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Testing the habituation-based model of exposures for child and adolescent anxiety

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Abstract

Exposure has been identified as key to effective treatment of youth anxiety. However, the precise theoretical mechanisms of exposure are a matter of debate. Emotional Processing Theory emphasizes the need for fear activation during exposure and its habituation both within and across exposures. Despite the popularity of the theory to explain exposure, it has not been tested with anxious youth.

Objective—To determine whether Emotional Processing Theory parameters predict anxiety severity, coping abilities, and global functioning after cognitive-behavioral treatment (CBT).

Methods—The present study examined 72 youth ($M_{\text{age}} = 10.50$ years; 45% female; 87.5% non-Hispanic Caucasian) diagnosed with an anxiety disorder and who received family or individual CBT. Three exposure habituation variables, initial fear activation (peak anxiety), within session habituation, and between session habituation, were assessed using Subjective Units of Distress and examined as predictors of outcome at posttreatment and at 1-year follow-up. Outcomes were measured using the Coping Questionnaire, Multidimensional Anxiety Scale for Children, Revised Children's Manifest Anxiety Scale, Children's Global Assessment Scale, and clinician severity ratings on the Anxiety Disorder Interview Schedule.

Results—Emotional Processing Theory variables did not predict any anxiety outcomes at posttreatment or follow-up with one exception: Initial fear activation predicted less anxiety at follow-up among youth without GAD. Additionally, within and between session habituation were not associated with one another. Between session habituation was not associated with initial fear activation.

Conclusion—These findings suggest a limited role of habituation within CBT for anxiety in youth. An alternative to EPT, inhibitory learning theory, is discussed.

Keywords

Exposure; child; anxiety; cognitive behavioral therapy; emotional processing theory; inhibitory learning

Cognitive behavioral therapy (CBT) is the first line intervention for anxious youth and, according to the Division of Clinical Psychology of the American Psychological Association criteria (Chambless & Hollon, 1998) is considered “well established” (Hollon & Beck, 2013). Although particular aspects of CBT for various anxiety disorders in youth vary by treatment manual, exposure is a core element across specific interventions. Exposure is perhaps the most integral component of CBT, influencing the trajectory of improvement (Peris et al, 2015), predictive of treatment outcome (e.g., Voort, Svecova, Jacobsen, & Whiteside, 2010), and showing comparable performance when conducted in isolation and compared to more comprehensive CBT interventions (e.g., Deacon & Abramowitz, 2004). Additionally, exposure as a therapeutic tool is strengthened by its versatility, capable of being conducted across varied settings and tailored to individual presentations (Peterman, Read, Wei, & Kendall, 2014). Despite the typically reported efficacy of CBT with exposure (~60–65% treatment responders), a substantial percentage of anxious youth are nonresponders at posttreatment. For example, in the largest randomized controlled trial (RCT) for youth anxiety to date (Walkup et al. 2008), approximately 40% who received CBT without medication were treatment nonresponders, and 50% retained their anxiety diagnosis at 6-month follow-up (Piacentini et al. 2014). Although treatment response was significantly higher among youth with combined CBT and medication, about 20% still did not show substantial improvement at posttreatment and follow-up. Rates of response and remission for CBT are fairly comparable across RCTs for youth anxiety and related disorders (Kendall, 1994; Kendall, Flannery-Schroeder, Panichelli-Mindel, Southam-Gerow, Henin, & Warman, 1997; Kendall, Hudson, Gosch, Flannery-Schroeder, & Suveg, 2008; POTS Team, 2004). Furthermore, effect sizes are moderate-to-large for CBT, although small when CBT is compared to an active control (Reynolds, Wilson, Austin, & Hooper, 2012). Thus, CBT outcomes are generally favorable, but there is room for improvement.

Less than preferred outcomes for some outpatients has been a concern, with speculations about the presence of comorbidity, low motivation, contextual factors (e.g. family support), and inadequate dosage of therapy (for youth with severe anxiety who may require higher-level care; Kendall, Settapani, & Cummings, 2012) as possible factors. That said, it also possible, especially given that exposure is a critical component of CBT, that exposures are not conducted or not done properly in some cases, and that exposure therapy can be performed in alternative ways to maximize treatment effects.

As one strives to enhance outcome for treatment nonresponders, it is worth revisiting the theoretical foundations of exposure therapy. One model that has been proposed to explain the mechanisms of change within exposure is Emotional Processing Theory (EPT; Rachman, 1980; Foa & Kozak, 1986; Foa & Kozak, 1996). EPT postulates that exposure activates a memory-based fear structure, consisting of interpretations about a stimulus, physiological response, and anticipated feared outcomes (Lang, 1971). Contact with any of these components (e.g. stimulus, anxious feelings or thoughts) evokes an individual’s fear structure, often leading to escape and avoidance behaviors that temporarily deactivate the structure but do not remove it, and thus, maintain anxiety (i.e. the structure is merely dormant). In exposure, the fear structure is activated for a prolonged period of time, inhibiting avoidance behaviors which allows for new learning. As such, individuals are exposed to information that is incompatible with the initial fear structure (e.g. “the panic

attack will kill me” to “a panic attack is just unpleasant feelings that can do no real harm”) and a new non-fear structure replaces the original. The shift in fear structures may take repeated trials. Within this model, the process of fear reduction, or habituation, reflects new learning and changes in cognitive process. Thus, the EPT model presumes that exposure works when (1) the initial fear structure is activated (IFA), (2) there is the presence of within-session habituation (WSH), and (3) there is evidence of habituation between exposure trials (BSH). The EPT model also assumes that WSH is a precursor for BSH, with the latter serving as a source for long-term learning (Rauch & Foa, 2006).

Support for EPT in exposure therapy for adults has been conflicted, with some studies finding evidence for IFA, WSH, and BSH (Beck, Shipherd & Zebb, 1997, Grayson, Foa & Steketee, 1982, Kozak, Foa, & Steketee, 1988), others revealing little support (Jaycox, Foa, & Morral, 1998, van Minnen & Hageraars, 2002), and yet others evidencing a mixed picture (e.g. differences by anxiety outcome measure, EPT variable, or exposure session number; Hayes, Hope & Heimberg, 2008; Norton, Hayes-Skelton, & Klenck, 2011). Craske and colleagues (2008) reviewed the findings and concluded that evidence is largely inconsistent for IFA, with support coming from studies that use heart rate to measure IFA rather than other measures of physiological arousal (e.g. skin conductance), behavioral avoidance, or self-report. Likewise, the authors did not find compelling evidence for the importance of WSH, and only limited support for BSH. In addition, the studies are limited in number and several are methodologically flawed including poor operationalization of EPT variables, monomethod assessment of EPT and anxiety outcomes, and failure to connect EPT with *change* in anxiety. Research published since the Craske et al review has also been conflicted. For example, Baker and colleagues (2010) reported that IFA and WSH did not predict outcome on a self-report or a behavioral approach test among adults treated for fear of heights. BSH was inconsistent in its predictive ability, showing predictive power for some outcome variables and not others at post. Furthermore, WSH and BSH did not correlate, violating one of EPT’s core assumptions (Jaycox et al., 1998; Plendl & Wotjak, 2010). In another study (Kircanski et al. 2012) results were again mixed: WSH and BSH predicted outcome at post and follow-up on some, but not all, anxiety measures for adults with contamination fears, and IFA actually predicted poorer outcome. In one additional study, low IFA predicted improved outcome; however, greater IFA was related to improvement in the second exposure only and WSH predicted outcome only in the third (of three) tested exposures (Norton et al., 2011).

Critics of EPT assert that performance in a task does not necessarily predict learning, and that latent learning may occur even when there is no behavioral or physiological change within a given situation (e.g. habituation; Bjork & Bjork, 2006). Other research also supports improvement in anxiety despite an absence of habituation (Lang & Craske, 2000; Tsao & Craske, 2000). Such views originate from animal learning and memory paradigms that have failed to find rapid habituation as a strong predictor of long-term learning (Woods & Bouton, 2008). Additionally, though habituation may happen, learning (e.g. extinction) may be restricted to the specific context in which the exposure occurred, failing to generalize to situations outside of session and to produce long-term change (Craske et. al., 2008).

Acknowledging these criticisms, an alternative and more recent model for exposure has been proposed, known as Inhibitory Learning Theory (ILT; Craske et al. 2008). ILT denies that exposure weakens fear structures, which are then eclipsed by new non-fear structures (as in EPT). ILT proposes the exposures help patients develop an inhibitory meaning (i.e. non-threatening) of a feared situation or stimulus, which may not impact the original excitatory (i.e. anxiety-provoking) meaning. Cues from the environment may activate either the excitatory or inhibitory meaning, which may depend on the context of the exposure. The ILT model for exposure facilitates development of a non-threat fear association and retrieval cues to activate it. As such, improvement is judged by follow-up assessments (rather than habituation), and emphasis is on fear toleration rather than reduction.

Despite the mixed findings and the presence of an alternate theory, EPT remains the dominant model that often shapes exposure for anxious youth. For example, empirically supported treatments use Subjective Units of Distress (SUDS) to track habituation during the exposure (Freeman & Garcia, 2009; Hope, Heimberg, & Turk, 2010; Kendall & Hedtke, 2006; Pincus, Ehrenreich, & Mattis, 2008). The SUDS curve is often reviewed with youth as evidence of new learning. Furthermore, EPT's habituation-based model also guides the length of exposures, with a 50% reduction in SUDS as the widely-accepted, though arbitrarily chosen, benchmark to discontinue the exercise (Kendall, Robin, Hedtke, Suveg, Flannery-Schroeder, & Gosch, 2005). Consequently, the presence of fear reduction for one exposure permits advancement to more challenging situations on the youth's fear hierarchy. Throughout the process, therapists are mindful of habituation across sessions (BSH) that denote long-term learning.

The precise theoretical model that guides exposure has implications for multiple stages of intervention. As Abramowitz (2013) proclaims, theory largely influences psychological assessment, the content of psychoeducation, the way exposure is conducted, relapse prevention, and resources for troubleshooting when therapy is stalled. Remarkably, EPT has not been tested within a sample of anxious youth despite widespread acceptance of its parameters. Over the past few decades, SUDS and habituation have been inherent to exposure therapy for anxiety but the theoretical debate about the mechanisms within exposure has resurfaced in the adult literature (Craske et al. 2008). Given that investigations of mechanisms of change is currently a research priority for the National Institute of Mental Health and given the absence of tests focusing on youth samples, the current study tested the EPT model with a sample of anxious youth receiving treatment as part of a larger RCT. We examined whether specific EPT factors (e.g. IFA, WSH, and BSH) predicted anxiety severity, anxiety-related impairment, and perceived coping abilities at posttreatment and at one-year follow-up. Additionally, other potential predictors (e.g., age and presence of GAD diagnosis) were tested. Of note, GAD was chosen as a predictor variable (as opposed to other diagnoses) because of the heterogeneous nature of GAD worries and presence of somatic symptoms (Southam-Gerow, 2014). Such features may complicate the generalizability of gains following habituation within or between sessions.

It was hypothesized that IFA, WSH, and BSH would modestly predict treatment outcome variables at posttreatment. Because we predicted only modest effects at posttreatment, we hypothesized that significant posttreatment EPT variables would no longer predict outcome

variables at one-year follow-up. We also hypothesized that EPT would predict better outcome among youth without a GAD diagnosis.

Methods

Participants

The sample was comprised of 72 youth ($M_{\text{age}} = 10.50$ years, $SD = 1.73$) and their parents. Forty-five percent of the sample was female. The sample was primarily non-Hispanic Caucasian (87.5%), but also included African American (9.7%) youth. The primary diagnoses for youth in the present study at pretreatment were Generalized Anxiety Disorder (GAD; 50.0%), Separation Anxiety Disorder (SAD; 23.60%), and Social Anxiety Disorder/Social Phobia (SoP; 26.40%). Including both primary and secondary diagnoses, 54 youth (75.00%) met criteria for GAD, 43 youth (59.70%) met criteria for SAD, and 47 youth (65.30%) met criteria for SoP.

Participants were from a randomized controlled trial (RCT) evaluating the efficacy of individual CBT and family CBT as compared to a family-based educational support and attention control (Kendall, Hudson, Gosch, Flannery-Schroeder, & Suveg, 2008). Recruitment occurred between 2000 and 2006. A more comprehensive description of recruitment and enrollment information, including a Consolidated Standards of Reporting Trials (CONSORT) diagram can be found elsewhere (Kendall et al., 2008). In brief, individuals were eligible for the RCT if they were ages 7–14 and met diagnostic criteria for a primary diagnosis of GAD, SAD, or SoP (social anxiety disorder). Individuals were excluded if they reported psychotic symptoms, intellectual disability, were participating in concurrent treatment, or were on antianxiety or antidepressant medication. Participants were excluded from the present analyses if they provided SUDS ratings at fewer than three exposure sessions because fewer than three exposure sessions would not allow for calculation of average between session habituation. Participants were also excluded from the present analyses if they were in the Family Education/Support/Attention (FESA) condition since FESA did not include an exposure component.

Procedures

All procedures were approved by the University's Institutional Review Board. At baseline, parents consented to study procedures and youth provided assent. At baseline, independent evaluators (IEs) administered a semi-structured diagnostic interview (described below) separately to parents and youth to assess youth for anxiety disorder diagnoses. Youth and their parents completed a variety of self-report measures at baseline. Following the baseline assessment, participants were randomly assigned to one of three conditions: individual CBT (Coping Cat; Kendall & Hedtke, 2006), Family CBT (Howard, Chu, Krain, Marrs-Garcia, & Kendall, 2000), or Family Education and Support Control (Krain, Hudson, Choudhury, & Kendall, 2000). Participants in all conditions completed 16 weekly, 60-minute sessions with a therapist. Therapist adherence to protocols was checked, and therapists were judged to be adherent to the protocols used (Kendall et al., 2008). Treatment for the family CBT and individual CBT was comprised of two parts (each eight-weeks in duration). The first part (sessions 1–9) provided psychoeducation and taught skills to the child and family about how

to manage anxiety. The second part (sessions 9–16) focused on providing the child/family with opportunities to practice new skills through exposure tasks. Throughout each exposure task, youth provided SUDS ratings every two minutes to indicate how nervous or afraid they were in that moment. Participants completed assessments at post-treatment and 1-year follow-up.

Measures

Independent Evaluator (IE) Administered

Anxiety Disorders Interview Schedule for DSM-IV – Child/Parent Versions (ADIS-C/P): Independent evaluators, masked to treatment condition, diagnosed anxiety disorders using the ADIS-C/P (Silverman & Albano, 1996). The ADIS-C/P is a semi-structured diagnostic interview with established reliability and convergent validity (Lyneham, Abbott, & Rapee, 2007; Wood, Piacentini, Bergman, McCracken, & Barrios, 2002). An IE assigned clinical severity ratings (CSRs) for each assessed disorder based on parent and child interviews that were conducted separately (using a 0 to 8 scale). CSR ratings of 4 or greater are required to meet DSM-IV criteria for a diagnosis. In the present study, CSRs from participants' principal anxiety disorder and the mean CSR of all anxiety disorder diagnoses were used. IEs were required to reach and maintain interrater diagnostic reliability of 0.85 (Cohen's κ).

Children's Global Assessment Scale (CGAS): IEs masked to treatment condition assigned each participant a CGAS score to rate their overall functioning (Shaffer et al., 1983). CGAS scores range from 1 to 100, with higher scores indicating better functioning. IEs are provided with anchors to assign CGAS scores, and inter-rater reliability among IEs had to reach greater than 0.85. The CGAS has been shown to have high retest reliability (0.70 – 0.95) and to discriminate youth in inpatient versus outpatient settings (Shaffer et al., 1983). In the present study, the CGAS was used as a measure of global functioning and impairment.

Self/Parent Report Measures

Coping Questionnaire – Child Version (CQ-C): The CQ assesses a child's sense of coping with anxious distress in three challenging situations that are individualized to the participant based on information obtained in the diagnostic interview (Kendall & Marrs-Garcia, 1999). Each situation is rated on a scale of 1 (*not at all able to help*) to 7 (*totally able to help myself*), and items are summed to obtain a total score. The CQ has demonstrated adequate internal consistency, strong retest reliability, and has been shown to be a useful measure of improvement following treatment (Kendall & Marrs-Garcia, 1999). In the present sample, the internal consistency of the CQ was 0.60.

Multidimensional Anxiety Scale for Children – Child Version (MASC-C): The MASC is a 39-item self-report measure of anxiety severity with excellent internal consistency and strong convergent validity (March, Parker, Sullivan, Stallings, & Conners, 1997) and predictive validity (Wei et al., 2014). The scale assesses four factors of anxiety severity: physical symptoms, social anxiety, harm avoidance, and separation anxiety. In the present study, the MASC total raw score was used. The MASC-C asks children to rate how they

have been thinking, feeling, or acting over the past two weeks on a scale of 1 (*never*) to 4 (*often*). In the present sample, the internal consistency of the MASC was 0.92.

Revised Children's Manifest Anxiety Scale (RCMAS): The RCMAS is a 36-item measure of anxiety severity with excellent internal consistency, retest reliability, and convergent validity (Reynolds & Paget, 1981; Reynolds & Richmond, 1978). The scale assesses three factors: physiological, worry, and fear. In the present study, total RCMAS scores were used. The RCMAS asks youth to respond "Yes" or "No" to a series of statements to indicate whether the statement is descriptive of them. A total score is computed based on 28 of the items, with the remaining eight items used only to calculate subscale scores. In the present sample, the internal consistency of the RCMAS was 0.82. Total anxiety *t*-scores were used in the present study.

In-Session Measures

Subjective Units of Distress Ratings (SUDS): SUDS ratings were provided by the child using a 0 (*no anxiety*) to 8 (*maximum anxiety*) scale. SUDS ratings were gathered at each exposure session (i.e., sessions 10–16) before the exposure task, every two minutes during the exposure, and at post-exposure. SUDS ratings were used to calculate habituation variables (IFA, WSH, BSH). To be consistent with both past research (e.g., Baker et al., 2010; Kircanski, Wu, & Piacentini, 2014) and theoretical conceptualizations of these constructs (e.g., Craske et al., 2008), these habituation variables were calculated in multiple ways. All variables were calculated so that higher values indicated that more habituation occurred.

IFA was calculated two ways: *Average IFA* (highest SUDS rating in the first quartile of each exposure session $\div$ number of exposure sessions) and *Maximum IFA* (highest SUDS rating in the entire exposure session $\div$ number of exposure sessions). These variables were transformed into Z-scores and summed to create a composite score representing IFA. WSH was also calculated in two ways: *Average WSH* ([maximum SUDS in first quartile of exposure – post exposure SUDS] $\div$ number of exposure sessions) and *Rate of Change in WSH* ([{pre-exposure SUDS – post-exposure SUDS} $\div$ number of SUDS ratings in an exposure] $\div$ number of exposure sessions). These variables were also transformed into Z-scores and summed to create a composite score representing WSH. BSH was also calculated two ways: *Average BSH* ([maximum SUDS rating at session *t* – maximum SUDS rating at session *t* + 1] $\div$ number of exposure sessions) and *Rate of BSH* ([maximum SUDS at first exposure – maximum SUDS at last exposure] $\div$ number of exposure sessions). These variables were also transformed into Z-scores and summed to create a composite score representing BSH. Finally, the 50% rule of habituation (i.e., that SUDS reduce by 50% before ending the exposure) was tested by creating a variable representing the proportion of exposure sessions where SUDs decreased by 50%.

Data Analytic Approach

Prior to analyses, variables were examined for normality. Skewness and kurtosis statistics suggested data were approximately normally distributed. Means and standard deviations of study variables are presented in Table 1. To evaluate missingness, independent-samples *t*-

tests tested whether individuals missing data on any study variable significantly differed from individuals who were not missing data. Missing data analyses indicated no significant pretreatment differences (all p 's > 0.05), and Little's MCAR test was nonsignificant, suggesting that data were likely missing at random, $\chi^2(324) = 334.75$, $p = 0.329$. Multiple imputation was used to handle missing data. Ten datasets were imputed using demographic variables as predictors and all other study variables as both predictors and outcomes of the imputed data.

Composite scores were created to reduce the number of outcome variables in the models. One composite score representing self-reported anxiety severity was created by standardizing participants' scores on the CQ, RCMAS, and MASC, and summing them to create the composite score. A second composite score representing independent-evaluator-rated anxiety severity was created by first standardizing participants' scores on the CGAS, primary anxiety disorder CSR, and mean anxiety disorder CSR. CGAS scores were multiplied by -1 since higher CGAS scores represent better functioning and the remaining variables comprising this composite score are coded in the opposite direction. These variables were summed to create the composite score representing independent-evaluator rated anxiety severity.

Linear regressions were conducted separately for each outcome variable. Pretreatment scores on the outcome variable, presence of GAD diagnosis (0 = no, 1 = yes), and the GAD $\times$ EPT variable interactions were used as predictor variables. The 50% rule was evaluated in a separate series of linear regressions since the 50% rule represents a distinct theory of exposures (i.e., the coping model) than IFA, WSH, and BSH (i.e., the EPT model). In sum, there were a total of 2 outcome variables assessed at 2 time points (i.e., posttreatment and 1-year follow-up). Thus, a total of 8 regressions were tested (2 EPT theories tested $\times$ 2 outcomes $\times$ 2 time points = 8 regressions). The squared semipartial correlations (i.e., $r_{a(b,c)}^2$) of each predictor variable were calculated for each predictor variable entered and represent the unique variance explained by each predictor variable.

Results

Preliminary Findings

Participants, on average, completed SUDS ratings during 5.14 (SD = 1.28) exposure sessions. Across all of these exposure sessions, the mean number of SUDS intervals collected was 5.72 (SD = 3.50). Mean scores of EPT and outcome composite score variables are presented in Table 1. Further demographic information, including comparisons across conditions and a CONSORT diagram, can be found elsewhere (Kendall et al., 2008). Correlations among study variables are presented in Table 2. In brief, IFA was positively associated with WSH, $r = 0.35$, $p < 0.01$. IFA was also significantly associated with the 50% rule, $r = -0.24$, $p < 0.05$. WSH was positively associated with the 50% rule, $r = 0.31$, $p < 0.01$. No additional associations between habituation variables were observed in the present sample. A summary of the regressions conducted and the significance of predictor variables is presented in Tables 3 (for IFA, WSH, and BSH) and 4 (for the 50% rule).

EPT Variable Findings

Posttreatment outcomes—The regression predicting self-reported anxiety severity at post-treatment did not reach significance, $F(8, 63) = 1.79, p = 0.10, R^2 = 0.20$. Similarly, the regression predicting IE-reported anxiety severity at posttreatment did not reach significance, $F(8, 63) = 1.72, p = 0.11, R^2 = 0.19$.

Follow-up outcomes—The regression predicting self-reported anxiety severity at follow-up was significant, $F(8, 63) = 2.27, p = 0.03, R^2 = 0.23$. However, the only significant predictor of self-reported anxiety severity at follow up was self-reported anxiety at pretreatment, $b = 0.30, t = 2.23, p = 0.03$.

The regression predicting IE-reported anxiety severity at follow-up was also significant, $F(8, 63) = 2.82, p = 0.009, R^2 = 0.26$. IE-reported anxiety severity at pretreatment was a significant predictor of IE-reported anxiety at follow-up, $b = 0.43, t = 2.97, p = 0.003$. There was a significant interaction between IFA and GAD, $b = 1.17, t = 2.33, p = 0.02$. For individuals without GAD, IFA was negatively associated with IE-reported anxiety at follow-up, such that higher IFA during exposure tasks was associated with lower IE-reported anxiety at follow-up, $b = -1.05, t = -2.34, p = 0.02$. There were no other significant predictors of IE-reported anxiety at follow-up.

50% Rule Findings

Posttreatment outcomes—The regression predicting self-reported anxiety at posttreatment from the 50% rule was not significant, $F(8, 63) = 1.65, p = 0.13, R^2 = 0.11$. Similarly, the regression predicting IE-reported anxiety at posttreatment from the 50% rule also was not significant, $F(8, 63) = 1.50, p = 0.18, R^2 = 0.09$.

Follow-up outcomes—The regression predicting self-reported anxiety at follow-up from the 50% rule was not significant, $F(8, 63) = 1.91, p = 0.07, R^2 = 0.12$. The regression predicting IE-rated anxiety at follow-up from the 50% rule was significant, $F(8, 63) = 2.17, p = 0.04, R^2 = 0.12$. However, the only significant predictor of IE-rated anxiety at follow-up was IE-rated anxiety at pretreatment, $b = 0.40, t = 2.72, p = 0.007$.

Discussion

The present study examined the degree to which features of the EPT model for exposure predicted improvement at posttreatment and one-year follow-up among anxious youth receiving CBT. Overall, the results do not provide robust support for EPT, the use of SUDS, or habituation as associated with (an effective tool for) treatment success. With one minor exception the analyses testing EPT's parameters yielded non-significant findings. Of particular note, WSH, BSH and the 50% rule did not predict outcomes at either time point. Although there was some evidence of higher IFA predicting less anxiety for youth without GAD, the finding was not unanimous across time point or by method of assessment.

Consistent with the adult literature, EPT's ability to predict outcome in youth is mixed at best (Baker et al., 2010, Jaycox et al., 1998; van Minnen & Hagenaars et al., 2002), though replication in additional youth samples is certainly needed. With regard to WSH, our

findings are consistent with revisions to EPT that downplay the necessity of habituation for improvement (Huppert & Foa, 2004). Research on latent learning has established that learning can occur without the immediate presence of physiological or behavioral change (Bjork & Bjork, 2006), and habituation does not guarantee generalization of learning (Craske et al., 2008; Swan, Carper, & Kendall, in press). Further, habituation's emphasis on symptom reduction may undermine the intention of CBT: coping *with* anxiety, not anxiety elimination. Thus, our data are consistent with the notion that although habituation often occurs during exposure and may predict some variance in outcome, it does not appear to be a major predictor of change.

In reference to EPT as a coherent theory, associations between EPT variables were inconsistent. For example, whereas IFA was associated with WSH (and the "50% rule") it did not correlate with BSH. Moreover, WSH and BSH were not significantly associated with one another, inconsistent with the assumption that WSH presupposes BSH (Rauch & Foa, 2006). Thus, in addition to our study showing poor predictive power of EPT variables to anxiety outcome it also questions the uniformity of EPT in understanding exposures. That being said, other past studies have used alternative operationalizations of EPT constructs (e.g. Baker et al., 2010; Hayes, Hope & Heimberg, 2008; Norton, Hayes-Skelton, & Klenck, 2011) which may account for different findings in terms of how EPT variables associate with one another and their predictions to outcome.

What do these results mean for clinicians implementing exposures with anxious youth? The findings suggest that habituation can be noted within exposure but should not be the sole factor to determine improvement or exposure discontinuation. In other words, clinicians would benefit from moving away from an overreliance on SUDS. Although our results included a significant finding for IFA, EPT's poor predictive power does not support a universal application of habituation with anxious youth. Additional research is needed with youth to investigate differential patterns of change based on unique youth profiles and their links to treatment outcome (see Heimberg & Becker, 2002), perhaps revealing the utility of EPT for a subset of youth.

Although our study does not largely support EPT parameters, it does not assume that tracking change in SUDS within exposure should be abandoned. However, the relevance of such tracking may lie in its proposed function. For instance, tracking change in SUDS to evaluate symptom reduction more generally may be less helpful than reassessing cognitive change during exposure (rather than just after or before; e.g. "what outcome do you (client) expect to happen" assessed every few minutes during exposure). In line with ILT, tracking shifting expectancies of negative outcome may be a better guide to (a) assessing improvement, and (b) signaling when it is appropriate to end the exposure (Abramowitz & Arch 2014), with some data supporting this approach as superior to traditional habituation (Salkovskis, Hackmann, Wells, Gelder & Clark, 2007). Moreover, post-exposure processing that contrast expectations to outcome can further reinforce new learning during exposure rather than simply showing a graph of the child's SUDS (Tiwari, Kendall, Hoff, Harrison & Fizur, 2013). Other research suggests that tracking SUDS may be more pertinent to outcome when tracking overall symptom change between sessions rather than during the exposure tasks (Kircanski, Wu, & Piacentini, 2014). Arguably, SUDS may have some utility *during*

exposure to enhance motivation, client “buy in,” and reduce drop-out, illustrating to youth “they get easier over time if one perseveres.” Testing the use of habituation in the initial stages of exposure for these purposes remains an area for future research. However, such a message may be counterproductive for youth who do not habituate, who rigidly equate habituation with success, or who falsely report habituation to prematurely terminate exposures.

Although the majority of findings did not support EPT, one significant finding warrants some attention. In terms of IFA, youth without GAD had better outcomes at follow-up. Though the results should not be overstated given that most GAD interaction tests were non-significant, our findings suggest that IFA may be more applicable to youth without GAD. One explanation is that given the abstract nature of GAD fears compared to other anxiety disorders, a relatively higher number of imaginal exposures may need to be employed (Benjamin, O’Neil, Crawley & Beidas, 2010). As such, the fear activation that occurs within imaginal exposures may be less generalizable to real life situations, and subsequently, treatment outcome. Additionally, whereas social anxiety and separation anxiety are more circumscribed to one type of fear (e.g. negative evaluation or harm to self/caregiver), GAD worries are more diffuse. Fear activation in one domain (e.g. perfectionism) may have little impact on other worry areas (e.g. harm-to-self) and thus may be less important to overall outcome. In other words, IFA within one exposure may not be indicative of overall outcome because GAD often represents an amalgamation of worries. However, some may argue that the specific content of anxiety does not matter and effects should extend given shared underlying mechanisms (Boswell, Thompson-Hollands, Farchione & Barlow, 2013). Future research can assess whether EPT variables on homework exposures outside of therapy predict different outcomes given their generalizability.

The paper has some limitations that merit acknowledgement. First, EPT variables were only assessed using child-reported SUDS. It is unclear the extent that youths’ self-reporting of SUDS truly relates to anxiety levels (e.g. avoidance, physiological arousal), particularly among younger children who may be developmentally immature in their metacognitive abilities (Smith & Hudson, 2013). Therapists SUDS, although collected, were not included in the analyses because therapists were not masked to the child’s SUDS (Benjamin et al., 2010). Further, objective measures of EPT such as behavioral avoidance tests and physiological markers (e.g. heart rate) were not gathered. Future studies would benefit from the inclusion of a wider range of reporters and objective assessments regarding EPT parameters. Second, the inclusion of youth with heterogeneous anxiety disorders and the absence of data that measures specific type of exposure may limit conclusions about BSH. For example, there is no indication whether consecutive exposures targeted the same type of anxiety or whether the focus was shifted to a comorbid anxiety. Theoretically, youth who received consistent exposures for social anxiety may have experienced greater BSH overtime than those who completed fewer social anxiety exposures. Likewise, data on in-vivo vs. imaginal exposures are not available as are explanations of why individual exposures were ended. However, given the shared underlying deficits, cognitive processes, behavioral responses, and treatment techniques across youth anxiety disorders, the specific content of the anxiety may not be hugely important to the process of BSH. Fourth, the study was unable to isolate the effects of exposure from other treatment components (e.g. cognitive

restructuring, relaxation, psychoeducation). However, we note that research has found that early introduction of exposures is associated with positive outcomes (Gryczkowski et al., 2013) and the entry of exposure into typical CBT has shown to be followed by a significant acceleration in the rate of progress in treatment (even after other treatment techniques are introduced; Peris et al., 2015). In other words, exposure has evidenced unique contributions to outcome (Voort et al., 2010). Finally, the sample was demographically restricted, with an overrepresentation of upper-middle class Caucasian families.

The study benefits from several strengths. Foremost, it is the first to date to systematically assess EPT in a sample of youth with anxiety disorders, and the research is bolstered by the multiple ways in which EPT and outcome variables were operationalized. In particular, outcome was assessed using multiple reporters (parent, child, and clinician) and by examining various dimensions of outcome: symptom severity, global functioning, and use of constructive coping abilities. Using SUDS to predict outcomes in addition to symptom reduction reduced shared method variance and increased the generalizability of findings. Additionally, the heterogeneity of anxiety disorders among the sample and variation in treatment formats adds to the relevance of the findings to real-world populations. It is also worth noting that findings were assessed at one-year follow up to examine long-term effects of EPT. Unlike some studies in adulthood, the present study examined WSH using multiple ratings within an exposure, rather than only contrasting pre- and post-exposure SUDS change. Likewise, the present study examined exposures across an average of 5.14 exposure trials (maximum of 7) to assess BSH as opposed to two to three trials (Hayes et al., 2008; Norton et al., 2011). Finally, data are strengthened by being part of a larger RCT (see Kendall et al., 2008). As such, treatment was standardized, clinicians were specifically trained in CBT for anxiety, and sessions were coded for therapist adherence. Thus, EPT was not largely supported despite the presence of well-trained therapists and structured interventions representing the “gold standard” in youth anxiety treatment.

Future studies would be wise to examine alternative theories, such as Inhibitory Learning Theory, as explanations for the benefits of exposures. ILT has received support from neuroscience research that postulates that extinction is a form of inhibitory learning rather than elimination of fear (Myers & Davis, 2007). Such research has examined the role of the prefrontal cortex, amygdala in inhibitory learning (Sotres-Bayon, Cain, & LeDoux, 2006), although more neuroscience research is needed with reference to both EPT and ILT (Craske et al., 2014). Within an ILT model, outcomes for nonresponders may be improved by less structured and more variable practice of exposures. This can be accomplished through changing the spacing of exposure trials, conducting exposures across multiple contexts, presenting multiple conditioned excitors (feared stimuli) simultaneously, removal of safety signals and behaviors, and increasing retrieval cues (e.g. wristband worn in past successful exposure; Craske, Liao, Brown, & Vervliet, 2012). To date, this approach has not been examined for exposures with youth, but data with adults provide preliminary support (Culver, Stovanova, & Craske, 2012; Kircanski et al. 2012; Deacon et al., 2013; Salkovskis et al., 2007).

At the beginning we posed the question whether exposures with anxious youth should continue with the EPT model or adjust to an alternative perspective (e.g. ILT). Based on the

results, we do not find consistent support for EPT, yet replication is warranted before EPT is completely abandoned for new approaches. Although the absence of consistent findings to support EPT does not indicate evidence for ILT, they do suggest a need to explore alternative theories of exposures in youth. Approaches that maximize distress-tolerance, disconfirmation of distorted beliefs, and acceptance of unwanted feelings and cognitions may enhance exposure outcomes and address nonresponders. Craske and colleagues (2014) recently developed guidelines for the clinical application of ILT, but they have yet to be empirically tested in youth. While the present study moves toward a better understanding of exposure in youth, more research is needed to test these theories and to determine whether EPT has clinical utility or whether ILT is a favorable alternative.

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Table 1

Means, standard deviations (SDs) and score ranges on EPT and outcome variables.

Variable	Mean (SD)	Range
<i>EPT Variables</i>		
IFA	0.00 (1.89)	−4.92 – 4.02
WSH	0.00 (1.44)	−2.68 – 3.68
BSH	0.05 (1.68)	−4.70 – 4.72
50% Rule *	0.74 (0.28)	0 – 1
<i>Outcome Variables at Pretreatment</i>		
Self-Reported Anxiety	0.08 (1.77)	−3.69 – 4.62
IE-Reported Anxiety	−0.01 (2.36)	−6.34 – 4.55
<i>Outcome Variables at Posttreatment</i>		
Self-Reported Anxiety	−0.03 (1.51)	−4.60 – 3.22
IE-Reported Anxiety	0.06 (2.58)	−4.48 – 5.60
<i>Outcome Variables at Follow-Up</i>		
Self-Reported Anxiety	0.05 (1.67)	−6.49 – 3.00
IE-Reported Anxiety	0.13 (2.69)	−3.82 – 5.84

* Mean for 50% rule represents proportion of exposures during which a child's SUDS rating decreased by 50%.

Note: EPT variables are coded such that positive numbers indicate a greater degree of habituation took place (i.e., SUDS scores decreased).

Table 2

Pearson correlations among all study variables.

Variable	Pretreatment Self- Reported Anxiety	Posttreatment Self-Reported Anxiety	Follow-up Self- Reported Anxiety	Pretreatment IE-Reported Anxiety	Posttreatment IE-Reported Anxiety	Follow-up IE- Reported Anxiety	IEA	WSH	BSH	50% Rule
Pretreatment Self-Reported Anxiety	-									
Posttreatment Self-reported Anxiety	0.33 *	-								
Follow-up Self-reported Anxiety	0.32	0.48 **	-							
Pretreatment IE-reported Anxiety	0.33 **	0.15	0.01	-						
Posttreatment IE-Reported Anxiety	0.14	0.29 *	0.11	0.21	-					
Follow-up IE- reported Anxiety	0.13	0.27	0.22	0.34 **	0.45 ***	-				
IEA	0.27 *	0.19	0.11	-0.19	-0.11	-0.16	-			
WSH	0.26 *	0.08	-0.06	-0.07	-0.20	-0.17	0.35 **	-		
BSH	0.05	0.05	0.05	0.12	0.00	-0.05	-0.15	0.16	-	
50% Rule	-0.16	-0.08	-0.08	-0.06	-0.08	-0.05	-0.24 *	0.31 **	0.18	-

* $p < 0.05$
** $p < 0.01$
*** $p \leq 0.001$

Table 3

Summary of regressions examining EPT variables and significance of predictors.

	<i>b</i>	<i>SE_b</i>	<i>p</i>	<i>r_{a(b,c)}²</i>
<u>Posttreatment Self-Reported Anxiety</u> $F(8,63) = 1.79, p = 0.10$				
Pre-tx self-reported anxiety	0.29	0.14	0.04	0.08
GAD	0.42	0.49	0.39	0.01
IFA	-0.04	0.27	0.89	0.00
WSH	0.34	0.32	0.30	0.01
BSH	-0.25	0.25	0.33	0.01
IFA x GAD	0.21	0.31	0.50	0.00
WSH x GAD	-0.50	0.38	0.19	0.03
BSH x GAD	0.39	0.32	0.24	0.03
<u>Follow-up Self-Reported Anxiety</u> $F(8, 63) = 2.27, p < 0.05$				
Pre-tx self-reported anxiety	0.30	0.14	0.03	0.09
GAD	-0.32	0.60	0.60	0.01
IFA	-0.47	0.31	0.12	0.04
WSH	0.11	0.36	0.76	0.00
BSH	-0.06	0.25	0.82	0.00
IFA x GAD	0.68	0.36	0.06	0.06
WSH x GAD	-0.41	0.41	0.31	0.02
BSH x GAD	0.21	0.30	0.49	0.01
<u>Posttreatment IE-Reported Anxiety</u> $F(8, 63) = 1.72, p = 0.11$				
Pre-tx IE-reported anxiety	0.29	0.15	0.06	0.06
GAD	-1.73	0.78	0.03	0.07
IFA	-0.38	0.42	0.37	0.01
WSH	-0.64	0.50	0.19	0.02
BSH	0.48	0.37	0.20	0.02
IFA x GAD	0.43	0.47	0.35	0.01
WSH x GAD	0.36	0.58	0.53	0.01
BSH x GAD	-0.54	0.46	0.24	0.02
<u>Follow-up IE-Reported Anxiety</u> $F(8, 63) = 2.82, p < 0.01$				
Pre-tx IE-reported anxiety	0.43	0.15	0.003	0.12
GAD	-0.51	0.79	0.52	0.00
IFA	-1.05	0.45	0.02	0.07
WSH	0.18	0.51	0.73	0.00
BSH	-0.66	0.39	0.09	0.04
IFA x GAD	1.17	0.50	0.02	0.07
WSH x GAD	-0.44	0.58	0.46	0.01
BSH x GAD	0.75	0.46	0.10	0.04

Note: IE = Independent-evaluator; IFA = Initial Fear Activation; WSH = Within Session Habituation; BSH = Between Session Habituation; GAD = Generalized Anxiety Disorder

Table 4

Summary of regressions examining 50% rule variable and significance of predictors.

	<i>b</i>	<i>SE_b</i>	<i>p</i>	<i>r_{a(b,c)}²</i>
<u>Posttreatment Self-Reported Anxiety</u> <i>F</i> (8, 63) = 1.65, <i>p</i> = 0.13				
Pre-tx self-reported anxiety	0.28	0.13	0.04	0.09
GAD	0.38	1.16	0.75	0.00
50% Rule	0.10	1.09	0.92	0.00
50% Rule x GAD	-0.19	1.46	0.90	0.00
<u>Follow-up Self-Reported Anxiety</u> <i>F</i> (8, 63) = 1.50, <i>p</i> = 0.18				
Pre-tx self-reported anxiety	0.30	0.13	0.03	0.10
GAD	-0.12	1.27	0.93	0.00
50% Rule	-0.15	1.17	0.90	0.00
50% Rule x GAD	-0.03	1.60	0.98	0.00
<u>Posttreatment IE-Reported Anxiety</u> <i>F</i> (8, 63) = 1.91, <i>p</i> = 0.07				
Pre-tx IE-reported anxiety	0.26	0.16	0.09	0.05
GAD	-2.55	1.78	0.15	0.03
50% Rule	-1.65	1.65	0.32	0.01
50% Rule x GAD	1.77	2.19	0.42	0.01
<u>Follow-up IE-Reported Anxiety</u> <i>F</i> (8, 63) = 2.17, <i>p</i> < 0.05				
Pre-tx IE-reported anxiety	0.40	0.15	0.01	0.11
GAD	-1.35	2.06	0.51	0.01
50% Rule	-1.08	1.82	0.55	0.00
50% Rule x GAD	1.33	2.48	0.59	0.00

Note: IE = Independent-evaluator; GAD = Generalized Anxiety Disorder