6-20-2018

The Influence of a Personal Values Intervention on Cold Pressor-Induced Distress Tolerance

Brooke M. Smith
Utah State University

Jennifer L. Villatte
University of Nevada

Clarissa W. Ong
Utah State University

Grayson M. Butcher
Utah State University

Michael P. Twohig
Utah State University

Michael Levin
Utah State University

See next page for additional authors

Follow this and additional works at: https://digitalcommons.usu.edu/psych_facpub

Part of the [Educational Psychology Commons](#), and the [Psychology Commons](#)

Recommended Citation

Smith, Brooke M.; Villatte, Jennifer L.; Ong, Clarissa W.; Butcher, Grayson M.; Twohig, Michael P.; Levin, Michael; and Hayes, S. C., "The Influence of a Personal Values Intervention on Cold Pressor-Induced Distress Tolerance" (2018). *Psychology Faculty Publications*. Paper 1636.

https://digitalcommons.usu.edu/psych_facpub/1636

This Article is brought to you for free and open access by the Psychology at DigitalCommons@USU. It has been accepted for inclusion in Psychology Faculty Publications by an authorized administrator of DigitalCommons@USU. For more information, please contact rebecca.nelson@usu.edu.

Authors

Brooke M. Smith, Jennifer L. Villatte, Clarissa W. Ong, Grayson M. Butcher, Michael P. Twohig, Michael Levin, and S. C. Hayes

The Influence of a Personal Values Intervention on Cold Pressor-Induced Distress Tolerance

Behavior Modification

1–23

© The Author(s) 2018

Reprints and permissions:

sagepub.com/journalsPermissions.nav

DOI: 10.1177/0145445518782402

journals.sagepub.com/home/bmo

**Brooke M. Smith¹, Jennifer L. Villatte¹,
Clarissa W. Ong², Grayson M. Butcher²,
Michael P. Twohig², Michael E. Levin¹,
and Steven C. Hayes¹**

Abstract

Research has demonstrated that values and acceptance interventions can increase distress tolerance, but the individual contribution of each remains unclear. The current study examined the isolated effect of a values intervention on immersion time in a cold pressor. Participants randomized to Values ($n = 18$) and Control ($n = 14$) conditions completed two cold pressor tasks, separated by a 30-min values or control intervention. Immersion time increased 51.06 s for participants in the Values condition and decreased by 10.79 s for those in the Control condition. Increases in self-reported pain and distress predicted decreases in immersion time for Control, but not Values, participants. The best-fitting model accounted for 39% of the variance in immersion time change. Results suggest that a brief isolated values exercise can be used to improve distress tolerance despite increased perceptions of pain and distress, such that values alone may be sufficient to facilitate openness to difficult experiences.

¹University of Nevada Reno, USA

²Utah State University, Logan, USA

Corresponding Author:

Brooke M. Smith, Department of Psychology, University of Nevada Reno, 1664 N. Virginia St., Reno, NV 89557-0296, USA.

Email: brooke.smith@aggiemail.usu.edu

Keywords

cold pressor task, distress tolerance, pain tolerance, values, therapeutic modules, acceptance and commitment therapy

Introduction

The actual or perceived ability to tolerate aversive internal and external events, referred to as distress tolerance, is of interest to clinical scientists due to its link with various forms of psychopathology (Leyro, Zvolensky, & Bernstein, 2010; Zvolensky, Vujanovic, Bernstein, & Leyro, 2010). Lower levels of distress tolerance have been positively linked to substance use problems (Ozdel & Ekin, 2014), anxiety and trauma symptom severity (Vujanovic, Bonn-Miller, Potter, Marshall, & Zvolensky, 2011), mood disorders (Allan, Macatee, Norr, & Schmidt, 2014), hoarding symptoms (Timpano, Shaw, Cougle, & Fitch, 2014), obsessions (Macatee, Capron, Schmidt, & Cougle, 2013), eating disorders (Hambrook et al., 2011), personality disorders (Daughters, Sargeant, Bornovalova, Gratz, & Lejuez, 2008), panic disorder (Schmidt, Richey, & Fitzpatrick, 2006), depression (Harrington, 2006), generalized anxiety disorder (Holaway, Heimberg, & Coles, 2006), and obsessive-compulsive disorder (Tolin, Abramowitz, Brigidi, & Foa, 2003). The relationship between distress tolerance and many forms of psychopathology provides empirical support for its possible role as a transdiagnostic process that may contribute to both the development and maintenance of topographically disparate psychological issues (Leyro et al., 2010).

The distress component of distress tolerance has been conceptualized as aversive cognitive, emotional, or physiological states, and the tolerance component has referred to either the perceived capacity or behavioral act of tolerating these aversive states (Leyro et al., 2010). The behavioral act of tolerating aversive states is typically operationalized as the length of time a participant can withstand contact with an aversive stimulus (Zvolensky et al., 2010). As such, distress tolerance describes a way of responding to distressing internal events and has been linked to the related construct of experiential avoidance, which is the tendency to attempt to alter or avoid internal experiences, such as thoughts, emotions, and bodily sensations, even when doing so is problematic (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). Conceptually, distress tolerance can be understood as being inversely related to experiential avoidance, and this inverse relationship has been empirically demonstrated in several studies (Feldner et al., 2006; Zettle et al., 2005).

Interventions aiming to decrease experiential avoidance (or increase acceptance) have been found to increase distress tolerance, as measured by acute pain induction procedures (see Kohl, Rief, & Glombiewski, 2012 for a

review). Hayes, Bissett, et al.'s (1999) study was the first to demonstrate that a short acceptance intervention led to greater pain tolerance during a cold pressor task than an intervention encouraging cognitive control or a placebo condition. Subsequent research has demonstrated the effectiveness of acceptance interventions for increasing pain tolerance during a cold pressor task as compared with suppression (Masedo & Esteve, 2007), cognitive restructuring (Kohl, Rief, & Glombiewski, 2013), and spontaneous coping strategies (Forsyth & Hayes, 2014). Two studies extended these findings to shock tolerance tasks, showing that acceptance strategies increased task persistence relative to distraction, instruction, cognitive, and control conditions (McMullen et al., 2008). This body of research indicates that behavioral distress tolerance can be manipulated with acceptance-based interventions.

At the same time, many studies using acceptance interventions for distress tolerance have implicitly or explicitly invoked personal values by promoting acceptance as a means to achieving valued ends (Hayes, Bissett, et al., 1999; Lillis, Hayes, Bunting, & Masuda, 2009; Masedo & Esteve, 2007). As discussed by Páez-Blarrina et al. (2008), pain tolerance studies usually occur in an implicit motivational context, such that most studies using acceptance-based interventions typically appeal to values in some way. Recognizing this, Páez-Blarrina et al. (2008) explicitly included personal values in the motivational contexts of both acceptance and cognitive control interventions and found that both conditions similarly increased pain tolerance, implying that values may be the active component that leads to increased distress tolerance. In addition, Branstetter-Rost, Cushing, and Douleh (2009) found that including values in an acceptance intervention further improved tolerance relative to an acceptance-only intervention, suggesting values may enhance effects on distress tolerance produced through acceptance. Targeting acceptance and values-based action in the context of chronic pain has been found to be consistently associated with improvement in outcome measures over time, including functioning, depression, and anxiety (McCracken & Vowles, 2008; Vowles & McCracken, 2008; Vowles, McCracken, & O'Brien, 2011), suggesting that such interventions can contribute to meaningful change over time. However, questions remain regarding the specific, isolated influences of each treatment component. Some evidence suggests that components may have a differential impact on therapeutic processes and outcomes when delivered in isolation (Villatte et al., 2016).

To our knowledge, no studies have investigated the isolated effects of values interventions on distress tolerance. By examining the efficacy of isolated therapeutic components, we encourage development of more targeted and precise interventions that can be tailored to the needs of specific individuals. Such empirically supported components lend themselves to applications

within a modular therapeutic approach or as additions to empirically supported treatment packages. Furthermore, isolating the effects of such processes aids our understanding of transdiagnostic processes contributing to the etiology, maintenance, and treatment of psychopathology. Therefore, the current study investigated the isolated effect of a values-only intervention on distress tolerance, as measured by immersion time in a cold pressor task.

Method

Participants

Fifty-five participants responded to study advertisements and enrolled in the study. Sixteen participants were excluded due to reaching the maximum immersion time of 300 s on the first cold pressor trial, a limit imposed, in accordance with previous research, to prevent injuries resulting from excessive exposure to the cold water and to increase experimental power (Hayes, Bissett, et al., 1999; Masedo & Esteve, 2007). The current exclusion rate (33.33%) was smaller than the 58% exclusion rate reported by Hayes, Bissett, and colleagues (1999) and the 42.81% exclusion rate reported by Masedo and Esteve (2007). Two participants were excluded for answering “yes” on the medical screening questionnaire, and one participant was excluded for indicating nonfluency in English on the demographic questionnaire. In addition, four participants’ data were not used because water temperatures in the cold pressor apparatus did not fall within the specified range.

The remaining 32 participants ranged in age from 18 to 28 years, with a mean age of 20.4 years ($SD = 2.60$). The sample was 72% female, 55% White/Non-Hispanic, 19% Asian/Pacific Islander, 13% African American, 10% Hispanic, and 3% who identified themselves as either part of another racial group or did not respond to the question. Participants were randomly assigned to one of two conditions (Values $n = 18$, Control $n = 14$).

Procedure

The study was approved in advance by the institutional review board. Participants were recruited from undergraduate psychology classes at the university and through fliers posted on campus. Participants received either class credit or a US\$5 Starbucks gift card in exchange for participation. Informed consent and medical and demographic questionnaires were completed prior to the experiment. If participants answered “yes” to any item on the medical questionnaire or indicated nonfluency in English, they were excused from further participation in the study. English fluency was an inclusion criterion due to the language-heavy nature of the experimental manipulation.

Participants were asked to identify their nondominant hand, which they placed into a bucket of room temperature water (approximately 22°C) for 3 min to regulate the temperature of the hand and forearm. During this time, the experimenter read scripted directions for the cold pressor task. At the end of 3 min, participants placed their hand and forearm in the ice water. A digital stopwatch was used to measure immersion time and participants were instructed to keep their arm in the water “as long as you can stand it,” at which point they would remove their arm from the water, saying the word “out.” If participants reached the maximum immersion time of 300 s, they were asked to remove their hand from the water.

Verbal pain and distress ratings were recorded at 30-s intervals by the experimenter. Recovery pain and distress ratings were also taken at 30 and 60 s after removal from the cold water. Participants were asked to refrain from drying their hand and arm during this time.

After the first cold pressor trial (Pre), participants were randomized to one of two experimental conditions, Values or Control, and they were given the appropriate intervention. They then completed a second cold pressor task (Post), procedurally identical to the first, and were debriefed. Debriefing consisted of inquiring about the condition of the participant's arm and asking if he or she had any questions regarding the study.

Materials and Apparatus

The cold pressor apparatus consisted of a 43 cm × 43 cm × 43 cm ice cooler divided into two sections by a metal screen and filled with water to a depth of 36 cm. Ice was placed on one side of the screen along with an aquarium pump that circulated water throughout the cooler for the duration of the experiment. Openings in the screen allowed for the free flow of water between sections but were not large enough to allow ice cubes placed in one section to reach the other section. A digital thermometer was used to measure and maintain water temperature within a range of 0°C to 2°C. Participants immersed their nondominant hand and forearm in the ice-free section of the cooler, and the apparatus was elevated to the level of participants' torsos. A bucket filled with room temperature water (approximately 22°C) was situated next to the cold pressor. This experimental setup is consistent with previous studies (Masedo & Esteve, 2007).

Measures

Medical screening questionnaire. A health questionnaire based on Branstetter-Rost et al. (2009) was used to identify whether participants had a history of the following medical conditions: peripheral vascular disease, diabetes,

Reynaud's Disease, peripheral neuropathy, high blood pressure, or cold related injury. The questionnaire also assessed for current injuries to the non-dominant hand and forearm, current use of beta blockers, or ingestion of pain medication or alcohol within the previous 4 hr.

Demographic questionnaire. Participants provided demographic information including their age, sex, ethnicity, and English language fluency.

Immersion time. Distress tolerance was measured by total time a participant's hand remained immersed in the cold water. A digital stopwatch was used to measure time. On both trials, participants were asked to remove their hand from the water if they reached the maximum immersion time of 300 s.

Subjective pain and distress ratings. Participants were asked to rate subjective pain and distress at 30-s intervals while their arm was immersed in the cold pressor and directly following its removal. Ratings were also made at two additional 30-s intervals following removal, referred to as the "recovery period." Recovery periods were used as a means of assessing for any possible "rebound effect" of pain and distress, in accordance with previous studies (Cioffi & Holloway, 1993; Masedo & Esteve, 2007). "Pain" was defined as the painful physical sensations in the hand and forearm. "Distress" was defined as the participant's emotional experience of distress. Ratings were made on a scale from 1 (*no pain/distress*) to 10 (*worst possible pain/distress*) using a visual analog scale that was displayed in front of the participant. Pain and distress ratings were prompted at each interval by the experimenter with the words "pain" and "distress." Participants indicated ratings orally, and ratings were recorded by the experimenter. These ratings served as both secondary outcomes and manipulation checks on the pain and distress elicited by the cold pressor task.

Study Conditions

Each intervention was 30 min long and was delivered via computer as a pre-recorded Microsoft PowerPoint slideshow presentation that progressed at a fixed rate. Because the "slideshow" mode in PowerPoint does not allow slides to be skipped, participants were unable to interfere with the presentation of content. Participants wore headphones to hear the audio instructions that accompanied each presentation. For experimenters to remain unaware of condition, the presentations began with a single slide identifying the protocol by letter only. This same letter was used to identify the corresponding manila envelopes that contained information accompanying each presentation, as

well as the presentation's computer file. The experimenter placed the correct envelope next to the computer and opened the file corresponding to one of the two conditions. Once the program started, the experimenter left the room and entered again only when alerted by the participant that the presentation had ended. Participants were asked not to mention the nature of the activities they had completed to the experimenter.

Values condition. Participants in the Values condition were asked to complete worksheets and a visualization exercise intended to clarify their personal values and relate those values to the cold pressor task. Worksheets were contained in the manila envelope next to the computer and participants were guided through the visualization exercise by the audio portion of the slideshow. Exercises were aimed at clarifying participant values and isolating them from other therapeutic processes, including acceptance. No mention was made of acceptance, and acceptance skills were not directly taught.

Exercises were acceptance and commitment therapy (ACT)-based values interventions (Hayes & Smith, 2005; Hayes, Strosahl, & Wilson, 1999) and consisted of four parts: general values clarification, values assessment, values ranking, and visualization. In the values clarification, participants imagined they were attending their own funeral and wrote a eulogy based on what they believed a loved one would say about them had they lived their ideal life. During the values assessment, participants wrote in more detail about each of nine frequently valued life domains and what they would like to embody in each area. Examples of domains include family, spirituality, and career. Afterward, participants rated the personal importance of each domain on a Likert-type scale from 1 (*low importance*) to 10 (*high importance*) in the values ranking exercise. From these rankings, participants identified their most important value, which was used during the visualization exercise. The visualization was a combination and modification of two well-known ACT metaphors, the Mountain Metaphor and the Swamp Metaphor (Hayes, Strosahl, & Wilson, 1999). A script of this exercise is included in Appendix B. Participants were asked to imagine they were hiking up a mountain and the peak of the mountain represented their most important value. During the hike they encountered a deep, cold river that they had to cross to reach this value. Participants were asked to imagine that the cold pressor was like this river, thus creating a relation of coordination between their personal value and the arbitrary task of immersing their arm in cold water.

Control condition. Participants in the control condition were asked to read neutral reading material consisting of information relating to different "wonders of the world" for 30 min. Reading material was contained in a

Table 1. Mean (*SD*) for Immersion Times and Pain and Distress Ratings at Pre- and Postintervention.

	Immersion time		Pain rating		Distress rating	
	Pre	Post	Pre	Post	Pre	Post
Values (<i>n</i> = 18)	96.61 (96.58)	147.67 (106.43)	6.92 (1.65)	7.55 (1.51)	4.45 (2.44)	4.80 (2.45)
Control (<i>n</i> = 14)	94.64 (85.28)	83.86 (79.17)	7.35 (1.32)	7.68 (1.41)	6.25 (2.11)	5.72 (2.44)

manila envelope next to the computer. The slideshow presentation alerted the participant when 30 min was complete, and the participant was told to inform the experimenter.

Results

Initial Analyses

All statistical analyses were conducted in R (R Core Team, 2015) using the tidyverse (Wickham, 2017), psych (Revelle, 2017), lme4 (Zeileis & Hothorn, 2002), and furniture (Barrett & Brignone, 2017) packages. Despite the small number of males (Values *n* = 3, Control *n* = 6) compared with females (Values *n* = 15, Control *n* = 8), a chi-square test indicated that this difference was nonsignificant between groups ($p = .216$). Distress ratings at Pre were significantly different between groups, $t(30) = 2.23$, $p = .033$, with participants in the Values condition reporting significantly less distress than participants in the Control condition. No other demographic or baseline variables differed between groups. To partially adjust for baseline differences between groups in distress ratings and the nonnormal distribution of Pre and Post immersion time scores, difference scores for immersion time, pain, and distress were used in all statistical analyses (see Difference Score Calculations).

Difference Score Calculations

Immersion time difference scores were calculated by subtracting Pre from Post immersion times. Pain and distress ratings were averaged for each participant across the intervals during which the participant's hand was immersed in the cold pressor. Pain and distress difference scores were then calculated by subtracting Pre from Post average ratings. Table 1 presents descriptive statistics for immersion time and pain and distress ratings at each trial, and Table 2 presents descriptive statistics for immersion time and pain and distress difference scores. Figure A1 in Appendix A shows individual participant

Table 2. Mean (*SD*) for Immersion Time, Pain, and Distress Difference Scores by Condition.

	Immersion time	Pain rating	Distress rating
Values (<i>n</i> = 18)	51.06 (48.77)	0.63 (1.63)	0.35 (1.69)
Control (<i>n</i> = 14)	-10.79 (84.67)	0.33 (1.38)	-0.53 (1.57)

immersion times, average pain ratings, and average distress ratings during both trials by condition. Pain and distress difference scores were significantly correlated ($r = .67, p < .001$).

Pain and Distress Ratings

To test for differences in mean pain and distress ratings from Pre to Post, paired samples *t* tests were conducted with Bonferroni-adjusted alphas of .025. Results indicated that mean pain did not significantly change from Pre to Post, $t(31) = -1.87, p = .071$. Similarly, no statistically significant changes were observed between Pre and Post mean distress ratings, $t(31) = 0.11, p = .913$.

Immersion Time and Interactions With Differences in Pain and Distress

As shown in Figure 1, immersion time for participants in the Values condition increased by an average of 51.06 s ($SD = 48.77$) from Pre to Post, while immersion time for those in the Control condition decreased by an average of 10.79 s ($SD = 84.67$).

Table 3 presents the results of linear regression models with immersion time difference score as the dependent variable and the effect of treatment condition represented by a dummy code. Condition was a significant predictor in all models ($ps < .05$). Model 1 is a simple linear regression including only treatment condition as a predictor of immersion time difference. Treatment condition was significant ($\beta = 61.84, p < .05$), with an adjusted R^2 of .16. When the main effect of pain difference score and its interaction with treatment condition was added to the model (Model 2), adjusted R^2 increased by .14, and the main effect ($\beta = -35.18, p < .01$) and interaction ($\beta = 36.46, p < .05$) were both significant. Figure 2 shows the interaction effect between pain difference score and treatment condition on immersion time difference. To increase the interpretability of the interaction and due to the small sample size, pain ratings were dichotomized into two groups for the purpose of plotting: (a) those who reported decreased pain or no

Figure 1. Immersion time during pre- and postintervention.
Note. Mean time (in seconds) participants’ arms were immersed in the cold pressor pre- and postintervention in the Values and Control conditions (error bars represent standard error of the mean).

Table 3. Beta Coefficients (SE) From Linear Regression Models of Immersion Time Difference Scores.

	Model 1	Model 2	Model 3	Model 4
Intercept	−10.79 (17.84)	0.79 (16.69)	−29.87 (16.12)	−21.14 (19.22)
Condition (Values)	61.84* (23.78)	49.46* (22.70)	82.14*** (21.18)	70.68** (24.22)
Pain difference		−35.18** (12.18)		−13.66 (15.69)
Distress difference			−36.17** (10.04)	−28.13 (13.76)
Condition × Pain Difference		36.46* (15.14)		20.45 (19.56)
Condition × Distress Difference			32.73* (12.96)	20.25 (17.81)
R ²	.18	.37	.44	.47
Adjusted R ²	.16	.30	.39	.36
RMSE	66.74	60.62	56.98	57.93

Note. RMSE = root mean square error.
p* < .05. *p* < .01. ****p* < .001.

Figure 2. Interaction between condition and pain difference scores on immersion time difference scores.

Note. Participants who reported decreased pain from pre- to postintervention did not differ in immersion time change by condition. For participants who reported increased pain from pre- to postintervention, those in the Control condition decreased immersion time and those in the Values condition increased immersion time (error bars represent standard error of the mean).

change in pain from Pre to Post and (b) those who reported increased pain from Pre to Post. Participants whose average pain ratings either decreased or stayed the same from Pre to Post tended to increase their immersion time by approximately 30 s at Post, regardless of treatment condition. However, for participants whose average pain ratings increased from Pre to Post, those in the Control condition decreased their immersion time by approximately 50 s at Post, while those in the Values condition increased their immersion time by approximately 60 s at Post.

Likewise, when only the main effect of distress difference score and its interaction with treatment condition were included in the model (without the main effect of pain difference or its interaction with condition), both the main effect ($\beta = -36.17, p < .01$) and interaction ($\beta = 32.73, p < .05$) were significant, and adjusted R^2 increased by .23 from Model 1. Figure 3 shows the interaction effect between distress difference score and treatment condition on immersion time difference. Again, to increase the interpretability of the interaction and due to the small sample size, distress difference scores were

Figure 3. Interaction between condition and distress difference scores on immersion time difference scores.

Note. Participants who reported decreased distress from pre- to postintervention did not differ in immersion time change by condition. For participants who reported increased distress from pre- to postintervention, those in the Control condition decreased immersion time and those in the Values condition showed no change in immersion time (error bars represent standard error of the mean).

dichotomized into two groups for the purpose of plotting. Participants who reported less or the same amount of distress at Post compared with Pre tended to increase their immersion time by approximately 50 s at Post for those in the Values condition and 20 s at Post for those in the Control condition. However, for participants who reported increased distress at Post, those in the Control condition decreased their immersion time at Post by approximately 80 s, while those in the Values condition increased their immersion time at Post by approximately 50 s, similar to the level of those in the same condition who reported decreased distress or no change in distress.

Due to multicollinearity, when main effects of pain and distress difference scores and the interaction of each with condition were included in the model (Model 4), standard errors increased and only condition remained a significant predictor of immersion time difference. Post hoc pairwise *F* tests indicated that Model 2, including the main effect of pain difference and its interaction with condition, was a significantly better fit of the observed data

than Model 1, $F(2) = 4.18$, $p = .025$, with only condition as a predictor. Likewise, Model 3, including the main effect of distress difference and its interaction with condition, was a significantly better fit of the observed data than Model 1, $F(2) = 6.58$, $p = .005$. Model 4, including both main effects of pain and distress difference and their interactions with condition, was not a significantly better fit than either Model 2, $F(2) = 2.33$, $p = .117$, or Model 3, $F(2) = 0.55$, $p = .585$. Models 2 and 3 could not be directly compared because they were not nested; however, based on adjusted R^2 values, Model 3 fit the observed data best, with the full model accounting for 39% of the variance in immersion time difference scores, while Model 2 accounted for 30% of the variance in immersion time difference scores. Although the distributions of immersion time difference scores in both conditions contained some outliers, inspection of residual plots for each model indicated that model assumptions had been reasonably met, suggesting that the use of regression and difference scores was warranted (see Figures A2 and A3 in Appendix A).

Recovery Period

Repeated measures ANOVAs were conducted to test if there were significant differences in pain and distress ratings (a) over the recovery period (30 s, 60 s) following the intervention and (b) from the cold pressor task (mean) to the recovery period (30 s). Both pain and distress ratings decreased from the 30 s time point to the 60 s time point of the recovery period ($ps < .001$). In addition, there were significant decreases in pain and distress ratings from the cold pressor task to the 30 s time point of the recovery period ($ps < .001$), indicating a lack of a “rebound” effect. There was no significant main effect of condition or interaction effect ($ps > .10$).

Discussion

The present study found that participants who underwent an isolated values intervention improved their ability to tolerate acute pain and distress, as measured by immersion time in a cold pressor, compared with participants in the Control condition, despite no statistically significant differences in subjective perception of pain or distress. In other words, the values intervention did not alter the aversive nature of the event itself (i.e., the experience of pain/distress), but did alter participants' response to the aversive event. In addition, tests of models accounting for interaction effects between pain/distress difference scores and condition showed that following the Values intervention, participants similarly increased immersion time in the cold pressor regardless of changes in pain or distress. Conversely, Control participants only showed

an increase in immersion time when pain or distress decreased. If pain or distress increased, immersion time for Control participants decreased. This finding has clinical implications, which suggest that invoking values can serve the function of increasing engagement in behaviors even in the presence of difficult internal experiences. Despite use of an analog sample, the experiences of pain and distress and instinctive responses to them (e.g., avoidance) are arguably universal; thus, we briefly discuss these findings in relation to clinical work. Furthermore, the utility of values as a therapeutic tool is not circumscribed to clinical populations given that values or purpose is part of a conceptualization of positive mental health or flourishing (Keyes, 2002), which reflects more than the absence of psychopathology.

The isolation of values work from other therapeutic components suggests that values may be a useful component of a modular therapeutic approach. For example, a values module could be incorporated into exposure therapy for anxiety disorders (cf., Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014) or used with individuals who struggle with behavioral engagement (Villatte et al., 2016). Modular therapeutic approaches are best linked to specific skills deficits observed in clients (Chorpita, Daleiden, & Weisz, 2005) and, as such, a values module could be useful in providing a motivational context for therapy from a wide variety of perspectives. This ease of combination is suggested by the existing motivational interviewing literature. Motivational interviewing is designed to enhance motivation to move toward a specific goal by elucidating self-generated reasons for change, and it is frequently used in conjunction with cognitive behavior therapy (CBT) (Slagel & Gray, 2007; Westra, Arkowitz, & Dozois, 2009). Nonetheless, given our use of a nonclinical sample, it would be helpful to replicate the effects of a values intervention in a clinical group to buttress these interpretations.

Findings from the present study should be interpreted in the context of its limitations. First, this study used a small sample of undergraduate students and an analog design, which might limit its generalizability. Because the aim of the study was to isolate the effect of a therapy component, which required controlling as many extraneous variables as possible (to increase internal validity), external validity may have been compromised. Participants might not have successfully connected the cold pressor task to an inherently meaningful life value, which means that the motivational influences during the experiment could be equivocal, and findings may not extend to clinical samples.

Second, although subjective pain and distress ratings were recorded throughout the cold pressor task and included as moderators in our models, these ratings were not included in the calculation of distress tolerance itself, which was operationalized as time spent in the cold pressor task. Because

different individuals may experience varying levels of pain/distress during the same task, the same amount of time in the cold pressor may reflect different levels of distress tolerance (as there may be different levels of distress to be tolerated). Therefore, the construct of distress tolerance may be better captured by including levels of pain/distress in its calculation. In addition, individuals may perceive physical and emotional distress differently. For example, there is less stigma surrounding physical disabilities than mental illness (Corrigan & Watson, 2002). Thus, the present findings might not extend to cases of emotional discomfort. Future research should explore ways in which to include subjective experiences of pain/distress in the operationalization of distress tolerance, as well as examine the efficacy of a brief values exercise on the experience of emotional pain to determine if results based on physical pain generalize to uncomfortable emotional experiences. For a discussion of issues surrounding the measurement of distress tolerance, see Glassman et al. (2016).

Third, the significant difference in distress ratings between groups at baseline may indicate an important difference between the two conditions that was unrelated to the experimental manipulation. Relatedly, global reactions to the values intervention and control tasks were not measured, introducing the possibility that any irritation experienced by participants due to these factors could confound ratings of distress taken during the cold pressor tasks.

Finally, the Control condition did not control for all aspects of the experimental condition, and our results might have been influenced by potential confounding variables, undermining internal validity. For example, the Control condition did not include a writing component. Studies have shown that writing can be therapeutic of itself (Pennebaker, 1997). However, the amount of time spent writing in the current study (18.5 min) was shorter than studies demonstrating its therapeutic efficacy (approximately 15 to 30 min per day for 3 to 5 days). In addition, it is possible that the use of visualization in the Values condition provided a means of distraction that made it easier for participants to keep their hand in the cold pressor. Studies have shown that distraction can increase tolerance for painful events (Kohl et al., 2013; McGuire, Moore, Stewart, Barnes-Holmes, & Barnes-Holmes, 2015). Although participants in the Control condition may have engaged in distraction during the cold pressor task, they were not explicitly asked to visualize, thereby introducing a confounding factor that was not controlled for in the Control condition. Future research should control for distraction and writing components by including a more active control condition. Future research should also include an acceptance-only condition as a means of directly comparing values and acceptance treatment components.

Despite its limitations, the current study was a first step toward investigating the effects of an isolated values intervention on distress tolerance. That the intervention produced statistically significant effects with a relatively small sample size speaks to the strength of the Values condition. Furthermore, the significant interaction effects are consistent with the theory underlying values, which predicts that individuals who connect with their values are able to persist with behaviors even when difficult thoughts, emotions, and physical sensations arise. Therefore, the results of the current study contribute to research on values and distress tolerance and add support for values as an empirically supported treatment component.

Appendix A

Figure A1. Individual participants' immersion times, average pain ratings, and average distress ratings during pre- and postintervention, including means and medians, in the Values and Control conditions.

Figure A2. Residual plots of Model 2, predicting immersion time difference scores from condition, pain difference scores, and their interaction.

Figure A3. Residual plots of Model 3, predicting immersion time difference scores from condition, distress difference scores, and their interaction.

Appendix B

Mountain/River Metaphor

Suppose you are taking a hike in the mountains. You know how mountain trails are constructed, especially if the slopes are steep. They wind about, often they have “switchbacks,” which make you literally walk back and forth, and sometimes a trail will even drop back to below a level you had reached earlier. If I asked you at a number of points on such a trail to evaluate how well you are accomplishing your goal of reaching the mountaintop, I would hear a different story every time. If you were in switchback mode, you would probably tell me that things weren’t going well, that you were never going to reach the top. If you were in a stretch of open territory where you could see the mountaintop and the path leading up to it, you would probably tell me

things were going very well. Now imagine that we are across the valley with binoculars, looking at people hiking on this trail. If we were asked how they were doing, we would have a positive progress report every time. We would be able to see that the overall direction of the trail, not what it looks like at a given moment, is the key to progress. We would see that following this crazy, winding trail is exactly what leads to the top.

Now, close your eyes and take a couple of deep breaths. Center yourself, in the room, in your body. Allowing your eyes to remain closed, take a moment to fully visualize the following scene:

Imagine the mountain that we just described, and imagine that the top of this mountain represents your number one life value, the value that, in the last exercise, you identified as being the most important in your life. Suppose you are beginning the journey toward this value, toward the top of the mountain. It is a beautiful mountain and you can see the peak clearly in the distance. After you have hiked for some time along the path that leads toward this peak, you look up and notice a large river in front of you, directly crossing your path. You can hardly believe you didn't notice this river before. It's wide and there's a strong current. There is no bridge in sight and, as you look to the left and the right, you can find no spot in which to cross. You say to yourself, "I didn't realize I was going to have to cross this river. It's huge, the current is strong, and it looks freezing cold. I'm tired. Why didn't anyone tell me about this river?"

You are now faced with a choice: You can either abandon the journey altogether or you can attempt to wade across the river. If you choose to abandon the journey, you also choose to abandon your value. Because of this, because of what's important to you, you decide to enter the river and begin to wade across. You do this, not because you want to get cold and wet, but because it stands between you and where you are going.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

- Allan, N. P., Macatee, R. J., Norr, A. M., & Schmidt, N. B. (2014). Direct and interactive effects of distress tolerance and anxiety sensitivity on generalized anxiety and depression. *Cognitive Therapy and Research*, 38, 530-540. doi:10.1007/s10608-014-9623-y

- Barrett, T., & Brignone, E. (2017). furniture: Furniture for quantitative scientists (R Package Version 1.6.1). Retrieved from <https://CRAN.R-project.org/package=furniture>
- Branstetter-Rost, A., Cushing, C., & Douleh, T. (2009). Personal values and pain tolerance: Does a values intervention add to acceptance? *Journal of Pain, 10*, 887-892. doi:10.1016/j.jpain.2009.01.001
- Chorpita, B. F., Daleiden, E. L., & Weisz, J. R. (2005). Modularity in the design and application of therapeutic interventions. *Applied and Preventive Psychology, 11*, 141-156. doi:10.1016/j.appsy.2005.05.002
- Cioffi, D., & Holloway, J. (1993). Delayed costs of suppressed pain. *Journal of Personality and Social Psychology, 64*, 274-282. doi:10.1037/0022-3514.64.2.274
- Corrigan, P. W., & Watson, A. C. (2002). Understanding the impact of stigma on people with mental illness. *World Psychiatry, 1*(1), 16-20.
- Craske, M. G., Treanor, M., Conway, C. C., Zbozinek, T., & Vervliet, B. (2014). Maximizing exposure therapy: An inhibitory learning approach. *Behavior Research and Therapy, 58*, 10-23. doi:10.1016/j.brat.2014.04.006
- Daughters, S. B., Sargeant, M. N., Bornovalova, M. A., Gratz, K. L., & Lejuez, C. W. (2008). The relationship between distress tolerance and antisocial personality disorder among male inner-city treatment seeking substance users. *Journal of Personality Disorders, 22*, 509-524.
- Feldner, M. T., Hekmat, H., Zvolensky, M. J., Vowles, K. E., Secrist, Z., & Leen-Feldner, E. W. (2006). The role of experiential avoidance in acute pain tolerance: A laboratory test. *Journal of Behavior Therapy and Experimental Psychiatry, 37*, 146-158. doi:10.1016/j.jbtep.2005.03.002
- Forsyth, L., & Hayes, L. L. (2014). The effects of acceptance of thoughts, mindful awareness of breathing, and spontaneous coping on an experimentally induced pain task. *The Psychological Record, 64*, 447-455. doi:10.1007/s40732-014-0010-6
- Glassman, L. H., Martin, L. M., Bradley, L. E., Ibrahim, A., Goldstein, S. P., Forman, E. M., & Herbert, J. D. (2016). A brief report on the assessment of distress tolerance: Are we measuring the same construct? *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 34*, 87-99. doi:10.1007/s10942-015-0224-9
- Hambrook, D., Oldershaw, A., Rimes, K., Schmidt, U., Tchanturia, K., Treasure, J., . . . Chalder, T. (2011). Emotional expression, self-silencing, and distress tolerance in anorexia nervosa and chronic fatigue syndrome. *British Journal of Clinical Psychology, 50*, 310-325. doi:10.1348/014466510X519215
- Harrington, N. (2006). Frustration intolerance beliefs: Their relationship with depression, anxiety, and anger, in a clinical population. *Cognitive Therapy and Research, 30*, 699-709. doi:10.1007/s10608-006-9061-6
- Hayes, S. C., Bissett, R. T., Korn, Z., Zettle, R. D., Rosenfarb, I. S., Cooper, L. D., & Grundt, A. M. (1999). The impact of acceptance versus control rationales on pain tolerance. *The Psychological Record, 49*, 33-47.
- Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behavior Research and Therapy, 44*, 1-25. doi:10.1016/j.brat.2005.06.006

- Hayes, S. C., & Smith, S. (2005). *Get out of your mind and into your life: The new acceptance and commitment therapy*. Oakland, CA: New Harbinger Publications.
- Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York, NY: Guilford Press.
- Holaway, R. M., Heimberg, R. G., & Coles, M. E. (2006). A comparison of intolerance of uncertainty in analogue obsessive-compulsive disorder and generalized anxiety disorder. *Journal of Anxiety Disorders*, 20, 158-174. doi:10.1016/j.janxdis.2005.01.002
- Keyes, C. L. M. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of Health and Social Behavior*, 43, 207-222. doi:10.2307/3090197
- Kohl, A., Rief, W., & Glombiewski, J. A. (2012). How effective are acceptance strategies? A meta-analytic review of experimental results. *Journal of Behavior Therapy and Experimental Psychiatry*, 43, 988-1001. doi:10.1016/j.jbtep.2012.03.004
- Kohl, A., Rief, W., & Glombiewski, J. A. (2013). Acceptance, cognitive restructuring, and distraction as coping strategies for acute pain. *Journal of Pain*, 14, 305-315. doi:10.1016/j.jpain.2012.12.005
- Leyro, T. M., Zvolensky, M. J., & Bernstein, A. (2010). Distress tolerance and psychopathological symptoms and disorders: A review of the empirical literature among adults. *Psychological Bulletin*, 136, 576-600. doi:10.1037/a0019712
- Lillis, J., Hayes, S. C., Bunting, K., & Masuda, A. (2009). Teaching acceptance and mindfulness to improve the lives of the obese: A preliminary test of a theoretical model. *Annals of Behavioral Medicine*, 37, 58-69. doi:10.1007/s12160-009-9083-x
- Macatee, R. J., Capron, D. W., Schmidt, N. B., & Cougle, J. R. (2013). An examination of low distress tolerance and life stressors as factors underlying obsessions. *Journal of Psychiatric Research*, 47, 1462-1468. doi:10.1016/j.jpsychires.2013.06.019
- Masedo, A. I., & Esteve, M. R. (2007). Effects of suppression, acceptance and spontaneous coping on pain tolerance, pain intensity and distress. *Behavior Research and Therapy*, 45, 199-209. doi:10.1016/j.brat.2006.02.006
- McCracken, L. M., & Vowles, K. E. (2008). A prospective analysis of acceptance of pain and values-based action in patients with chronic pain. *Health Psychology*, 27, 215-220. doi:10.1037/0278-6133.27.2.215
- McGuire, B., Moore, H., Stewart, I., Barnes-Holmes, D., & Barnes-Holmes, Y. (2015). Comparison of acceptance and distraction strategies in coping with experimentally induced pain. *Journal of Pain Research*, 8, 139-151. doi:10.2147/JPR.S58559
- McMullen, J., Barnes-Holmes, D., Barnes-Holmes, Y., Stewart, I., Luciano, C., & Cochrane, A. (2008). Acceptance versus distraction: Brief instructions, metaphors and exercises in increasing tolerance for self-delivered electric shocks. *Behavior Research and Therapy*, 46, 122-129. doi:10.1016/j.brat.2007.09.002
- Ozdel, K., & Ekinci, S. (2014). Distress intolerance in substance dependent patients. *Comprehensive Psychiatry*, 55, 960-965. doi:10.1016/j.comppsych.2013.12.012
- Páez-Blarrina, M., Luciano, C., Gutiérrez-Martínez, O., Valdivia, S., Rodríguez-Valverde, M., & Ortega, J. (2008). Coping with pain in the motivational context of

- values: Comparison between an acceptance-based and a cognitive control-based protocol. *Behavior Modification*, 32, 403-422. doi:10.1177/0145445507309029
- Pennebaker, J. W. (1997). Writing about emotional experiences as a therapeutic process. *Psychological Science*, 8, 162-166.
- R Core Team. (2015). *R: A language environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.
- Revelle, W. (2017). psych: Procedures for psychological, psychometric, and personality research. Northwestern University, Evanston, IL, Retrieved from <https://CRAN.R-project.org/package=psych> Version = 1.7.8
- Schmidt, N. B., Richey, J. A., & Fitzpatrick, K. K. (2006). Discomfort intolerance: Development of a construct and measure relevant to panic disorder. *Journal of Anxiety Disorders*, 20, 263-280. doi:10.1016/j.janxdis.2005.02.002
- Slagel, D. M., & Gray, M. J. (2007). The utility of motivational interviewing as an adjunct to exposure therapy in the treatment of anxiety disorders. *Professional Psychology: Research and Practice*, 38, 329-337.
- Timpano, K. R., Shaw, A. M., Cougle, J. R., & Fitch, K. E. (2014). A multifaceted assessment of emotional tolerance and intensity in hoarding. *Behavior Therapy*, 45, 690-699. doi:10.1016/j.beth.2014.04.002
- Tolin, D. F., Abramowitz, J., Brigidi, B. D., & Foa, E. B. (2003). Intolerance of uncertainty in obsessive-compulsive disorder. *Journal of Anxiety Disorders*, 17, 233-242. doi:10.1016/S0887-6185(02)00182-2
- Villatte, J. L., Vilardaga, R., Villatte, M., Plumb Vilardaga, J. C., Atkins, D. C., & Hayes, S. C. (2016). Acceptance and commitment therapy modules: Differential impact on treatment processes and outcomes. *Behavior Research and Therapy*, 77, 52-61.
- Vowles, K. E., & McCracken, L. M. (2008). Acceptance and values-based action in chronic pain: A study of treatment effectiveness and process. *Journal of Consulting and Clinical Psychology*, 76, 397-407. doi:10.1037/0022-006X.76.3.397
- Vowles, K. E., McCracken, L. M., & O'Brien, J. Z. (2011). Acceptance and values-based action in chronic pain: A three-year follow-up analysis of treatment effectiveness and process. *Behavior Research and Therapy*, 49, 748-755. doi:10.1016/j.brat.2011.08.002
- Vujanovic, A. A., Bonn-Miller, M. O., Potter, C. M., Marshall, E. C., & Zvolensky, M. J. (2011). An evaluation of the relation between distress tolerance and posttraumatic stress within a trauma-exposed sample. *Journal of Psychopathology and Behavioral Assessment*, 33, 129-135. doi:10.1007/s10862-010-9209-2
- Westra, H. A., Arkowitz, H., & Dozois, D. J. A. (2009). Adding a motivational interviewing pretreatment to cognitive behavioral therapy for generalized anxiety disorder: A preliminary randomized controlled trial. *Journal of Anxiety Disorders*, 23, 1106-1117. doi:10.1016/j.janxdis.2009.07.014
- Wickham, H. (2017). tidyverse: Easily install and load "Tidyverse" packages (R Package Version 1.1.1). Retrieved from <https://CRAN.R-project.org/package=tidyverse>

- Zeileis, A., & Hothorn, T. (2002). Diagnostic checking in regression relationships. *R News*, 2(3), 7-10. Retrieved from <https://CRAN.R-project.org/doc/Rnews/>
- Zettle, R. D., Hocker, T. R., Mick, K. A., Scofield, B. E., Petersen, C. L., Song, H., & Sudarjanto, R. P. (2005). Differential strategies in coping with pain as a function of level of experiential avoidance. *The Psychological Record*, 55, 511-524.
- Zvolensky, M. J., Vujanovic, A. A., Bernstein, A., & Leyro, T. (2010). Distress tolerance: Theory, measurement, and relations to psychopathology. *Current Directions in Psychological Science*, 19, 406-410. doi:10.1177/0963721410388642

Author Biographies

Brooke M. Smith is a doctoral candidate at Utah State University. Her research focuses on mechanisms of change and the translation of basic behavioral principles to complex human behavior, particularly in the areas of mindfulness-based treatments and exposure therapy.

Jennifer L. Villatte is an assistant professor of Psychiatry & Behavioral Sciences at the University of Washington. She serves as core faculty in the Behavioral Research in Technology & Engineering (BRiTE) Center and is a KL2 Scholar at the Institute for Translational Health Sciences.

Clarissa W. Ong is a fourth-year graduate student in the Clinical/Counseling Program at Utah State University. Her research interests center on the development and evaluation of behavioral interventions for anxiety and related disorders.

Grayson M. Butcher is a graduate student of Behavior Analysis at the University of North Texas. His research interests include clinical behavior analysis, nonlinear contingency analyses, and instructional design.

Michael P. Twohig is a professor of Psychology at Utah State University in Logan, UT. His research focuses on Clinical Behavior Analysis and the use of Acceptance and Commitment Therapy in the treatment of anxiety and obsessive-compulsive disorders.

Michael E. Levin is an assistant professor at Utah State University. His research focuses on web/mobile app interventions and mechanisms of change in acceptance and mindfulness-based therapies.

Steven C. Hayes is Nevada Foundation professor of Psychology at the University of Nevada. An author of 44 books and nearly 600 scientific articles, he is known for his work on Acceptance and Commitment Therapy, a broadly applicable behavior change method, and Relational Frame Theory, an account of human cognition.