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Does distress tolerance interact with trait anxiety to predict challenge or threat appraisals?

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A B S T R A C T

Low distress tolerance (DT), the capacity to withstand aversive emotional or physical states, is associated with adverse psychological and physical functioning. However, we know relatively little about the psychological processes through which low DT results in poor functioning. The present study examined the effects of DT on cognitive appraisals of stress using an experimental stress-induction paradigm in 136 undergraduates. We hypothesized (1) lower DT predicts lower challenge appraisal and higher threat appraisal, and (2) these relationships are strengthened for those with higher trait anxiety. Results partially supported Hypothesis 1: Lower DT predicted higher threat appraisal, but not challenge appraisal. A significant interaction effect was found between DT and trait anxiety in predicting challenge appraisal, but the relationship was opposite from the direction predicted in Hypothesis 2, such that individuals with very high trait anxiety and lower DT made *higher* challenge appraisals. Future research should further examine the relations of DT, trait anxiety, and stress appraisals with respect to psychological well-being in young adults.

1. Introduction

Distress tolerance (DT) is an individual's perceived or behavioral capacity to withstand aversive emotional or physical states. Low DT has been associated with poorer psychological functioning, including psychopathology (e.g., depressive, eating, and substance use disorders), negative coping behaviors (e.g., substance use), and poor health behavior engagement (e.g., medication nonadherence) (Buckner, Keough, & Schmidt, 2007; O'Cleirigh, Ironson, & Smits, 2007). Specifically in young adults, low DT has been implicated in maladaptive behaviors, including risky driving and problematic marijuana use (Beck, Daughters, & Ali, 2013; Zvolensky et al., 2009). Thus, DT appears to be a generally salutary trait.

However, we know relatively little about the psychological processes underlying relationships between DT and psychological functioning. Empirical efforts to disentangle the subconstructs proposed to comprise DT, including tolerance of uncertainty, ambiguity, frustration, negative emotion, and physical discomfort (Bernstein, Zvolensky, Vujanovic, & Moos, 2009), are burgeoning. For example, DT is correlated with anxiety disorder symptoms, but the specific pattern of DT associations with symptoms varies across disorders and effects are diminished once accounting for more granular constructs of intolerance of uncertainty (Laposa, Collimore, Hawley, & Rector, 2015) and anxiety sensitivity (Allan, Macatee, Norr, Raines, & Schmidt, 2015). How these processes unfold during crucial developmental transitions characterized by periods of increased stress remains poorly understood, especially how young adults modulate negative emotional reactions to stress during the transition to early adulthood, given the rapid changes in inhibitory control, future-oriented thinking, and changing valence of sources of socialization as they individuate from family life (Weems, 2017).

1.1. Distress tolerance and cognitive appraisals

Cognitive theories of stress posit that cognitive appraisals, personal evaluations of a given event's significance for one's well-being (Lazarus & Folkman, 1987), are part of the psychological processes by which stress is interpreted and managed. Individuals form different cognitive appraisals of the same stressor, with some appraising threat (perception of harm or loss) and others appraising challenge (anticipation of growth or gain). Appraisals have important implications for psychological well-being as evidenced by research demonstrating that lower threat and higher challenge appraisals are associated with better psychological adjustment to chronic conditions and injuries (e.g., Kennedy, Evans, &

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Sandhu, 2009). DT may influence an individual's assessment of a stressor as a threat or challenge, but no studies have yet examined this relationship.

DT is linked to other psychological characteristics associated with threat and challenge appraisals, such as trait anxiety. Previous studies have found that lower DT is linked to increased anxiety symptoms as well as higher anxiety sensitivity (Allan et al., 2015; Laposa et al., 2015). However, scant research has specifically examined relationships between young adults' trait anxiety, a stable characteristic predisposing individuals to perceive situations as threatening (Spielberger, 1983), and DT (e.g., Ekinci & Kural, 2017).

Trait anxiety is well-established as a predictor of threat appraisal. Previous research has found that individuals with higher trait anxiety report higher threat appraisal and display greater attentional bias to threat-related stimuli in response to laboratory stress inductions (Jerusalem, 1990; Mogg, Bradley, & Hallowell, 1994). By comparison, relatively little research has been conducted on the effects of trait anxiety on challenge appraisal. Endler (1980) developed a multidimensional interaction model of stress, anxiety, and coping in which personality variables such as trait anxiety predict cognitive stress appraisals. Consistent with this model, a study of high school students studying for an exam found that higher trait anxiety was associated with lower challenge appraisal in the week prior to the exam (Lay, Edwards, Parker, & Endler, 1989). In sum, research has found an inverse relationship between DT and trait anxiety, a positive relationship between trait anxiety and threat appraisal, and preliminary evidence for an inverse relationship between trait anxiety and challenge appraisal.

1.2. Conjoint effects of distress tolerance and trait anxiety on appraisals

Studies of the relationships between state anxiety and cognitive stress appraisals are common (e.g., Allred & Smith, 1989), but few have examined links with trait anxiety. Trait anxiety may provide a more consistent picture of how individuals react across a range of contexts and stressors. Furthermore, higher trait anxiety may magnify the effects of poor DT on appraisals. Studies testing interactions of anxiety sensitivity and DT have found that high anxiety sensitivity and low DT sometimes (Allan, Macatee, Norr, & Schmidt, 2014), but not always (Keough, Riccardi, Timpano, Mitchell, & Schmidt, 2010) strengthen each other's effect on adverse psychological functioning. However, no studies have tested the interaction of DT with *trait anxiety*, as well as their multiplicative effect on stress appraisals. Examining the synergistic effect of DT and trait anxiety will inform how DT skill-building may influence evaluations of stress for individuals predisposed to anxiety. Understanding effects of DT on stress appraisals is particularly relevant in the context of trait anxiety, as DT skill-building may be one way of altering stress responses for highly anxious individuals.

1.3. The present study

The present study aims to fill the gap in research on relationships between DT and cognitive stress appraisals, drawing on extant research linking trait anxiety with DT and cognitive stress appraisals to characterize relationships among DT, trait anxiety, and threat and challenge appraisals. The variable nature of stressors encountered in daily living makes studying appraisals of stressors difficult. Therefore, we used a laboratory stress induction to address some of these limitations by controlling for the type and duration of the stressor. To date, no study has used a laboratory stress induction to measure the influence of DT on cognitive appraisals nor tested whether emotional-affective traits like anxiety moderate this link. We tested two hypotheses: (1) Lower DT will predict lower challenge appraisal and higher threat appraisal, and (2) the relationships in Hypothesis 1 will be strengthened for those with higher trait anxiety.

2. Methods

2.1. Participants

A sample of 136 undergraduates was recruited through the psychology participant pool at a large Northeastern US university as part of a larger study of cognitive appraisals and cardiovascular responses to a laboratory stressor. Those who smoked, had major medical conditions, or took medications affecting blood pressure were pre-screened as ineligible. Each participant came into the laboratory for a one-time 40-minute session during which they completed the baseline and stress induction procedures.

2.2. Procedure

2.2.1. Baseline

Participants completed the baseline survey: the demographic form, Distress Tolerance Scale (DTS; Simons & Gaher, 2005) and State-Trait Anxiety Inventory – Form Y2 (STAI – Form Y-2; Spielberger, 1983).

2.2.2. Stress induction

Next, participants were informed that they would be randomly assigned to either the control (no task) or experimental condition (task). Procedures were modified from the Trier Social Stress Task (TSST; Kirschbaum, Pirke, & Hellhammer, 1993). Participants were informed that all participants will be given a speech preparation period but only those in the experimental condition would take on the role of a job applicant interviewing with company managers and present a five-minute speech. Participants were also informed that they would learn the condition to which they were assigned after the preparation period.

At the beginning of the 10-minute preparation period, participants completed another set of measures, which included the Stress Appraisal Measure (SAM; Peacock & Wong, 1990). Afterwards, all participants were informed that they were assigned to the control condition, thus ending the session. Prior research has demonstrated that anticipation of the speech task elicits a heightened physiological response comparable to the response produced while performing the task, as well as higher threat appraisal when compared to a control condition (Feldman, Cohen, Hamrick, & Lepore, 2004).

2.3. Measures

2.3.1. Baseline

2.3.1.1. Demographic. Participants reported sex/gender, age, race/ethnicity, family income, and parental education.

2.3.1.2. Distress tolerance. The DTS, 15 items rated on a scale from 1 (strongly agree) to 5 (strongly disagree), with one reverse-scored item, assessed emotional ability to tolerate distress ($\alpha = 0.90$). Higher mean scores on the DTS indicate higher DT. The DTS has been validated on undergraduates, demonstrating good discriminant, criterion, and predictive validity, and test-retest reliability (Simons & Gaher, 2005).

2.3.1.3. Trait anxiety. The STAI, 20 items rated on a scale from 1 (almost never) to 4 (almost always), assessed trait anxiety, the dispositional tendency to feel stress, worry, and discomfort ($\alpha = 0.91$). Higher scores indicate higher trait anxiety. The STAI demonstrates high test-retest reliability and concurrent validity (Spielberger, 1983).

2.3.2. Stress induction

2.3.2.1. Challenge and threat appraisals. The challenge and threat subscales of the SAM assessed cognitive appraisals of the stressor. Each subscale has four items rated on a scale from 1 (not at all) to 5 (extremely). Threat refers to the perception of potential loss or harm (e.g., “Is this going to have a negative impact on me?”; $\alpha = 0.74$).

Challenge refers to anticipation of gain or growth (e.g., "How eager am I to tackle this problem?"; $\alpha = 0.80$). Higher scores indicate greater appraisal on that dimension. The SAM demonstrates satisfactory internal consistency and convergent validity in undergraduate samples (Peacock & Wong, 1990).

2.4. Data analytic plan

All analyses were conducted using SPSS 24. In addition to descriptive statistics and bivariate correlations for study variables, we conducted *t*-tests to examine mean differences between challenge and threat appraisals as well as gender differences on key study variables. Before conducting regression analyses, we confirmed the assumptions of regression were met. We found linear relationships between independent and dependent variables based on visual inspection of scatterplots, independence of errors using the Durbin-Watson statistic, no multicollinearity between DT and trait anxiety based on the Tolerance and Variance Inflation Factor, homoscedasticity of errors based on visual inspection of plotting residuals versus predicted values and independent variables, and multivariate normality based on visual inspection of P-P plots of standardized residuals.

We conducted two moderation analyses using hierarchical linear regression to test for interaction effects of trait anxiety and DT on challenge and threat appraisals (Baron & Kenny, 1986). To facilitate interpretation of interaction terms, predictor and moderator variables were mean-centered. A simple slopes test was used to test for the significance of the interaction in predicting challenge and threat appraisals. We also repeated our regression analyses controlling for gender.

3. Results

3.1. Descriptive statistics

Descriptive statistics for the sample are presented in Table 1 and for key study variables are presented in Table 2. Participants reported moderate abilities to tolerate distress, and a mean frequency between "sometimes" and "often" for trait anxiety. On average, participants appraised the stressor as a challenge between "slightly" and "moderately," and threat between "not at all" and "slightly." A paired *t*-test revealed that the mean for challenge was significantly higher than the mean for threat, $t(135) = 6.92$, $p < 0.001$, with a mean difference of 0.68 (95% CI, 0.49 to 0.88), indicating that participants appraised the stressor as more of a challenge than threat. Additional *t*-tests revealed no significant gender differences on challenge appraisal, but women reported higher threat appraisal ($M = 1.90$, $SD = 0.79$ vs. $M = 1.59$, $SD = 0.63$; $t(134) = -2.45$, $p < 0.05$), higher trait anxiety ($M = 2.10$, $SD = 0.52$ vs. $M = 1.92$, $SD = 0.50$; $t(132) = -2.02$, $p < 0.05$) and lower DT ($M = 3.46$, $SD = 0.71$ vs. $M = 3.87$, $SD = 0.78$; $t(132) = 3.11$, $p < 0.01$). Bivariate correlations between key study variables are presented in Table 2. DT was negatively correlated with trait anxiety; both DT and trait anxiety were positively correlated with threat appraisal, but unrelated to challenge appraisal.

Table 1
Sample descriptive statistics.

	Overall ($n = 136$)
Age (*M*(*SD*))	19.14 (1.23)
Race/ethnicity (%)	
White	53.7
Asian	27.9
Hispanic/Latino	14.7
Black/African-American	9.6
Bi-racial or multi-racial	6.6
Other	2.2
American Indian/Alaska Native	0.7
Native Hawaiian/Pacific Islander	0.7
Income (%)	
< $15,000	2.9
$15,000–$24,999	0.7
$25,000–$34,999	11.0
$35,000–$49,999	3.7
$50,000–$74,999	16.9
$75,000–$99,999	22.8
$100,000–$149,999	19.9
$150,000–$199,999	9.6
≥ $200,000	12.5
One parent with bachelor's degree or beyond (%)	58.0

Table 2
Descriptive statistics and bivariate correlations.

Variable	Range	*M* (*SD*)	1	2	3
1. Trait Anxiety	1.15–3.65	2.03 (0.52)			
2. Distress Tolerance	1.75–5.25	3.62 (0.76)	−0.61**		
3. Challenge	1.00–5.00	2.47 (0.86)	0.00	−0.07	
4. Threat	1.00–4.50	1.78 (0.75)	0.40**	−0.37**	−0.02

** $p < 0.01$.

3.2. Manipulation check

As part of the larger study, blood pressure data were collected to test hypotheses unrelated to the present study. Blood pressure data from the baseline period and stress induction were used for the manipulation check, demonstrating a significant increase in systolic blood pressure by 1.3 mm Hg, $t(134) = -2.40$, $p < 0.05$, suggesting a small but significant manipulation effect from the stress induction. Previous research demonstrates that passive anticipation activates the vascular system (increased systolic blood pressure; Gregg, James, Matyas, & Thorsteinsson, 1999).

3.3. Regressions

Hypothesis 1. Main Effects. Regression results are displayed in Table 3. For predicting threat appraisal, we found main effects of DT and trait anxiety, indicating that lower DT and higher trait anxiety predicted higher threat appraisal. There were no significant main effects of DT or trait anxiety in predicting challenge appraisal. Therefore, Hypothesis 1 was partially supported, in that higher DT predicted lower threat appraisal, but not challenge appraisal.

Hypothesis 2. Interaction Effects. DT and trait anxiety did not significantly interact in predicting threat appraisal. However, there was a significant interaction effect between DT and trait anxiety in predicting challenge appraisal. Adding the interaction term to the model resulted in a significant increase in the amount of variance explained for challenge. The full model accounted for 2% of the variance. Using Aiken and West's (1991) procedures, we tested simple slopes for the association between DT and challenge appraisal for five levels of trait anxiety: very high (+2 *SD* above mean), high (+1 *SD* above mean), moderate (mean), low (−1 *SD* below mean), and very low (−2 *SD* below mean). Displayed in Fig. 1, simple slopes analysis revealed that the slope of the regression line for very high trait anxiety was significantly different from zero. Using the Johnson-Neyman technique, a threshold of $p < 0.05$ was used to calculate the unstandardized region of significance (Preacher, Curran, & Bauer, 2006). Differences in the effects of trait anxiety on challenge appraisal emerged for individuals with unstandardized DT scores above 1.45, which comprised 3% of the sample. Therefore, among individuals with very high trait anxiety, individuals with lower DT tend to make higher challenge appraisals. Although we found a significant interaction between DT and trait anxiety in predicting challenge appraisal, the direction of the relationship was opposite of that hypothesized; therefore, Hypothesis 2 was not supported.

Table 3
Moderation analyses.

Predictors	Challenge				Threat			
	B (*SE*)	*β*	*t*	Adj. R^2	*B* (*SE*)	*β*	*t*	Adj. R^2
Step 1				−0.01				0.17
Intercept	2.47 (0.08)***		32.59		1.78 (0.06)***		29.92	
Distress Tolerance	−0.14 (0.13)	−0.12	−1.09		−0.22 (0.10)*	−0.22	−2.19	
Trait Anxiety	−0.11 (0.19)	−0.07	−0.61		0.38 (0.15)*	0.26	2.60	
Step 2				0.02				0.17
Intercept	2.39 (0.08)***		28.20		1.81 (0.07)***		26.91	
Distress Tolerance	−0.09 (0.13)	−0.08	−0.73		−0.24 (0.10)*	−0.24	−2.33	
Trait Anxiety	−0.12 (0.18)	−0.07	−0.67		0.38 (0.15)*	0.26	2.63	
Distress Tolerance × Trait Anxiety	−0.34 (0.17)*	−0.18	−2.00		0.13 (0.13)	0.08	1.00	
	Final model $F(3, 128) = 1.74$				Final model $F(3, 128) = 10.12$***			

* $p < 0.05$.
*** $p < 0.001$.

Gender significantly predicted challenge ($B = -0.34$, $SE = 0.16$, $p < 0.05$), but not threat appraisal. The interaction between DT and trait anxiety no longer predicted challenge appraisal after taking gender into account, suggesting that the strength of the moderating effect of trait anxiety is partly explained by women in our sample having lower DT and higher trait anxiety.

4. Discussion

4.1. Research findings

Our study of associations between DT, trait anxiety, and cognitive appraisals advances understanding of the psychological processes by which low DT leads to maladaptive behaviors. These results demonstrate that DT predicts interpretations of current stressors. As predicted in Hypothesis 1, lower DT predicted higher threat appraisal. Although prior research has not examined this specific relationship between DT and threat appraisal, our finding is consistent with previous literature linking low DT with other markers of threat sensitivity (e.g., panic symptoms; Kraemer, Luberto, & McLeish, 2013). In testing Hypothesis 2, we found that DT and trait anxiety each uniquely predict threat appraisal, but their conjoint effect does not contribute additional predictive value.

Contrary to Hypothesis 1, we did not find a main effect of DT on challenge appraisal. However, a relationship between DT and challenge appraisal emerged once the interaction between DT and trait anxiety was taken into account. The lack of a main effect of DT on challenge appraisal but presence of a significant interaction effect highlights the importance of examining personality traits, such as trait anxiety, as moderators when studying the relationship between these constructs. Of note, the directionality of the relationships is counterintuitive: Among individuals with very high trait anxiety, those more tolerant of distress appraised the stressor as *less* challenging compared to those less tolerant of distress.

One interpretation of these results is that individuals with higher DT are less likely to perceive an opportunity for growth or gain in a brief laboratory stress induction. This explanation resonates with a point underscored by theorists that DT is not "reward-contingent"; individuals with high DT do not endure stressful circumstances for the purpose of gain or growth (Zvolensky, Leyro, Bernstein, & Vujanovic, 2011). Another explanation is that individuals with higher DT are not predisposed to frame stressors as challenges because they either are relatively less reactive to stressors or may be already equipped to handle comparatively low-stress situations. With respect to the latter, it is possible that these findings do not hold when individuals are confronted with larger stressors that tax their capacities, such as traumas, as the direction of the relationship between DT and challenge appraisal may be reversed (i.e., positive association).

Our study yielded additional findings that were not examined as part of the original hypotheses, but inform the scant research about the relationships among DT, trait anxiety, and stress appraisals. DT and trait anxiety shared a fairly strong inverse relationship ($r = -0.61$), replicating a similar effect size from a prior study ($r = -0.66$; Kraemer et al., 2013). The strong but far from perfect association suggests that DT and trait anxiety are related but distinct constructs, and therefore should continue to be studied in tandem. We also found gender differences similar to those found in previous studies with undergraduates, such that females report lower DT and higher trait anxiety (e.g., Simons

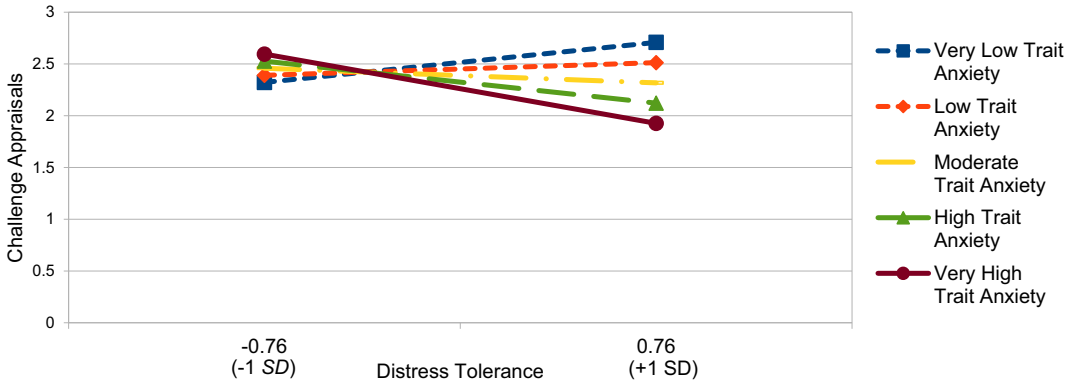

Fig. 1. Distress tolerance x trait anxiety predicting challenge.
Note. Very low trait anxiety: $B = 0.25$, $SE = 0.23$, $t(132) = 1.09$, p = ns. Low trait anxiety: $B = 0.08$, $SE = 0.17$, $t(132) = 0.49$, p = ns. Moderate trait anxiety: $B = -0.09$, $SE = 0.13$, $t(132) = -0.74$, p = ns. High trait anxiety: $B = -0.27$, $SE = 0.14$, $t(132) = -1.92$, p = ns. Very high trait anxiety: $B = -0.44$, $SE = 0.20$, $t(132) = -2.27$, $p < 0.05$.

& Gaher, 2005; Spielberger, 1983). Gender influences the interaction of DT and trait anxiety, such that their conjoint effect no longer predicts challenge appraisal.

Moreover, trait anxiety was positively associated with threat appraisal, which is consistent with the literature about the relationship between trait anxiety and attentional biases towards threat (e.g., Mogg et al., 1994). However, trait anxiety was not related to challenge appraisal. In fact, none of the key study variables were related to challenge appraisal, contradicting earlier research about negative relationships between trait anxiety and challenge appraisal (Lay et al., 1989), as well as between threat and challenge appraisals (e.g., Skinner & Brewer, 2002). The lack of consistency between findings about challenge appraisal may be due to our use of a laboratory speech task as the stressor, which has limited implications for well-being and opportunities for growth or gain. The research base on cognitive appraisals continues to be more informed about factors related to threat appraisal than those related to challenge appraisal. Developing a better understanding of the determinants of challenge appraisal is needed to promote resiliency, as challenge appraisals of stress predict better psychological well-being (e.g., Mak, Blewitt, & Heaven, 2004). In sum, our findings provide preliminary support that cognitive stress appraisals may play a role in the relationship between DT and psychological outcomes such as psychopathology, coping behaviors, and health behaviors.

4.2. Strengths and limitations

Our sample of students is relatively healthy and high-functioning, which may limit the generalizability of findings. Another potential limitation is that the stress induction may not have been sufficiently taxing, suggested by the low means and standard deviations for challenge and threat appraisals. The low variance for both challenge and threat appraisals may have limited our ability to detect stronger effects of DT and trait anxiety on appraisals. Furthermore, we did not measure aspects of psychological functioning such as psychopathology, coping behaviors, or health behaviors; therefore, our preliminary findings warrant further investigation about the potential explanatory role of cognitive appraisals in the relationship between DT and such psychological and behavioral outcomes.

Despite these limitations, the present study had a number of strengths. Our study is the first to examine the interaction effects of DT and trait anxiety on cognitive appraisals of a current stressor. We examined these associations using a stress induction task, which provides several advantages. Given that public speaking and being evaluated by others are common stressors for undergraduates, the use of a potential speech task as a stress induction allows us to validly infer how DT may impact their reactions to everyday stressors. In addition, the use of the same stressor for all participants also supports the view that our findings reflect individual differences in DT and trait anxiety rather than differences in stressors. Furthermore, the present study reinforced prior findings about the relationships between DT and trait anxiety, as well as between trait anxiety and cognitive appraisals.

4.3. Future directions

Given the developmental shifts in emotion regulation and cognitive processes pertinent to risk or threat assessments occurring in early adulthood (Casey, Jones, & Somerville, 2011), future longitudinal efforts may also lend strength to this field by describing the stability of stress appraisals over time. This is particularly warranted given neurodevelopmental evidence of age-related changes in the maturation of structures associated with behavioral activation and inhibition crucial in the regulation of fear, anxiety, and negative emotions (Weems, 2017). Paired with evidence of similar age-related developments in assessing risk and decision-making (e.g., Rudolph, Miranda-Domínguez, Cohen, et al., 2017), future longitudinal studies should test stress appraisals as a mechanism that links DT and aspects of psychological functioning such as engagement in risky behaviors (e.g., Beck et al., 2013).

Given our findings about gender effects predicting challenge appraisal, future studies should examine gender as a key variable when exploring the ways in which personality and emotion regulation skills affect stress appraisals. Other aspects of personality related to trait anxiety such as neuroticism may also interact with DT to influence stress appraisals. Subsequent studies should test brief interventions that target DT skill-building among undergraduates who are high on such personality traits to determine whether improved DT results in reduced risk engagement and increased psychological well-being. By delineating the psychological processes that link DT with stress-related cognitions and behaviors, we can identify targets of intervention for fostering optimal stress responses among young adults.

Disclosure statement

The authors have no financial interest or benefit arising from direct applications of their research.

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