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Evaluating Change in Beliefs About the Importance/Control of Thoughts as a Mediator of CBM-I and Responses to an ICT Stressor

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Abstract

This study evaluated an adaptation of a Cognitive Bias Modification-Interpretation (CBM-I) procedure designed to shift interpretations of intrusive thoughts related to beliefs about the Importance and Control of Thoughts (ICT). Individuals high in the ICT belief domain were randomly assigned to one of two conditions: (a) a positive ($n = 38$) condition in which scenarios about intrusive thoughts were repeatedly paired with benign interpretations; or (b) a control ($n = 39$) condition in which scenarios about intrusive thoughts were paired with 50% benign and 50% threatening interpretations. Further, participants engaged in an ICT stressor task. Structural equation modeling with bias-corrected bootstrapping was used to examine the effects of training on ICT-relevant interpretations, beliefs, and ICT stressor responding. As predicted, individuals in a positive (vs. control) training condition reported decreases in ICT-relevant interpretations and beliefs. Further, there was a small, statistically significant indirect (i.e., mediated) effect of training on measures of ICT stressor responding, which occurred via decreases in ICT-relevant beliefs. In sum, results indicate that training was effective in influencing interpretations and beliefs tied to Importance/Control of Thoughts and that there may be clinical utility to shifting this belief domain.

Keywords

Cognitive Bias Modification-Interpretation; Importance/Control of Thoughts; Intrusive Thoughts; Beliefs

Threatening interpretations and beliefs are central to theoretical and clinical conceptualizations of obsessive-compulsive disorder (OCD) (Obsessive Compulsive Cognitions Working Group [OCCWG], 1997; Whittal & McLean, 1999), and cognitive

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interventions for OCD are often built upon the idea that shifting OC interpretations and beliefs will lead to symptom reduction (e.g., Wilhelm et al., 2009). This treatment focus follows from cognitive-behavioral models of OCD, which suggest that it is the interpretation (vs. content) of intrusive, unwanted thoughts as personally meaningful and significant that is more strongly associated with the hallmark repetitiveness of thoughts, behaviors, and distress characterizing OCD (Frost & Steketee, 2002; Rachman, 1997, 1998; Radomsky et al., 2013; Salkovskis, 1985). The thought of harming a friend is not necessarily problematic, then; instead, it is the interpretation of this thought that one is a horrible person who actually will cause harm to their friend that is considered to lead to heightened symptoms of OCD.

Relevant research suggests that individuals with symptoms of OCD have elevations in certain types of maladaptive interpretations and beliefs. For instance, the OCCWG (OCCWG, 2003, 2005) found that interpretations of intrusions were elevated among a sample diagnosed with OCD, as compared to anxious controls, student controls, and community controls. Further, a large cross-cultural study found that the frequency, distress, importance, and persistence of one's most distressing intrusion were all significantly predicted by appraisals of intrusive thoughts (Moulding et al., 2014).

Critically, cognitive theories predict that pan-situational beliefs are associated with biased interpretations and that these beliefs also help to explain why intrusive thoughts lead to obsessions and compulsions (see discussion in Moulding et al., 2014; Rachman, 1997; OCCWG, 1997). In particular, the OCCWG (2003, 2005) identified the following belief domains that are heightened among individuals with OCD (vs. anxious controls, student controls, and community controls): (a) Importance/Control of Thoughts (i.e., the belief that thoughts are very important and indicative of one's moral character and that one should be in control of one's thoughts at all times); (b) Responsibility/Threat Estimation (i.e., the belief of one's responsibility to prevent harm, and a heightened sense that things can and will go wrong); and (c) Intolerance of Uncertainty/Perfectionism (i.e., difficulty tolerating uncertainty or ambiguity, and the belief that one needs to be perfect).

Research suggests that it is possible to manipulate OC-relevant interpretations and beliefs (e.g., Clerkin & Teachman, 2011; Forrester, Wilson, & Salkovskis, 2002; Rassin, Merckelbach, Muris, & Spaan, 1999; Teachman, Woody, & Magee, 2006; Zucker, Craske, Barrios, & Holgiun, 2002), resulting in reductions in cognitive, behavioral, and/or emotional responses. For instance, Cognitive Bias Modification for interpretation bias (CBM-I) procedures involve directly targeting a type of interpretation bias with repetitive computer tasks, such as having participants read and imagine themselves in a variety of ambiguous scenarios in which the emotional ambiguity of the scenario is consistently resolved in a positive manner (see; Beard & Amir, 2008; Mathews & Mackintosh, 2000; Murphy, Hirsch, Mathews, Smith, & Clark, 2007; Steinman & Teachman, 2010). Clerkin and Teachman (2011) recently applied CBM-I to the domain of intrusive thinking among individuals with OCD symptoms. They found that CBM-I was successful in reducing a range of maladaptive interpretations and OC beliefs. Moreover, when compared to a control group, there was some evidence that individuals in a "positive" training condition had more adaptive responses to an OC stressor task (i.e., they reported less urges to perform neutralizing activities).

Building on this work, other researchers have investigated whether CBM-I targeted at a range of OC belief domains impacted responses to several clinically relevant stressors (Williams & Grisham, 2013). Again, participants randomly assigned to a positive (vs. control) condition reported fewer negative and more positive OC-relevant interpretations. However, responses to a stressor were only impacted on a task related to Importance/Control of Thoughts (but not tasks related to Intolerance of Uncertainty/Perfectionism or Contamination/Estimation of Threat). Additionally, a third study using similar methodology found that OC beliefs changed from pre- to post-training in a positive (vs. control) condition, but that there was not a corresponding between-groups difference on responses to OC stressor tasks tapping Importance/Control of Thoughts, Intolerance of Uncertainty/Perfectionism, and Responsibility/Threat Estimation (Beadel, Smyth, Teachman, 2013).

Rather than targeting a broad range of OC-relevant beliefs, as done in previous work, the current study targeted interpretations related to a single belief domain, Importance/Control of Thoughts. This decision follows from the power of CBM-I to isolate and target focused mechanisms of action. Targeting interpretations related to a specific belief domain, as opposed to targeting multiple domains simultaneously, is critical in order to develop treatments tailored to specific symptom profiles. Further, recent studies have investigated whether change in maladaptive beliefs (assessed with the *Obsessional Beliefs Questionnaire-44* [OCCWG, 2005], *Salkovskis Responsibility Scale* [Bouvard et al., 2001], and *Personal Significance Scale* [Rachman, 2001]) influences subsequent symptom change within the context of more traditional psychotherapies for OCD (e.g., Cognitive Therapy; see Olatunji et al., 2013; Woody, Whittal, & McLean, 2011). Adding to this literature, our use of an experimental design allows us to directly test whether manipulating interpretations related to OC beliefs influences subsequent ICT stressor responding, thereby advancing clinical theory and treatment.

Summary and Hypotheses

In the current study, we recruited participants with elevated ICT-relevant beliefs (as opposed to elevated OCD symptoms more generally), with the idea that these individuals could most benefit from a CBM-I intervention specifically targeting interpretations related to these beliefs. We included a baseline measure of Importance/Control of Thoughts to determine whether change truly occurred in this belief domain (previous work by Beadel et al., 2013 and Clerkin & Teachman, 2011 did not include an identical baseline measure of ICT-relevant beliefs). Further, we tested whether change in ICT-relevant beliefs led to reductions in ICT stressor responding. We hypothesized that following training participants in a positive (vs. control) condition would have fewer OC interpretations and beliefs related to the Importance/Control of Thoughts, and less negative ICT stressor responding. Additionally, change in ICT-relevant beliefs was expected to mediate the relationship between condition and ICT stressor responding. To test these questions, we used structural equation modeling with bias-corrected bootstrapping, which allowed us to simultaneously evaluate the relationship between training and multiple dependent variables, reduce measurement error, and estimate the size of the mediation effect.

Method

Participants

We recruited students through the university's undergraduate psychology participant pool based on their responses to the Importance/Control of Thoughts (ICT) subscale of the *Obsessional Beliefs Questionnaire-44* (OBQ-44; OCCWG, 2005). According to the OCCWG (2005), individuals diagnosed with OCD had a mean score of 39.8 ($SD = 16.3$) on the ICT subscale. In the current study, individuals who scored within one-half of a standard deviation of this clinical cut-off were invited to participate (OBQ-ICT in the current sample: $M = 42.97$, $SD = 6.65$, $Range = 34-69$). This resulted in a final sample of 77 participants (74% female; $M_{age} = 18.74$, $SD = .88$). Race was reported as 87% Caucasian, 5.2% African American, 3.9% Bi- or multiracial, 1.3% Asian, and 2.6% other; ethnicity was reported as 98.7% non-Hispanic/Latino and 1.3% Hispanic/Latino.

Materials

Baseline OC symptoms and affect—The 18-item *Obsessive-Compulsive Inventory-Revised* (OCI-R; Foa et al., 2002) was included to assess participants' levels of OCD symptomology; the scale demonstrated good reliability ($\alpha = .86$).

The *Patient Health Questionnaire-4* (PHQ-4; Löwe et al., 2010) is a four-item questionnaire that assesses symptoms of depression and anxiety; the scale demonstrated acceptable reliability ($\alpha = .75$).

The Positive and Negative Affect Schedule-Negative Affect subscale (PANAS-NA; Watson & Clark, 1994) contains 10 items that measure negative affect. The PANAS-NA was used to evaluate negative affect prior to (PANAS-Pre) and following (PANAS-Post) training, as well as following the ICT stressor (PANAS-ICT). Reliability for this scale was good to excellent (PANAS-Pre, $\alpha = .86$; PANAS-Post, $\alpha = .83$; PANAS-ICT, $\alpha = .95$).

Training beliefs about the Importance/Control of Thoughts—The training of interpretation biases related to obsessional beliefs follows previous work by Mathews and Mackintosh (2000), which was later modified by Clerkin and Teachman (2011). Similar to previous research, the training paradigm was administered via computer. Please contact the first author for training materials.

Participants were asked to read and imagine themselves in 60 training scenarios (modified from Clerkin & Teachman, 2011) involving common triggers for ICT-relevant interpretations. For instance, the following scenario is designed to emphasize Importance of Thoughts: "You are out shopping at a nice department store. You suddenly have an unwanted thought about stealing some of the merchandise, even though this idea does not appeal to you. With regard to your morals, occasionally having thoughts like this is meaningful." The last word of each scenario always resolved the meaning of the scenario in a way that was either consistent or inconsistent with a maladaptive ICT-relevant belief (in this case, "meaningful" resolves the meaning of the scenario in a manner that is consistent with the belief that thoughts are meaningful and indicative of one's character). Participants were instructed to fill in the missing letter of the last word to ensure that they were paying

attention. Following the scenario, participants were asked a comprehension question to underscore the meaning of the scenario (in this case, “Are you a morally inferior person because you had this unwanted thought?”).

There were two training conditions, positive and control. All scenarios in the positive condition were resolved in a manner that was inconsistent with maladaptive ICT beliefs. In the control condition, half of the scenarios were resolved in a manner consistent with maladaptive ICT beliefs, and half were resolved in a manner inconsistent with maladaptive ICT beliefs. Importantly, participants were not asked to provide their actual interpretations or beliefs about the scenarios; they were simply asked to respond to the information presented in the computer program. Twenty-four filler scenarios were mixed in with the ICT-relevant scenarios to make the objective of training less obvious and to check the specificity of training. Participants also completed unrelated practice scenarios at the beginning of training.

Evaluation of training: ICT-relevant interpretations and beliefs

Interpretations¹: Following the training, participants viewed novel ICT-relevant test scenarios accessing interpretations related to a range of belief domains (i.e., *Recognition Scenarios*; modified from Mathews & Mackintosh, 2000; Clerkin & Teachman, 2011). In these scenarios, the meaning of the scenario was left ambiguous, even after the word fragment was completed (i.e., it was not clear whether the interpretation was consistent or inconsistent with a maladaptive ICT-relevant belief). For example, this scenario was designed to emphasize Control of Thoughts: “THE JOB INTERVIEW. You are preparing for a job interview. As you prepare, you have a number of unwanted, intrusive thoughts about messing up the interview. As thoughts about the interview pop into your mind, you think about whether or not these thoughts will mess up your interview if you can't get rid of t-em.” Each scenario was followed by a comprehension question to underscore the meaning of the scenario (in this case, “Are you getting ready for a job interview?”). Non-OC relevant Recognition Scenarios were also included to obscure the purpose of the training (used previously in Clerkin & Teachman, 2011, and Teachman & Addison, 2008).

After a brief filler task, participants saw the title of each of the ICT-relevant scenarios (e.g., “THE JOB INTERVIEW”), along with four interpretation options relevant to each scenario. One of the interpretation options was inconsistent with a maladaptive ICT-relevant belief (ICT Positive: “As thoughts about the interview pop into your mind, you realize that controlling all of them won't matter for whether or not you get the job”), one was consistent with a maladaptive ICT-relevant belief (OC Negative: “As thoughts about the interview pop into your mind, you realize that you need to control them if you want to make a favorable impression”), and two were positive and negative but were not ICT-relevant (referred to here as Foil items). Participants were asked to rate each interpretation option independently

¹The Recognition Scenarios and Ratings measure included a total of 10 scenarios across OC belief domains (4 related to Importance/Control of Thoughts; 3 related to Responsibility/Threat Estimation; and 3 related to Uncertainty/Perfectionism). Analyses in the current study focus only on the four Importance/Control of Thoughts scenarios. However, pointing to the specificity of training, t-tests indicated that there were no significant group differences in Recognition Ratings for Responsibility/Threat Estimation and Uncertainty/Perfectionism for any of the four variations across relevance (OC-relevant versus non-OC relevant) and valence (positive vs. negative) dimensions (all ps > .10).

as to how similar they thought it was to the scenario they had previously read (i.e., *Recognition Ratings*).

Beliefs: The *Obsessional Beliefs Questionnaire-Short Form* (OBQ-44; OCCWG, 2005) is a 44-item measure that assesses general belief domains thought to be critical for OCD, including the Importance/Control of Thoughts. This measure has shown internal and predictive validity for both clinical and non-clinical samples (OCCWG, 2005). In the present study, the 12-item Importance/Control of Thoughts subscale was administered to the psychology participant pool in order to recruit participants; it demonstrated inadequate reliability at baseline (Baseline OBQ-ICT; $\alpha = .44$). The OBQ-44 was also administered to participants after the training and Recognition Scenarios to evaluate change in obsessional beliefs following training; it demonstrated good reliability (analyses focus on the 12-item ICT subscale; Post-training OBQ-ICT [administered during study] $\alpha = .83$). Instructions for the post-training OBQ-ICT were modified slightly to capture state (relative to trait) beliefs (see Clerkin & Teachman, 2011).

The *Thought-action Fusion Scale* (TAF; Shafran, Thordarson, & Rachman, 1996) is a 19-item self-report measure. In this study, the TAF Scale was used as a convergent check to determine the degree to which training influenced Importance/Control of Thoughts beliefs, as thought-action fusion was one of the underlying constructs used to conceptualize the Importance/Control of Thoughts belief domain (OCCWG, 2005). This measure consists of two subscales: TAF-Moral subscale (i.e., the notion that thinking a negative thought is morally equivalent to committing a negative action), and TAF-Likelihood subscale (i.e., the notion that thinking a negative thought makes it more likely that a negative outcome will occur). Reliability for both subscales was excellent ($\alpha = .93$ for each).

Evaluation of training: Responses to an ICT stressor: Participants were guided through a manipulation to assess whether the training had an impact on responses to an ICT stressor (referred to as ICT stressor responding). First, participants were asked to read and reflect on a list of intrusive thoughts (e.g., harming someone, desire for sex with an inappropriate partner; adapted from Kyrios, 2000, and Rachman & de Silva, 1978). The participant was then prompted to choose a personally meaningful intrusive thought, write it on a slip of paper, and concentrate on the thought for one minute. Following this, peak distress associated with the task (referred to as *PANAS-ICT*) was evaluated.

Next, participants completed a questionnaire assessing how strong their urge was to engage in neutralizing activities, including ripping up the paper (on which their thought was written), throwing the paper away, writing out a new sentence, washing their hands, making a phone call, saying a prayer, or “other.” A *Neutralizing Urge* variable was calculated by taking an average of each of these items. Finally, participants were asked whether they wanted to engage in any of the activities and were given to opportunity to engage in the activity. The total number of activities completed was recorded (referred to as *Neutralizing Behavior*).

Procedure

All participants completed the OBQ-ICT subscale during the university's participant pool mass testing within no more than 3.5 months prior to participating in the study. Upon enrolling in the study, participants were randomly assigned to either the positive ($n = 38$) or control ($n = 39$) training condition according to a randomized block design. First, participants completed demographic and descriptive information, followed by baseline measures of symptoms (OCI-R and PHQ-4) and negative affect (PANAS-Pre). Second, participants completed either the positive or control CBM-I training condition, which lasted approximately 15-20 minutes. Following training, participants again rated their negative affect to evaluate any shifts resulting from training (PANAS-Post). Third, to evaluate the impact of training on interpretations and beliefs, participants viewed the Recognition Scenarios and completed Recognition Ratings, the post-training OBQ-44 (including the ICT subscale), and the TAF Scale. Finally, participants engaged in an ICT stressor in which they were asked to reflect on a personally meaningful intrusive, unwanted thought. Following this, measures assessing participants' distress (PANAS-ICT), neutralizing urge, and neutralizing behaviors were taken (i.e., ICT stressor responding). At the conclusion of the study, participants completed an exit questionnaire to determine their awareness of study hypotheses. Participants were then fully debriefed and compensated for their time. Procedures were approved by the Institutional Review Board, and all participants consented to participate.

Data Analytic Plan

Structural equation modeling (SEM) with bias-corrected bootstrapping was used in AMOS 22 to examine the effects of training on beliefs and ICT stressor responding, as well as to test whether change in beliefs would account for training condition differences in ICT stressor responding. We chose this approach because it permitted us to estimate the relationship between training and multiple dependent variables while simultaneously excluding measurement error and directly examining the possibility of mediation. Bias-corrected bootstrapping was used to test mediation by estimating the presence and size of the indirect (i.e., mediated) effect (Rucker, Preacher, Tormala, & Petty, 2011). By emphasizing these characteristics, this method follows recent recommendations *not* to conduct tests of mediation by first focusing on the significance of the direct and/or total effect. There is often greater power to detect the indirect effect (vs. the direct and/or total effect) and the indirect effect estimates the magnitude of mediation regardless of these other effects' significance (Rucker et al., 2011). As a result, initial non-significant tests of the direct or total effect can prevent theory-based tests of mediation from being conducted. Bias-corrected bootstrapping also provides bias-corrected estimates of the indirect effect, is robust against violations of multivariate normality (MacKinnon, Lockwood, & Williams, 2004), and maximizes power compared to traditional mediation tests (Fritz & MacKinnon, 2007).

For the models, we created latent variables to represent 'Change in ICT-relevant Beliefs' and 'ICT Stressor Responding'. For Change in ICT-relevant Beliefs, we represented the construct using four indicators: change in Importance of Thoughts, change in Control of Thoughts, change in TAF-Likelihood, and change in TAF-Morality. Specifically, from the

post-training OBQ-ICT subscale, we created two indicators that separately grouped the items representing Importance versus Control of Thoughts. From the TAF Scale, we created two indicators that entered the Moral and Likelihood subscales separately.² To capture change in each indicator, we calculated the residual variance left after accounting for the corresponding baseline scores (e.g., the residual variance of post-training Importance of Thoughts left after accounting for baseline Importance of Thoughts). For the two TAF indicators, which did not have baseline scores, we calculated the residual variance left after accounting for the baseline OBQ-44 Importance of Thoughts and Control of Thoughts subscales (entered as separate independent variables), as these dimensions are conceptually similar to TAF (Shafran et al., 1996). As a result, the final latent variable reflects the change in ICT-relevant beliefs that occurred during training. For ICT Stressor Responding, we used three indicators: change in negative affect during the ICT stressor, Neutralizing Urge, and Neutralizing Behavior. For negative affect, we calculated the residual variance left after accounting for negative affect reported after training. Thus, the negative affect indicator reflects the residual change in negative affect from before to after the ICT stressor.

Results

Sample Characteristics

Table 1 shows participant characteristics by training condition. Chi-square tests indicated that there were no significant differences between the training conditions for sex ($\chi^2(1, N = 77) = 2.23, p = .14$) or race ($\chi^2(1, N = 77) = .40, p = .53$). T-tests indicated that there were no significant differences between the training conditions for age ($t(75) = .03, p = .97, d = .01$), obsessive-compulsive symptoms assessed with the OCI-R ($t(75) = .18, p = .86, d = .04$), obsessional beliefs assessed with the OBQ-ICT ($t(75) = .93, p = .34, d = .21$), or baseline negative affect assessed with the PANAS-NA ($t(74) = 1.68, p = .10, d = .39$). There was a significant difference in depression and anxiety symptoms, as measured by the PHQ-4 ($t(75) = 2.98, p = .004, d = .69$), with the positive training condition reporting fewer symptoms than the control. We initially considered depression and anxiety symptoms (PHQ-4) as a possible covariate in subsequent analyses, but dropped this variable from our models (unless specified) because it did not affect the pattern of primary results.

Training Manipulation Check

To check the influence of the training manipulation and the specificity of its impact on Recognition Ratings, we conducted a 2 (Training condition: positive, control) $\times$ 2 (Valence: positive, negative) $\times$ 2 (ICT-relevance: ICT-relevant, foil) repeated measures analysis of variance (ANOVA), with training condition as the between-subjects variable and valence and ICT-relevance as within-subjects variables. There were significant main effects of valence ($F(1, 75) = 21.08, p < .001, \eta_p^2 = .22$) and ICT-relevance ($F(1, 75) = 173.98, p < .001, \eta_p^2 = .70$), as well as a significant training condition by valence interaction ($F(1, 75) = 37.49, p < .001, \eta_p^2 = .33$). All of these effects were subsumed by the expected significant training condition by valence by ICT-relevance interaction ($F(1, 75) = 34.72, p < .001, \eta_p^2 = .32$). Follow-up t-tests examining each of the four ICT-relevance and valence variations

²Using other variations to represent the cognitive latent variable resulted in the same pattern of findings.

individually showed that the positive (vs. control) training condition resulted in more positive ($t(75) = 5.11, p < .001, d = 1.18$) and fewer negative ($t(75) = 5.39, p < .001, d = 1.25$) interpretations associated with ICT. The training conditions did not differ for positive ($t(75) = .54, p = .59, d = .12$) or negative foils ($t(75) = .32, p = .75, d = .07$), indicating that training effects did not extend to generally positive or negative interpretations.

To test whether training directly influenced negative affect (assessed with the PANAS-NA), we conducted a 2 (Training condition: positive, control) $\times$ 2 (Time: pre-training, post-training) repeated measures ANOVA. Consistent with expectations, there was not a significant training condition by time interaction ($F(1, 74) = .04, p = .84, \eta^2_p = .001$). This reinforces the conclusion that training influenced ICT-relevant interpretations and beliefs, as opposed to general negative affect.

Effects of Training on Change in ICT-relevant Beliefs and ICT Stressor Responding

To examine the impact of training on change in ICT-relevant beliefs and ICT-relevant stressor responding, we used SEM to examine the pattern of relationships among these variables. In the models, the positive training condition was coded with a one, while the control training condition was coded with a zero. As seen in Figure 1, participants in the positive (vs. control) training condition reported significantly greater decreases in ICT-relevant beliefs ($\beta = -.33, p = .008, 95\% \text{ CI } [-.56, -.07]$) but did not reach significance for lesser ICT-relevant stressor responding ($\beta = -.21, p = .09, 95\% \text{ CI } [-.41, -.03]$), although the magnitude of both effects was relatively comparable. The magnitude of coefficients was similar when depression and anxiety symptoms, assessed with the PHQ-4, were included as a covariate ($-.24$ and $-.16$ respectively), although the significance of the ICT-relevant beliefs test crossed the $p = .05$ threshold ($p = .08$) with the covariate included.

Testing the Mediation of ICT Stressor Responding via Change in ICT-relevant Beliefs

Finally, we tested whether change in ICT-relevant beliefs due to training would account for participants' level of ICT-relevant stressor responding. To test the key question of mediation, we examined the size and significance of the estimated indirect effect of training on ICT stressor responding through change in ICT-relevant beliefs (i.e., training condition predicts change in ICT-relevant beliefs, which in turn predicts ICT stressor responding; see Figure 1). In other words, we evaluated the estimate of the relationship between training condition and ICT stressor responding that occurred via change in ICT-relevant beliefs. Results showed that, as expected, decreases in ICT-relevant beliefs were in the direction of predicting lower ICT stressor responding ($\beta = .31, p = .07, 95\% \text{ CI } [-.02, .63]$). For the critical test of mediation, the estimate of the relationship between training condition and ICT stressor responding that occurred via change in ICT-relevant beliefs (i.e., the indirect effect) was significantly different than zero and small in magnitude ($-.10, p < .05, 95\% \text{ CI } [-.31, -.002]$). Inclusion of depression and anxiety symptoms (PHQ-4) as a covariate did not substantially alter the indirect effect ($-.08, p < .05, 95\% \text{ CI } [-.27, -.001]$). These findings suggest that change in ICT-relevant beliefs does mediate the relationship between training and ICT stressor responding, but to a small degree.

Checking for Demand Effects

During debriefing, participants were asked to guess the purpose of the study and of the training paradigm in particular. Excluding participants who guessed that the study was intended to influence their negative affect ($n = 5$) or thoughts ($n = 21$) did not alter the pattern of central results, and in fact increased the magnitude of coefficients, indicating that the central results are not attributable to demand effects. We retained all participants in the final analyses to maximize our sample size and power.

Discussion

The current study evaluated an adaptation of a CBM-I procedure targeting interpretations related to a maladaptive belief implicated in OCD symptoms – Importance/Control of Thoughts, or the belief that thoughts are personally significant and should thus be controlled. As predicted, we found that individuals in a positive (vs. control) training condition reported decreases in ICT-relevant beliefs, as measured by well-established measures of obsessive beliefs (OBQ-ICT) and thought-action fusion (TAF Scale). Further, the impact of training on ICT stressor responding was in the anticipated direction, although it did not reach significance.³ Importantly, there was a small, significant indirect effect of training on measures of ICT stressor responding via decreases in ICT-relevant beliefs (albeit the direct effect of training on ICT stressor responding was at the level of a nonsignificant trend). Considered as a whole, results indicate that training was effective in influencing beliefs tied to ICT, and that there may be clinical utility to shifting this belief domain.

Testing and targeting ICT-relevant interpretations and beliefs is critical given the dominant role they play across a variety of clinical orientations, most notably cognitive-behavioral (Whittal & McLean, 1999) and acceptance-based behavioral therapies (Hannan & Tolin, 2005). While therapeutic strategies differ across these approaches, a unifying goal is enhancing psychological flexibility so that clients come to see their thoughts as “just thoughts,” and do not engage in control attempts that are likely to be counterproductive across OCD and many other problem areas (Magee, Harden, & Teachman, 2012). In cognitive-behavioral therapy, clients are encouraged to consider that simply having a thought (e.g., I am a terrible, immoral person) does not necessarily make this thought true. In acceptance-based therapies, rather than challenging its truth, clients are encouraged to accept and “disentangle” themselves from the thought, therefore giving it less importance.

Harnessing the power of CBM-I to target ICT by repeatedly assigning non-threatening interpretations without requiring explicit interpretation or belief change, could be clinically useful. Indeed, prior work using similar methodology points to the need to more closely match CBM-I with a given person's symptom profile (see discussion in Beadel, et al., 2013; pp. 13-14). For instance, someone with elevated beliefs tied to ICT might benefit from having this belief domain targeted in such a direct way (hence complementing more traditional forms of talk therapy, which typically use a broad array of tools and strategies to

³Including depression and anxiety symptoms (assessed with the PHQ-4) slightly weakened the magnitude of the coefficients for the paths from training to ICT-relevant beliefs and ICT stressor responding. The significance of the ICT beliefs test crossed the $p = .05$ threshold ($p = .08$) with the covariate included, but the significance of the indirect effect did not.

target a broad array of mechanisms). Future research is needed to test this question, as well as to test the conditions (if any) under which targeting a single belief domain is more clinically useful than targeting multiple belief domains, as done in prior research (see Beadel et al., 2013; Clerkin & Teachman, 2011; Williams & Grisham, 2013). Regardless, given the time and investment involved in any form of intervention, identifying the mechanisms of action in symptom reduction is vital.

Supporting the utility of this CBM-I adaptation, there was a small but meaningful impact of training on short-term ICT stressor responding via the training effects on ICT-relevant beliefs (i.e., the indirect effect). Thus, it seems likely that ICT-relevant beliefs play some role in the development or maintenance of OC-relevant symptoms. Clinically, it is meaningful that the impact of CBM-I did not depend upon fear activation (recall that there were no significant training group differences in the measure of negative affect administered immediately following training and before the measure of interpretation bias). This finding is consistent with prior CBM-I studies (e.g., Amir, Bomyea, & Beard, 2010; Beadel et al., 2013; Clerkin & Teachman, 2011; Murphy, et al., 2007; Teachman & Addison, 2008), as well as research suggesting that fear reduction during exposure (habituation) may not be necessary to predict therapeutic outcomes (Craske, Kircanski, Zelikowsky, Mystkowski, Chowdhury, & Baker, 2008; Craske, Liao, Brown, Vervliet, 2012). Thus, this research adds to the literature suggesting that CBM-I interventions may provide a “gateway” into treatment for the many individuals who are either unwilling or unable to engage in more traditional, exposure-based treatments.

Given the initial “proof of concept” in this study, it is necessary to consider ways to enhance the size and generalizability of the effects. First, like previous CBM-I studies (Beadel et al., 2013; Menne-Lothmann et al., 2014; Williams & Grisham, 2013), this study suggests that downstream effects on responses to a clinically relevant stressor can be difficult to detect after single-session studies. It is likely that in line with other forms of cognitive-behavioral therapies, additional training sessions will exert a more powerful training effect. Second, it is probable that individuals need additional time and practice to consolidate new learning about unwanted, intrusive thoughts into their existing belief systems and that this time/practice is necessary to meaningfully impact clinically relevant responding. Thus, future work examining more long-term responses to clinically relevant stressors (i.e., ICT stressor responding assessed several days or weeks after training) is needed. These extensions of this study are also needed to evaluate the broader meaningfulness of the ICT belief domain for psychopathology, particularly in light of recent theories that dysfunctional beliefs central to cognitive-behavioral theories may be epiphenomena of OCD (Cogle & Lee, 2014).

Finally, the small size of the indirect effect (and the small, non-significant trend for the direct path between training and ICT stressor responding) suggests that dysfunctional beliefs associated with ICT are only one of several mediating factors. For instance, theoretical and empirical accounts of CBM-I suggest that change in interpretation bias is a mechanism of action driving symptom reduction and other cognitive changes associated with CBM-I (see Beadel et al., 2013; Mathews & Mackintosh, 2000). Further, there is some evidence that OC-relevant beliefs (assessed with the OBQ-44) influence the occurrence of, and distress

associated with, intrusive thoughts via appraisal and control strategies (Moulding et al., 2014).

We were unable to test whether change in interpretation bias mediated the relationship between condition and ICT stressor responding given that we only included a manipulation check measure of interpretation bias (i.e., ICT-relevant Recognition Ratings) following training. It will be critical for future researchers testing mediation by interpretations to use more comprehensive, established measures of interpretations (e.g., Interpretations of Intrusions Inventory; OCCWG, 2005), which can be administered both prior to and following training. Notwithstanding, it is important to highlight that Beadel and colleagues (2013) found that change in interpretation bias did not fully mediate change in OC beliefs (assessed with the OBQ-44) as a function of training, and Moulding et al. (2014) found that some direct effects linking OC-relevant beliefs and intrusive thoughts outcomes remained after accounting for appraisal and control strategies. Thus, while change in interpretations appears to be one of the active change processes in CBM-I, greater research is needed to fully understand the mechanisms driving therapeutic effects.

Limitations and Conclusions

This work should be interpreted in light of several limitations. First, the reliability for the measure used to screen participants into this study (i.e., the baseline OBQ-ICT) was low. This may have been due to the fact that the current sample included a restricted range of participants, as the reliability for the entire participant pool was acceptable (though this leaves unclear why the reliability for the OBQ-ICT was adequate during the actual testing session).⁴ Nevertheless, it is notable that by including a pre- and post-training measure of OCT-relevant beliefs and using SEM to exclude measurement error, this study was able to demonstrate that change in ICT-relevant beliefs did occur. Second, we used a student population in the current study, so it is not known how well these findings will generalize to a sample of individuals diagnosed with OCD. That said, all participants in the present study scored within one standard deviation on the OCI-R of a sample diagnosed with OCD ($M = 28.01$, $SD = 13.53$). Further, there is increasing evidence that obsessional thoughts likely exist along a continuum (Clark et al., 2014; Lee, Lee, Kim, Kwon, & Telch, 2005). Third, we were only able to effectively test change in ICT-relevant beliefs as a potential mediator linking CBM-I and ICT stressor responding. Change in interpretation bias and other possible mechanisms, like the potential for positive reinforcement to influence cognitive changes (MacLeod, Koster, & Fox, 2009), must continue to be evaluated while carefully weighing the tradeoffs between using multiple measurements of change and introducing issues such as practice effects.

Notwithstanding these limitations, the current study contributes to the quickly developing literature that CBM-I can influence clinically relevant outcomes via a very brief, experimental intervention (Clerkin & Teachman, 2011; Lang, Moulds, & Holmes, 2009; Steinman & Teachman, 2010; Wilson, MacLeod, Mathews, & Rutherford, 2006). Further,

⁴Previous research evaluating CBM-I in the context of intrusive thinking and heightened OC symptoms also found that a pre-selection measure (in that case, the OCI-R) administered during mass testing had poor reliability among a high symptom subgroup ($\alpha = .47$). See Clerkin and Teachman (2011) for details.

this research helps move the field one step closer to applying clinical care on the basis of underlying mechanisms tied to symptom improvement, as opposed to applying clinical care on the basis of one's clinical diagnosis. This is exciting because if developed further, simple interventions such as this could yield easily disseminable, trans-theoretical tools that help individuals to evaluate their thoughts in healthier ways.

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References

- Amir N, Bomyea J, Beard C. The effect of single-session interpretation modification on attention bias in socially anxious individuals. *Journal of Anxiety Disorders*. 2010; 24:178–182. doi:10.1016/j.janxdis.2009.10.005. [PubMed: 19926442]
- Badel JR, Smyth FL, Teachman BA. Change processes during cognitive bias modification for obsessive compulsive beliefs. *Cognitive Therapy and Research*. 2013; 38:103–119. doi: 10.1007/s10608-013-9576-6.
- Beard C, Amir N. A multi-session interpretation modification program: Changes in interpretation and social anxiety symptoms. *Behaviour Research and Therapy*. 2008; 46:1135–1141. doi: 10.1016/j.brat.2008.05.012. [PubMed: 18675400]
- Bouvard M, Robbe-Grillet P, Milliere M, Pham S, Amireche S, Fanget F, Cottraux J. Validation of a scale for responsibility (Salkovskis Responsibility Scale). *Encephale*. 2001; 27:229–237. [PubMed: 11488253]
- Clark DA, Abromowitz J, Alcolado GM, Alonso P, Belloch A, Bouvard M, Wong W. Part 3. A question of perspective: The association between intrusive thoughts and obsessionality in 11 countries. *Journal of Obsessive-Compulsive and Related Disorders*. 2014 Advance online publication. doi: 10.1016/j.jocrd.2013.12.006.
- Clerkin EM, Teachman BA. Training interpretation biases among individuals with symptoms of obsessive-compulsive disorder. *Journal of Behavior Therapy and Experimental Psychiatry*. 2011; 42:337–343. doi: 10.1016/j.jbtep.2011.01.003. [PubMed: 21371415]
- Cogle JR, Lee H-J. Pathological and non-pathological features of obsessive-compulsive disorder: Revisiting basic assumptions of cognitive models. *Journal of Obsessive-Compulsive and Related Disorders*. 2013 doi: /10.1016/j.jocrd.2013.11.002i.
- Craske MG, Kircanski K, Zelikowsky M, Mystkowski J, Chowdhury N, Baker A. Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*. 2008; 46:5–27. doi: 10.1016/j.brat.2007.10.003. [PubMed: 18005936]
- Craske MG, Liao B, Brown L, Vervliet B. Role of inhibition in exposure therapy. *Journal of Experimental Psychopathology*. 2012; 3:322–345. doi:10.5127/jep.026511.
- Foa EB, Huppert JD, Leiberg S, Langner R, Kichic R, Hajcak G, Salkovskis PM. The Obsessive-Compulsive Inventory: Development and validation of a short version. *Psychological Assessment*. 2002; 14:485–496. doi: 10.1037/1040-3590.14.4.485. [PubMed: 12501574]
- Forrester E, Wilson C, Salkovskis PM. The occurrence of intrusive thoughts transforms meaning in ambiguous situations: An experimental study. *Behavioural and Cognitive Psychotherapy*. 2002; 30:143–152. doi: 10.1017/S1352465802002023.
- Fritz MS, MacKinnon DP. Required sample size to detect the mediated effect. *Psychological Science*. 2007; 18:233–239. doi: 10.1111/j.1467-9280.2007.01882.x. [PubMed: 17444920]
- Frost, RO.; Steketee, G. *Cognitive approaches to obsessions and compulsions: Theory, assessment, and treatment*. Pergamon/Elsevier Science Inc.; Amsterdam, Netherlands: 2002.

- Gerbing DW, Anderson JC. Improper solutions in the analysis of covariance structures: Their interpretability and a comparison of alternate respecifications. *Psychometrika*. 1987; 52:99–111. doi: 10.1007/BF02293958.
- Hannan, SE.; Tolin, DF. Acceptance and mindfulness-based behavior therapy for obsessive-compulsive disorder.. In: Orsillo, SM.; Roemer, L., editors. *Acceptance and mindfulness-based approaches to anxiety: Conceptualization and treatment*. Springer Science + Business Media; New York, NY: 2005. p. 271-299. doi: 10.1007/0-387-25989-9_11
- Kyrios, M. A cognitive perspective on the etiology of obsessive-compulsive disorder.. Paper presented at the annual meeting of the Association for the Advancement of Behavior Therapy; New Orleans, LA. 2000, November;
- Lang TJ, Moulds ML, Holmes EA. Reducing depressive intrusions via a computerized cognitive bias modification of appraisals task: Developing a cognitive vaccine. *Behaviour Research and Therapy*. 2009; 47:139–145. doi:10.1016/j.brat.2008.11.002. [PubMed: 19091308]
- Lee H, Lee S, Kim H, Kwon S, Telch MJ. A comparison of autogenous/reactive obsessions and worry in a nonclinical population: A test of the continuum hypothesis. *Behaviour Research and Therapy*. 2005; 43:999–1010. doi:10.1016/j.brat.2004.06.017. [PubMed: 15967171]
- Löwe B, Wahl I, Rose M, Spitzer C, Glaesmer H, Wingenfeld K, Brähler E. A 4-item measure of depression and anxiety: Validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *Journal of Affective Disorders*. 2010; 122:86–95. doi: 10.1016/j.jad.2009.06.019. [PubMed: 19616305]
- MacKinnon DP, Lockwood CM, Williams J. Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research*. 2004; 39:99–128. doi: 10.1207/s15327906mbr3901_4. [PubMed: 20157642]
- MacLeod C, Koster EW, Fox E. Whither cognitive bias modification research? Commentary on the special section articles. *Journal of Abnormal Psychology*. 2009; 118:89–99. doi:10.1037/a0014878. [PubMed: 19222317]
- Magee JC, Harden K, Teachman BA. Psychopathology and thought suppression: A quantitative review. *Clinical Psychology Review*. 2012; 32:189–201. doi: 10.1016/j.cpr.2012.01.001. [PubMed: 22388007]
- Mathews A, Mackintosh B. Induced emotional interpretation bias and anxiety. *Journal of Abnormal Psychology*. 2000; 109:602–615. doi: 10.1037/0021-843X.109.4.602. [PubMed: 11195984]
- Menne-Lothmann C, Viechtbauer W, Höhn P, Kasanova Z, Haller SP, Drukker M, Lau JYF. How to boost positive interpretations? A meta-analysis of the effectiveness of cognitive bias modification for interpretation. *PLOS ONE*. 2014; 9 doi:10.1371/journal.pone.0100925.
- Moulding R, Coles ME, Abramowitz JS, Alcolado GM, Alonso P, Belloch A, Wong W. Part 2. They scare because we care: The relationship between obsessive intrusive thoughts and appraisals and control strategies across 15 cities. *Journal of Obsessive-Compulsive and Related Disorders*. 2014 Advance online publication. doi: 10.1016/j.jocrd.2014.02.006.
- Murphy R, Hirsch CR, Mathews A, Smith K, Clark DM. Facilitating a benign interpretation bias in a high socially anxious population. *Behaviour Research and Therapy*. 2007; 45:1517–1529. doi: 10.1016/j.brat.2007.01.007. [PubMed: 17349970]
- Obsessive Compulsive Cognitions Working Group. Cognitive assessment of obsessive-compulsive disorder. *Behaviour Research and Therapy*. 1997; 35:667–681. doi: doi:10.1016/S0005-7967(97)00017-X. [PubMed: 9193129]
- Obsessive Compulsive Cognitions Working Group. Psychometric validation of the Obsessive Beliefs Questionnaire and the Interpretation of Intrusions Inventory: Part I. *Behaviour Research and Therapy*. 2003; 41:863–878. doi: 10.1016/S0005-7967(02)00099-2. [PubMed: 12880642]
- Obsessive Compulsive Cognitions Working Group. Psychometric validation of the Obsessive Belief Questionnaire and Interpretation of Intrusions Inventory - Part 2: Factor analyses and testing of a brief version. *Behaviour Research and Therapy*. 2005; 43:1527–1542. doi: 10.1016/j.brat.2004.07.010. [PubMed: 16299894]
- Olatunji BO, Rosenfield D, Tart CD, Cottraux J, Powers MB, Smits JJ. Behavioral versus cognitive treatment of obsessive-compulsive disorder: An examination of outcome and mediators of change.

- Journal of Consulting and Clinical Psychology. 2013; 81:415–428. doi: 10.1037/a0031865. [PubMed: 23421734]
- Rachman, S. Personal Significance Scale: Unpublished manuscript. 2001.
- Rachman SS. A cognitive theory of obsessions. Behaviour Research and Therapy. 1997; 35:793–802. doi: 10.1016/S0005-7967(97)00040-5. [PubMed: 9299799]
- Rachman SS. A cognitive theory of obsessions: Elaborations. Behaviour Research and Therapy. 1998; 36:385–401. doi: 10.1016/S0005-7967(97)10041-9. [PubMed: 9670600]
- Rachman SS, de Silva PP. Abnormal and normal obsessions. Behaviour Research and Therapy. 1978; 16:233–248. doi: 10.1016/0005-7967(78)90022-0. [PubMed: 718588]
- Radomsky AS, Alcolado GM, Abramowitz JS, Alonso P, Belloch A, Bouvard M, Wong W. Part1 - You can run but you can't hide: Intrusive thoughts on six continents. Journal of Obsessive-Compulsive and Related Disorders. 2013 doi: 10.1016/j.jocrd.2013.09.002.
- Rassin E, Merckelbach H, Muris P, Spaan V. Thought–action fusion as a causal factor in the development of intrusions. Behaviour Research and Therapy. 1999; 37:231–237. doi: 10.1016/S0005-7967(98)00140-5. [PubMed: 10087641]
- Rucker DD, Preacher KJ, Tormala ZL, Petty RE. Mediation analysis in social psychology: Current practices and new recommendations. Social and Personality Psychology Compass. 2011; 5:359–371. doi: 10.1111/j.1751-9004.2011.00355.x.
- Salkovskis PM. Obsessional-compulsive problems: A cognitive-behavioral analysis. Behaviour Research and Therapy. 1985; 23:571–583. doi: 10.1016/0005-7967(85)90105-6. [PubMed: 4051930]
- Shafran R, Thordarson DS, Rachman SS. Thought-action fusion in obsessive-compulsive disorder. Journal of Anxiety Disorders. 1996; 10:379–391. doi: 10.1016/0887-6185(96)00018-7.
- Steinman SA, Teachman BA. Modifying interpretations among individuals high in anxiety sensitivity. Journal of Anxiety Disorders. 2010; 24:71–78. doi: 10.1016/j.janxdis.2009.08.008. [PubMed: 19747797]
- Teachman BA, Addison LM. Training non-threatening interpretations in spider fear. Cognitive Therapy and Research. 2008; 32:448–459. doi: 10.1007/s10608-006-9084-z.
- Teachman BA, Woody SR, Magee JC. Implicit and explicit appraisals of the importance of intrusive thoughts. Behaviour Research and Therapy. 2006; 44:785–805. doi: 10.1016/j.brat.2005.05.005. [PubMed: 16046211]
- Watson, D.; Clark, L. The PANAS-X: Manual for the positive and negative affect schedule - expanded form. The University of Iowa; 1994.
- Whittal ML, McLean PD. CBT for OCD: The rationale, protocol, and challenges. Cognitive and Behavioral Practice. 1999; 6:383–396. doi: 10.1016/S1077-7229(99)80057-1.
- Wilhelm S, Steketee G, Fama JM, Buhlmann U, Teachman BA, Golan E. Modular cognitive therapy for obsessive-compulsive disorder: A wait-list controlled trial. Journal of Cognitive Psychotherapy. 2009; 23:294–305. doi:10.1891/0889-8391.23.4.294. [PubMed: 21072138]
- Williams AD, Grisham JR. Cognitive Bias Modification (CBM) of obsessive-compulsive beliefs. BMC Psychiatry. 2013; 13 doi:10.1186/1471-244X-13-256.
- Wilson EJ, MacLeod C, Mathews A, Rutherford EM. The causal role of interpretive bias in anxiety reactivity. Journal of Abnormal Psychology. 2006; 115:103–111. doi:10.1037/0021-843X.115.1.103. [PubMed: 16492101]
- Woody SR, Whittal ML, McLean PD. Mechanisms of symptom reduction in treatment for obsessions. Journal of Consulting and Clinical Psychology. 2011; 79:653–664. doi:10.1037/a0024827. [PubMed: 21823783]
- Zucker BG, Craske MG, Barrios V, Holguin M. Thought action fusion: Can it be corrected?. Behaviour Research and Therapy. 2002; 40:652–664. doi:10.1016/S0005-7967(01)00054-7.

- SEM with bias-corrected bootstrapping was used to examine the effects of CBM-I.
- A positive (vs. control) condition predicted decreases in ICT-relevant beliefs.
- Decreases in ICT beliefs mediated the impact of training on ICT stressor responding.

Figure 1.

Structural Equation Model Testing Change in ICT-relevant Beliefs as a Mediator of the Relationship Between Training Condition and ICT Stressor Responding. *Note.* * $p < .05$, $^+p < .10$. Circles indicate latent variables, rectangles indicate measured (indicator) variables, and curved arrows indicate error terms for each variable. 'Importance' refers to beliefs about the Importance of Thoughts, 'Control' refers to beliefs about the Control of Thoughts, 'Morality' refers to the TAF-Moral subscale, 'Likelihood' refers to the TAF-Likelihood subscale, and 'Negative Aff.' to Negative Affect. Due to a slightly negative error variance for the neutralizing urge indicator, this error term was set to zero (Gerbing & Anderson, 1987).

Table 1

Baseline Sample Characteristics

	Training Condition					
	Positive		Control		Full Sample	
	<i>M or N</i>	<i>SD or %</i>	<i>M or N</i>	<i>SD or %</i>	<i>M or N</i>	<i>SD or %</i>
Age	18.74	.92	18.74	.85	18.74	.88
Sex (Female)	31	82%	26	67%	57	74%
Race						
Caucasian	34	90%	33	85%	67	87%
Black	2	5%	2	5%	4	5%
Asian	0	0%	1	3%	1	1%
More than one	0	0%	3	8%	3	4%
Other	2	5%	0	0%	2	3%
OCI-R	15.87	8.88	16.23	8.99	16.05	8.88
PHQ-4	2.50 ^a	1.98	3.97 ^b	2.35	3.25	2.28
OBQ-ICT (baseline)	43.68	7.32	42.28	5.94	42.97	6.65
PANAS-NA (baseline)	12.35	2.98	13.77	4.23	13.08	3.72

Note: Training condition differences are noted by unique letter superscripts (i.e., 'a' vs. 'b') and are all significant at $p < .05$. OCI-R is the *Obsessive-Compulsive Inventory-Revised*, PHQ-4 is the *Patient Health Questionnaire-4*, OBQ-ICT is the Importance/Control of Thoughts subscale of the *Obsessive Beliefs Questionnaire-44*, PANAS-NA is the Negative Affect subscale of the *Positive and Negative Affect Schedule*. Percentages for race may not add up to 100% due to rounding.