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Validation of Self-Report Measures of Emotional and Physical Distress Tolerance

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Abstract The Distress Tolerance Scale (DTS) and Discomfort Intolerance Scale (DIS) are self-report measures developed for the assessment of emotional and physical distress tolerance, respectively. However, little evidence exists for their construct and specifically criterion-related validity. The current study examined the associations of these self-report measures with lab-based assessments of perceived emotional tolerance and physical discomfort tolerance. Undergraduate participants (N=166) were administered four film clips intended to induce sadness, disgust, fear, and anger, and a handgrip persistence task intended to elicit physical discomfort. The DTS, but not the DIS, was significantly associated with self-reported emotional tolerance and perceived threat associated with each film after controlling for emotional intensity. Among DTS subscales, the absorption subscale was the only subscale incrementally predictive of negative perceptions of the sad film, the appraisal subscale was incrementally predictive of negative perceptions of the other three films, and little support for the incremental validity of the tolerance and regulation subscales was found. The DTS also incrementally predicted tolerance and perceived threat of film-elicited emotions across films after controlling for anxiety sensitivity. The DIS was only marginally predictive of handgrip task persistence and was unrelated to emotional film perceptions. Overall, these findings uniquely add to the empirical literature on the construct and criterion-related validity of the DTS and DIS.

Keywords Distress tolerance · Discomfort tolerance · Construct validity · Assessment · Anxiety sensitivity

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Investigators have increasingly shifted focus to core processes involved in the onset and maintenance of psychiatric disorders as a means of improving therapeutic efficiency and developing more parsimonious accounts of psychopathology (Barlow et al. 2004; Hayes et al. 2006; Nolen-Hoeksema and Watkins 2011). One transdiagnostic process that has drawn significant research attention is distress tolerance, reflecting the perceived or objective ability to withstand distressing emotional or physical states (Leyro et al. 2010). Lower levels of distress tolerance have been linked to various forms of psychopathology, including bulimic symptoms, depression, social anxiety, generalized anxiety, panic symptoms, and obsessive-compulsive symptoms (Keough et al. 2010; Leyro et al. 2010). Such interest in distress tolerance has been paralleled by the proliferation of psychosocial interventions for psychological disorders designed to promote tolerance for distress (Hayes et al. 1999; Linehan 1993; Orsillo and Roemer 2005).

Two widely utilized self-report measures of distress tolerance are the Distress Tolerance Scale (DTS; Simons and Gaher 2005) and the Discomfort Intolerance Scale (DIS; Schmidt et al. 2006), which were developed for the

assessment of the perceived capacity to tolerate negative emotion and physical discomfort, respectively. These scales represent two types of distress tolerance that have been furthermore distinguished from tolerance of uncertainty, tolerance of ambiguity, and tolerance of frustration (Zvolensky et al. 2011). Factor analytic work has demonstrated the latent independence of these scales (Bernstein et al. 2009). Separate investigations have generally found that the DTS and DIS do not correlate with behavioral measures of distress tolerance (Bernstein, Marshall, and Zvolensky 2011; McHugh et al. 2011; McHugh and Otto 2011; Marshall-Berenz et al. 2010. One explanation for observed orthogonality is that perceived tolerance and behavioral (objective) tolerance reflect distinct constructs and processes (Bernstein et al. 2011). Another account is that perhaps the DTS may be related more narrowly to specific assessments of negative emotional tolerance rather than assessments that induce frustration (e.g., mirror tracing task) or physical discomfort (e.g., breath-holding). Behavioral measures of distress tolerance, including the mirror tracing, breath holding, and PASAT-C tasks (Strong et al. 2003; Hajek et al. 1987; Lejuez et al. 2003) assess distress tolerance based on time spent persisting in the face of frustration or discomfort. For example, in the mirror tracing task, participants are asked to solve a difficult, frustrating task that produces loud buzzing sounds when errors are made. They may end the task at any time, and distress tolerance is measured by duration of time spent on the task. For the breath holding task, participants are asked to hold their breath for as long as they can and distress tolerance is measured by latency to taking a breath. These tasks arguably assess task persistence and motivation rather than distress tolerance *per se*. Thus, an absence of significant correlations between these behavioral measures with the DTS and DIS may be expected. Similarly, the DIS may be related more narrowly to tolerance of physical discomfort, but perhaps not to states of discomfort that are characterized by emotional and physical distress (e.g., Bernstein, Marshall, and Zvolensky 2011; Zvolensky et al. 2011).

Past work on distress tolerance holds a high degree of clinical and theoretical applicability, but a number of research gaps remain. Although the DTS and DIS have been found to correlate with multiple self-report measures of psychological or mood symptoms (Leyro et al. 2010; Keough et al. 2010), there is limited behavioral evidence for their construct validity and criterion-related validity with respect to tolerance of distress, specifically. Such validity would be important to establish, since it is possible that their associations with other self-report measures could be, in part, due to response bias, shared method variance, the possibility that these putative DT measure(s) may not directly reflect individual difference in tolerance of emotional and/or physical distress per se, or may reflect individual difference in DT as well as additional constructs such as those related to emotion regulation. Though the DTS has been found to predict psychopathology above and beyond measures of negative affect (e.g., Keough et al. 2010) the possibility remains that individuals with lower distress tolerance are prone to heightened emotional reactivity and intensity of emotional reactivity accounts for the observed relations between DTS and symptoms of psychopathology. Poor distress tolerance may be an epiphenomenon of heightened emotional reactivity and affect intensity. Additionally, it is unclear whether the DTS represents (perceived) tolerance for distress broadly, or distress that is characterized exclusively by a particular negative emotion(s). For example, it is possible that the DTS assesses tolerance for emotions characterized by arousal, such as anxiety or anger, rather than tolerance for sadness. The items of this measure all refer to 'distress' rather than any one negative emotion; thus, it is difficult to determine what negative emotion respondents could be considering when rating their answers. Other validation studies of the DTS and DIS have also been limited by utilization of behavioral measures of emotional tolerance and physical discomfort that concurrently elicit multiple forms of distress (e.g., carbon dioxide-enriched air laboratory challenge; Marshall-Berenz et al. 2010).

The DTS consists of four subscales, assessing: 1) perceived ability to tolerate emotional distress, 2) attention being absorbed by negative emotions, 3) subjective appraisal of distress, and 4) regulation efforts to reduce distress. While the DTS as a full scale is considered a measure of perceived capacity to withstand negative psychological states, it is noteworthy that only the first subscale is directly related to tolerance for negative emotional states. Consideration of these subscales could provide greater understanding of the construct of distress tolerance and its representation among these four different subscales and their associated constructs. This measure is increasingly being used in psychopathology research, and additional understanding of it is needed.

The aim of the current investigation was to test the associations between the DTS and DIS and two different types of in vivo assessments of emotional distress tolerance and physical discomfort tolerance. To address the study aims, we sampled an unselected student population. Consistent with past work in this domain (e.g., Simons and Gaher 2005), we thought an unselected sample was useful for this investigation as it would likely yield a broader range of scores than a clinical sample and reflect individual differences in the broader population important to a validation study. Participants completed self-report measures, including the DTS and DIS, and then viewed four emotional films that have been used to induce sadness, disgust, fear, and anger. Emotional response was measured via self-reported peak negative emotion (emotion intensity) associated with these films. Tolerance and perceived threat of the film-elicited emotions were also assessed. Subsequently,

tolerance for physical discomfort was assessed by the administration of a handgrip persistence task. We predicted that the DTS and its subscales, but not the DIS, would be correlated with levels of tolerance and perceived threat of each film, even after controlling for gender and the degree of emotional response to the films. Further, we hypothesized that the DIS, but not the DTS, would correlate with persistence on the handgrip task, operationalized here as an objective measure of physical discomfort/distress tolerance. Lastly, we predicted that these associations would remain when controlling for sensitivity to anxiety-related symptoms (i.e., anxiety sensitivity). This last analysis was conducted to ensure the distinctness of these measures from an existing measure of negative emotional perception and to demonstrate the incremental value of the DTS as a measure of emotion dysregulation.

Method

One-hundred and sixty-six participants were recruited through introductory psychology courses at a large southeastern university. Students were required to participate in studies conducted by different laboratories in the psychology department as partial fulfillment of their course requirements. To ensure that participants were not coerced into participation students could write a brief research paper as an alternative to study participation. Participants were told that they would be participating in a study examining everyday behaviors and emotions where they were to complete a series of questionnaires. All participants provided written informed consent for participating in the experiment. The sample was 63.9 % female and ranged in age from 18 to 30 years (M=18.69, SD=1.3 years). The sample consisted of the following ethnic groups: 75.3 % were White (not Hispanic), 11.4 % were Hispanic, 9.0 % were Black (not Hispanic), 3.6 % were Asian, and 0.6 % reported 'other' ethnicity.

Procedure

The current investigation was part of a two-hour study that focused on emotion regulation and anxiety. Participants arrived at the lab and after completing informed consent were asked to fill out a series of questionnaires that were administered via a computer. Following the first set of questionnaires, participants viewed a series of four emotional film clips that were presented in randomized order. Tolerance and perceived threat ratings of elicited emotions were completed after each film clip. Participants completed several additional questionnaires and assessments. After these were administered, participants completed the handgrip dynamometer task.

Measures

Distress Tolerance Scale (DTS; Simons and Gaher 2005) The DTS is a 15-item self-report measure of one's ability to tolerate psychological distress. Each item is rated on a 5-point Likert-type scale (1= strongly agree to 5= strongly disagree). The measure contains four subscales: perceived ability to tolerate emotional distress (e.g., I can't handle feeling distressed or upset), attention being absorbed by negative emotions (e.g., When I feel distressed or upset, I cannot help but concentrate on how bad the distress actually feels), subjective appraisal of distress (e.g., My feelings of distress or being upset are not acceptable), and regulation efforts to alleviate distress (e.g., When I feel distressed or upset I must do something about it immediately). The scale has been found to demonstrate good internal consistency, good test-retest reliability, and discriminant validity with measures of negative affect (Simons and Gaher 2005). In the current sample, the total score and subscale scores showed adequate to good internal consistency: α's=.64 (tolerance), .80 (appraisal), .78 (absorption), .70 (regulation), and .89 (total score). Lower scores on this measure indicate lower distress tolerance.

Discomfort Intolerance Scale (DIS; Schmidt et al. 2006) The DIS is a 5-item measure on which participants indicate, on 7-point Likert-type scales (0= not at all like me to 6= extremely like me), their agreement with statements related to their intolerance of physical discomfort. Higher scores reflect lower levels of discomfort tolerance. Factor analysis by Schmidt et al. (2006) indicates that the DIS is composed of two distinct subfactors, Intolerance of Discomfort or Pain (e.g., I can tolerate a great deal of physical discomfort—reverse scored) and Avoidance of Physical Discomfort (e.g., I take extreme measures to avoid feeling physically uncomfortable). In the current sample, the subscales and total score showed adequate to excellent internal consistency: α's=.90 (intolerance of discomfort or pain), .61 (avoidance), and .75 (total score).

Anxiety Sensitivity Index (ASI; Reiss et al. 1986) The ASI is a 16-item self-report measure that assesses the fear of consequences of bodily sensations associated with anxiety. In the current sample, the scale showed good internal consistency, α=.83. The ASI mean for the current sample was 16.31 (SD=8.3).

Emotional Films and Assessment of Tolerance and Perceived Threat of Emotions (Gross and Levenson 1995) Four film clips intended to elicit four different negative emotions including fear, disgust, sadness, and anger were shown to participants in randomized order. These film clips were taken from Gross and Levenson (1995), who found each

to be the optimal clips (i.e., negative emotion intensity and specificity) for evoking these specific negative emotions, out of over 250 evaluated film clips (see Rottenberg et al. 2007 for a review). The clips, with the exception of the disgust-related film (which was available online), were extracted from the original films using the specifications by Gross and Levenson (1995). These films included *The Champ* (sadness, length =2 mins 51 s), *Cry Freedom* (anger, 2 mins 36 s), *Silence of the Lambs* (fear, 3 mins 29 s), and *Amputation* (disgust, 1 min 3 s). The clip from *The Champ* showed a boy crying at his father's death. The *Cry Freedom* clip showed police shooting at children and protesters. The clip from *Silence of the Lambs* showed a basement chase scene. The *Amputation* clip depicted the amputation of an arm.

After each film clip, participants rated peak fear, disgust, sadness, and anger experienced during the film using a 1 (*none at all*) to 6 (*extreme*) Likert-type scale. Additionally, participants rated their perceived tolerance for and perceived threat of the emotions experienced during the film through four author-constructed questions. These questions included (1) "How well were you able to tolerate the feelings triggered by the film clip?" (1= *Tolerated with no difficulty*—6= *Unable to tolerate at all*), (2) "How fearful were you of the feelings triggered by the film clip?" (1= *Not at all fearful*—6= *Extreme fear*), (3) "How threatening or dangerous were the feelings triggered by the film clip?" (1= *Not at all threatening/dangerous*—6= *Extremely threatening/dangerous*), and (4) "Rate the degree to which you were able to focus on the clip without turning away or distracting yourself" (1= *No distraction/turning away at all*—6= *Always distracted myself/turned away*). These four items were summed for each film and used for analyses of negative perceptions of each different emotion. The internal consistencies of these four measures ranged from adequate to good: sadness (α=.61), fear (α=.83), disgust (α=.83), anger (α=.84), and total score (α=.91).

Handgrip Task and Assessment of Physical Discomfort Tolerance (Vohs et al. 2005) Variations of the handgrip task we administered have been used in previous studies as a measure of self-control (e.g., Vohs et al. 2005). Participants were introduced to the hand dynamometer (Baseline® Smedley Digital Grip Tester) and were told that it is a widely used test for the assessment of general strength. They were told that they would be asked to squeeze the handle as hard as they can, which would be an index of their general strength. They were given a demonstration of how the dynamometer works by the research assistant. The research assistant then recorded the participant's maximum squeeze. Participants were then told that their endurance would be tested by having them hold their strength at '___ kg,' where the designated number was 33 % of their maximum squeeze. They were told that they would be timed using a stopwatch. Their grip endurance (i.e., latency to let go or desist on the task) was then timed. If at any time during the task participants gripped more than 2 kgs below their designated number, they were asked to squeeze harder. The experimenter stopped the timer once they could not maintain their designated number. As a manipulation check, participants then rated their peak pain and discomfort (0= *no pain/discomfort at all*—10= *extreme pain/discomfort*) experienced during the task. Physical discomfort tolerance was assessed using task persistence.

Data Analysis

We addressed main study hypotheses through a series of correlation and partial correlation analyses. To assess associations between the DTS, DIS, and perceived tolerance and threat associated with the films above and beyond emotional response to the films, we controlled for peak target emotion in our analyses of the emotional film ratings. Zero-order and partial correlation analyses were Bonferroni corrected for the five primary analyses of interest (the handgrip task and tolerance and perceived threat for each of the four emotional films), and a cutoff of p=.01 (.05/5) was used to determine statistical significance for these analyses. A hierarchical regression analysis was also conducted to evaluate the unique contributions of these measures in predicting overall tolerance and perceived threat for the emotional films above and beyond anxiety sensitivity, gender, and emotional intensity across films.

Results

The total scores for the DTS and DIS were correlated with each other, r=−.38, p<.001, which reflects that lower distress tolerance was associated with higher discomfort intolerance. Additionally, the subscales of the DTS were correlated with the subscales of the DIS in the expected directions, r's=−.15 to −.35. Peak target emotion ratings were correlated with tolerance and perceived threat ratings for the sad (r=.43), anger (r=.51), fearful, (r=.62) and disgust (r=.59) films, p's<.001. The tolerance and perceived threat ratings for each emotional film were not significantly associated with handgrip persistence, r's<.10, p's>.40.

Emotional Film Analyses

As a manipulation check of the film clip-based emotion elicitation, average peak emotion intensity ratings as well as tolerance and perceived threat ratings for each of the four

films are presented in Table 1. Paired *t*-tests were conducted to ensure that the target emotion was the most intense emotion experienced for each film. These analyses indicated that peak sadness was significantly higher than any other negative emotion for *The Champ*, disgust was significantly higher than other emotions for *Amputation*, and fear was significantly higher than other emotions for *Silence of the Lambs*. However, for *Cry Freedom*, participants reported significantly greater disgust than anger, $t=3.56$, $p<.001$, and significantly greater anger than fear, $t=12.33$, $p<.001$, though no significant differences between anger and sadness, $t=1.81$, $p=.07$.

Correlation analyses were conducted to examine the associations between tolerance and perceived threat for each film and the DTS and DIS total scores and subscales (see Table 2). These analyses indicated significant associations between lower DTS subscales and total scores (lower perceived tolerance) and tolerance and perceived threat of film-elicited emotions; though tolerance and perceived threat for the sad film was not associated with DTS-regulation. Total DIS scores and subscales were also correlated with tolerance and perceived threat of the disgust film. Partial correlations controlling for gender and peak target emotion reduced the associations between DIS scores and tolerance of distress and perceived threat to non-significance. Further, DTS total scores remained significantly correlated with tolerance and perceived threat of emotions for each film. DTS-tolerance was only correlated with tolerance and perceived threat of the anger film, and DTS-regulation was not correlated with tolerance and perceived threat of any film. DTS-absorption was correlated with tolerance and perceived threat of sad and disgust films, while DTS-appraisal was correlated with tolerance and perceived threat for each film except the sad film.

We next conducted a regression analysis to examine whether the DTS and ASI predicted unique variance in tolerance and perceived threat of film-elicited emotions. Given that the DIS was not associated with tolerance and perceived threat for any film, it was not included in these analyses. Tolerance and perceived threat of film-elicited emotion scores summed across films were used as the dependent variable for this analysis ($M=31.05$, $SD=12.6$, range =16 to 80). Further, we created a variable representing sum of emotional intensity to the four films based on standardized values of peak target emotion in response to the four films. Degree of emotional response to the films was strongly associated with degree of tolerance and perceived threat of the film-elicited emotions, $r=.65$, $p<.001$. This regression analysis revealed that both DTS and ASI predicted unique variance in total tolerance and perceived threat of film-elicited negative emotions, even when covarying for gender and emotional intensity entered at Step 1 of the regression equation (see Table 3).

We also evaluated potential gender differences in relations between DTS and emotional film task ratings. Overall, women ($M=3.52$, SD=.67) reported lower total DTS scores than men ($M=3.86$, SD=.65), $F(1,164)=9.94$, $p<.005$, and women also reported greater overall emotional intensity across the films, $F(1, 164)=48.79$, $p<.0001$, and greater intolerance and perceived threat associated with film-induced emotions across films, $F(1, 164)=20.34$, $p<.0001$, relative to men. Partial correlation analyses, which controlled for average emotional intensity across films, found relationships between DTS total scores and ratings of tolerance and perceived threat across films did not differ between men, $r=-.24$, $p=.07$, and women, $r=-.22$, $p=.02$ (Fisher's $z=-0.14$, $p=.89$). Though these associations were only marginally significant; these non-significant associations were likely attributable to lower sample size.

Physical Discomfort Tolerance Analyses

Paired-samples *t*-tests indicated that the handgrip task evoked significantly greater discomfort ($M=3.38$, $SD=2.5$) than pain ($M=2.79$, $SD=2.2$), $t(165)=4.04$, $p<.001$. Tests of the normality of distribution revealed abnormalities for persistence on this task ($M=51.63s$, $SD=50.6$, range =.17 to $180s$). A log transformed variable was calculated for this measure and used for all analyses. Correlational analyses revealed associations between lower grip duration and greater DIS total and DIS-intolerance scores that were only marginally significant, after Bonferroni corrections. Grip duration was not correlated with any other scale. We also conducted partial correlation analyses controlling for

Table 1 Means and standard deviations for emotional film ratings

	Fear (1= None at all – 6= Extreme)	Disgust (1–6)	Sadness (1–6)	Anger (1–6)	Perceived threat and tolerance (4–24)
The Champ (sadness)	1.37 (.76)	1.35 (.74)	4.36 (1.2) [a]	1.43 (.85)	6.00 (2.3)
Cry Freedom (anger)	2.89 (1.5)	4.67 (1.3)	4.51 (1.3)	4.35 (1.4) [a]	8.37 (4.3)
Amputation (disgust)	2.13 (1.4)	4.58 (1.5) [a]	1.66 (1.0)	1.38 (.81)	9.07 (4.8)
Silence of the Lambs (fear)	3.44 (1.3) [a]	2.98 (1.3)	1.67 (.98)	1.86 (1.1)	7.60 (3.8)

* Target emotion

Table 2 Descriptives, correlation and partial correlation analyses of associations between perceptions of emotion-related threat and tolerance, peak target emotion, handgrip persistence and distress tolerance and discomfort intolerance scales

Films	DTS – tolerance	DTS – appraisal	DTS – absorption	DTS – regulation	DTS – total score	DIS – intolerance	DIS – avoidance	DIS – total score
M (SD)	3.37 (.87)	3.94 (.76)	3.57 (.89)	3.42 (.84)	3.65 (.68)	4.60 (2.9)	7.55 (3.1)	12.15 (5.1)
Champ (Sadness) - perceived threat and tolerance	−.23* (−.15) [a]	−.23* (−.19)	−.33* (−.28)*	−.12 (−.06)	−.28* (−.21)*	−.04 (−.09)	.07 (.07)	.02 (−.01)
Champ - peak sadness	−.26*	−.14	−.23*	−.19	−.23*	.14	.06	.11
Cry Freedom (Anger) - perceived threat and tolerance	−.33* (−.21)*	−.36* (−.25)*	−.34* (−.18)	−.25* (−.10)	−.39* (−.24)*	.11 (−.05)	.16 (.09)	.16 (.03)
Cry Freedom - peak anger	−.28*	−.30*	−.35*	−.27*	−.36*	.23*	.10	.19
Silence of the Lambs (Fear) - perceived threat and tolerance	−.31* (−.14)	−.30* (−.21)*	−.29* (−.19)	−.25* (−.18)	−.35* (−.23)*	.10 (−.03)	.16 (−.00)	.16 (−.02)
Silence of the Lambs - peak fear	−.30*	−.21*	−.20*	−.14	−.26*	.16	.24*	.24*
Amputation (Disgust)- perceived threat and tolerance	−.25* (−.19)	−.31* (−.28)*	−.27* (−.22)*	−.21* (−.17)	−.32* (−.27)*	.23* (.13)	.25* (.13)	.28* (.16)
Amputation - peak disgust	−.14	−.12	−.15	−.10	−.15	.18	.22*	.23*
Handgrip persistence	.02 (.00) [b]	.09 (.08)	.09 (.09)	−.03 (−.05)	.06 (.05)	−.20 (−.18)	−.11 (−.12)	−.18 (−.18)

DTS Distress Tolerance Scale, *DIS* Discomfort Intolerance Scale

[a] Film partial correlations controlled for peak target emotion and gender

[b] Handgrip persistence partial correlations controlled for gender and target grip strength

* $p<.05$, ** $p<.01$

gender and target grip strength. Again, we found only marginally significant associations between DIS-total and DIS-intolerance scores and grip duration, though no other scale was associated with grip duration. These findings are presented in Table 2. Grip duration was unrelated to ASI scores, $r=.02$, $p=.84$, so no additional analyses examining the uniqueness of the associations between DIS scores and grip duration were performed.

We also evaluated potential gender differences in relations between DIS and handgrip task performance. Overall, women ($M=13.26$, SD=5.41) reported greater DIS scores than men ($M=10.18$, SD=3.77), F (1, 164)=15.24, $p<.0002$, which reflected greater discomfort intolerance among women. Men showed greater target grip strength ($M=13.30$, SD=3.0) than women ($M=8.61$, SD=2.45), F (1, 164)=118.08, $p<.0001$. However, men ($M=57.44s$, SD=57.35) and women ($M=48.34s$, SD=46.24) did not significantly differ on task persistence, F (1, 164)=.15, $p=.70$. Additionally, when controlling for target grip strength, greater DIS scores were not significantly associated with task persistence for men, $r=-.11$, $p=.39$, though they were marginally associated with lower task persistence for women, $r=-.21$, $p=.03$; the magnitude of the association did not though differ between men and women, Fisher's $z=0.66$, $p=.51$.

Table 3 Regression analyses of the distress tolerance scale and anxiety sensitivity index predicting perceptions of emotion-related threat and tolerance in response to films

	ΔR^2	F	β	p
Step 1	0.42	59.38		< 0.001
Gender			0.03	*ns*
Emotional intensity			0.64	< 0.001
Step 2	0.06	9.22		< 0.001
Distress Tolerance Scale			−0.15	< .02
Anxiety Sensitivity Index			0.16	< .02

Discussion

The findings of the current study provide novel evidence related to the validity of the DTS and DIS as measures of emotional and physical distress tolerance, respectively. Consistent with prediction, the DTS was significantly incrementally predictive of tolerance and perceived threat for disgust, fear, anger, and sadness evoked by film clips, after controlling for peak emotional intensity in response to the films. Notably, these incremental associations though significant were small in magnitude—the largest incremental effect involved 8 % of shared variance. The present findings provide some degree of support to theorizing that the DTS is a measure of generalized emotional distress tolerance and applies to multiple forms of emotional distress. This also provides evidence for theorizing that the DTS is distinct from, though significantly related to, emotional reactivity or intensity. The fact that the DTS predicted additional variance in emotion-related tolerance and threat when controlling for emotional intensity and anxiety sensitivity provides further evidence for its value as an assessment

instrument. In contrast, the DIS was unrelated to tolerance and perceived threat associated with the emotional films and was only marginally correlated with persistence on a discomforting handgrip task among women but not men. The observed degree of shared variance suggests that individual differences measured by the DIS and handgrip persistence do not likely reflect the same latent individual difference variable. These contrasting findings further attest to the theoretical argument that individual differences in perceived emotion or psychological tolerance and perceived physical discomfort tolerance, as measured by the DTS and DIS, reflect distinct latent variables (Bernstein et al. 2009; Bernstein, Marshall, and Zvolensky 2011).

The nature of the association between perceived distress tolerance, as indexed by the DTS, and tolerance and perceived threat of the film-elicited emotions is furthermore complicated by the pattern of significant and null associations between individual DTS subscales and tolerance and perceived threat of the film-elicited emotions (after controlling for emotional intensity). These null associations were contrary to our predictions. We do not want to overinterpret the differences observed between individual DTS subscales and tolerance and perceived threat, and thus we tentatively review these findings as they may contribute to the understanding of the latent construct(s) measured by the DTS and its subscales. The DTS-tolerance subscale was only incrementally associated with tolerance and perceived threat for the anger film clip. The nonsignificant *incremental* associations between DTS-tolerance and tolerance and perceived threat of all other film-elicited emotions are striking, given that this subscale best reflects the core construct which the DTS putatively measures. It is important to note, however, that the zero-order correlations between DTS-tolerance subscale and tolerance and perceived threat for the film-elicited emotions were significant, but were nonsignificant after controlling for peak target emotion and gender.

It was further interesting to note that the DTS-regulation subscale was *incrementally* unrelated to tolerance and perceived threat for any film. This is potentially interesting from a theoretical standpoint in that it suggests a tenuous connection between tolerance and perceived threat for negative emotions as measured by ratings in response to the film clips and efforts to decrease or escape negative emotions as measured by the DTS-regulation subscale, at least after controlling for peak target emotion and gender. Perhaps such efforts are motivated more by the persistence or intensity of these negative emotions rather than the tolerance and perceived threat of the emotions—though future research is needed to test such possibilities.

The DTS-absorption subscale was uniquely predictive of tolerance and perceived threat for sad and disgust films, while the DTS-appraisal subscale was predictive of tolerance and perceived threat for each film except the sad film. The associations demonstrated between DTS-appraisal and ratings for these three films are not surprising, given that this subscale assesses negative perceptions of distress (e.g., 'My feelings of distress or being upset are not acceptable' and 'My feelings of distress or being upset scare me'), closely related in content to the questions used to measure tolerance and perceived threat of the film-elicited emotions. One hypothesis regarding the null association observed between DTS-appraisal and tolerance and perceived threat for the sad film is that, perhaps, this subscale assesses negative perceptions of distressing emotions characterized by high rather than low arousal. This ambiguity in part results from the broad non-specific language of "distress" to which the DTS refers. We thus do not know what specific forms of distress participants think of when responding to the DTS. In contrast, we furthermore hypothesize that the DTS-absorption subscale incremental predictive association with tolerance and perceived threat ratings for the sad film specifically may be because of the unique role of ruminative attentional focus in tolerance and perceived threat for sadness. The DTS-absorption subscale reflects individual differences that are conceptually distinct from those assessed by the DTS-tolerance and -regulation subscales, which conceptually appear more related to avoidance and escape responding to feelings of distress.

The current study found multiple gender differences in scores on the DTS and on emotional film assessments. Specifically, women reported poorer distress tolerance and greater emotional reactivity across these assessments. Though we did not address this question in the current investigation, future research may wish to evaluate how differences in distress tolerance and emotional reactivity may account for gender differences in various psychiatric disorders.

Previous research failed to find associations between the DTS and the DIS and performance on lab-based assessments of distress tolerance (Bernstein et al. 2011). However, this set of results may be at least in part because the DTS may be related more narrowly to specific behavioral measures of negative emotional tolerance rather than assessments that elicit physical discomfort or frustration that were tested in earlier studies (e.g., mirror-tracing persistence, PASAT, breath-holding, carbon dioxide-enriched air inhalation, and hyperventilation). Indeed, in the present study, the DTS did not predict persistence on the handgrip persistence task. Similarly, the DIS may be related more narrowly to tolerance of physical discomfort but perhaps not to states of discomfort that are concurrently characterized by emotional distress as well as physical distress that were tested in earlier work (e.g., mirror-tracing, PASAT-C, CO2-enriched air exposure) (Bernstein, Marshall, and Zvolensky 2011; Zvolensky et al. 2011). However, in the

present study, like the DTS, tolerance and threat perception in response to the film clips was also measured via self-report—in contrast to the reviewed behavioral distress tolerance tasks in which behavioral latency to discontinue the tasks reflected (behavioral) tolerance. Thus, the observed incremental associations between DTS and tolerance and perceived threat in response to the film clips may be in part or fully accounted for the possibility that both measures reflect *perceived* emotional distress tolerance; indeed, in the event that a *behavioral* measure of emotional distress tolerance (e.g., latency to discontinue) in response to the film clips was tested, the association with the DTS may not be similarly observed (Bernstein et al. 2011; Leyro et al. 2010). This reflects a central next test in this line of study.

The present investigation has a number of limitations. First, the in vivo assessment of film-elicited emotional (perceived) tolerance utilized self-report ratings, and the associations between these ratings and DTS scores may be due to shared method variance. Unfortunately, behavioral assessments of tolerance for negative emotions are not well-developed (Bernstein & Brantz 2012). Future research may see benefit from the development of such assessments, including facial coding and/or eye tracking assessments of responses to emotional films. Second, the sample in this study was young and relatively homogeneous (i.e., predominantly female and Caucasian), and future studies may wish to examine the validity of these measures using more representative or clinical samples. Third, the emotional film used to induce anger provoked greater disgust than anger and similar levels of anger and sadness. The elevated levels of disgust in response to this film, which depicted scenes of violence against children, were likely a result of moral disgust (i.e., feeling 'disgusted'), which often accompanies feelings of anger. Specific inductions of anger through film are quite difficult, as they are often accompanied by multiple emotions (Rottenberg et al. 2007). Future research may wish to assess the associations between the DTS and tolerance for emotional response to more direct methods of anger induction (e.g., writing about a time someone wronged you). Fourth, the internal consistency for the items assessing tolerance and perceived threat for the sad film (α=.61) was lower than that for the items for the other films (α's >.80). This may be due, in part, to the lower scores found for this measure. Future research may benefit from different assessments of tolerance for sadness. Fifth, the behavioral measure of physical distress tolerance measure was administered following questionnaires and the emotional film tasks, which may have influenced performance on this task. Last, the behavioral measure of physical distress tolerance used in this study is also limited by the confounding of persistence with tolerance mentioned earlier, which may account for the weak associations found between the DIS and persistence on this assessment. Perhaps behavioral assessments not relying on persistence or task motivation may have found more robust associations.

Scores on the DTS have been linked to various forms of psychopathology, including symptoms of anxiety, depression, and bulimia (e.g., Anestis et al. 2007; Keough et al. 2010). The heterogeneity of this measure, as well as the limited validity for its subscales found in the current study, necessitates closer investigation of features of distress tolerance in relation to different disorders using varied methodology. Additionally, caution should be used when interpreting associations between total DTS scores and symptom measures, as such findings may not reflect true relationships between emotional distress tolerance *per se* and psychopathology.

To summarize, the current study provides partial evidence for the criterion-related validity of the DTS as a measure of perceived emotional distress tolerance and little support for the DIS as a measure of physical distress tolerance. Less evidence for incremental predictive validity was found among specific subscales of the DTS, including the tolerance subscale thought to be most representative of the construct the DTS was designed to measure. Effect sizes for the incremental associations between the DTS subscales and the tolerance and perceived threat emotional film ratings were small in magnitude. The unique and specific associations between the DTS and performance on the in vivo tasks may be further interpreted to mean that the DTS and DIS assess independent individual difference constructs (Bernstein et al. 2009). Future work is essential in continuing to work to delineate the latent construct(s) measured by the DTS, to advance measurement of perceived tolerance of negative emotions beyond extant self-report measurement methodology, and to develop advanced means to behaviorally and experimentally measure emotional distress tolerance.

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