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The Relationship Between Experiential Avoidance and Physiological Reactivity

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ABSTRACT

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and Physiological Reactivity to Stress

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Due to the universal nature of stress, and its impact on physical health, it is important to understand how it is related to other psychological variables. The current study was undertaken in order to investigate whether an individual's cardiovascular reactivity to stress is impacted by their level of experiential avoidance, as measured by the Acceptance and Action Questionnaire (AAQ-II). Individuals who are experientially avoidant are more likely to attempt to escape or prevent certain experiences and make effort to change them or avoid the contexts in which they occur. Previous research has indicated that experiential avoidance is related to some measures of physiological stress.

One hundred twenty-eight college students (ages 18-29) were administered a questionnaire that included measures of general stress, experiential avoidance, and depression. After completing the questionnaire, a baseline reading of cardiovascular activity was taken. After that baseline reading, research assistants administered the Trier Social Stress Test (TSST), a series of tasks designed to induce physiological stress that consists of an anticipation period, a speech, and a math task. Measurements of cardiovascular activity were taken throughout administration. It was hypothesized that increased experiential avoidance would predict higher blood pressure and heart rate both before engaging in the stress task. It was also hypothesized that increased experiential avoidance would predict higher cardiovascular reactivity during administration of the TSST.

As was expected, higher experiential avoidance predicted higher baseline heart rate. This finding adds to the body of research that supports the connection between psychological constructs and physiological reactivity. However, experiential avoidance did not significantly predict baseline blood pressure or any measures of physiological reactivity during the TSST.

Keywords: experiential avoidance, acceptance, stress, cardiovascular reactivity

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The Relationship Between Experiential Avoidance and Physiological Reactivity to Stress

Stress is a universal experience that can originate in nearly any setting, such as families, work, education, and interpersonal relationships. For example, the American Institute of Stress (2001) has estimated that the cost of workplace stress to the United States economy is the range of $150 billion to $300 billion over the past 10 years. Previous research has shown that individuals' emotional stress reactivity is likely stable over time (Howland, Armeli, Feinn, & Tennen, 2017) and that low tolerance of distress is related to negative outcomes like substance abuse and diagnosis of personality disorders (Wray, Simons, Dvorak & Gaher, 2012). Keller et al. (2012), found that those who reported experiencing "a lot of stress" and also perceived that "stress impacts health a lot," also had a substantial increase in risk for premature death (p. 682). According to the DSM-5 (American Psychiatric Association, 2013), millions of individuals are diagnosed with stress-related disorders every year, and they are some of the most commonly seen disorders in some settings (e.g., hospital psychiatric consultations). Many more examples could be given of the impact of stress on individuals and our society, but this sample shows that stress is something that effects many people in diverse ways.

An early stress researcher, Richard Lazarus (1966) insisted that stress is an important topic to study because it "results in intense and distressing experience and appears to be of tremendous influence in behavior" and effects the ability of an individual to efficiently adapt (p. 2). However important it might be, researchers have historically struggled to even define what stress is. While some individuals, like Hans Selye (1975) encouraged a vague use of the word that could be universally understood, others have more recently argued that a specific definition would be beneficial to researchers (Koolhaas et al., 2011). Koolhaas et al. (2011) and Segerstrom and Miller (2004) highlighted that the word stress is sometimes used alternatively to refer to events that cause physiological arousal, and the arousal itself, which can lead to additional confusion. Koolhaas et al. (2011) also proposed a definition of stress that includes the occurrence of an event that is viewed by an individual as unpredictable or uncontrollable. However, the definition of stress applied to the current study comes from Sapolsky (2004). His broad definition of stress included anything that disrupts our body's state of balance (allostasis) and specified that the physiological stress response is what a body does to reestablish that balance.

In contrast to stress, the concept of acceptance can be defined as the implementation of a purposefully "open, receptive, flexible, and nonjudgmental" attitude in each present moment, regardless of one's experience (Hayes, Strosahl, &Wilson, 2011, p. 77). Acceptance, then, seems to have features that directly challenge the aspects of stress discussed above. For example, if a stressful experience is being perceived as unpredictable or uncontrollable, an accepting approach might focus on being open to the lack of control and flexible in how it is dealt with. However, Hayes et al. (2011) call attention to the fact that acceptance is not a passive resignation to a situation, nor does it necessarily mean enjoying an experience and wishing for it to continue. Instead, it is actually allowing oneself to connect with private or external events as well as being open to those events and from "moment-to-moment experience" (p. 215). On the other end of the spectrum, experiential avoidance is often thought of as the opposite of acceptance (Hayes, Luoma, Bond, Masuda, & Lillis, 2006), and while acceptance is part of developing psychological flexibility, experiential avoidance is part of psychological *in*flexibility.

The connection between acceptance/avoidance and flexibility/inflexibility is important because acceptance and experiential avoidance have historically been considered the major, overarching terms that guided Acceptance and Commitment Therapy (ACT). In recent years, though, they have been somewhat replaced in that function by the terms psychological flexibility and inflexibility for the sake of clarity. Therefore, some previous ideas and theories about experiential avoidance are now more often applied to psychological inflexibility (Bond et al., 2011). To provide theoretical context, the ACT model for psychological flexibility includes 6 values that lead to its development, namely acceptance, cognitive defusion, self as context, being in the present moment, values, and committed action. On the other hand, the ACT model for psychological inflexibility consists of the opposites of those principles: experiential avoidance, cognitive fusion, attachment to conceptualized self, inaction, impulsivity or avoidant persistence, lack of values clarity and weak self-knowledge (Hayes et al, 2011; Hayes et al., 2006). Experiential avoidance, however, is often thought to be connected to more than just psychological phenomena.

Physiological Stress

In addition to psychological stress, which is often observed via self-report, individuals also experience stress physiologically, which is often considered a disruption in the balance of the body systems, called homeostasis. McEwen and Wingfield (2003) define homeostasis as "the stability of physiological systems that maintain life," saying that this term applies specifically to certain systems that must be maintained in within particular limits (p. 3). In conjunction with homeostasis, another – more dynamic – idea of balance in the body is allostasis. McEwen and Wingfield (2003) discuss allostasis as "achieving stability through change," emphasizing the fact that while homeostasis deals with systems that are required for sustaining life, allostasis covers the processes that maintain balance in response to environmental changes (p. 3). McEwen (2004) described a state called "allostatic overload" which includes when an organism's "energy demands exceed energy income," which can cause an overload of stress hormones in the body

(p. 2). McEwen suggests that this can occur through four different mechanisms, namely frequent experience of stress, failure to habituate to recurring stressors, inability to shut down physiological stress response, and inadequate allostatic response from some systems that requires additional intervention from other body systems. This is important because experiencing allostatic overload over lengthy periods of time can lead to problems in different body systems, including the immune, nervous, and cardiovascular systems (McEwen, 1998).

Sapolsky (2004) emphasized that while modern-day humans do not face daily physical threats to our lives as frequently as some mammals do in the wild, our physiological stress response to psychological stressors looks very similar. He highlights that several body systems are involved in changes that occur during the natural stress response, but specifically the cardiovascular system diverts blood flow to the limbs (ideal for outrunning a predator) whether the stressor at hand is an imminent, physical danger or a psychological phenomenon. Physiological stress reactivity in the body – which includes increased heart rate and blood pressure – that is induced through either repeated exposure to acute stressors or prolonged exposure to chronic stressors have both been connected to higher risk for cardiovascular disease many times over, including when other risk factors are controlled for (e.g., Black & Garbutt, 2002; Kamarck et al., 1997; Lovallo, 2016).

One system that is important to the body's regulation of the stress response is the autonomic nervous system, which consists of the sympathetic nervous system and parasympathetic nervous system. While always active, even during a state of normal balance, the sympathetic nervous system becomes excited during the body's stress response, and is critical to the manifestation of the so-called "fight-or-flight" response, including increases in heart rate and blood pressure (Chrousos & Gold, 1992; Lovallo, 2016; Lucas-Thompson, Lunkenheimer, &

Granger, 2017). On the other hand, the parasympathetic nervous is responsible for bringing the body back to allostasis and is thereby an antagonist of the sympathetic nervous system. When sympathetic activation is overall higher and parasympathetic activation is low, risk for hypertension increases (Amerena & Julius, 1995). There is evidence that indicates that both blood pressure and heart rate reactivity to stressful tasks can predict future cardiovascular function, including hypertension and other cardiac issues (Ko & Lin, 2012; Matthews, Woodall, & Allen, 1993; Stewart & France, 2001).

Experiential Avoidance

Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) was based on the overarching idea that many forms of psychopathology can be viewed as maladaptive methods of experiential avoidance. Experiential avoidance can be specifically defined as the process by which an individual attempts to escape or prevent certain internal experiences and makes effort to change the content or the frequency of these undesired experiences or avoid contexts in which they occur. These avoided experiences could include things such as thoughts, emotions, memories, and physical sensations that are not desirable to the individual which can also include positive emotions or experiences (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Hayes et al. (2011) listed 3 main "costs" of experiential avoidance. First, disconnecting the present moment from an individual's personal history reduces "experiential intelligence" (p. 271). Second, individuals who are engaging in avoidance may not realize that they are avoiding, and therefore have not had the chance to consciously decide if avoiding is what they want to do. Finally, avoidance decreases opportunities for an individual to experience positive growth through avoidance of certain actions and situations.

Though these points would make experiential avoidance appear universally unrewarding or unattractive, Hayes et al. (1996) gave several reasons that individuals engage in experiential avoidance at such pervasive rates. One example is that consciously planning to avoid hazards in everyday life is something that can be useful in many situations (e.g., cautiously driving in inclement conditions, or engaging in regular preventative health care like brushing teeth) which may train individuals to avoid. Another example begins early in life, when children are taught to suppress emotions through modeling of adults and direct commands (e.g., "stop crying or I'll give you something to cry about"). This may lead to generalization for the child that certain emotions or emotive behaviors are unacceptable and should be ignored or prevented. Finally, experiential avoidance often has immediate, short-term benefits that drive individuals to engage in avoidance rather than acceptance. This is because individuals often choose to do what is instantly rewarding, rather than considering what they might prefer if they took a longer-term perspective.

Negative Outcomes and Avoidance

Kashdan, Barrios, Forsyth, and Steger (2006) reported that higher experiential avoidance was related to higher occurrence psychopathology and increased emotional distress, and predicted lower positive emotions and perceptions of life events. Dahl, Wilson, and Nilsson (2004) found that those who experience chronic pain and/or stress who completed an ACT-based intervention that included training on acceptance were less likely to be away from work due to sickness, and used fewer medical resources than those in a treatment as usual group. In addition, previous research has shown that caregivers of those with dementia – identified as a highly stressed population – who are more experientially avoidant had more depressive symptoms than those who scored lower on a measure of avoidance (Spira et al., 2007).

More specific to the current study, experiential avoidance has been linked to increased physiological stress reactivity. For example, Feldner, Zvolensky, Eifert, and Spira (2003) found that individuals who were higher on measures of experiential avoidance had higher physiological stress reactivity to a biological stressor (inhalation of CO_2-enriched air). In another study that used a biological agent to introduce panic symptoms, individuals high in experiential avoidance reported having more panic symptoms, but were not significantly different than other groups in physiological responses, including heart rate (Karekla, Forsyth, & Kelly, 2004). In addition, Lindsay, Young, Smyth, Brown, and Creswell (2018), investigated the mechanism of action by which mindfulness led to decreased stress. They performed a randomized controlled trial that compared a control group and two mindfulness activity groups; one that featured acceptance, and one that did not. They concluded that acceptance was the mechanism of action that led to decreased physiological stress, including blood pressure.

Current study and Hypothesis

Much of the existing research supports the idea that individuals who are more accepting have a less extreme physiological response to stress, but not all studies have agreed. The current study will investigate whether there is a predictive relationship between experiential avoidance and physiological stress reactivity, as measured by the AAQ-II and cardiovascular measures respectively. It is hypothesized that higher levels of experiential avoidance (measured by the AAQ-II) will predict higher baseline cardiovascular stress, and higher stress reactivity (both observed via systolic blood pressure [SBP], diastolic blood pressure [DBP], and heart rate [HR]) when exposed to a stressor. Specifically, it is hypothesized that:

1. Higher scores on the AAQ-II will predict higher cardiovascular measures at baseline
    a. Higher scores on the AAQ-II will predict higher SBP at baseline

   b. Higher scores on the AAQ-II will predict higher DBP at baseline
   c. Higher scores on the AAQ-II will predict higher baseline HR
2. Higher scores on the AAQ-II will predict increased cardiovascular reactivity to the TSST
   a. Higher scores on the AAQ-II will predict higher reactivity SBP
   b. Higher scores on the AAQ-II will predict higher reactivity in DBP
   c. Higher scores on the AAQ-II will predict higher HR reactivity

Since high physiological reactivity is associated with multiple negative outcomes – as discussed above – knowing that there is a relationship between reactivity and experiential avoidance could inform decisions about treatment of stress and possible focus on acceptance-based approaches.

Method

Participants

Participants in the study included one hundred twenty-eight adults (88 women, 40 men; mean age = 20.9 years, *SD* = 2.56) who were recruited from the Brigham Young University Counseling and Psychological Services Center. All of these individuals had taken the Outcome Questionnaire – 45.2 and received total scores of over 63, which has been determined to be an adequate cutoff score to indicate a clinical level of distress (Beckstead et al., 2003; Steffen, Fidalgo, Schmuck, Tsui, & Brown, 2014; Vermeersch, Lambert, & Burlingame, 2000). Individuals with diagnosed cardiovascular disorders or who were taking medications that affect cardiovascular function were screened out from participation. Data collection began in 2013 and was completed in 2017.

Measures

The Outcome Questionnaire. The Outcome Questionnaire – 45.2 (OQ; Lambert, Okiishi, Finch & Johnson, 1998) was designed to measure three aspects of an individual's level of functioning: levels symptom distress, performance in various social roles and activities, and perceived quality of interpersonal relationships (Beckstead et al., 2003). Some of its main functions are to measure the level of distress an individual is experiencing at the time of administration and to be sensitive to change over short periods of time (Lambert et al., 1998; Wells, Burlingame, Lambert, Hoag, & Hope, 1996). Vermeersch et al. (2004) concluded that the OQ Total score was sensitive to change in multiple populations, including college counseling centers, and was used to indicate participant distress level in the screening process. In different populations, the OQ Total score has been shown to have test-retest reliability scores in the .80-.90 range (Pearson product-moment correlation coefficient) and internal consistency of .93 (Cronbach's alpha) (Lambert et al., 1998; Vermeersch et al., 2004). Overall, the OQ is considered to be a satisfactory measure of participant distress.

Acceptance and Action Questionnaire. In order to measure individuals' level of experiential avoidance, the Acceptance and Action Questionnaire (AAQ-II) was used. The AAQ-II contains questions that focus on negative evaluations of feelings, avoidance of certain thoughts and feelings, distinguishing a thought from its referent, and behavioral adjustment in the face of difficult thoughts or feelings (Bond et al., 2011). Respondents rate statements on a 7-point Likert scale from "Never True" to "Always True." Items include statements such as "I'm afraid of my feelings," and "Worries get in the way of my success." A higher score on the AAQ-II indicates a higher level of experiential avoidance.

The original version of the measure (AAQ-I) was widely used, but had some psychometric issues, including somewhat low internal consistency that the creators of the measure postulated was probably due to item complexity, so the AAQ-II was created in order to overcome those problems (Bond et al., 2011). Over several studies, the AAQ-II has been found to have good internal consistency (mean alpha coefficient of .84) and 3- and 12-month test-retest reliability of .81 and .79 respectively, which are also acceptable. An exploratory factor analysis of an early version of the AAQ-II during its development showed evidence for measuring a unidimensional construct, which was stated to be experiential avoidance. When confirmatory factor analysis was used, the single-factor model was shown to have good fit in 3 samples (RMSEA $\leq .06$, SRMR $\leq .08$, CFI $\geq .95$) The AAQ-II was also shown to have convergent and divergent validity consistent with the creator's predictions when compared to several widely used mental health measures (Bond et al., 2011).

Trier Social Stress Test. The Trier Social Stress Test (TSST; Kirschbaum, Pirke & Hellhammer, 1993) is a set of tasks meant to increase physiological stress in individuals. In this protocol, individuals were first told to prepare a speech on why they should be given a job of their choice and then given 5 minutes to prepare. They were then informed that they were being recorded (they were not), that the research assistants were specially trained to monitor nonverbal behavior, and that their overall interview performance would be analyzed later on. Then they were instructed to give their speech and were asked to continue if they stopped speaking before 5 minutes had gone by. Immediately following the speech, they were instructed to serially subtract the number 17 from 2023 for 5 minutes and were told to start over if they made a mistake. Throughout these tasks, their heart rate and blood pressure were monitored. Allen, Kennedy, Cryan, Dinan, and Clarke (2014) reported that the TSST effectively induced physiological reactivity in several body systems, including the cardiovascular system. In agreement with this finding, Buske-Kirschbaum, Geiben, Höllig, Morschhäuser, and Hellhammer (2002) showed that heart rate was consistently higher than baseline during the TSST, and Juster, Perna, Marin, Sindi, & Lupien (2012) saw sharp decreases in mean arterial pressure once the TSST was completed, indicating that the TSST significantly impacted blood pressure.

Beck Depression Inventory – II. The Beck Depression Inventory – II (BDI-II; Beck, Steer, & Brown, 1996) was created to measure the presence and severity of depression in both clinical and non-clinical populations of adolescents and adults and is frequently used in both research and clinical settings. It was developed in reaction to complaints that the original Beck Depression Inventory lacked content validity (Dozios, Dobson, & Ahnberg, 1998) and has been shown to correlate highly with other methods of testing for depression (Sprinkle et al., 2002). It has also been found to have good test-retest reliability, with scores typically being found around .90 (Beck et al., 1996; Dozios et al., 1998; Sprinkle et al., 2002; Whisman, Perez, & Ramel, 2000). In addition, during the development of the AAQ-II, it was shown that the BDI-II correlated with it to a moderate degree, which Bond et al. (2011) reported as evidence that the constructs of experiential avoidance and depression are related, but still distinct.

Procedure

Participants were recruited through a university counseling center in order to investigate the impact of a biofeedback intervention as an addition to therapy. They were given a preliminary questionnaire that included the OQ, and if they scored above the distress cutoff they were invited to participate. When they came to the lab for their appointment, participants immediately filled out an online survey that included a consent form and several questionnaires (including the AAQ-II and BDI-II). At that point, participants were asked about demographic information, including age, ethnicity, and sex. Their weight and height were then measured, and waist and hip measurements were also obtained. At that point, a research assistant attached a blood pressure cuff to their left arm and placed electrocardiograph electrodes on their right wrist and left ankle. Additional electrodes were then placed on the first and second fingers of the participant's non-dominant hand in order to measure skin conductance, and finally, a respiration belt was added to measure respiration rate.

After the instruments were determined to be measuring correctly, participants were given a restful activity to complete for the next 15 minutes. Some participants were taught a diaphragmatic breathing technique and told to practice it for that time, while others were instructed to quietly watch a "relaxing video" of fish swimming. For the purposes of this study, these two groups are considered to have inconsequential differences, since the physiological effects of diaphragmatic breathing do not occur immediately and would not be expected to be seen at this point in the protocol. For example, Caldwell & Steffen (in press) showed that significant physiological differences between individuals that practiced diaphragmatic breathing and those in a control condition took 8 weeks to develop. During these activities, baseline heart rate and blood pressure measurements were taken at 10, 12, and 14 minutes.

After those baseline measurements, the TSST was administered by two research assistants who were instructed to keep neutral facial expressions throughout the interaction in order to decrease social feedback. The participants were not aware of the presence of a second research assistant until the speech delivery portion of the TSST, when the second assistant walked from behind a divider and began pretending to take notes on the participant's presentation. After the participant prepared their speech, gave it, and completed the math task, there was a rest period lasting 10 minutes. Throughout the TSST, heart rate and blood pressure were recorded, with intervals between readings being at least 2 minutes. Specifically, measurements were taken at minutes 2 and 4 during the speech prep and speech delivery phase, and at minutes 2, 4, and 6 during the math task. During the final resting period (at the conclusion of the math task) participants were instructed to sit quietly, and their heart rate and blood pressure were again measured at minutes 1 and 3 for immediate recovery, and again at minutes 7 and 9. After the 10 minutes, participants were detached from all physiological measurement devices, paid $5 and scheduled for their next appointment.

Results

Data Analysis

In order to test the Hypothesis 1 – that experiential avoidance as measured by the AAQ-II predicts a. Systolic blood pressure (SBP), and b. diastolic blood pressure (DBP) at baseline as well as c. heart rate (HR) at baseline – a multiple regression model was used. Multiple regression was also used to test Hypothesis 2, that AAQ-II scores would predict a. increased SBP and b. DBP in reaction to stress, and c. increased HR in reaction to stress. When testing stress reactivity, baseline cardiovascular measurements (SBP, DBP, HR) were controlled for. Body mass index (BMI), age, and sex were controlled for in all analyses.

Data Preparation

First, data were visually inspected for obvious keying and simple data entry errors, which were corrected by inserting information from original protocols. When individuals had only one set of cardiovascular measurements in a particular task, the available information was used alone. All other missing values were likewise filled with data from original protocols, where possible, but the listwise method for dealing with missing values in SPSS was used in all other cases. Histograms that were inspected for the individual variables showed an acceptable level of normality. A scatterplot matrix that was inspected in order to visually identify obvious bivariate outliers between all variables showed no clear issues, and the blocked adaptive computationally efficient outlier nominators (BACON) function in STATA 14.1 also showed no substantial issues with multivariate outliers. All of this indicated that it was acceptable to proceed with the planned analysis.

Planned Analysis

The initial analysis was intended to establish whether scores on the AAQ-II predicted baseline physiological stress. It was shown that, when controlling for BMI and sex, AAQ-II scores did not predict baseline SBP or baseline DBP, as seen in Tables 1 and 2. However, AAQ-II did significantly predict baseline HR ($\beta = 0.26$; $p = 0.005$), shown in Table 3.

Table 1
Regression – Baseline SBP

	Unstandardized Coefficients		Standardized Beta		
Variable	B	Std. Err.	Coefficients	t	P-Value
Constant	83.38	5.89		14.15	0.00
Sex	7.09	1.68	0.36	4.22	0.00*
BMI	0.54	0.21	0.22	2.56	0.01*
AAQ	0.01	0.61	0.01	0.11	0.91

* indicates significance at p <.05

Table 2
Regression – Baseline DBP

	Unstandardized Coefficients		Standardized Beta		
Variable	B	Std. Err.	Coefficients	t	P-Value
Constant	54.72	4.01		13.64	0.00
Sex	0.07	1.14	0.01	0.06	0.95
BMI	0.25	0.14	0.15	1.72	0.09
AAQ	0.07	0.04	0.15	1.62	0.11

* indicates significance at p <.05

Table 3
Regression – Baseline HR

Variable	Unstandardized Coefficients B	Std. Err.	Standardized Beta Coefficients	t	P-Value
Constant	54.51	7.00		7.78	0.00
Sex	-1.09	1.99	-0.05	-0.55	0.59
BMI	0.28	0.25	0.10	1.14	0.26
AAQ	0.21	0.07	0.26	2.89	0.01*

* indicates significance at p <.05

Next, regression models were run with AAQ-II predicting each of the physiological measures taken during the TSST to establish whether AAQ-II predicted physiological stress reactivity. It was found that AAQ-II did not significantly predict SBP, DBP, or HR, when controlling for BMI, sex, and corresponding baseline measurements (see Tables 4-6).

Table 4
Regression – Reactivity SBP

Variable	Unstandardized Coefficients B	Std. Err.	Standardized Beta Coefficients	t	P-Value
Constant	72.07	18.35		3.93	0.00
Sex	6.39	3.46	0.17	1.85	0.07
BMI	-0.32	0.41	-0.07	-0.78	0.01*
B SBP	0.49	0.17	0.26	2.87	0.01*
AAQ	-0.10	0.12	-0.08	-0.87	0.39

* indicates significance at p <.05

Table 5
Regression – Reactivity DBP

Variable	Unstandardized Coefficients B	Std. Err.	Standardized Beta Coefficients	t	P-Value
Constant	38.93	11.17		3.53	0.01
Sex	2.81	2.01	0.12	1.39	0.17
BMI	-0.43	0.25	-0.15	-1.71	0.09
B SBP	0.70	0.16	0.38	4.39	0.01*
AAQ	-0.03	0.07	-0.03	-0.39	0.70

* indicates significance at p <.05

Table 6
Regression – Reactivity HR

Variable	Unstandardized Coefficients B	Std. Err.	Standardized Beta Coefficients	t	P-Value
Constant	-4.99	19.648		-0.25	0.80
Sex	0.69	4.59	0.01	0.15	0.88
BMI	0.33	0.57	0.05	0.57	0.57
B SBP	1.04	0.21	0.43	5.03	0.00*
AAQ	0.13	0.17	0.07	0.78	0.44

* indicates significance at p <.05

Post-Hoc Analysis

In an attempt to confirm that the measurement of the AAQ-II obtained in the current study were similar to what has been obtained in previous research, a final regression model was run to see if AAQ-II predicted scores on the Beck Depression Inventory – II (BDI-II). This measure was included in the initial questionnaire that participants completed when they visited the lab for their appointment, because it was part of the hypothesis of the original version of the study. Previous research has shown that the AAQ-II should be expected to predict scores on the BDI, since the constructs being measured are somewhat similar (i.e., experiential avoidance and depression). In this analysis, it was shown that AAQ-II did, in fact, significantly predict BDI at baseline, even when controlling for sex ($\beta = 0.75$; $p < 0.001$), as shown in Table 7.

Table 7
Regression – BDI

Variable	Unstandardized Coefficients B	Std. Err.	Standardized Beta Coefficients	t	P-Value
Constant	-7.37	2.99		-2.47	0.02*
Sex	-0.76	1.35	-0.03	-0.57	-0.57
AAQ	-0.60	0.05	0.75	12.41	0.00*

* indicates significance at p <.05

Discussion

As was hypothesized (Hypothesis 1a), these data showed that greater experiential avoidance predicted higher resting heart rate before any lab-based stressor was presented. This implies that that individuals who engage in more experiential avoidance are more likely to have a higher heart rate in everyday life. The finding is in line with the a priori hypothesis that avoidance is related to physiological stress response. It should be noted that the effect is relatively small ($\beta = 0.26$) but statistically significant ($p=0.005$). This has importance for the field because previous research has found greater resting heart rate to be related to multiple negative health outcomes, such as increased risk of hypertension and other cardiovascular diseases, negative prognosis among those with cardiovascular disease, hospitalization for heart failure, as well as both cardiovascular and noncardiovascular death (e.g., Kwok et al., 2013; Lonn et al., 2014; Wang et al., 2014). Bohm et al. (2013) even suggested that resting heart rate could predict differing responses to medication used to treat heart failure.

Given this information, engaging in interventions to reduce experiential avoidance and increase acceptance could be a potential area of focus for those who wish to increase cardiovascular health, specifically through decreasing resting heart rate. Goodwin, Forman, Herbert, Butryn, and Ledley (2012) completed a pilot study examining the impact of ACT interventions that emphasize acceptance on cardiovascular patient adherence to healthy lifestyle choices, and Spatola et al. (2014) proposed a randomized controlled trial that would similarly examine patient adherence to doctor instructions among cardiac patients. However, further research is needed in order to establish a strong relationship between the two variables if recommendations like this are to be provided to patients.

Though baseline HR was significantly predicted by AAQ-II scores, data analysis did not support the other hypotheses of the study. Specifically, experiential avoidance was not found to significantly predict baseline SBP and DBP, and also failed to significantly predict cardiovascular reactivity to the TSST, as measured by HR, SBP, and DBP. This was unexpected, due to the findings of previous research (referenced above), but several possible explanations for this discrepancy are discussed in the limitations section below. Since the TSST was originally developed in a university setting (using young adults ranging in age from 15-33) the age of the sample in this study, alone, should not have keep the TSST from producing stress in the participants (Kirschbaum et al., 1993).

Due to the nonsignificant results that came from the regression equations between experiential avoidance and physiological reactivity, the decision was made to perform a post-hoc analysis that consisted of the regression model for AAQ-II scores predicting scores on the BDI-II. This was run in order to establish whether or not the data would provide results that would be expected given the literature base. Previous research (including that done in the development of the AAQ-II) has shown that the BDI-II and AAQ-II are highly correlated ($r = .71$; Bond. et al., 2011). Since, in the present analysis, AAQ-II scores significantly predicted scores on the BDI-II, it was determined that the AAQ-II data that was used was not fundamentally different than previously used samples. However, there are other issues with the data and this study that may have impacted the findings.

Limitations and Future Directions

As discussed in the introduction, a review of previous research would suggest that finding a relationship between experiential avoidance and physiological response to stress could be reasonably expected (e.g., Feldner et al., 2003; Karekla et al., 2004; Lindsay et al.; 2018).

However, some influencing factors in this study likely impacted the results that were found; one limitation was the homogeneity of the sample. The participants were overwhelmingly similar in demographics, most being young, healthy, Caucasian, university students. Due to this, it is logical that their stress reactivity would be less pronounced than in a sample that is more diverse. In future research, efforts should be made to obtain a sample that is more representative of settings other than young undergraduate students at a religious university. In addition to diversity, the sample was relatively small after the exclusion of data from participants who did not complete all of the measures or did not have physiological data available. Furthermore, since the participants were recruited almost exclusively when they were engaging in psychotherapy at the BYU counseling center, it is possible that some of them were exposed to principles of acceptance and avoidance of emotions and experiences prior to completing the questionnaires. If some participants had more knowledge of these topics than others, it could have led to systematic differences in how this sample responded to the questionnaires. Future studies could include individuals who were not seeing therapists as comparison groups.

Another potential issue came from the length of the study. The project began in 2013 and data gathering was completed in 2017, and over those 4 years, several changes were made to the project. These changes included the recruitment and inclusion of certain groups (e.g., a group that would practice mindfulness, one that consisted of those for whom therapy was not producing desired outcomes, etc.) and the use of cortisol samples as part of the physiological data. The research assistants that were administering protocols were mostly undergraduate students who had varying levels of training in the practice of research and who participated in the study for varying amounts of time. Due to the transitory nature of undergraduate research assistants, it is likely that some mistakes were made when they were in the process of learning. However, the initial, online survey containing the questionnaires was used throughout the different phases of the project, and participants were administered mostly identical protocols throughout the length of the study. In follow-up studies, using a more stable group of trained research assistants over a shorter period of time would likely mitigate some of the administrative issues that were present in this study.

Finally, while the TSST is considered by many researchers to be the gold-standard lab-based stressor, the original development of the TSST was focused on its impact on stress hormones (such as cortisol) and heart rate (Kirschbaum et al., 1993). While this (and additional evidence) indicates that there is empirical evidence of the effect of the TSST on cardiovascular stress, it may be beneficial to measure other physiological responses in addition to blood pressure and heart rate. If the TSST does not impact blood pressure as much as other physiological systems, focusing mainly on blood pressure could lead to artificially inflated or deflated measurement of physiological reactivity. Though some cortisol samples were gathered in the course of the study, blood pressure and heart rate were taken during the first appointment in every group, so they were the more reasonable to use for the present analysis. Future research might benefit from obtaining cortisol samples or other physiological reactivity measurements in throughout administration of the TSST in order to include them in the analysis, in addition to heart rate and blood pressure.

Conclusions

Due to the limitations discussed here, and the fact that most of the results were nonsignificant, no definitive conclusions can be made about the relationship between experiential avoidance and physiological reactivity to stress. Also, as stated above, the statistically significant relationship between avoidance and baseline heart rate needs to be interpreted with caution when considered in light of the fact none of the other relationships were significant when they were expected to be. Future research is needed in order to discover how the constructs of avoidance and stress physiology interact, more specifically. However, this does indicate the possibility of a more extensive relationship between them. Overall, this study adds to the body of research focused on understanding the different ways that psychological constructs impact the human body. This understanding could be applied to create or inform interventions for those who are interested in either increased cardiovascular or psychological health.

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