample (n=700) that the total TAFS scores were more strongly related to OCD features than to either worry or depression. In line with this finding, TAFS total scores have consistently displayed an association to OC symptoms (Shafran et al., 1996), with many studies reporting mild to moderate ranges of association between TAF and obsessional pathology (0.20 to 0.38; Gwilliam et al., 2004, Rassin et al., 2000; Rassin, Diepstraten et al., 2001; Rassin & Koster, 2003; Rassin, Merkelbach et al., 2001).

The relevance of TAF for OCD has been demonstrated more strongly for TAF-L, relative to TAF-M. Researchers have found TAF-L to be related to OC symptoms and general worry (Berle & Starcevic, 2005; Meyer & Brown, 2013; Shafran et al., 1996), while TAF-M does not

seem to be significantly and specifically related to obsessional complaints (Abramowitz et al., 2006; Shafran et al, 1996; Shafran & Rachman, 2004). However, in a student sample (n = 600) by Bailey et al., (2014), TAF-M displayed stronger associations to a measure of OC symptoms than to any other measure of pathology (i.e. symptoms of agoraphobia, depression and generalized anxiety). Additionally TAF-M displays efficacy as a marker of general pathology when it is in excess of what is accepted in the individual's culture (Siev, Chambless, & Huppert, 2010) (i.e. excessive guilt about using blasphemous curse words or lustful thoughts), and it is consistently related to depression (Abramowitz, Whiteside, Lynam, & Kalsy, 2003; Shafran et al., 1996), a common co-occurring disorder with OCD. Taken together, it is reasonable to conclude that both TAF-L and TAF-M are important cognitive biases with important theoretical and clinical relevance for OCD, although their specificity has not been consistently demonstrated.

Can TAF be Influenced or Reduced?

Cognitive theory and recent research suggests that TAF may contribute to the maintenance of OCD, thus, cognitive interventions designed to reduce TAF are expected to lower the level of OCD symptoms (Rassin, Diepstraten, et al., 2001). Rachman (1997) strongly encourages that in OCD treatment changing misinterpretations of intrusive thoughts is an important goal: "It follows from the theory that the most direct and satisfactory treatment of obsessions is to assist patients in modification of putatively casual catastrophic misinterpretations of the significance of their intrusive thoughts. Bluntly, if these misinterpretations are 'corrected', the obsession should cease" (p. 799). From these considerations, an important question to ask is "Is TAF a modifiable interpretation bias that is subject to change?" As Rachman et al., (1996) first demonstrated using a "sentence completion

paradigm", researcher are able to evoke OC-relevant negative interpretations of intrusive thoughts (Rachman et al., 1996; van den Hout, can Pol, & Peters, 2001). In this sentence paradigm participants are asked to think of a close friend or loved-one, then read a sentence meant to elicit OC-relevant intrusive thoughts, then write the name of a close friend or loved-one into the sentence, and then visualize it occurring (e.g. *I hope ____ is in a car accident*). Immediately following the sentence paradigm participants experienced substantial increases in anxiety, guilt, and feelings of responsibility from this manipulation. As important as findings that TAF can be brought on experimentally is that TAF can be reduced. Research has found that TAF decreases with successful treatment of patients with OCD using cognitive behavioral therapy, even without specifically addressing it (Jonsson, Hougaard & Bennedsen, 2011; Rassin, Diepstraten, et al., 2001; Shafran & Rachman, 2004). Additionally, in non-clinical samples, there is some evidence that TAF severity, and reported anxiety, may be significantly reduced utilizing broad "anti-TAF" strategies (Zucker, Craske, Barrios, & Hoguin, 2002). Zucker et al., (2002) found in a sample of 72 undergraduates who scored highly on the TAF subscale of the Responsibility Appraisal Questionnaire (RAQ; Rachman, Thordarson, Shafran, & Woody, 1995), giving them a simple "anti-TAF" message ("*Often, when people have these bothersome thoughts they feel as though somehow, their thoughts will make the event more likely to happen. This way of thinking is wrong.*"), before writing a sentence and visualizing a TAF relevant scenario (i.e. hoping a close friend would be hurt in a car accident), significantly lowered TAF subscale scores from baseline to post-task ($t(32)=3.61$; $p<0.001$; about 20% reduction in the TAF scores), and prevented some of anxiety and the urge to neutralize elicited by the sentence paradigm. This is an important finding indicating TAF can be reduced by directly disputing its erroneous nature. However, this study showed only a mild level of reduction in TAF, probably

due to a single intervention session and its training modality (based on persuasion rather than interpretation training).

In a study by Marino-Carper, Negy, Burns and Lunt (2010) the authors recruited 139 undergraduates with high TAF. The authors divided the participants into three groups, either psychoeducation on TAF, psychoeducation on thoughts and cognitions, or psychoeducation on stress. All three groups then completed a task to elicit TAF and the authors found at post assessment participants who had received psychoeducation regarding TAF reported significantly lower TAF-M scores than participants in groups who had received psychoeducation regarding either thoughts in general or stress. With respect to the amount of change in TAF-L from baseline to 2-week follow-up, the TAF-education group showed about 30% reduction, whereas the General-education group showed a 20% increase and the Stress-education group showed no significant change in TAF scores. In addition, the group that received psychoeducation regarding TAF was the only group that did not experience a significant increase in thought suppression from baseline to post-intervention, and was also the only group to experience an increase in both frequency of and belief in low-responsibility thoughts from baseline to follow-up.

Research evidence continues to support that TAF can be reduced in both clinical and non-clinical populations, and targeted interventions towards changing this cognitive bias are likely to prove fruitful.

Cognitive Bias Modification

A promising emerging area of research in anxiety disorders treatment is cognitive bias modification (CBM). A cognitive bias refers to the tendency to give priority in processing to negative or threatening information, either through increased allocation of attention resources

(*attentional bias*) or via rapid assignment of negative or threatening appraisals to ambiguous information (*interpretive bias*) (Williams, Blackwell, Mackenzie, Holmes, & Andrews, 2013). As mentioned earlier, the presence of interpretive biases, particularly to negative moral or likelihood thoughts, is in-line with the major cognitive models of OCD.

In general, CBM is a cognitive experimental methodology that works by modifying a participant's biases (either attentional or interpretation) suspected to contribute to maintaining the psychopathology by training healthier responses (Williams et al., 2013). CBM has demonstrated efficacy in modifying cognitive biases implicated in the anxiety disorders and the resultant change in selective information processing has been shown to impact upon clinically relevant symptoms (MacLeod, 2012). For example, CBM techniques have shown effectiveness in reducing clinical symptoms and dysfunction across a range of disorders including depression (Lang, Moulds, Holmes, 2009; Williams et al, 2013), generalized anxiety disorder (Amir, Beard, Burns, & Bomyea, 2009), and social anxiety (Rapee et al., 2013). Significantly, following CBM training research has displayed reductions in symptoms (Mathews & MacLeod, 2002), as well as emotional reactivity to subsequent stressor tasks (Holmes, Lang, & Shah, 2009). These results suggest that changes in symptoms and reactivity to stressor tasks may reflect the development of new trained associations. Thus, CBM may prove to be a fruitful therapeutic technique in addition to exposure based interventions, or when exposure based interventions are rejected or fail.

Interpretation Training (CBM-I)

So, how can CBM be applied to OCD? A technique in CBM called interpretation training (CBM-I) is growing in evidence of its impact in OCD treatment. CBM-I's purpose is to modify a subject's maladaptive cognitive appraisals about personally relevant emotional

information by training healthier, less threatening interpretations. This process has been shown in past research to be effective, and the training of healthier interpretations led to lower distress and impairment (Mathews & Mackintosh, 2000). Moreover, CBM-I is well accepted by patients and with low reports of dropout from trainings (Clerkin & Teachman, 2011).

In utilizing CBM-I past research has employed a word completion task designed to have participants imagine themselves in scenarios intended to elicit negative OC-relevant interpretations (Beadel, Smyth & Teachman, 2014; Clerkin and Teachman, 2011; Williams & Grisham, 2013). In the active training condition participants are presented with common obsessional thoughts, and then presented with a following sentence reducing the impact of the previous statement. Then before moving on, the participant must "fill-in" missing letters for a key word crucial to the interpretation of the sentence. This ensures the participant reads the sentence and understands the meaning (e.x. "*You and a friend are having a personal discussion. You tell her that you sometimes have bizarre thoughts about hurting people you care about – thoughts you don't really want to have. Your friend tells you this is really nor_al*"). The neutral condition differs in that participants are not provided with a disconfirming thought, and completes a word in-line with an OC-relevant interpretation (e.x. in the sentence above the word "*we_rd*" is used instead of "*nor_al*"). Utilizing this "sentence paradigm" across five experiments, Mathews and Mackintosh (2000) confirmed that this experimental procedures was successful in producing in participants the intended pattern of interpretation; either modified interpretations in the active group, or no change in interpretation in the control group (MacLeod & Clark, 2013).

A study by Clerkin and Teachman (2011), utilized CBM-I to evaluate whether non-clinical participants high in OC symptoms could be trained to attribute less significance and

adopt healthier interpretations towards their intrusive thoughts. The authors split participants into either Positive (n = 50) or Neutral (n = 50) CBM-I conditions and tested whether this training influenced participants' later responses to an OC-stressor task (a task designed to provoke distress and urges to engage in a compulsion or neutralization behavior). The positive group was always required to resolve an ambiguous scenario in a manner inconsistent with an OC interpretation (e.g. would need to fill in the word "normal" in regards to worries about the strangeness of obsessional thoughts), while the neutral group were required to solve half the scenarios inconsistent with an OC interpretation, and half consistent with an OC interpretation. What the researchers found was those participants high in OC symptoms, and placed in the positive bias interpretation training condition endorsed healthier OC-relevant interpretations and beliefs following training (compared to a neutral training group), and reported less negative emotion during a following stressor task after controlling for baseline negative affect.

Similarly, a study by Williams & Grisham (2013) testing the efficacy of CBM-I for OC symptoms recruited 89 non-clinical participants and assigned them to either a positive CBM-I condition (n = 41) or control CBM-I condition (n = 37). In both conditions participants were provided with an ambiguous scenario and then required to add a letter to complete a key word that determined the meaning of the sentence in a positive or negative manner (e.g. *You are riding the bus home from work. The passenger beside you sneezes so you offer them a tissue. You think to yourself that offering a tissue was a behavior that was k_nd/ r_sky*"). In the positive condition participants filled in words which lead to positive interpretations of the ambiguous situation. The control condition differed in that half of the situations were resolved in a positive manner, while the other half were resolved in a negative manner. Results indicated the participants in the positive condition evidenced changes in interpretation bias towards more positive interpretations

compared to the control condition. Much like the study by Clerkin and Teachman (2011), participants engaged in an OC Stressor task designed to elicit in the importance of thoughts, and participants in the positive condition reported less distress and urge to neutralize compared to those in the control condition. Further, the authors found the severity of participants' OC symptoms at baseline did not moderate the effects of positive interpretation training, thus the training effects were robust (Williams & Grisham, 2013).

A study by Yiend et al., (2014) conducted a double blind randomized controlled study looking at the impact of a single session of CBM-I on depression, and subsequent influence on mood and resilience to stress. The study recruited 40 community individuals seeking treatment of depression and assigned 19 to the active group (CBM-errors intervention) and 21 to the control group (neutral interpretation). Results indicated that a single session of CBM-I was enough to induce positive interpretation bias in clinically depressed individuals, but there was little evidence for changes in mood or stress response. The authors suggest that it is possible additional session of CMB-I for depression could have impacted mood and stress response, but this would have to be investigated in future research. Although this study is not about OCD, the findings add to the literature demonstrating the potential clinical utility of CBM-I in changing interpretation biases.

A meta-analysis was conducted by Hallion and Ruscio (2011) on the effectiveness of CBM on cognitive biases, anxiety and depression. The authors reviewed 45 studies, which incorporated over 2,591 participants, and found that CBM-I's ability to impact biases displayed a large effect size of ($g = 0.81$), while CBM-A effect size was much smaller ($g = 0.29$). These findings were not impacted by the clinical characteristics of the sample, the number of training sessions, or type of control group. Additionally, both forms of CBM had a small but significant

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effect on symptoms in posttests (g = 0.13, p < .001). The authors note that the effect sizes for symptom change in CBM studies does not match effect sizes in empirically supported treatments for anxiety disorders, but the effect sizes show promise as possible complementary interventions administered in conjunction with traditional psychotherapy (Hallion & Ruscio, 2011).

There is strong support for the ability of CBM procedures to change interpretation bias in different pathologies (Amir, Beard, Burns, & Bomyea, 2009; Lang, Moulds, Holmes, 2009; Rapee et al., 2013; Williams et al, 2013; Yiend et al., 2014), and these changes in interpretation bias are reliably accompanied by decreases in both distress and impairment (Mathews & Mackintosh, 2000; MacLeod, 2012). Consistently participants report high acceptability with the CBM procedures (Clerkin & Teachman, 2011), and along with the growing findings in the efficacy for CBM-I for OCD (Clerkin and Teachman, 2011; Williams & Grisham, 2013), the training displays promise as a potential complementary intervention to current empirically supported interventions in the disorder (Hallion & Ruscio, 2011). Yet, before any further assertions can be made to incorporate CBM-I into OCD treatment further support for its ability to lower relevant OC-related cognitions is needed.

OCD Treatment and Limitations

Currently, the most efficacious treatment of OCD is exposure and response prevention (ERP), yet some patients find this treatment unacceptable even before beginning it (Foa et al., 2005). A treatment is only effective if it is able to be applied, thus it is imperative that treatments for OCD continually display efficacy but also improve in acceptance by patients. Other hindrances to OCD treatment include insufficient gains from therapy (Eddy, Dutra, Bradley, & Westen, 2004), relapse following treatment (Riggs & Foa, 1993), or failure to respond in ERP in about 25-45% patients (Franklin, Abramowitz, Kozak, Levine & Foa, 2000;

Riggs & Foa, 1993; Stanley & Turner, 1995). Additionally, it is not uncommon for those with OCD to wait between 7-10 years before initiating treatment (Marques et al., 2010; Rasmussen & Tsuang, 1986), and even when OCD sufferers seek treatment, they are rarely receiving well-established, efficacious treatment from a competent therapist (Marques et al., 2010; Stobie et al., 2007).

Some patients are unwilling to engage in any form of cognitive or behavioral treatment. For these patients utilizing medications to reduce obsessions might be a viable first step before enticing them to begin CBT (Barlow, 2002). Medication use for OCD have demonstrated increases in symptom relief, yet there are some significant issues, such as, 1) any gains from medication use for OCD vanish if medication is stopped (Eddy et al., 2004)., 2) there are some unfavorable side effects for patients because of their use (i.e. SRI, MAOI, Tricyclic use) (Abramowitz, Franklin, & Foa, 2002; Eddy et al., 2004)., and 3) even if symptoms do decrease, they could still remain at a clinically significant level (Eddy et al., 2004). Moreover, research devoted to enhancing the effects of psychological and pharmacological treatments has shown negligible effects, and specifically a combination of ERP and clomipramine is not superior to ERP alone (Foa et al., 2005).

In acknowledging the limitations of the current treatments for OCD, without question, there is a great need to improve them and create viable supplements and/or alternatives. Improvements and advances can be approached by both increasing treatment acceptability to sufferers and by ensuring treatment dissemination, which may be in the form of shorter targeted treatments. In this line of thought, assessing the potential value of utilizing additive or alternative treatments in OCD - such as CBM-I - is important to consider and research. This is not without precedent, as Abramowitz et al, (2005) reported decreases in dropouts in exposure-

based treatments were accompanied by inclusion of cognitive techniques. CBM-I has displayed great efficacy in changing cognitive biases in various disorders, and is highly accepted by participants, thus it is a logical choice to further research as a potential treatment in OCD.

Why choose TAF for the current interpretation training study?

There are several reasons to specifically target TAF with CBM-I in the current study. First, TAF has been shown as an important cognitive bias in OCD (Thompson, 2013); especially, cognitive theories of OCD highlighting TAF's contributing role in the maintenance of obsessional intrusions and their negative experiences. Second, research has indicated that TAF is a malleable cognitive process that is responsive to interventions, even those using a brief psychoeducational procedure (Marino-Carper et al., 2010; Rassin et al., 2001, Thompson, 2013; Zucker et al., 2002). Third, TAF is an interpretation bias that is specifically linked to triggering events (i.e., obsessional thoughts), which makes it a good candidate for applying the CBM-I paradigm. Therefore, a targeted intervention aimed at modifying interpretations of obsessional thoughts linked to TAF appears likely to help those high in OC symptoms decrease their TAF belief, and potentially lowering the severity of their intrusive thoughts as well.

The novelty in the current proposal was the utilization of computers in CBM-I for TAF. The use of computerized interventions is becoming more and more common for various disorders, as computers have the potential to help reach people without psychological resources geographically close to them, treatments can be done in the privacy of one's home, and CBM-I is generally well accepted by patients.

The current study

The Objective and hypotheses of the Current Study

The study recruited UWM undergraduates (n=39) who displayed high OC symptoms and randomly assign them to either the active or control training conditions. The active condition is TAF Modification (TAFMOD), designed to decrease TAF linked to obsessional thoughts. The maintenancecondition is TAF Maintenance (TAFMAN), designed to sustain TAF-like interpretation of obsessional thoughts. We sought to test the following hypotheses:

1) There will be a reduction in TAF from baseline to post in the TAFMOD group, while no significant change in TAF from baseline to post will be displayed in the TAFMAN group.

2) Those in the TAFMOD group will display greater reductions in (1) the severity of overall obsessional symptoms and (2) the severity of the primary (= the most distressing) obsession. As an exploratory hypothesis, if we find significant reductions in emotional distress, obsessional frequency, or obsessing severity, we will examine whether these reductions are associated with changes in TAF.

3) Individuals in the TAFMOD group will report an ease of use, as well as overall favorable reactions to this intervention (Treatment Acceptability Questionnaire).

Methods

Eligibility and Recruitment

UWM undergraduates who are at least 18 years old and who were interested in the study completed the study's online consent form, as well as the OCI-R and TAFS (online prescreening measures) through the SONA website. UWM undergraduates who completed the online consent and the prescreening measures and display OC symptoms by either (A) either a score of 21 and over on the OCI-R (Foa, et al., 2002), or a score of 4 or higher on the obsessing subscale of the OCI-R (Foa, et al., 2002), and (B) a score of 21 or higher on the TAFS, were invited to sign-up

for a study appointment through SONA. There are no established cutoff scores for the TAFS, but using pilot study data using a cutoff of 21 eliminated the bottom third of participants, and ensured those who progressed further in the study had a level of TAFS at baseline which was able to be potentially improved by post assessment. Additionally, individuals whose primary language is not English were not included in the study. Assessment and training programs are all written in English (we are not able to present a version in another language) – it is important for participants to understand subtlety of slightly varying vignettes in the training program. Taken together, recruited 39 students with elevated OC symptoms and TAF beliefs who took part in an initial computerized screening and determined eligible.

Participants

Thirty-nine non-clinical students at the University of Wisconsin-Milwaukee (UWM) a participated in the current study in exchange for course credit and a ten dollar gift card. The mean age of participants was 26 years (SD = 8.87), and participants were predominately female (76.9%). The sample was composed of a variety of ethnic and racial characteristics (with multiple selections allowed): 56.4% White, 28.2% Black, 12.8% Asian or Pacific Islander, 2.6% Native American, and of these 7.7% identified as Hispanic, and 2.6% Multiracial.

Measures

<u>*Self-Report Measures:*</u>

The *Thought-Action-Fusion Scale (TAFS) (Shafran, Thordarson, & Rachman, 1996)* is a 19 item self-report measure which assesses the degree to which a person lends importance and responsibility to a variety of intrusive and distressing thoughts containing moral and likelihood themes. The measure uses a 5-point scale ranging from 0 (Disagree Strongly), to 4 (Agree Strongly). There are 12 moral TAF questions and 7 likelihood TAF questions. TAFS Likelihood

Example: *"If I think of myself falling ill, this increases the risk that I will fall ill."* TAFS Moral

Example: *"Thinking of cheating in a personal relationship is almost as immoral to me as*

actually cheating." The scale provides a moral TAFS subscale score (TAF-M), a likelihood

TAFS subscale score (TAF-L), and an overall total score used to determine overall severity.

There are no cutoff scores but higher TAFS scores are indicative of higher rates of TAF

cognitions (Shafran et al., 1996). In student and community samples the TAFS-L scale is broken

down into the TAFS-LS scale (likelihood to self) and the TAFS-LO (likelihood to others)

because various studies have shown that although both TAFS-LS and TAFS-LO are both

associated with OC symptomatology (Berle & Starcevic, 2005), and TAFS-LO's association is

particularly strong (Shafran et al., 1996). The three scale model has displayed moderate to strong

association between the scales (*r=.25 - .69*; Abramowitz, Whiteside, Lynam, & Kalsy, 2003;

Bailey, Wu, Valentiner, & McGrath, 2014; Coles, Mennin, & Heimberg, 2001; Rassin,

Merkelbach et al., 2001). The TAFS was used as a primary outcome measure at baseline, after

each IT session, and during post-training assessment to determine changes in overall TAF

severity (TAF total score), but also changes in moral TAF (TAF-M) and likelihood TAF (TAF-

L) scores.

The *Obsessive-compulsive Inventory Revised (OCI-R) (Foa et al., 2002)* is an 18-item

measure of OCD symptoms. Participants rate the degree to which they have been bothered by

OCD symptoms in the past month on a 5-point scale from 0 ("Not at all") to 4 ("Extremely").

The measure assesses six types of symptoms: (1) Washing, (2) Checking, (3) Obsessing, (4)

Mental neutralizing, (5) Ordering, and (6) Hoarding. A score of 21 or greater is a recommended

cutoff for the presence of OC symptomatology (Foa et al., 2002). The OCI-R was administered

to assess the severity of obsessing, as well as the overall severity of OC symptoms.

The *Yale-Brown Obsessive Compulsive Scale Checklist (Y-BOCS Checklist) (Goodman et al., 1989)* is a 57 item self-report measure which identifies *current* and *past* obsession and compulsions. The obsession checklist of the Y-BOCS includes various domains of mental intrusions: (a) Aggressive Obsessions, (b) Contamination Obsessions, (c) Sexual Obsession, (d) Hoarding/Saving Obsessions, (e) Religious Obsession, (f) Symmetry or Exactness, or (g) other Miscellaneous Obsessions. The Y-BOCS Checklist will serve to identify the primary obsession for each participant (i.e., the most distressing obsession chosen by the participant), and this obsession was used during the POETS.

The *Primary Obsession Evaluation of TAF Scale (POETS)* is an author-constructed self-report scale which is designed to assess the participant's TAF emotional reaction toward their primary obsession. The TAFS measures general TAF interpretations, and the POETS was constructed as there was no measure to assess TAF-relevant emotional and cognitive reactions toward a specific (primary) obsessional intrusion. In using the POETS a study clinician helps the participant identify their primary obsessive thought using the participant's Y-BOCS Obsession Checklist as a guide, and asking about any "current" endorsed obsessions. (See appendix C for measure details). The scale uses a 7-point scale from 0 ("not distressing at all"), to 6 ("extremely distressing") in regards to the primary obsessional thought (causing the most distress). The scale uses the main obsessional thought and then asks questions in 3 domains (5 questions each): (1) General Emotional Reactions, (2) Moral TAF, and (3) Likelihood TAF. In considering the primary obsessional the 3 domains were created in relevance to the TAF construct as the general emotional reaction domain gauges comfort with the presence of the thought, the moral domain gauges the moral implications of the thought to the individual, and the likelihood domain gauges the belief to which having the thought will cause it to occur.

The *Revised Obsessional Intrusions Inventory* (*ROII) (Purdon & Clark, 1993; Purdon & Clark, 1994)* is a 52 item measure of the <u>frequency</u> of obsessional intrusive thoughts, images, and impulses. Participants rate the frequency of each of the 52 obsessional thoughts on a 7-point scale from 0 ("I have never had this thought"), to 6 ("I have this thought frequently throughout the day"). The measure was used at baseline and post-training assessment to determine changes in the frequency of obsessional thoughts, images, and impulses of the participants.

The *Revised Obsessional Intrusions Inventory - Distress (ROII-Distress)* is a 52 item self-report measure, modified from the original ROII by the study authors, to assess how <u>distressing</u> various intrusive thought, images, and impulses *would be* to the participant in the event of their intrusion. Participants rate the distress associated with different thoughts on a 7-point scale from 0 (Not Distressing), to 6 (Extremely Distressing). Unlike the original ROII, the ROII-Distress does not use a time frame as the obsessive thoughts, images, or impulses may not have occurred to the participant yet, but asks instead *if* the thought occurred what their level of distress would be. The measure was used at baseline, after each CBM-I training, and at the post-training assessment to determine any changes in the distress participants report to various obsessional thoughts, images, and impulses.

The *Depression Anxiety Stress Scale (DASS-21) (Lovibond & Lovibond, 1995)* is a 21 item self-report scale that measures the extent the participant is experiencing three emotional states (depression, anxiety, and stress) and asks 7 items for each emotional state. The measure uses a 4-point scale ranging from 0 ("did not apply to me at all"), to 3 ("applied to me very much, or most of the time"). This measure was given at baseline and post-training assessments to determine any changes in emotional states pre and post study IT.

The *Treatment Acceptability Questionnaire (TAQ) (Hunsley, 1992)* is a 6-item self-report measure which is modified by the study authors from the original 6-item TAQ to instead inquire about training acceptability (modified from "treatment acceptability") and study staff (modified from "treatment provider"). The measure is given after each IT and at the post-training assessment to examine the participant's experience and opinion with the study IT and study staff. Each question is on a 7-point scale with responses closer to 1 more negative and responses closer to 7 more positive.

Clinician Administered Measures

The *Yale-Brown Obsessive Compulsive Scale (Y-BOCS) (Goodman et al., 1989)* is a 12-item semi-structured interview designed to assess the severity, belief in, and details about the patient's most upsetting obsessions and compulsions. Each item is scored ranging from 0 (not present), to 4 (extreme symptoms). The scale provides totals for both obsessions and compulsions, with both added together to create a total score, where a cutoff of 16 is generally used to identify clinically symptomatic levels of OCD. This scale is used at baseline and post-training assessments by a study clinician as the primary measure of OC symptom severity in participants.

The *Mini International Neuropsychiatric Interview (M.I.N.I) (Sheehan et al., 1998)* is a clinician administered semi-structured interview addressing emotional disorders (anxiety and depressive disorders), eating disorders, substance use, alcohol use, and psychotic symptoms. This measure was used to determine psychopathology and comorbidity of disorders in study participants.

The *Clinical Global Impression Severity & Improvement Scale (CGI-S & CGI-I) (Guy, 1976).* The CGI-S is a 1 question clinician rated scale in which the participant's illness (i.e.

OCD) is rated based on the clinician's experience with other participants with the same disorder. The CGI-S is on a 7-point-scale from 1 (normal) to 7 (extremely ill) and is given at both the baseline and post-training. Whereas, the *CGI-I* is a report on the participant's improvement or worsening of symptoms based on the participant's baseline score. The CGI-I on a 7-point-scale from 1 (much improved) to 7 (very much worse) and is only given at the post-training assessment.

Interpretation Training (Active Training vs. MaintenanceTraining)

The current study used a computerized interpretation training version of the procedures in the "word completion task" used in past research (Clerkin and Teachman, 2011; Williams & Grisham, 2013; Beadel et al., 2014) which presents a statement to the participant meant to elicit either moral or likelihood TAF.

In the active condition participants are presented with an obsessional thought meant to elicit either moral or likelihood TAF, and then presented with a following sentence reducing the impact of the previous statement. Before the participant is able to move on they must fill-in a missing letter inside a key word for the interpretation of the sentence. Example: *I was eating lunch with my best friend. All of a sudden, a thought of poking my friend's eye with my fork came into my head. Having this thought in my mind is (meani_gless), as everyone has these thoughts but they almost never lead to any action.* If the participant fails to fill in and correctly spell the key word they are given an error message and told to try again. This procedure ensures that the participant reads each sentence and understands the meaning.

The maintenance condition differs in that participants are not provided with a disconfirming sentence, and instead are provided with a sentence in line with TAF beliefs.

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Example: *I was eating lunch with my best friend. All of a sudden, a thought of poking my friend's eye with my fork came into my head. Having this thought in my mind is (unaccept_ble). If my friend knew what I was thinking he/she would have thought I am dangerous and unpredictable.* Like the active condition, participants are unable to move on until they correctly solve the word with the missing letter.

In both the TAFMOD and TAFMAN conditions participants worked on a computer through 80 randomized distressing thought scenarios as part of their interpretation training. Each time the participant is successful in completing the incomplete word they are presented on the next page with one sentence of encouragement, and then proceed to the next thought scenario on the next page. The first interpretation training took take place on the same day as the baseline assessment. The following 2 trainings were sent to the participants through a secure links pasted into emails. If participants do not have an Internet-connected computer at home, they were guided to complete this training procedure in our laboratory.

Procedures

     Pre Screening.

General information about the study is found on the UW-Milwaukee online research study participation site (SONA) and those interested were directed to the study's prescreening consent form. Once an electronic signature is provided participants were automatically presented with an electronic version of the OCI-R and TAFS. Participants at or above the OCI-R cutoffs (total score $\geq$ 18, or obsessing scale $\geq$ 5) and TAFS cutoff (total score $\geq$ 21) were contacted by study staff and asked to set up a baseline assessment appointment. Participants below the cutoff scores were sent an email thanking them for their interest but informing them they are not eligible.

Pre-Training Assessment

The RA obtained a signature on the main study consent form, after answering of the participant's any questions or concerns. Participants then preceded though computerized self-report questionnaires which included a demographics questionnaire, contact information sheet (to gain primary email and phone numbers), and self-report measures containing the Y-BOCS checklist, TAFS, revised ROII-Distress Assessment Scale, ROII-Frequency Assessment Scale, DASS, OCI-R, and POETS. These self-report questionnaires took participants between 30 minutes to 1 hour to complete. Importantly, participants were instructed to let the study staff know when they reached the POETS (the final self-report measure), as at this point an IE spook with the participant, using their responses on the Y-BOCS checklist, to confirm a primary obsessive thought for the POETS. Next the study IE conducted the M.I.N.I. to screen for potential emotional, substance, or eating disorders, the Y-BOCS Severity form in order to obtain initial levels of OC distress and impairment, and the CGI-S for clinical severity of OC symptoms.

Randomization

Following the baseline assessment, using a preset computerized randomization list, participants were be randomized to either the TAFMOD or TAFMAN conditions.

Interpretation Training and Process Measures

Following randomization participants started their appropriate CBM-I condition training (TAFMOD or TAFMAN). Each training session and accompanying measures took about 21 minutes to complete (SD = 9.2), with a range from 12 to 44 minutes.

After each training session participants completed process measures to evaluate potential changes in relevant variables which may change following CBM-I: the TAFS to assess TAF

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belief, the ROII-Distress Assessment Scale to assess emotional reactions, the POETS to assess their emotional reactions to their primary obsessional thought, the PANAS to assess current mood, and the TAQ to determine how acceptable treatment was to the participant.

The second and third trainings (along with corresponding process measures) were emailed to participants five days after completing their previous training, and participants were instructed to complete each individual training in one sitting in a private and quite location.

Post-Training Assessment

The Post-Training Assessments were scheduled to occur at least three days after the third training was completed. In the rare instances when a participant does not finish all 3 study trainings in an acceptable amount of time (around three weeks) we still invited them to the lab to conduct this post-training assessment.

The Post-Training assessment measures procedures are identical to the baseline assessment except the M.I.N.I. only included the OCD module and any other positively endorsed modules from the baseline assessment, and both the CGI-S and CGI-I were rated.

Data Analysis

To test hypothesis 1 (i.e., the effect of TAFMOD vs. TAFMAN on the level of TAF) and hypothesis 2 (i.e., TAFMOD's impact on OC symptoms), we conducted a series of repeated measure ANOVAs, including Group (TAFMOD vs. TAFMAN) and Time (Pre-training vs. Post-training assessment). A significant Group by Time interaction in these analyses would indicate differential change in the target outcome variable (e.g., TAF or obsessional severity) between the two training conditions. However, despite the multiple comparisons (i.e., repeated measure ANOVAs on TAF), severity of overall mental intrusions (i.e. distress, frequency, and overall severity), and severity of primary obsession, we did not apply a Bonferroni correction. The

Bonferroni correction is intended to reduce Type I errors when multiple tests or comparisons are conducted, but it also would cause a decrease in power for the study (Moran, 2003; Nakagawa, 2004; Verhoeven, Simonsen & McIntyre, 2005). At this exploratory stage in this line of work it is important to examine many relevant outcome variables and the Bonferroni correction is too stringent, especially when effect sizes and p-values will be reported for each analysis.

To test hypothesis 3, that those in the TAFMOD condition would report an ease of use and favorable reaction to CBM-I, we examined TAQ data at a descriptive level (TAQ domains: 1. Acceptability, 2. Ethics of procedure, 3. Effectiveness of training, 4. Possible side effects, 5. knowledge of study staff, 6. Trustworthiness of study staff). There are no established cutoff scores for the author modified TAQ so statistical analysis would be unreliable. Also, evaluation of treatment acceptability and experience in the TAFMAN group is not relevant; thus, only the TAFMOD group was examined for the treatment experience.

The study aimed to recruit 17 participants for both the TAFMAN and TAFMOD group. In consideration that there is a lack of previous research on the effects of CBM-I on TAF or other relevant outcomes, we assumed a standard medium effect size for power analyses (f=.25). For the clinical utility of the training program, we aimed to detect at least a moderate size of training effect on the reduction of TAF/OC symptoms. In close approximation to our study design, when using a repeated measure ANOVA (2 assessment time points and 2 training conditions), with an $\alpha = .05$, a correlation of .5 among repeated measures, and a nonsphericity correction of 1.0. Based on this power analysis, the required sample size is 17 per group to achieve the power of .80 in detecting a medium-sized Group by Time interaction effect ($f =.25$, which corresponds to $\eta^2_p =.06$) on change in TAFS (Hypothesis 1) or change in obsessional symptom indices (Hypothesis 2). After taking into account an approximate 20% patient attrition (n=6), a total of

40 recruited participants (= 20 per group) would offer an adequate sample size to detect a medium size of effects.

Results

Participants

There were 186 UWM undergraduate students who completed the online prescreen for the study, 91 were eligible to participate, and 39 completed a baseline assessment and were randomized. Of the 39 eligible, 22 were allocated to the TAFMOD group and 17 to the TAFMAN group. Of those in the TAFMOD group, 16 finished all the study procedures, while 10 of the TAFMAN group did the same. For those who dropped from the study there is no clear understanding of the exact reason, they simply became unresponsive to messages and prompts to continue with the study. Two participants in the TAFMAN group withdrew. One participant withdrew before randomization because she became too overwhelmed when speaking about a period of depression during the MINI, and the second participant decided after being randomized that he did not have the time or interest in completing the rest of the study procedures.

Unfortunately, due to slow recruitment and some participant dropout currently the study has 16 TAFMAN and 10 TAFMOD participants who completed all study procedures. Given the sample size of 26 the actual power in the study lowered to .69.
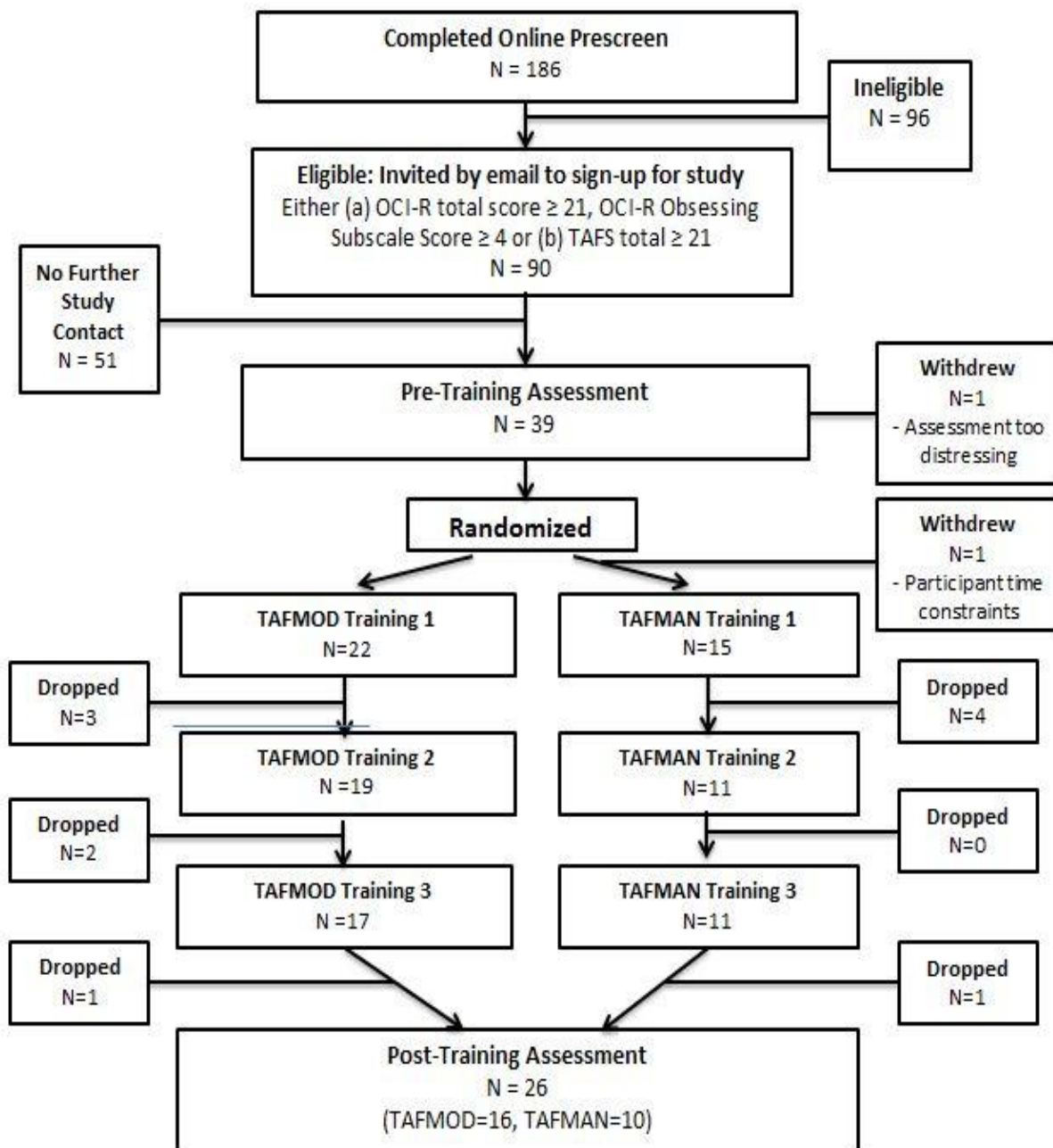
Consort Diagram

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Figure 1. Participant Study Flow and Randomization

Demographics and Baseline Characteristics

Comparing the demographic and baseline characteristics of all those who were randomized, the two groups did not differ in respect to gender ($p = .67$), age ($p = .18$), ethnicity ($p = .36$), marital status ($p = .18$), past psychological treatment obtained ($p = .74$), or current psychological treatment ($p = .46$).

Table 1
Baseline Demographics of All Eligible Participants

	TAFMOD n = 22	TAFMAN n = 17	Fisher's Exact Test or T-test (2-sided)
Gender			$p = .67$
Female	16 (72.7)	13 (86.7)	
Male	6 (27.3)	2 (13.3)	
Age	X=26.64 (SD=8.9)	X=23.47 (SD=6.2)	$t (37) =1.37$
Ethnicity			$t (37) = -.93$
White	11 (50.0)	10 (66.7)	
Black	9 (40.9)	1 (6.7)	
Asian	2 (9.1)	3 (20)	
Pacific Islander	0 (0)	0 (0)	
Native American	0 (0)	0 (0)	
Multiracial	0 (0)	0 (0)	
Hispanic/Latino	1 (4.5)	1 (6.7)	
Marital Status			$p = .57$
Never Married	16 (72.7)	14 (93.3)	
Married	3 (13.6)	0 (0)	
Divorced/Annulled	3 (13.6)	1 (6.7)	
Past Psych Treatment			$p = .74$
Yes	13 (59.1)	11 (73.3)	
Talk Therapy/Counseling	13 (59.1)	10 (66.7)	
Drug Therapy	5 (22.7)	8 (53.3)	
Other	0 (0)	0 (0)	
Current Psych Treatment			$p = .46$
Yes	5 (22.7)	6 (40)	
Talk Therapy/Counseling	4 (18.2)	4 (26.7)	
Drug Therapy	3 (13.6)	5 (33.3)	
Other	0 (0)	0 (0)	

Note. Percentages presented in brackets (%)

Comparing the demographic and baseline characteristics of all those who were study

completers, the two groups did not differ in respect to gender ($p = .12$), age ($p = .34$), ethnicity ($p = .53$), marital status ($p = .48$), past psychological treatment obtained ($p = .68$), or current

psychological treatment ($p = 1.0$).

Table 2
Baseline Demographics of Study Completers

	TAFMOD n = 16	TAFMAN n = 10	Fisher's Exact Test or T-test (2-sided)
Gender			$p = .12$
Female	11 (68.8)	10 (100)	
Male	5 (31.2)	0 (0)	
Age	X=26.06	X=23.20	$t (24) = .96$
	(SD=7.77)	(SD=6.6)	
Ethnicity			$t (24) = .63$
White	9 (56.3)	7 (70)	
Black	6 (37.5)	1 (10)	
Asian	1 (6.3)	2 (20)	
Pacific Islander	0 (0)	0 (0)	
Native American	0 (0)	0 (0)	
Multiracial	0 (0)	0 (0)	
Hispanic/Latino	0 (0)	0 (0)	
Marital Status			$p = .48$
Never Married	12 (75)	9 (90)	
Married	2 (12.5)	0 (0)	
Divorced/Annulled	2 (12.5)	1 (10)	
Past Psych Treatment			$p = .68$
Yes	9 (56.3)	7 (70)	
Talk Therapy/Counseling	9 (56.3)	6 (60)	
Drug Therapy	4 (25)	5 (50)	
Other	0 (0)	0 (0)	
Current Psych Treatment			$p = 1.0$
Yes	5 (31.5)	3 (30)	
Talk Therapy/Counseling	4 (25)	3 (30)	
Drug Therapy	3 (18.8)	3 (30)	
Other	0 (0)	0 (0)	

Note. Percentages presented in brackets (%)

Training Data

The two groups were very similar in the manner in which they engaged in training, with the

TAFMOD group completing slightly more trainings on average (TAFMOD mean = 2.68,

TAFMAN mean = 2.29), average time to complete a training (TAFMOD mean = 19.16,

TAFMAN mean = 17.42), the percent of participants who completed all three trainings

(TAFMOD mean = 77.3, TAFMAN mean = 64.7), and average number of days to complete all

study procedures (TAFMOD mean = 25.5, TAFMAN mean = 21.8).

Table 3
Interpretation Training Information

	TAFMOD	TAFMAN
Avg. # Training Sessions Completed	2.68	2.29
Avg. Completion Time (mins)		
Training 1	21.10	20.25
Training 2	16.50	18.00
Training 3	19.89	14.00
Participants Completed (%)		
Training 1	100	88.2
Training 2	86.4	64.7
Training 3	77.3	64.7
Avg. Days Between Trainings		
T1 to T2	8.17	6.36
T2 to T3	6.53	4.73
T3 to Post	12.44	10.45
Baseline to Post	25.5	21.8

Note. Avg. =Average, (%) = Percent, Mins = Minutes

Table 4

ANOVA of Study Measures at Pre-Training and Post-Training Assessments

	TAFMOD		TAFMAN		Group				Time				Group x Time			
	Pre	Post	Pre	Post												
Measure	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	df	F	η_p^2	p	df	F	η_p^2	p	df	F	η_p^2	p
TAFS Total	40.00 (10.63)	23.63 (14.54)	41.10 (11.35)	28.70 (15.82)	1,24	0.52	0.02	0.48	1,24	21.27	0.47	0.01	1,24	0.41	0.02	0.53
TAF Moral	27.69 (9.66)	16.13 (10.00)	25.50 (8.34)	20.00 (10.60)	1,24	0.06	0.01	0.81	1,24	19.83	0.45	0.01	1,24	2.5	0.09	0.13
TAFS Likelihood	12.31 (6.93)	7.50 (7.94)	15.60 (5.46)	8.70 (7.59)	1,24	0.81	0.03	0.38	1,24	16.54	0.41	0.01	1,24	0.53	0.02	0.48
OCIR Total	28.58 (12.29)	21.00 (14.42)	28.40 (6.79)	22.20 (12.66)	1,24	0.01	0.01	0.92	1,24	9.85	0.29	0.01	1,24	0.11	0.01	0.74
OCIR Obsess	4.38 (2.33)	3.06 (2.29)	4.30 (2.31)	3.00 (2.26)	1,24	0.01	0.01	0.93	1,24	7.22	0.23	0.01	1,24	0.01	0.01	0.99
YBOCS Total	12.00 (8.34)	10.29 (7.26)	16.80 (5.65)	12.70 (8.12)	1,22	1.52	0.07	0.23	1,22	7.95	0.27	0.01	1,22	1.34	0.06	0.26
YBOCS Obsession	5.07 (3.63)	4.64 (3.79)	8.10 (2.77)	6.00 (4.32)	1,22	2.36	0.1	0.14	1,22	5.77	0.21	0.03	1,22	2.52	0.10	0.13
YBOCS Compulsion	6.93 (5.15)	5.64 (4.19)	8.70 (3.80)	6.70 (6.41)	1,22	0.59	0.03	0.45	1,22	3.39	0.13	0.08	1,22	0.16	0.01	0.69

					df	F	η²	p	df	F	η²	p	df	F	η²	p
ROII Frequency	107.86 (52.18)	105.43 (38.59)	98.67 (26.12)	96.56 (34.31)	1,21	0.3	0.01	0.59	1,21	0.15	0.01	0.71	1,21	0.01	0.01	0.98
ROII Distress	190.88 (85.65)	144.13 (77.16)	163.00 (84.82)	119.60 (60.85)	1,24	0.94	0.04	0.34	1,24	7.44	0.24	0.01	1,24	0.01	0.01	0.92
POETS Total	57.31 (21.91)	46.25 (22.15)	69.80 (16.76)	55.50 (20.99)	1,24	1.88	0.07	0.18	1,24	18.97	0.44	0.01	1,24	0.31	0.01	0.58
POETS GE	23.31 (7.49)	20.38 (8.24)	26.10 (7.95)	22.40 (6.58)	1,24	0.72	0.03	0.41	1,24	7.51	0.24	0.01	1,24	0.1	0.01	0.76
POETS Moral	15.44 (9.58)	11.81 (8.25)	20.90 (7.75)	14.60 (10.67)	1,24	1.46	0.06	0.24	1,24	14.05	0.37	0.01	1,24	1.02	0.04	0.32
POETS Likelihood	18.56 (7.36)	14.06 (8.39)	22.80 (7.05)	18.50 (5.93)	1,24	2.65	0.1	0.12	1,24	10.63	0.31	0.01	1,24	0.01	0.01	0.94
DASS Total	76.13 (29.13)	66.13 (23.33)	76.00 (22.05)	75.40 (23.59)	1,24	0.28	0.01	0.6	1,24	1.04	0.04	0.32	1,24	0.82	0.03	0.38
DASS Depression	23.75 (10.75)	20.75 (7.89)	25.60 (7.71)	27.40 (12.26)	1,24	1.57	0.06	0.22	1,24	0.09	0.01	0.77	1,24	1.46	0.06	0.24
DASS Anxiety	22.88 (8.97)	19.25 (7.99)	22.00 (8.42)	21.80 (6.70)	1,24	0.08	0.01	0.78	1,24	1.46	0.06	0.24	1,24	1.17	0.05	0.29
DASS Stress	29.50 (11.72)	26.13 (9.37)	28.40 (9.23)	26.20 (8.24)	1,24	0.07	0.79	0.79	1,24	0.07	0.79	0.79	1,24	0.07	0.01	0.79

Hypothesis 1 - TAF Time and Condition Comparison ANOVA

To test hypothesis 1 we conducted a series of repeated measure ANOVAs on TAFS total scores and its subscales (likelihood and moral), including Time (Pre-training vs. Post-training assessment) and Condition (TAFMOD vs. TAFMAN) (see Table 4). For TAFS total scores, the Group X Time interaction was not significant, $(F(1,24) = .406 , p = .530, \eta_p^2 = .02)$. There was not a significant main effect of group, $(F(1,24) = .52 , p = .48, \eta_p^2 = .02)$, but there was a significant main effect of time $(F(1,24) = 21.27 , p = .001, \eta_p^2 = .47)$. Both groups experienced significant reductions in TAFS from baseline to post (TAFMOD 41.9% reduction, TAFMAN 30.2% reduction) (see Figure 2).

The TAFS Moral subscale interaction of Group by Time, displayed a non-significant trend, $(F(1,24) = 2.503, p = .127, \eta_p^2 = .09)$, with a small-sized effect size. When comparing mean score change between the groups, the TAFMOD group experienced significant reductions (M = 16.13, SD = 10.00, 41.8%), while the TAFMAN groups TAF Moral scores experienced moderate reductions (M = 30.00, SD = 10.60, 21.6%) (see Figure 3).

In looking at the TAFS Likelihood subscale, the interaction of Group by Time was not significant, $(F(1,24) = .525, p = .476, \eta_p^2 = .02)$, but both TAFMOD (M = 7.50, SD = 7.94, 39.1% reduction) and TAFMAN (M = 8.70, SD = 7.59, 44.3% reduction) experienced significant drops in scores (see Figure 4).

Hypothesis 2 – TAFMOD will display greater reductions in overall obsessional severity (frequency or distress) and the severity of primary obsession.

To test hypothesis 2 (i.e., TAFMOD's impact on obsessional severity), we conducted a series of repeated measure ANOVAs, including a Group by Time interaction for the ROII

Frequency Scale, ROII Distress Scale, and OCI-R Obsession scale (see Table 4). The interaction was not significant for the ROII Frequency Scale ($F(1,21) = .001$, $p = .98$, $\eta_p^2 = .01$) (see Figure 6), ROII Distress Scale ($F(1,24) = .01$, $p = .92$, $\eta_p^2 = .01$) (see Figure 5), and OCIR Obsession Subscale ($F(1,24) = .008$, $p = .93$, $\eta_p^2 = .01$) (see Figure 7). There was not a significant main effect of group, for any of the scales, but there was a significant main effect of time for the ROII Distress ($F(1,24) = 7.44$, $p = .001$, $\eta_p^2 = .24$), and OCIR Obsession Subscale ($F(1,24) = 7.22$, $p = .01$, $\eta_p^2 = .23$), and approaching significance for the ROII Frequency Scale ($F(1,21) = 0.15$, $p = .70$, $\eta_p^2 = .01$). Both groups experienced general reductions in obsessional severity scores in various OC symptom measures from baseline to post, but with no significant group difference.

Primary Obsession Analyses

Next, a Group by Time repeated measures ANOVA was conducted for the primary obsession measure in the study, the POETS. The POETS is broken down by total score, and subscales for general emotionality (GE), moral TAF, and likelihood TAF (see Table 4). The interaction of Group by Time was not significant for the POETS Total Score ($F(1,24) = .309$, $p = .583$, $\eta_p^2 = .01$), and was not for any of the subscales (see Figure 8), POETS GE ($F(1,24) = .099$, $p = .099$, $\eta_p^2 = .01$) (see Figure 9), POETS Moral ($F(1,24) = 1.020$, $p = .323$, $\eta_p^2 = .04$) (see Figure 10), POETS Likelihood ($F(1,24) = .005$, $p = .942$, $\eta_p^2 = .01$) (see Figure 11). There was not a significant main effect of group for any of the scales, but there was a significant main effect of time for POETS Total Score ($F(1,24) = 18.97$, $p = .001$, $\eta_p^2 = .44$), POETS GE ($F(1,24) = 7.51$, $p = .001$, $\eta_p^2 = .24$), POETS Moral ($F(1,24) = 14.05$, $p = .001$, $\eta_p^2 = .37$), and POETS Likelihood ($F(1,24) = 10.63$, $p = .003$, $\eta_p^2 = .31$). It appears that most participants experienced a reduction in their negative reactions toward primary obsession from pre-training to post-training.

Measures of general OCD symptoms

Next, as part of an exploratory set of analyses beyond the second hypothesis, we conducted Group by Time repeated measures ANOVAs of general OCD symptoms for the OCIR total scores, YBOCS total scores, YBOCS Obsession Scale, and YBOCS compulsion scores (see Table 4). The interaction was not significant for the OCIR total score ($F(1,24) = .113$, $p = .740$, $\eta_p^2 = .01$), YBOCS total ($F(1,22) = 1.34$, $p = .26$, $\eta_p^2 = .06$), YBOCS Obsession Scale ($F(1,22) = 2.52$, $p = .13$, $\eta_p^2 = .10$), and YBOCS Compulsion Scale ($F(1,24) = .160$, $p = .693$, $\eta_p^2 = .01$). There was not a significant main effect of group, for any of the scales, but there was a significant main effect of time for the OCIR Total ($F(1,24) = 9.85$, $p = .004$, $\eta_p^2 = .29$), YBOCS Total Score ($F(1,22) = 7.95$, $p = .001$, $\eta_p^2 = .27$), YBOCS Obsession Scale ($F(1,22) = 5.77$, $p = .03$, $\eta_p^2 = .21$), and approaching significance for the YBOCS Compulsion Scale ($F(1,22) = 3.39$, $p = .08$, $\eta_p^2 = .13$). Participants in both groups also experienced reductions of their general OC symptoms from pre-training to post training.

General emotional distress

Finally, a Group by Time repeated measures ANOVA was conducted for the measures of general emotional distress, the DASS and its subscales for depression, anxiety, and stress (see Table 4). The interaction of group by time was not significant for the DASS Total Score ($F(1,24) = .815$, $p = .376$, $\eta_p^2 = .03$), or for any of the subscales, DASS Depression ($F(1,24) = 1.46$, $p = .239$, $\eta_p^2 = .06$), DASS Anxiety ($F(1,24) = 1.173$, $p = .290$, $\eta_p^2 = .05$), and DASS Stress ($F(1,24) = .074$, $p = .788$, $\eta_p^2 = .01$). There was not a significant main effect of group or time with the DASS and any of the subscales.

Hypothesis 3 - General Treatment Acceptability of Training in the TAFMOD Group

In general, participants in the TAFMOD group found the training to be acceptable (mean=4.81, SD=1.38), ethical (mean=5.69, SD=1.49), effective (mean=4.44, SD=1.26), and acceptable (mean=5.38, SD=1.54). Participants also rated the treatment provider as very knowledgeable (mean=6.19, SD=1.11) and very trustworthy (mean=6.00, SD=1.46). Overall, computerized CBM-I treatment appears to be accepted and tolerable for almost all participants, with no participants reporting minimum scores in any domain.

Table 5
TAQ Participant Report of Training Acceptability

	Mean	Std. Deviation
1. Overall, how acceptable did you find the treatment to be?	4.81	1.37
2. How ethical do you think this treatment was?	5.69	1.49
3. How effective do you think this treatment was?	4.44	1.26
4. How acceptable were the side effects of this treatment?	5.38	1.54
5. How knowledgeable do you think your treatment provider was?	6.19	1.10
6. How trustworthy do you think the psychologist was?	6.00	1.46

 Correlations of Mean Change Scores from Pre-Training to Post-Training

First, to look into the relationship of baseline measures scores in TAFS and OC symptom scores we ran a Pearson correlation between the measures (see Table 7). What we observed was a significant positive correlation between TAF total scores and measures of overall OC symptoms (OCI-R), and the frequency of distressing thoughts (ROII Frequency), and a significant correlation with main obsession scores (POETS Total). The two TAFS subscales showed a significant correlation with OC symptoms and frequency of distressing thoughts, yet the subscales differed as only the TAFS Likelihood displayed a significant correlation with the main

obsessional thoughts. The TAFS was not significantly correlated with Clinician YBOCS Total

scores or ROII Distress scores.

To look into the relationship between symptom change scores in TAFS and OC

symptoms, zero-order Pearson correlations were examined among mean change scores from Pre-

Training to Post-Training. What was observed was that change scores from TAF-related

measures (TAFS and POETS) and their subscales were significantly correlated. Changes in

TAFS scores were not significantly correlated with reductions in overall OCD symptoms, as

measured by the OCI-R and Y-BOCS. Reductions in TAF Likelihood was associated with

reduction in overall obsessional frequency (ROII frequency) with a medium effect size ($r = .35$),

which was not significant due to low power. Additionally, a reduction in moral TAF toward the

primary obsession (POETS Moral) was significantly associated with the reduction in YBOCS

Obsession ($r = .53$). Overall the pattern did not show robust associations between changes in TAF

and changes in OC symptoms in the current study sample. Also, the changes in general TAF

beliefs and changes in TAF toward their primary obsessions seem to be associated with OC

symptom change in a different pattern.

Table 6

Pearson Correlations of Mean Change Scores from Pre-Training to Post-Training

	TAF Total	TAF Moral	TAF Likelihood	OCIR Total	Clinician YBOCS Total	POETS Total	ROII Distress
TAF Total	1.00						
TAF Moral	**.85****						
TAF Likelihood	**.69****	0.20					
OCIR Total	**.54****	**.41***	**.45****				
Clinician YBOCS Total	0.18	0.16	0.10	0.20			
POETS Total	**.36***	0.22	**.36***	**.48****	0.32		
ROII Distress	0.17	0.12	0.14	0.18	0.24	0.05	
ROII Frequency	**.51****	**.39***	**.40***	**.47****	**.50****	**.50****	0.20

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 7

Pearson Correlations of Mean Change Scores from Pre-Training to Post-Training

	TAF Total	TAF Moral	TAF Likelihood	OCIR Total	OCI-R Obsession	Clinician YBOCS Total	Clinician YBOCS Obsession	Clinician YBOCS Compulsion	ROII Distress	ROII Frequency	POETS Total	POETS GE	POETS Moral
TAF Total	1												
TAF Moral	.93**												
TAF Likelihood	.86**	.62**											
OCIR Total	.363	.34	.31										
OCI-R Obsession	.15	.19	.06	.67**									
Clinician YBOCS Total	.19	.21	.11	.40*	.44*								
Clinician YBOCS Obsession	.21	.20	.16	.37	.12	.53**							
Clinician YBOCS Compulsion	.10	.13	.04	.25	.44*	.85**	.02						
ROII Distress	.03	.02	.03	-.01	.34	-.03	-.16	.07					
ROII Frequency	.27	.16	.35	.25	.28	.24	.40	.04	.09				
POETS Total	.61**	.48*	.65**	.22	.13	.18	.42*	-.05	.06	.33			
POETS General Emotionality	.46*	.41*	.41*	.41*	.36	.49*	.39	.34	.21	.27	.72**		
POETS Moral	.43*	.31	.51**	.06	-.03	.10	.53**	-.21	-.21	.21	.72**	.24	
POETS Likelihood	.49*	.38	.54**	.05	-.02	-.14	.05	-.19	.14	.25	.80**	.42*	.36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion

Prominent cognitive theories of OCD have directly posited TAF's contributing role in the maintenance of obsessional intrusions and their negative experiences. Additionally, research has consistently reported that TAF is cognitive process that is responsive to interventions (Marino-Carper et al., 2010; Rassin et al., 2001, Thompson, 2013; Zucker et al., 2002). Therefore, developing a targeted intervention aimed at modifying interpretations of obsessional thoughts linked to TAF appeared to be a useful line of research to help those high in emotional problems associated with TAF biases.

Overall, the current results did not show a significant difference between the TAFMOD and TAFMAN group in reducing TAF beliefs and OC symptomatology, although both groups displayed a significant reduction not only in TAFS, but in general OC symptoms as well. Our first hypothesis was that a reduction in TAF from baseline to post in the TAFMOD group would be found, while no significant change in TAF from baseline to post would be displayed in the TAFMAN group. For TAFS total scores, there was no significant Group by Time interaction $[F(1,24) = .406 , p = .530]$ or main effect of group, $[F(1,24) = .52 , p = .48]$. There was only a significant main effect of time $[F(1,24) = 21.27 , p = .001]$. Both groups experienced significant reductions in TAFS from baseline to post (TAFMOD 41.9% reduction, TAFMAN 30.2% reduction). Additionally, on the TAFS Likelihood and Moral subscales, the interaction of Group by Time was also non-significant. On the TAF Moral subscale the TAFMOD scores experienced a large drop (M = 16.13, SD = 10.00, 41.8%), while the TAFMAN groups scores displayed a moderate decrease (M = 30.00, SD = 10.60, 21.6%). Conversely, on the TAF Likelihood subscale both groups experienced significant drops in scores (TAFMOD 39.1% reduction, TAFMAN 44.3% reduction). Taken together, these results indicate that both groups

experienced notable drops in general moral and likelihood TAF from Pre-Training to Post-Training. Notably, the TAFMOD group experienced twice as much of a reduction in moral scores than the TAFMAN group. These findings are in-line with the study hypotheses that TAFMOD is more effective in reducing moral TAF than TAFMAN.

Our second hypothesis was that participants in the TAFMOD group will display greater reductions in (1) the severity of overall obsessional symptoms and (2) the severity of the primary (= the most distressing) obsession. Between the two conditions there was no significant Group by Time interaction for the ROII Frequency scale, ROII Distress scale, the OCIR Obsession scale, or the POETS and any of its subscales. Though, when looking at the main effect of time there were significant reductions (or trend for reductions) in the following measures and their subscales: ROII Distress Scale, ROII Frequency Scale OCIR Obsession Subscale, and POETS (total, GE, moral, likelihood). In an exploratory analyses incorporating measures of general OC symptoms the same pattern existed, where no Group by Time, or Group interactions were significant, but the effect of time was significant for the OCIR Total, YBOCS Total, YBOCS Obsession Scale, and YBOCS Compulsion scores. These findings indicate that the two groups did not differ significantly in their pattern of symptom reduction, but both groups continued to display significant drops in obsessional symptom, primary obsession scores, and even general OC symptoms at post-training. The approximately equivalent symptom reduction in both groups was unexpected, as the TAFMAN training was not constructed to challenge current TAF beliefs and therefore influence reductions in OC symptoms and primary obsessional severity.

Our last hypothesis was that individuals in the TAFMOD group would report an ease of use, as well as overall favorable reactions to this intervention. Results indicated participants reported favorable experiences of the intervention and its format. Treatment acceptance was

examined as the subject matter of the trainings could be emotionally distressing for participants, and lead to dislike of the training. The general support for the training in the study is in line with past CBM-I research which also reported generally very favorable participant acceptance (Clerkin & Teachman, 2011).

Correlational analyses were conducted to examine the associations between change scores in our study key study measures, including the TAFS. Results indicated that changes in TAFS and its subscales were not significantly correlated with changes in measures of OC symptomatology, but it was correlated significantly with changes in the POETS and its subscales. The POETS is designed to assess the participant's TAF reaction toward their primary obsession. Therefore, a drop in overall TAF beliefs would be expected to correlate with drops in POETS scores. Consequently, even though there were drops in both TAF scores and OC symptoms scores after training, these reductions appear to be mostly independent of one another.

Another consideration in the findings from the study is the reductions in OCD symptom scores, which was surprising given the relatively short time period. It is well accepted in research that OC symptoms will wax and wane along with stress in the sufferer's life, but true remission of symptoms without treatment is rarely experienced (Ambramowitz, 2006; Steketee, Eisen & Dyck, 1999). The lowering of TAF in the matter of a few weeks, or even a single intervention has been found in past research (Zucker, Craske, Barrios, & Hoguin, 2002), but the amount of reduction of OC symptoms in a few week period was unexpected. As stated earlier, there is strong support for the ability of CBM-I to change interpretation bias in various pathologies (Amir, Beard, Burns, & Bomyea, 2009; Lang, Moulds, Holmes, 2009; Rapee et al., 2013; Williams et al, 2013; Yiend et al., 2014), and changes in interpretation bias are consistently associated with decreases in both distress and impairment (Mathews & Mackintosh,

2000; MacLeod, 2012). But the drop in OC symptoms over roughly three weeks was more than was anticipated in a training meant to influence one of a few major cognitive biases in OCD. Yet, the sample was not a true clinical sample, and caution must be employed before considering any impact of training beyond a student sample.

It is important to note that change in TAFS total and subscale scores correlated strongly with the POETS, a measure which assess the participant's emotional and cognitive reaction toward their primary obsession. This makes theoretical sense, in that as both groups saw decreases in their TAF belief, the negative impact of their primary obsession would decrease as well. The decrease in POETS total and subscales score also follows the main findings of the study that both the TAFMOD and TAFMAN group both experienced decreases in main outcome measures.

What are possible explanations for these null findings in the context of overall symptom improvements across group? One plausible explanation for overall symptom improvement in both conditions is demand characteristics. During the consent procedure, participants were informed that the purpose of the study is to determine if multiple sessions of interpretation training can influence the impact of distressing thoughts. It is possible participants could interpret the study description to mean that we were looking for improvements in scores due to trainings. This expectation could have motivated some participants to display a greater lowering of symptoms than they objectively experienced from Pre-Training to Post-Training in order to help satisfy our study goals.

As both groups displayed general decreases in TAF, OC symptoms, and primary obsession scores, another consideration for overall symptom reductions is the influence of a regression towards the mean. The sample primarily consisted of non-clinical undergraduates,

primarily non-clinical, who displayed elevated initial TAFS and OCI-R scores. Participants were selected for the study based on cutoff scores, thus it is possible our sample consisted of participants with inflated initial scores, whose scores would naturally decrease at post-training. Participants drawn to the study may have been experiencing an increase in intrusive thoughts due to various reasons (e.g. exam stress, academic costs, interpersonal issues, etc) and were drawn to the subject matter of the study. This is similar to the phenomenon that doctors see flu patients at their worst, thus without the direct influence of professional advice or medications patients will generally improve in symptoms simply by the passage of time. It is possible that participants reduction in pre-training to post training could be a natural trend over time towards their general mean state. If the regression to the mean is true, it would help to explain why both training condition groups showed improvements.

Another consideration would be that both groups experienced reductions in their TAF and general OC symptoms for different reasons. The TAFMOD group may have derived benefit for the reasons presumed, that the IT helped alter dysfunctional interpretations for intrusive thoughts, and they learned to incorporate these cognitive reappraisals for their own intrusive thoughts. The TAFMAN group may have derived benefit from other non-interpretative processes such as habituation, as they were presented with 80 randomized distressing thought scenarios but they did not receive interpretation training to challenge these thoughts. As a result, it is possible the TAFMAN group experienced a general habituation to the scenarios over the course of the training. When the participants experience their own intrusive thoughts in the future they have learned the anxiety is temporary and will dissipate on its own without them attending directly to it. The idea of experiencing habituation through the trainings could also have been experienced by the TAFMOD group as well. It is possible those in the TAFMOD

group also experienced anxiety and distress from at least a portion of the thought scenarios, and if cognitive reappraisal inherent in this group's training did not help them, then like the TAFMAN group, they would experience habituation and a drop in their anxiety over the course of the trainings.

A different possibility could be best termed an inoculation or normalizing effect. The specific content of obsessions is very ideographic, thus our scenarios may not have touched on the specific concerns of individual participants. Going through the TAF training without directly tapping the individual specific obsession may have provided a lower distress learning situation. In this situation the participant is able to evaluate the thought and lack of negative outcome from similar, but not identical, obsessions to their own. Then, when obsessional thoughts occurred for these participants in the future the tolerance of the past thoughts may have increased their overall tolerance to subsequent TAF-ridden experiences of inappropriate mental intrusions.

Limitations

The current study has some clear limitations. Firstly, the study completers sample contained a surprisingly high amount of participants who had either sought either psychological or drug treatment in the past (TAFMOD = 56.3%, TAFMAN = 70%), or were currently receiving psychological or drug treatment (TAFMOD = 31.5%, TAFMAN = 30.7%). This high amount of treatment experience was unexpected, but the two conditions did not differ significantly in the amount of treatment experience at Pre-Training. Engagement in treatment was not followed systematically, so it is possible that changes in treatment may have occurred during study participation. Currently, the impact of possible changes is also unknown.

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A second potential limitation to address was the level of dropout in the study, with only 16 of 39 participants completing all the study procedures. The amount of dropout during the procedures was relatively equal between the TAFMAN group (29.4%), versus the TAFMOD group (27.7%), but still indicated that about one-third of the randomized participants did not finish the study procedures. The reasons for participant dropout is unclear, as participants who dropped were unresponsive to email contact, but there are two likely reasons. First, the subject matter and themes of the trainings, and even measures battery, covers topics and ideas which may be aversive to some participants. Therefore, participants may have chosen to stop proceeding in the study rather than continue being prompted to think about cognitions and symptoms they would prefer not to. This explanation is unlikely the most promising answer, as TAQ results showed very high acceptance of the trainings. TAQ results following training 1 were analyzed, consisting of 97.4% of randomized participants, and results indicated almost identically high rates of training acceptance, ethical procedures, and effectiveness as post-training TAQ results. The second, and more likely explanation for dropout, could be the nature of the undergraduate sample. The likely primary motivation for most of the study participants was to receive extra course credit for their participation, and once they received their desired amount of credit their motivation to continue in the study could have significantly diminished. Included in the dropout numbers were two participants in the maintenance condition who withdrew from the study before completing the first training. The first participant became too distressed with questions related to depression in the MINI and asked to end participation, and the second completed the baseline measures, but said the completion of the training and future trainings would take too much time. These withdrawals do not seem tied to the TAFMAN condition itself, but to the circumstances of those participants.

Another limitation in the study was that trainings 2 and 3 were sent by email and completed by the participants on their own time, wherever they felt was appropriate. Participants completion of trainings 2 and 3 could not be observed, so it is possible their attention and focus on these trainings was less than ideal. Training completion times were recorded, and the time it took for participants to complete trainings 2 and 3 was well within the range of training 1. Therefore, the idea of significant differences in training experiences for trainings 2 and 3 due to time is not well supported.

Due to time and resource limitations with the current study and participants a follow-up procedure with participants was not included in the procedures. Therefore it is unknown if any potential drops in TAF or OC symptom scores at post-training assessment were maintained, or even if differences between the groups would have emerged at follow-up. Future studies would be served well to incorporate a follow-up time point to address these potential interactions.

Currently, there have been no inter-rater analyses completed with the clinician scored measures. The study independent evaluator was very well trained and had years of experience in using and scoring the clinician administered measures, but comparing scores with an independent rater, who reviewed the assessment procedures, would tremendously help the reliability of the clinician rated measures.

Finally, the study employed per-protocol analyses, but there was no intent to treat analyses completed. Yet, there were participants who dropped or withdrew from the study after randomization. As repeated measures ANOVAs were used in many of the primary analyses participants who dropped or withdrew were automatically excluded in data analyses by SPSS. Generally, per-protocol analysis tends to produce more favorable treatment outcomes, compared to the intent-top-treat analysis, as dropouts tend to present more unfavorable treatment responses.

Therefore, given the current null findings based on the per-protocol analysis and the equivalent attritions between the two groups, it is unlikely that intent-to-treat analysis would have displayed significantly different findings.

Future Research

As noted, there was not a follow-up time assessment included in the study design. It would be important to incorporate a follow-up time point for a few separate reasons. First, a follow-up would be able to track if any gains or losses made by participants following the end of training. This would inform if there are any protective or harmful factors which may influence long term outcomes

As stated earlier, the sample was made up of entirely an undergraduate sample. The study employed an eligibility screen to ensure at least some level of TAF and OC symptoms were present in the participants, but using a clinical sample with OCD in the future would be ideal to test the benefit of the trainings. As clinical OCD does not usually display spontaneous remission of symptoms, thus changes in measure scores could be more confidently attributed to training effects.

The current study used a TAF maintenance group for comparison, but future studies should consider adding further comparison groups. The first consideration for a comparison group would be a condition where participants complete the pre-training assessment and post-training assessment with no training. This would allow the study to control for the possible effects of regression towards the mean, as changes could be attributed to time alone. A second consideration would be to include a comparison group who completed trainings made of non-TAF scenarios, but still identical in the word completion task format. This group would allow

for the comparison of possible demand characteristics, as the training would not be formatted to influence or even tap into TAF obsessions.

Recent research by Craske and colleagues (2014) have identified processes of treatment implementation which could enhance learning in treating anxiety. Among the suggestions by Craske et al. (2014) future studies may consider addressing targets such as variability and multiple contexts to enhance inhibitory learning. First, the study used a training model including 80 randomized TAF scenarios, and it is possible adding even more scenarios would lead to greater variability in TAF scenarios, thus increasing the range of TAF beliefs the training could address. Though, comparatively, this study presented well more scenarios than most other CBM-I study designs, but adding more scenarios may still increase the variability and impact of each treatment. A second consideration would be to incorporate the training in multiple contexts. This could be done by encouraging to participants to complete trainings in the lab, as well as privately in their homes, traveling, eating, or many other situations. The restriction would be a finding a place where the participant could complete the training uninterrupted. By completing the trainings in multiple contexts, learning is encouraged as it is not associated with the laboratory and computer. By further facilitate this endeavor the use of cell phones or tablets to complete trainings may enable participants much more freedom, than a desktop or laptop computer would provide.

Outside of the suggestions made by Craske et al (2014), another consideration, is that providing participants more training session (i.e. 4, 6, 8, or more) would increase the dosage of treatment and may have a further impact on the training effects participants experience. The potential to greatly increase the potency of training may be from incorporating ideographically tailored TAF thought scenarios. The participant's obsession could be expressed in a few

different thought scenario contexts to also ensure a diversity of situations. A final suggestion to increase treatment potency would be to progressively make each successive training more difficult than the last to ensure learning is taking place. Ensuring the difficulty increases helps ensure learning, as with the current sentence completion paradigm, participants are not able to move on unless they learn to correctly respond. This process could occur in phases, with phase one having the participant complete the key word in the sentence. Phase two could then have the participant choose a healthier interpretation of the sentence among competing choices. A final phase could ask the participant to write out their own healthier responses following the TAF scenario. These changes, completed in succession, will likely be more challenging to the participant, but may ensure deeper learning than simply solving an incomplete word. This is also another way to add variability of the learning context, consistent with the principles of inhibitory learning (Craske et al., 2014).

Summary

Participants who completed the study procedures, in general, experienced significant drops in their TAF and OC symptoms scores from pre-training to post-training assessment. As both the TAFMAN and TAFMOD group experienced significant reductions in scores it is unclear if the findings can be attributed to a mechanism of the trainings, demand characteristics, habituation, immunization, or another unknown influence. There were only overall symptom reductions without the expected group differences in the study findings. Replication using a larger clinical sample would be useful to examine the effects of CBM-I centered on dysfunctional TAF beliefs associated with obsessional intrusions.

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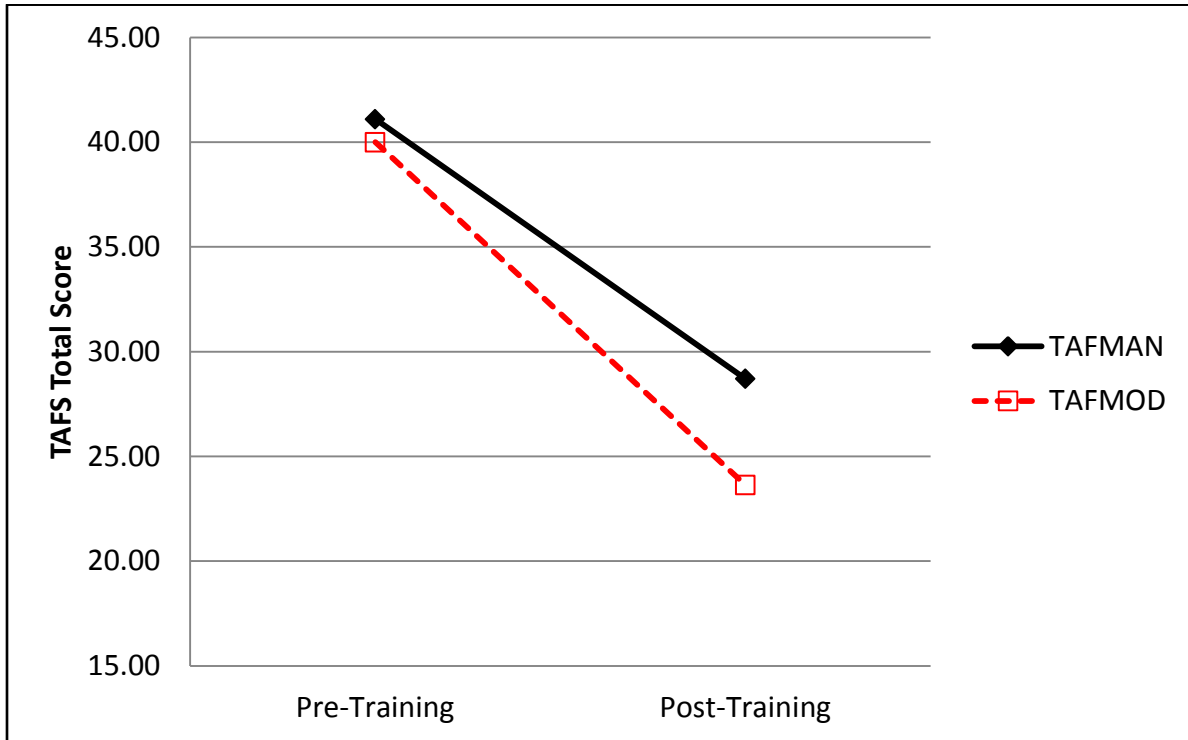**Appendices**

Appendix A. Figures

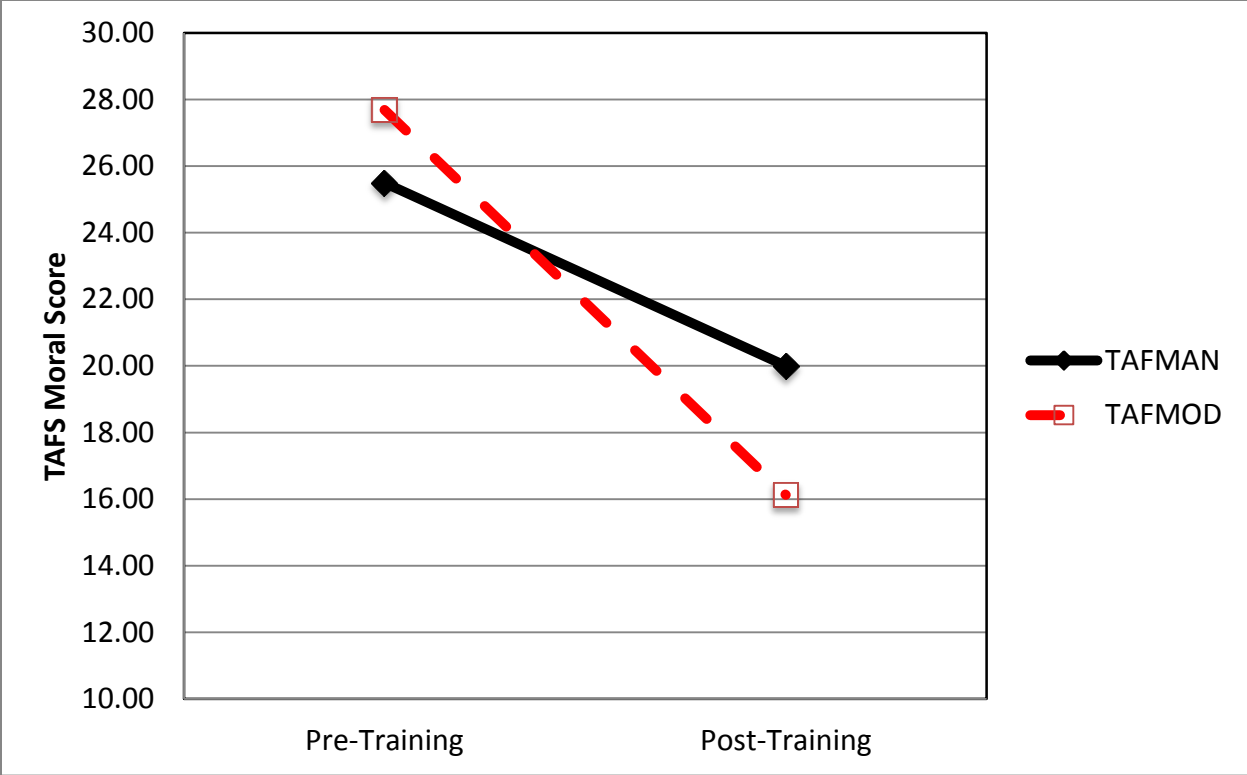Figure 2. Pre- to Post-Training TAFS Total Scores

68

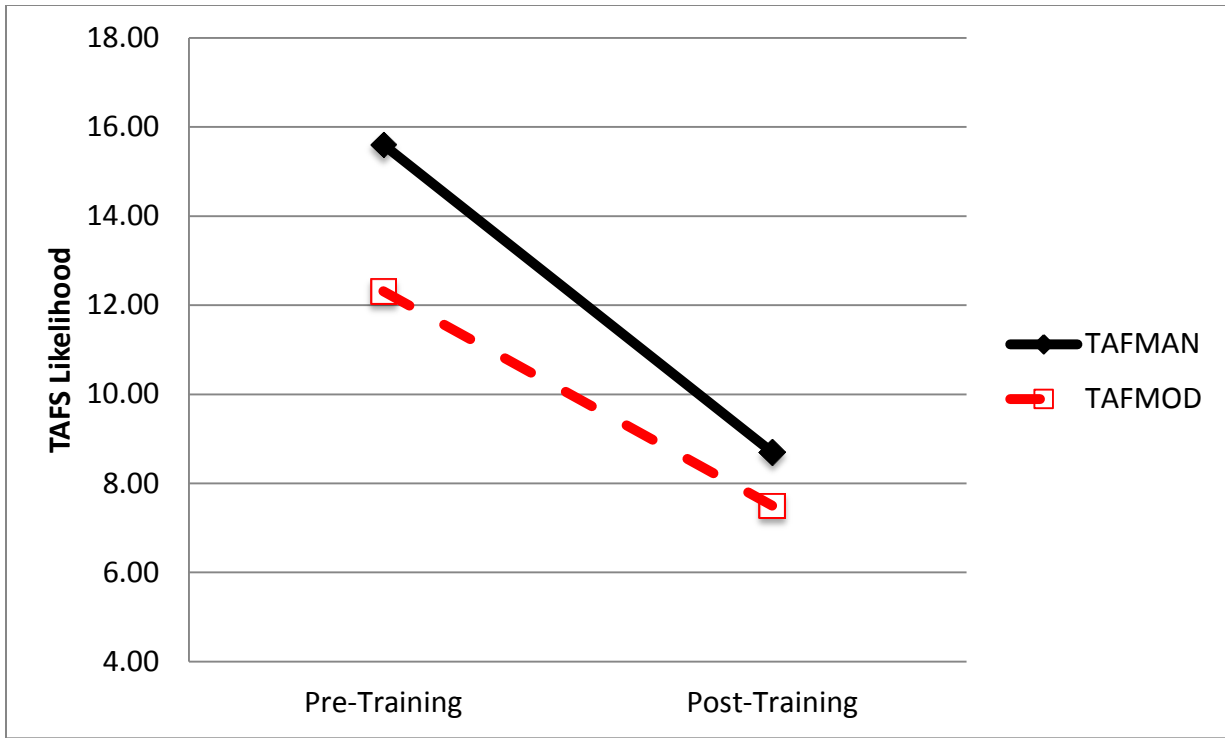Figure 3. Pre- to Post-Training TAFS Moral Subscale Scores

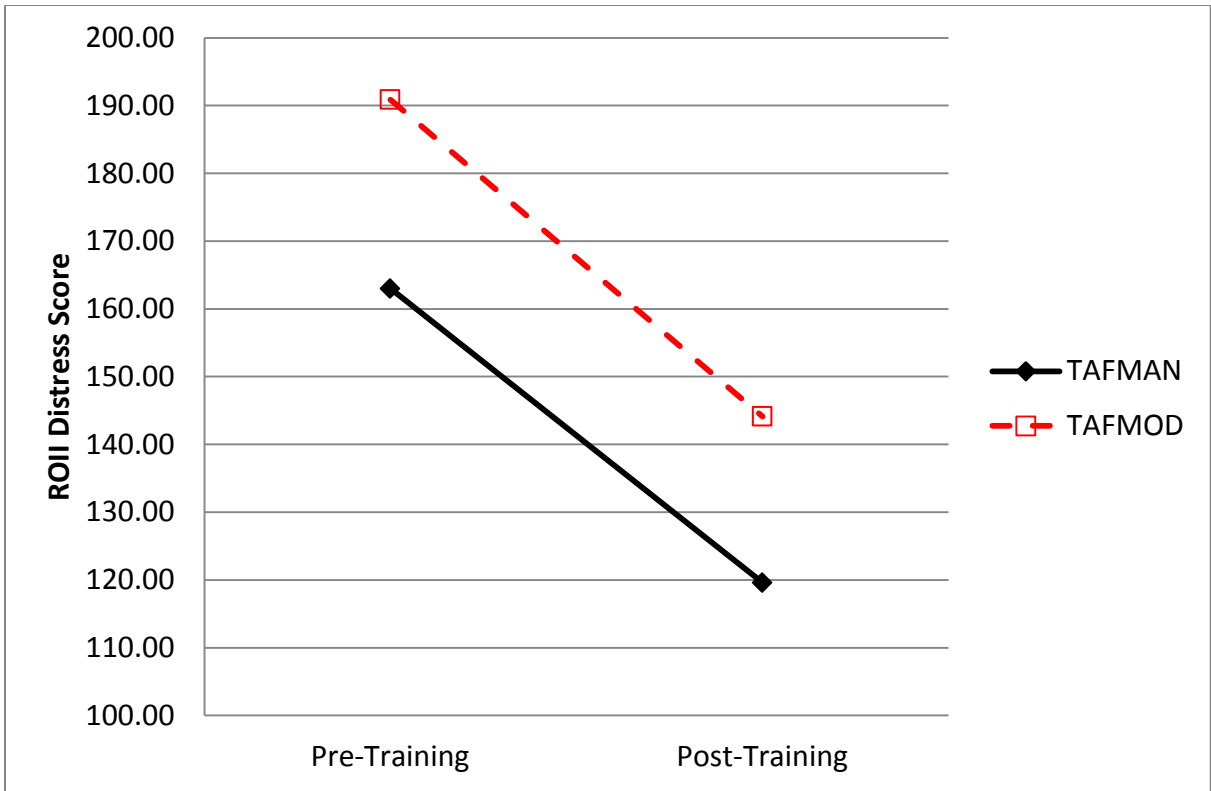Figure 4. Pre- to Post-Training TAFS Likelihood Subscale Scores

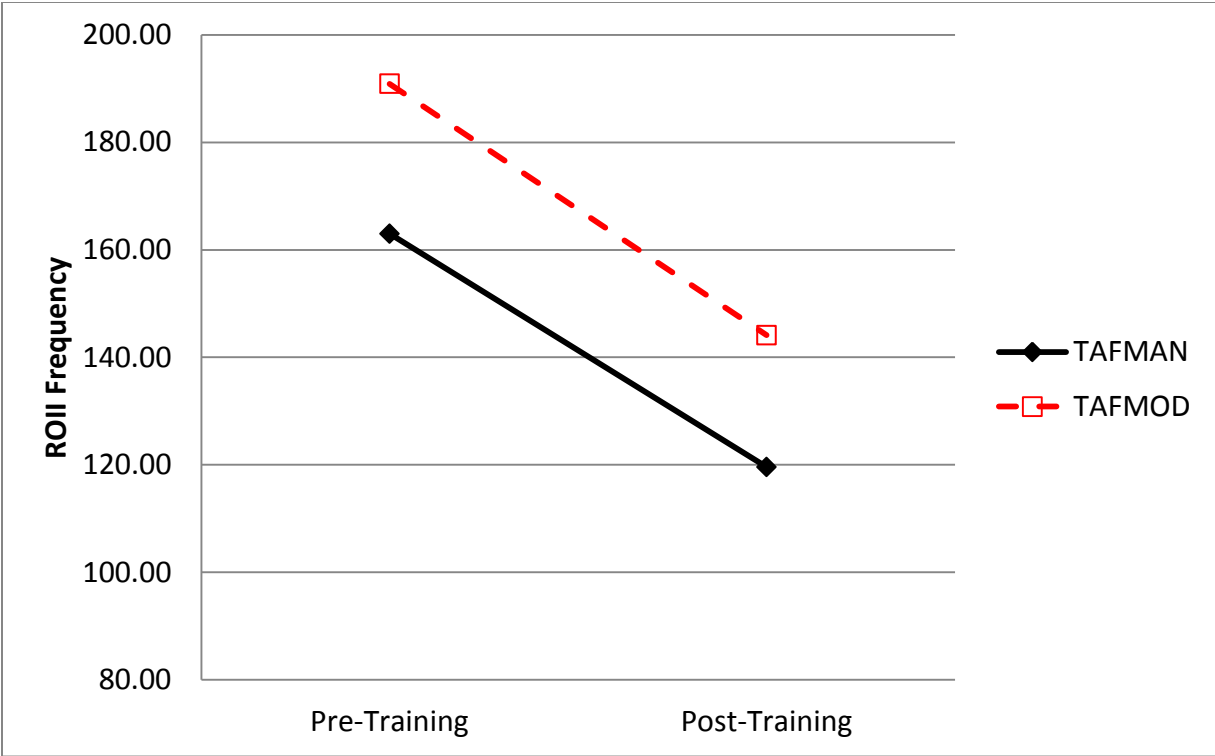Figure 5. Pre- to Post-Training ROII Distress Scores

Figure 6. Pre- to Post-Training ROII Frequency Scores

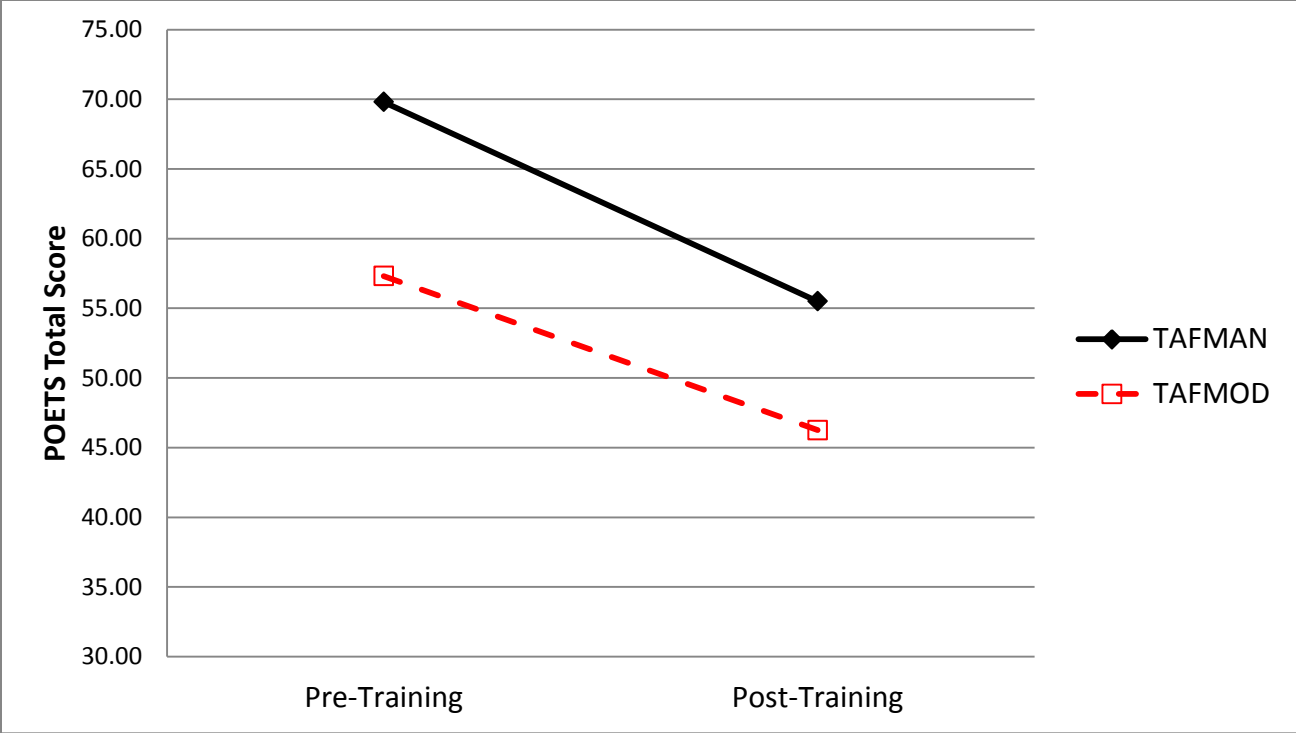Figure 7. Pre- to Post-Training OCI-R Obsession Subscale Scores

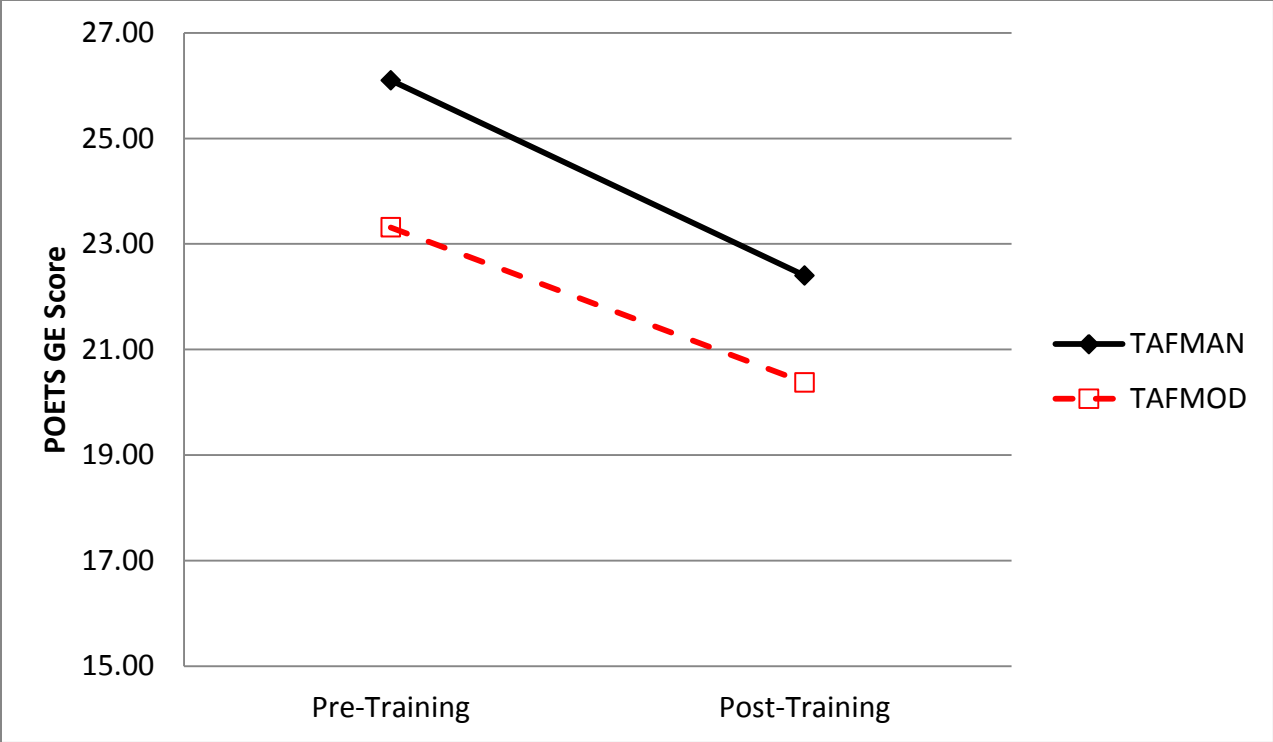Figure 8. Pre- to Post-Training POETS Total Scores

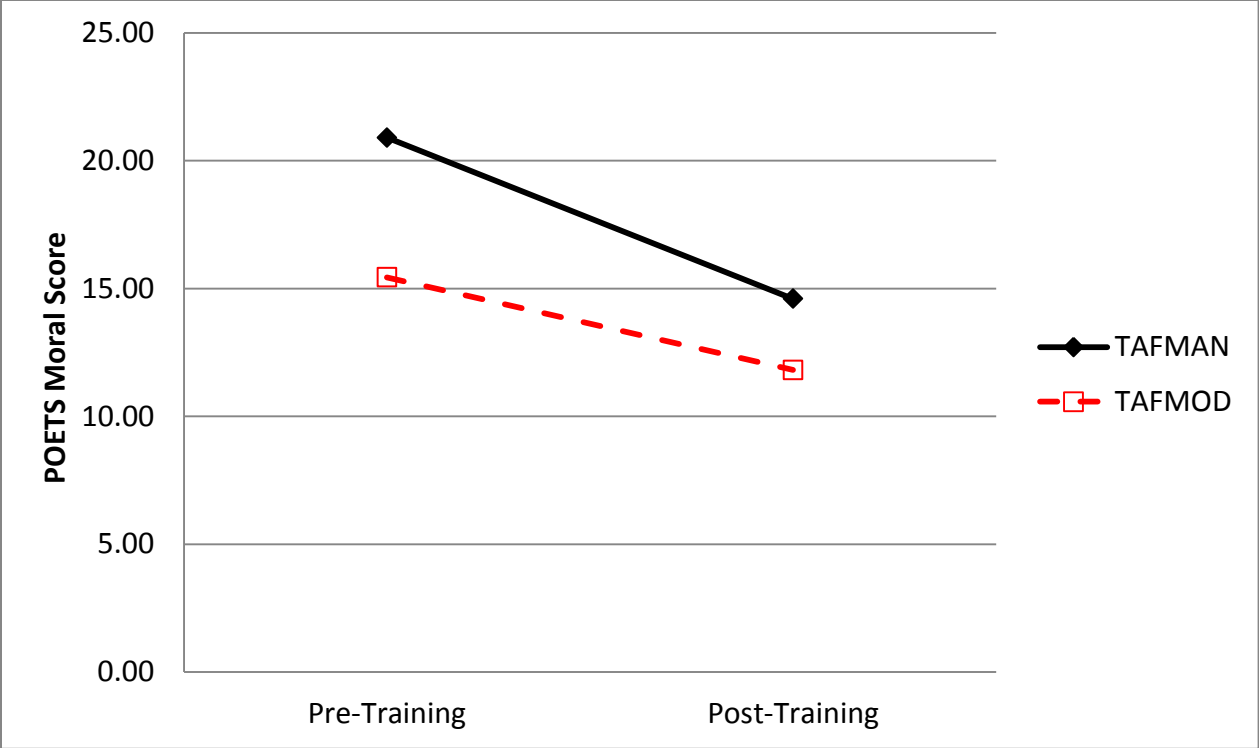Figure 9. Pre- to Post-Training POETS General Emotional Reaction Scores

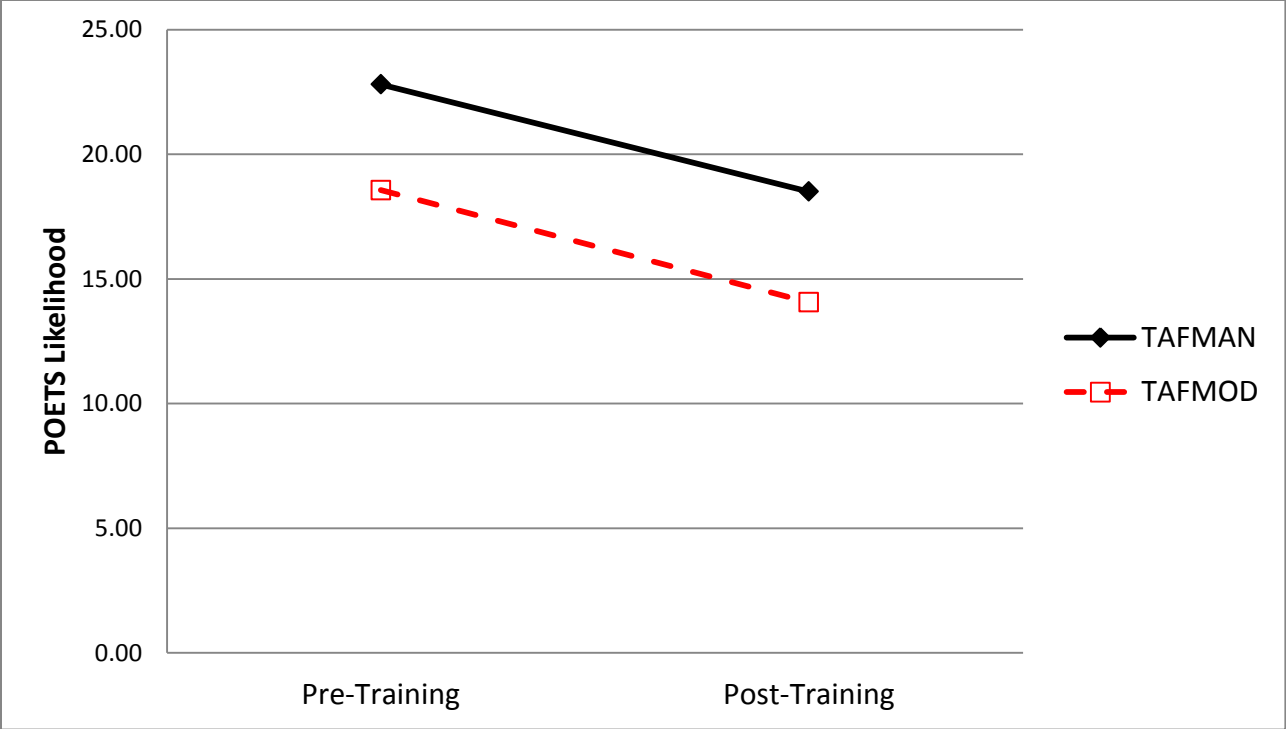Figure 10. Pre- to Post-Training POETS Moral Subscale Scores

Figure 11. Pre- to Post-Training POETS Likelihood Subscale Group Mean Scores

Appendix B: Measures

Primary Obsession Evaluation of TAF Scale (POETS)

Please answer the following questions only regarding your primary obsessional thought presented on the screen*

0 – Not at all   4 – Quite
1 – Slightly   5 – Very
2 – Somewhat   6 – Extremely
3 – Moderately

General Emotional Reactions
- **How unpleasant is this thought?**
  0 1 2 3 4 5 6
- **How unacceptable is this thought?**
  0 1 2 3 4 5 6
- **How difficult is it for you to stop this thought?**
  0 1 2 3 4 5 6
- **How important is it that you control, or suppress, this thought?**
  0 1 2 3 4 5 6
- **How strong is your desire to avoid situations that might make this thought occur?**
  0 1 2 3 4 5 6

Moral
- **How guilty does this thought make you feel?**
  0 1 2 3 4 5 6
- **To what extent does having this thought mean I am a terrible person?**
  0 1 2 3 4 5 6
- **To what extent is having this thought as bad as doing/causing it?**
  0 1 2 3 4 5 6
- **To what extent is having the thought in mind as unacceptable as doing it?**
  0 1 2 3 4 5 6
- **To what extent does having this thought mean that I am the type of immoral person who would act on it?**
  0 1 2 3 4 5 6

Likelihood
- **How much do you worry that you might act on this thought or that it might otherwise happen in real life?**
  0 1 2 3 4 5 6
- **How likely is it that this thought will come true in real life?**
  0 1 2 3 4 5 6
- **To what extent does thinking about it make it more likely to happen?**
  0 1 2 3 4 5 6
- **To what extent does having this thought signify harm/danger to yourself or others?**
  0 1 2 3 4 5 6
- **Because you have this thought in mind, how responsible would you feel if this actually occurred?**

TAF SCALE

The following statements refer to experiences that people may have in their daily lives. For each item,

circle the answer best describes how strongly you agree or disagree with each statement.

Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
0	1	2	3	4

1. Thinking of making an extremely critical remark to a friend is almost as unacceptable to me as actually saying it…………………………………….

0   1   2   3   4

2. If I think of a relative/friend losing their job, this increases the risk that they will lose their job………………………………………………

0   1   2   3   4

3. Having a blasphemous thought is almost as sinful to me as a blasphemous action…………………………………………………

0   1   2   3   4

4. Thinking about swearing at someone else is almost as unacceptable to me as actually swearing…………………………………………………
…

0   1   2   3   4

5. If I think of a relative/friend being in a car accident, this increases the risk that he/she will have a car accident………………………………….

0   1   2   3   4

6. When I have a nasty thought about someone else, it is almost as bad as me carrying out a nasty action………………………………………….

0   1   2   3   4

7. If I think of a friend/relative being injured in a fall, this increases the risk that he/she will have a fall and be injured……………………………..

0   1   2   3   4

8. Having violent thoughts is almost as unacceptable to me as violent acts…

0   1   2   3   4

9. If I think of a relative/friend falling ill this increases the risk that he/she will fall ill……………………………………………………
…...

0   1   2   3   4

10. When I think about making an obscene remark or gesture in church or synagogue, it is almost as sinful as actually

doing it………………….. 0   1   2   3   4

11. If I wish harm on someone, it is almost as bad as doing harm………….. 0   1   2   3   4

12. If I think of myself being injured in a fall, this increases the risk that I will have a fall and be injured…………………………………………… 0   1   2   3   4

13. If I think about making an obscene remark or gesture to someone else, it is almost as bad as doing it…………………………………………. 0   1   2   3   4

14. When I think of myself being in a car accident, this increases the risk that I will have a car accident…………………………………………. 0   1   2   3   4

15. When I think unkindly about a friend, it is almost as disloyal as doing an unkind act………………………………………………… ….. 0   1   2   3   4

16. If I think of myself falling ill, this increases the risk that I will fall ill…. 0   1   2   3   4

17. If I have a jealous thought, it is almost the same as making a jealous remark……………………………………………… …………… 0   1   2   3   4

18. Thinking of cheating in a personal relationship is almost as immoral to me as actually cheating…………………………………………. 0   1   2   3   4

19. Having obscene thoughts in a church or synagogue is unacceptable to me………………………………………………… …………….. 0   1   2   3   4

Treatment Acceptability Questionnaire (for TAF Study)

Please answer these questions that deal with your reactions to the treatment. Circle the number that best describes your reactions.
Participant ID: _____ Experimenter: _____ Date: _____

1. Overall, how acceptable did you find the procedure to be?

VERY UNACCEPTABLE   1 2 3 4 5 6 7   VERY ACCEPTABLE

2. How ethical did you think this procedure was?

UNETHICAL   1 2 3 4 5 6 7   FULLY ACCEPTABLE

3. How effective did you think this training was?

VERY INEFFECTIVE   1 2 3 4 5 6 7   VERY EFFECTIVE

4. How distressing did you think the training was?

VERY UNDISTRESSING   1 2 3 4 5 6 7   VERY DISTRESSING

5. How easy did you find the training?

VERY EASY   1 2 3 4 5 6 7   VERY DIFFICULT

6. How strongly was your overall mood affected by the training?

NOT AT ALL   1 2 3 4 5 6 7   VERY STRONGLY

7. How acceptable were the side effects of this treatment?

VERY UNACCEPTABLE   1 2 3 4 5 6 7   VERY ACCEPTABLE

8. How knowledgeable did you think the study staff was?

NOT KNOWLEDGEABLE   1 2 3 4 5 6 7   VERY KNOWLEDGEABLE

9. How trustworthy did you think the study staff was?

VERY UNTRUSTWORTHY   1 2 3 4 5 6 7   VERY TRUSTWORTHY

ROII Distress Assessment Scale

This questionnaire deals with a variety of upsetting, unpleasant thoughts many people report having pop into their minds from time to time. These thoughts tend to intrude into our minds against our will and <u>interrupt</u> what we are doing, or what we are already thinking about. Let's imagine that these thoughts have just popped into your head. How *distressing* would each of these thoughts be to you?

0 – Not distressing at all
1 – Slightly distressing
2 – Somewhat distressing
3 – Moderately distressing
4 – Quite distressing
5 – Very distressing
6 – Extremely distressing

While driving, I have had unacceptable intrusive thoughts of:

1. Driving into a storefront window 0 1 2 3 4 5 6

2. Running the car off the road   0 1 2 3 4 5 6

3. Hitting pedestrians or animals   0 1 2 3 4 5 6

4. Swerving into oncoming traffic   0 1 2 3 4 5 6

5. Purposefully smashing into poles or trees   0 1 2 3 4 5 6

When I see or use a sharp object (knife, razor, scissors, etc.), I have had unacceptable intrusive thoughts of:

6. Slitting my wrist or throat   0 1 2 3 4 5 6

7. Cutting off my finger, toe or hand   0 1 2 3 4 5 6

When I am in a high place (like a cliff, bridge, window, high building, etc.), I have had unacceptable intrusive thoughts of:

8. Jumping off of a high place   0 1 2 3 4 5 6

9. Pushing a stranger off of a high place   0 1 2 3 4 5 6

10. Pushing a close friend or family member off of a high place   0 1 2 3 4 5 6

When I am near traffic or railway/subway tracks, I have had unacceptable intrusive thoughts of:

11. Jumping in front of a train, subway, or car   0 1 2 3 4 5 6

12. Pushing a stranger in front of a train subway or car 0 1 2 3 4 5 6

13. Pushing a close friend or family member in front of a train, subway or car   0 1 2 3 4 5 6

When I am around others and I am not provoked, I have had unacceptable intrusive thoughts of:

14. Kicking, pushing or otherwise hurting complete strangers   0 1 2 3 4 5 6

15. Saying something rude to, or insulting a stranger   0 1 2 3 4 5 6

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16. Bumping into people in the hallway or tripping them on the stairs   0 1 2 3 4 5 6

17. Insulting someone in authority, such as a police officer, minister or priest   0 1 2 3 4 5 6

Even though I am not angry at close friends or family members, and am otherwise unprovoked by them, I have had unacceptable intrusive thoughts of:

18. Saying something rude or insulting to one of them   0 1 2 3 4 5 6

19. Hitting or punching one of them   0 1 2 3 4 5 6

20. Choking one of them   0 1 2 3 4 5 6

21. Stabbing one of them with a knife or other sharp object   0 1 2 3 4 5 6

Even though I know it's probably not true, I have had unacceptable intrusive thoughts that:

22. I left the heat, stove or lights on in the house/apartment which may cause a fire   0 1 2 3 4 5 6

23. I left the door of the house apartment unlocked and there is an intruder inside   0 1 2 3 4 5 6

24. I left the water taps running in the house/apartment which may cause a flood   0 1 2 3 4 5 6

When I am in a public gathering (class, meeting, church) and am not provoked, I have had unacceptable intrusive thoughts of:

25. Blurting out obscenities at the person talking   0 1 2 3 4 5 6

26. Accidently belching or "breaking wind" loudly   0 1 2 3 4 5 6

27. Throwing something at the speaker   0 1 2 3 4 5 6

28. Suddenly walking out of the meeting thereby causing a scene   0 1 2 3 4 5 6

Even though I am not angry or otherwise provoked, I have had unacceptable intrusive thoughts of:

29. Scratching the paint of cars I pass with my keys or another sharp object   0 1 2 3 4 5 6

30. Picking something up and throwing it through a window   0 1 2 3 4 5 6

31. Deliberately breaking or wrecking something (dishes, ornaments, pool table that belongs to me, my friends or my family   0 1 2 3 4 5 6

32. Shoplifting or stealing something even though I don't really want it   0 1 2 3 4 5 6

33. Grabbing the money out of a cashier's till when purchasing an item   0 1 2 3 4 5 6

34. Holding up the bank teller while doing routine banking   0 1 2 3 4 5 6

Out of the blue and for no particular reason, I have had unacceptable intrusive thoughts of:

35. Having sex with a person who I would never want to have sex with   0 1 2 3 4 5 6

36. Having sex with a person who has authority over me (minister, boss)   0 1 2 3 4 5 6

37. That the fly of my pants is unzipped or that my blouse is unbuttoned   0 1 2 3 4 5 6

38. Throwing my arms around and kissing an authority figure   0 1 2 3 4 5 6

39. Lifting my skirt or dropping my pants, thereby indecently exposing myself   0 1 2 3 4 5 6

40. Engaging in sexual activity that goes against my sexual preference (e.g., homosexual, heterosexual)
0 1 2 3 4 5 6

Suddenly and for no particular reason I have had unacceptable intrusive thoughts of:

41. Authority figures (minister, boss) being naked   0 1 2 3 4 5 6

42. People I come in contact with being naked   0 1 2 3 4 5 6

43. Having sex in a public place   0 1 2 3 4 5 6

44. Engaging in a sexual act that I would find completely disgusting   0 1 2 3 4 5 6

When I am in a public place, I have had unacceptable intrusive thoughts that:

45. I am going to catch a sexually transmitted disease (STD) from touching a toilet seat or tap   0 1 2 3 4 5 6

46. I will become dirty, or contaminated, by touching public door-knobs   0 1 2 3 4 5 6

47. I will become dirty, or contaminated, by putting a public telephone to my ear   0 1 2 3 4 5 6

48. I will contract a fatal disease from touching things strangers have touched   0 1 2 3 4 5 6

49. I will transmit a fatal disease by using public facilities   0 1 2 3 4 5 6

Even though the house/apartment already looks tidy, I have had unacceptable intrusive thoughts that:

50. I must check to ensure that absolutely everything is put away.   0 1 2 3 4 5 6

51. I must check to ensure that all specks of dust have been picked up off the floor   0 1 2 3 4 5 6

52. I must check to see if there is dirt in unseen places   0 1 2 3 4 5 6