2024

The Effect of Completing the ACE Questionnaire on Electrodermal Activity

Nicholas P. Cherry

The Effect of Completing the ACE Questionnaire on Electrodermal Activity

Nicholas P. Cherry

Presented to the Faculty of the

Graduate School of Clinical Psychology

George Fox University

in partial fulfillment

of the requirements for the degree of

Doctor of Psychology

in Clinical Psychology

Newberg, Oregon

Approval Page

The Effect of Completing the ACE Questionnaire on Electrodermal Activity

by

Nicholas P. Cherry

has been approved

at the

Graduate School of Clinical Psychology

George Fox University

as a Dissertation for the PsyD degree

Committee Members

Ken Logan PsyD, Chair

Roger Bufford PhD, Member

May 15, 2024

Abstract

The adverse childhood experience (ACE) questionnaire assesses the number of traumatic experiences during childhood and has been shown to predict negative health outcomes associated with more adverse events during childhood (Felitti et al., 1998; Mersky et al., 2013). While studies have examined the immediate impact of recent traumas on the individual's physiology, few have examined the effect of administering questionnaires about past adverse events. This study utilized electrodermal activity to measure sympathetic nervous system activity while participants completed the ACE questionnaire compared to participants who completed a benign survey. Half of the ACE questionnaire participants were given a verbal prompt before completing the questionnaire. Participants who completed the ACE questionnaire without a prompt, participants who completed the ACE questionnaire with a prompt, and participants who completed the benign survey were compared by analyses of variance. Analyses found no significant differences between the three groups. Participants with low ACE scores (< 4) and high ACE scores (≤ 4) were compared on measures of EDA with an independent samples *t*-test. No significant difference was found between those with high and low ACE scores. Individuals who completed the ACE questionnaire also did not demonstrate a significant difference in their electrodermal activity while taking the questionnaire when compared with those who completed a presumably benign alternative task. These results provide no evidence that completing the ACE increased autonomic arousal. Generalizability is limited as the sample consisted of primarily White, Christian college students and only had six participants in the high ACE score group. However, the current study suggests the ACE questionnaire does not cause individuals significant distress and is psychologically safe to administer.

Keywords: trauma, ACEs, sympathetic nervous system, electrodermal activity

Table of Contents

Table of Tables

The Effect of Completing the ACE Questionnaire on Electrodermal Activity

Chapter 1

Since the original adverse childhood experiences (ACEs) study almost 25 years ago (Felitti et al., 1998), research has focused on the significance of childhood trauma on the developing brain and its negative health consequences in adulthood. Individuals with a history of trauma often have difficulties with the regulation of their autonomic nervous system, specifically with sympathetic nervous system (SNS) arousal (Weber & Reynolds, 2004; Schuurmans et al., 2021). Constant SNS arousal can result in hypervigilance, anxiety, and other mental health symptoms. The ACE questionnaire is often utilized for research and clinical purposes to evaluate an individual's childhood history of trauma. The current study investigated the effect of completing the ACE questionnaire on electrodermal activity. It also examined the effects on the nervous system after introducing the ACE questionnaire to the participant with a supportive prompt compared to receiving the questionnaire without any prompt.

Previous clinical experiences with the ACE questionnaire inspired the research questions for the current study. The ACE questionnaire has been utilized to inform clients' trauma histories and therapy treatment. In some clinical settings, the ACE questionnaire is administered without the clinician present. Childhood trauma is an understandably sensitive subject for many individuals. Completing the ACE questionnaire before an intake interview or without adequate rapport and trust with the clinician may impact therapeutic rapport and the client's sense of safety during an evaluation or therapeutic treatment. One of the purposes of measuring

physiological reactivity to the ACE questionnaire was to assess how completing the questionnaire may impact a client's sense of safety in an evaluation or intake interview.

We hypothesized that participants who received the ACE questionnaire would have more electrodermal activation, participants with an elevated ACE questionnaire score would have more dysregulation, and participants who received the ACE questionnaire with no prompt would have more elevated electrodermal activity than the prompted group. Our study also utilized several additional measures for correlations. The Acceptance and Action Questionnaire–II (AAQ-II) measures an individual's psychological flexibility, and the Duke University Religion index (DUREL) assesses an individual's religious involvement. Researchers collected scores from these measures to examine any correlations between physiological reactivity produced during the completion of the ACE questionnaire and psychological flexibility or religious involvement.

ACEs Research and History

In the past 25 years, research into ACEs has developed a more nuanced understanding of how childhood trauma impacts an individual. Studies indicate numerous correlations between early childhood stressors and negative impacts on an individual's physical and mental health. One of the original studies found that people with a higher number of ACEs are linked to an increased likelihood of struggling with physical health conditions such as severe obesity, smoking, drug use, sexually transmitted diseases, ischemic heart disease, cancer, chronic lung disease, skeletal fractures, and liver disease (Felitti et al., 1998). Further studies have continued to demonstrate correlations between stressful childhood experiences and negative physical health outcomes, primarily associated with increased risk of age-related diseases, obesity, heart disease, and substance use (Gilbert et al., 2015; Campbell et al., 2016).

Early childhood stress is also heavily correlated with an increased risk of mental health disorders later in life (Edwards et al., 2003; Hughes et al., 2017). Researchers describe a dose-response relationship between childhood maltreatment and mental health symptoms. Multiple adverse childhood experiences can lead to an increased likelihood of experiencing symptoms of depression, anxiety, psychosis, and trauma-related disorders (Varese et al., 2012). Evidence suggests that symptoms associated with elevated ACE questionnaire scores impact individuals throughout their lifespan and are prevalent in early adulthood (Mersky et al., 2013). Associations between ACE scores and increased likelihood of poor health outcomes are more frequent for individuals with four or more ACEs.

Another impact of childhood trauma is demonstrated in the correlation between early-life maltreatment and increased difficulty with executive functioning tasks. Malarbi et al. (2017) performed a meta-analysis of various studies focusing on the effects of childhood trauma on cognitive functioning. Studies consistently show deficits in cognitive functioning in children who experienced trauma in comparison to control groups.

The current study aimed to identify possible physiological dysregulation in an individual who completes the ACE questionnaire, particularly if that individual has an elevated ACE questionnaire score. Previous studies have demonstrated a blunted biological response to stress tasks (Brindle et al., 2022). Due to the physical, emotional, and cognitive impacts of childhood trauma, an individual with a trauma history is likely to become dysregulated in recalling childhood events in a situation, such as completing an ACE questionnaire, engaging in a psychological intake, or participating in related research. This study aimed to improve understanding of an individual's physiological reactivity during the ACE questionnaire and the processes to help regulate them.

The AAQ-II and the DUREL

In addition to the ACE questionnaire, the current study utilized the AAQ-II and the DUREL. The AAQ-II is a questionnaire developed to measure an individual's experience with experiential avoidance. The questionnaire originally consisted of 10 questions but was shortened to seven on a 7-point Likert scale ranging from *never true* to *always true*. The current study utilized the AAQ-II as a supplementary measure of psychological inflexibility for individuals with a history of adverse childhood events. Higher psychological flexibility has been associated with fewer symptoms of depression and posttraumatic stress disorder (Richardson & Jost, 2019).

The DUREL is a brief measure of religiosity. Studies have found the questionnaire to be a reliable and valid measure of religiosity (Koenig & Büssing, 2010). The current study used the DUREL as a supplementary measure of the impact of adverse childhood experiences on an individual's experience with religion. There is evidence of changes in religious beliefs following a traumatic event, with a decrease in religiosity associated with a higher likelihood of posttraumatic stress disorder (ter Kuile & Ehring, 2014).

Impact of Trauma on the Autonomic Nervous System

Research has consistently demonstrated that the dysregulation of the autonomic nervous system (ANS) causes many psychological and physiological difficulties (Porges, 2007; Porges, 2021). The ANS regulates unconscious bodily processes such as breathing, blood pressure, and digestion. It is also responsible for coordinating the body's response to stress. Early life stressors can disrupt the homeostasis of this system, resulting in an individual who experiences a sympathetic dominant response (flight/fight/freeze) or a parasympathetic shutdown (depression, dissociation, etc.). Researchers have also determined how a history of maltreatment impacts the brain later in adulthood. Effects include a smaller prefrontal cortex, a smaller hippocampus, and

greater activation in the hypothalamic-pituitary-adrenal axis (Danese & McEwen, 2012). Structures within the prefrontal cortex are responsible for evaluating threats, and the hypothalamic-pituitary-adrenal axis activates the sympathetic nervous system in response to threats. Individuals with a trauma history demonstrate a decreased ability to maintain physiological stability in response to an environmental stressor. The current study aimed to measure the reactivity of the SNS, specifically with electrodermal activity, in response to participants completing the ACE questionnaire.

When an individual encounters a stressor such as childhood abuse, the amygdala activates the SNS to coordinate the body's response to the stressor (Weber & Reynolds, 2004). With fMRI scans, Gerin et al. (2019) found heightened amygdala reactivity in individuals who experienced early life stressors compared to non-maltreated peers. Their study supported the understanding that childhood trauma has a lasting impact on the neurocognitive development of an individual, specifically with their stress response system. Several studies have supported the impact of early childhood trauma on the SNS (De Bellis & Zisk, 2014; Kuras et al., 2017; Metz et al., 2020; Monteleone et al., 2020). In these studies, there are significant, distinct differences in the physiological responses of individuals who experienced childhood trauma compared to non-traumatized individuals.

EDA as a Measure of Sympathetic Arousal

Electrodermal activity (EDA), also known as the galvanic skin response, refers to the variation of the electrical characteristics of the skin. EDA measures the change in sweat gland activity due to emotional arousal and stress levels. When an individual experiences increased stress, the SNS is activated and causes the eccrine sweat glands to release more moisture onto the skin. This affects the electrical properties of the skin and its conductivity level. EDA can be

measured by tonic skin conductance level (SCL) or phasic skin conductance response. SCL is the average level of conductivity that changes due to increased moisture over a specific time whereas the skin conductance response is the changes in conductance within a few seconds. Tonic measures of SCL are typically utilized for an indication of stress arousal (Ali et al., 2023). The current study aimed to measure the change in the SCL of participants as they experienced a potential stressor of completing the ACE questionnaire.

EDA has been utilized in previous studies as a measure of autonomic reactivity. Grasser et al. (2022) found significant associations between skin conductance response during a trauma interview and trauma exposure in youth resettled as refugees. Their study supported the feasibility of skin conductance response as a biomarker for posttraumatic symptoms. Similarly, EDA has been found to be activated during exposure to traumatic memories among active-duty soldiers with combat-related posttraumatic stress disorder (Gramlich, 2021). Various studies have supported using EDA to measure SNS activity (e.g., Posada-Quintero & Chon, 2020). Moreover, van der Mee et al. (2021) showed the validity of EDA-based measures of the SNS utilizing a wrist-worn device and dry electrodes. Our study utilized similar biofeedback equipment with a wrist-worn device and dry electrodes.

Progressive Muscle Relaxation

The current study also included a mindfulness progressive muscle relaxation exercise following the survey to assess the autonomic regulation of our participants as well as ensure the psychological safety of the participants. Research has supported mindfulness and progressive muscle relaxation as an evidence-based practice to reduce stress and SNS activity (Varvolig & Darviri, 2011; May et al., 2016). Specifically, intentional mindfulness exercises such as progressive muscle relaxation and meditation have been shown to decrease the physiological

reactivity of SNS activation and lower bodily stress responses (Scavone et al., 2020; Ditto et al., 2006). Moreover, mindfulness interventions have been demonstrated to be effective in treating symptoms resulting from childhood trauma (Ortiz & Sibinga, 2017). Researchers utilized a mindfulness-based progressive muscle relaxation intervention for the current study to mitigate possible stressors associated with completing the ACE questionnaire. Furthermore, the researchers examined how the participant's nervous system responds to the exercise.

Research Questions

The current study examined the effect of completing the ACE questionnaire on an individual's EDA. The study was comprised of three primary investigations to determine the impact of the ACE questionnaire:

Question 1: Do individuals completing a benign survey have a different EDA than individuals completing the ACE questionnaire? We anticipated finding a significant difference between the EDA of the individuals who completed the benign survey (control group) and the ACE questionnaire (treatment group).

Question 2: Do individuals who complete the ACE questionnaire have a different EDA if given a verbal prompt to prepare them for the questionnaire? In the ACE questionnaire group, half of the participants were given a verbal prompt describing the content of the ACE questionnaire. The researchers examined differences in EDA between the participants who completed the ACE questionnaire without a prompt (control group) and participants who received a verbal prompt before completing the ACE questionnaire (treatment group). We anticipated finding a significant difference between these two groups.

Question 3: Do individuals with a low ACE score have different EDA responses than individuals with high ACE scores? Given that individuals with high ACE scores are more likely to have increased mental and physical health symptoms and a possible higher sensitivity to upregulation, we anticipated finding a significant difference in stress responses between individuals with a low ACE score (ACE score = 0–3) and individuals with a high ACE score (ACE score = 4 or more).

Chapter 2

Methods

Participants

The study consisted of 46 participants, split three ways into a control group and two experimental groups. Participants in the control group received a benign survey without any questions related to mental health and without any prompt. One of the treatment groups involved participants taking the ACE questionnaire with no introduction to the questionnaire. The second treatment group received a verbal prompt about the content of the ACE questionnaire before completing it. The current study utilized a convenience sample from a population of approximately 2,500 undergraduate students. The university is a private, religious college with a primarily White, Christian population. Participants were offered research credits to fulfill a requirement for one of their undergraduate psychology courses. Other options were available to fulfill research credits, as students were not limited to only our study to satisfy this requirement. Students signed up online for a proposed time slot through the scheduling software SONA utilized by the university. Participants were given a general overview of the procedure to prepare them for the data collection. Furthermore, students were notified of free therapeutic services offered by the university if they felt a need to process any unforeseen stress caused by their participation in our study.

There were initially 50 participants involved in the study. One participant was excluded due to invalid data collection. Three participants were excluded from the data analysis because their scores were considered outliers after determining the *Z*-scores of all participants. The final

analyses were conducted with 46 participants (see Table 1). All 46 participants were undergraduate college students who were 18 to 22 years old. The sample comprised 63% female (*n* = 29) and 37% male (*n* = 17). Most of the sample were 1st-year students (*n* = 31), followed by 2nd-year students (*n* = 7), 4th-year students (*n* = 5), and 3rd-year students (*n* = 3). Most participants identified as Christian (*n* = 41). Others identified as Catholic (*n* = 2), agnostic (*n* = 1), Sikh (*n* = 1), and preferred not to disclose (*n* = 1). In the sample, 63.1% of the participants identified as White (*n* = 29), 21.7% identified as Hispanic or Latino (*n* = 10), 8.7% identified as Asian (*n* = 4), 4.3% identified as White and Hispanic or Latino (*n* = 2), and 2.2% identified as Black or African American (*n* = 1). Half of the sample were employed part-time (*n* = 23), and the other half of the sample indicated they were not employed (*n* = 23). Of the 46 students, 23 of them reported they exercised 4 to 7 times a week, 18 participants indicated they exercised 1 to 3 times a week, and five participants noted they did not exercise. For relationship status, most of the participants identified as single (*n* = 35); 10 participants identified as partnered, and one participant was married.

Materials

Materials included a demographic survey, the ACE questionnaire, the benign survey which served as a non-activating survey, the AAQ-II, and the DUREL (see Appendix D; see Appendix E; see Appendix F). The benign survey is a 10-item questionnaire that asked the participant about their involvement in certain hobbies and activities during their childhood. All surveys were presented in paper format. The researcher also created a recording of a progressive muscle relaxation exercise to reregulate the participants at the end of data collection.

ACEs Scale

The ACEs Scale (Felitti et al., 1998) is a 10-item questionnaire that asks participants to answer “yes” or “no” to indicate whether they experienced each of a list of 10 traumatic childhood experiences (e.g., physical neglect, sexual abuse, domestic violence). The ACE questionnaire is an applicable screener for early traumatic events with an acceptable internal consistency ($\alpha = 0.701$) in studies with adolescents (Oláh et al., 2023).

AAQ- II

The AAQ-II is a seven-item questionnaire in which respondents rate the degree to which they agree or disagree with a statement on a 7-point Likert scale. The questionnaire measures participants' experiential avoidance and psychological inflexibility based on their responses. The AAQ-II demonstrates satisfactory internal consistency ($\alpha = 0.88$; Bond et al., 2011). There were some concerns related to the divergent validity of the questionnaire, specifically with the 10-item version (Wolgast, 2014). However, studies have found the AAQ-II to have appropriate reliability and validity to measure psychological inflexibility with a moderately high internal consistency (Ankney et al., 2022).

DUREL Index

The DUREL index is a five-item questionnaire that measures religious involvement. The questionnaire breaks down participants' religious involvement into three dimensions: Organizational Religious Activity (ORA), Non-Organizational Religious Activity (NORA), and Intrinsic Religiosity. The first two items on the DUREL measure attendance to religious meetings and activities, with six possible answers ranging from *never* to *more than once per week*. They comprise the ORA and NORA scales respectively. The following three items ask about religious belief or experience, with five possible answers ranging from *definitely not true* to *definitely true of me*, measuring Intrinsic Religiosity. The Intrinsic Religiosity subscale has suitable reliability (Cronbach's $\alpha = 0.75$). The total index also has appropriate internal consistency (Cronbach's $\alpha = 0.78–0.91$; Koenig & Büssing, 2010). In the present sample, alpha was 0.88.

Procedure

Participants scheduled a time on the software SONA to undergo the experiment which took place in a lab at their university. Participants were then randomly assigned to one of three groups. Group 1 received the ACE. Group 2 was given a prompt regarding the ACE content, and then received the ACE. Group 3 received the benign survey, a presumable benign task presumed to be affectively neutral and to thus have no effect on the SNS.

After arriving at the lab, participants were briefed on the procedure and the expectations of their participation. Participants were then given an informed consent to sign (see Appendix B). Participants had been previously notified of the procedure before signing up for the experiment.

Upon completion of the informed consent, the researcher set up the wrist device and electrodes required to attain EDA measurements. The study utilized BIOPAC portable

biofeedback equipment to measure the EDA of participants as they completed the ACE questionnaire. This machine consists of two electrodes and a wrist device for recording the data from the participant. The researcher used a laptop to record the EDA data. There was a 5-min period of rest to allow participants to adjust to the biofeedback equipment and to establish a baseline SCL. While waiting for the baseline period to finish, the researcher would converse with the participants regarding their classes or hobbies.

The researcher distributed the demographics questionnaire and a writing utensil for the participants to complete while waiting for the baseline period to be finished. To assess the demographics of our participants, we used a short questionnaire asking about their age, gender, ethnicity, socioeconomic status, education level, exercise level, religiosity, employment status, income, and marital status (see Appendix C).

Depending on which treatment group participants were involved in, they either received an introduction to the ACE questionnaire or were immediately handed the survey appropriate to their group—either the ACE or the benign survey. The participants then completed the assigned questionnaire. After completing the ACE questionnaire or benign survey, the participant is then administered the AAQ-II, followed by the DUREL.

Following the questionnaires, the researcher played a video that guided participants through the mindfulness progressive muscle relaxation exercise. A recorded mindfulness progressive muscle relaxation exercise was facilitated to maintain consistency between participants. At the end of the exercise, the researcher removed the biofeedback equipment and reminded the participants of the free psychological services available at the university.

The same researcher collected all participant data. EDA data was collected during each phase of the study: baseline, treatment group (ACE/control), AAQ-II administration, DUREL

administration, and during a progressive muscle relaxation exercise. Each section's minimum, maximum, mean, and standard deviation of microsiemens (μS) were measured for each participant. Additionally, the time for each phase was recorded to accurately measure EDA data during each part of the procedure. One participant was removed before the analysis due to corrupt data collection.

Research Design

The independent variables in the study are the type of questionnaire administered to the participant, the prompt for the ACE questionnaire, and the number of ACEs. The dependent variable is the change in EDA for each participant. The outcome measures for EDA were the mean μS during the survey period, the maximum μS during the survey period, the difference between the max and minimum μS during the survey period, and the difference between the max μS during the survey period and the minimum μS during the progressive muscle relaxation period. Additionally, the scores for the AAQ-II and the DUREL were also analyzed.

Data Analysis

All analyses were completed in SPSS Statistics. Prior to inputting the data into SPSS, the values of the outcome measures were each multiplied by a thousand (10^3) to utilize larger values while completing the analyses. After running the analyses, the means and standard deviations were divided by a thousand to obtain accurate values. A descriptives analysis was conducted to determine the *Z*-scores of the dependent variables. Examining the *Z*-scores revealed three outliers that were removed from the data before the analyses. These scores were determined to be outliers due to their abnormal values that were likely due to a data collection error or equipment malfunction. Independent samples *t*-tests were utilized to analyze the first and third hypotheses. Participants were separated by whether they completed the benign survey or the ACE

questionnaire. A one-way analysis of variance with a Tukey post hoc analysis was utilized to test the second hypothesis.

Chapter 3

Results

Effect of ACE Questionnaire

To test for stress effects of taking the ACE questionnaire (see Table 2), an independent sample *t*-test was conducted to analyze differences in mean EDA measures between the benign survey group (control) and the group that completed the ACE questionnaire (treatment). No significant difference was found between the average EDA measures of the ACE group (M = 3.64, SD = 2.18) and the control group (M = 3.84, SD = 1.66), $t(44) = -0.34$, $p = 0.74$.

Another comparison was made by looking at differences between the maximum EDA scores (see Table 2) from each group. Participants in the benign group (control) had a mean maximum EDA score of 4.26 μS (SD = 2.29), while those in the treatment group had a mean maximum EDA score of 4.24 μS (SD = 1.99). No significant difference was found between the maximum scores of each group, $t(44) = -0.03$, $p = 0.98$.

An additional comparison was made looking at difference scores between maximum and minimum EDA values for each group (see Table 2). The mean difference score of the ACES group (M = 0.98, SD = 0.43) compared to the mean difference score of the control group (M = 0.66, SD = 0.43) demonstrated no significant difference between groups, $t(44) = 1.43$, $p = 0.16$.

Finally, a comparison of differences between the EDA maximum score during the survey period and the minimum EDA score during the progressive muscle relaxation period was considered for each group (see Table 2). The mean change in the ACE group (M = 0.86, SD =

0.67) compared to the mean change of the benign group (M = 0.92, SD = 0.72) was found to be insignificant, $t(44) = -0.32$, $p = 0.75$.

While we anticipated finding higher EDA values in participants taking the ACE test, no differences were found, suggesting that the ACEs test did not cause more physiological arousal than taking the benign test.

Effect of Verbal Prompting

A series of one-way analyses of variance (see Table 3) were conducted to assess for amplifying effects of a verbal prompt before taking the ACEs questionnaire on physiological arousal (EDA) between groups taking the ACE questionnaire after being verbally warned about the content of the questionnaire (n = 16), taking the questionnaire without being verbally prompted (n = 16), and the control group who took a benign survey (n = 14). Four 1-way analyses of variance were conducted with one testing difference using mean EDA scores from the entire questionnaire administration time, another using the maximum EDA scores during the survey period, another using mean differences in maximum and minimum EDA scores during the survey period, and the last using mean difference score between the maximum EDA score during the survey period and minimum EDA score during the progressive muscle relaxation period (see Table 3).

Using mean EDA scores (see Table 3), no significant effect of the verbal prompt or the ACE test was found between the three groups; $F(2,43) = 0.07$, $p = 0.93$. Likewise, no significant effect was found between groups using maximum EDA scores; $F(2,43) = 0.12$, $p = 0.89$; no significant difference was found using mean maximum and minimum EDA difference scores; $F(2,43) = 1.06$, $p = 0.36$, and finally no significant difference was found using mean difference

scores between maximum EDA scores during the survey period and the minimum EDA scores during the relaxation period; $F(2,43) = 0.48$, $p = 0.62$.

Results suggest that a verbal prompt before taking the ACE questionnaire does not change stress levels any more or less than taking the ACE test alone or a benign test (see Table 3). The results also validate findings noted in the previous section, where the ACE questionnaire alone does not elevate stress levels differently than a benign test or a verbally prompted ACE test.

Effect of the Number of ACEs

Using the same four score categories noted in the previous sections, an independent paired *t*-test was conducted to analyze the differences in mean EDA values between individuals with a low ACE questionnaire score (lower than four) and individuals with a high ACE questionnaire score (equal to or higher than four).

Looking first at comparing the mean overall EDA scores between groups (see Table 4), no significant effect was found between the high ACE group ($M = 3.80$, $SD = 0.86$) or low ACE scores group ($M = 3.61$, $SD = 1.81$), $t(30) = -0.26$, $p = 0.80$. Comparing the maximum EDA score of each ACE group (see Table 4), no significant difference was found between the high ACE group ($M = 4.21$, $SD = 2.17$) or low ACE scores group ($M = 4.37$, $SD = 0.95$), $t(30) = -0.17$, $p = 0.87$. Looking next at the mean maximum-minimum EDA difference score for each ACE group, no significant difference was found between the high ACE group ($M = 0.92$, $SD = 0.24$) and the low ACE group ($M = 1.00$, $SD = 0.87$), $t(30) = 0.22$, $p = 0.83$. Finally, considering the mean difference score between the maximum EDA value during the test administration and the minimum EDA score during the progressive muscle relaxation no significant difference was

found between the high ACE group (M = 0.86, SD = 0.20) and the low ACE group (M = 0.83, SD = 0.75), $t(30) = 0.11$, $p = 0.92$.

Ancillary Results

AAQ-II

To assess differences in psychological flexibility and number of ACEs, an independent sample *t*-test was utilized to analyze differences in mean AAQ-II scores between individuals with a high number of ACEs and individuals with a low number of ACEs (see Table 5). There was no significant difference between the average AAQ-II scores for the high ACEs group (M = 26.83, SD = 6.43) and the low ACEs group (M = 19.12, SD = 9.58), $t(30) = -1.87$, $p = 0.07$.

DUREL

An independent sample *t*-test was conducted to evaluate differences in religiosity in individuals with a low number of ACEs and individuals with a high number of ACEs (see Table 6). The independent variable for the analysis was the score on the ACE questionnaire, and the dependent variables were the three indices of the DUREL: ORA, NORA, and Intrinsic Religiosity. For the ORA index, there was no significant difference between the ACE questionnaire group with low scores (M = 4.42, SD = 1.30) and the ACE questionnaire group with high scores (M = 3.50, SD = 0.55), $t(30) = 1.69$, $p = 0.10$. Similarly, there was no significant difference in the NORA index between the ACE questionnaire group with low scores (M = 3.77, SD = 1.63) and the ACE questionnaire group with high scores (M = 2.50, SD = 1.64), $t(30)$ = 1.72, $p = 0.10$. However, there was a significant difference in the measure of Intrinsic Religiosity for the ACE questionnaire group with low scores (M = 11.73, SD = 3.05) and the ACE questionnaire group with high scores (M = 8.83, SD = 2.99), $t(30) = 2.10$, $p = 0.04$ (see Table 6).

Chapter 4

Discussion

The purpose of the current study was to investigate the relationship between completing the ACE questionnaire and the reactivity of an individual's sympathetic nervous system, particularly for individuals with a history of childhood trauma. EDA was utilized as a measure of SNS activity. Our goal was to understand how individuals with a history of trauma experience reporting their past trauma on a physiological level. Three hypotheses were examined. The hypotheses were that individuals would have a higher EDA when completing the ACE questionnaire in comparison to individuals completing a control survey; that individuals who received a preparatory verbal prompt before completing the ACE questionnaire would have a different EDA than individuals who did not receive the prompt; individuals with a high number of ACEs would have a higher EDA than individuals with a low number of ACEs.

ACE Versus Control Survey

The independent paired *t*-test between the ACE questionnaire group and the benign survey group did not show any significant differences between the two groups. Our results do not suggest that an individual's EDA increases more when taking the ACE questionnaire than a benign inventory. The results suggest that, at least in our sample, the SNS, as measured by electrodermal activity, does not appear to react to the ACE questionnaire any differently than other questionnaires not asking about trauma history. Also, our findings do not indicate that a personal history of trauma makes someone more susceptible to being triggered by taking the ACE questionnaire any more or less than taking other questionnaires.

Prompted ACE Responses

Similar to the benign activity, we did not find that a verbal prompt about the ACE had any discernable effect on a stress response in either high or low ACE score participants. Thus, we cannot reject the null hypothesis that a pre-test prompt would have no effect on ACE-associated EDA.

In ancillary results of the AAQ-II and DUREL surveys, we expected to find significant differences between AAQ-II scores for the high number of ACEs group and low number of ACEs group in our study. However, the current study did not reveal any significant interactions aside from a significant difference in AAQ-II scores for the high number of ACEs group and the low number of ACEs group, suggesting psychological flexibility is not related to ACEs in this sample. Makriyianis et al. (2019) found psychological inflexibility to be a mediator between ACEs and depression and anxiety. The lack of a significant difference in our study may be due to the small sample size of the high ACEs group. Another possible explanation for the lack of differences is the participants in the current study were all relatively successful college students. They may have developed the resilience and psychological flexibility necessary to succeed academically despite experiencing adverse childhood events.

Results demonstrated differences in religious experience for those with high and low ACEs, specifically for a measure of Intrinsic Religiosity. This result suggests that ACEs may alter internal religious/spiritual experiences in important ways. There is evidence that young adults with more ACEs have reduced religious involvement (Harris et al., 2021). While the current study did not reveal significant differences in religious involvement, confounding variables may have impacted the results. Students attending the private, Christian university from which participants were recruited are required to attend chapel meetings. The participants in the

current study may have considered chapel attendance to be religious involvement. This likely lessened any potential differences in religious involvement between participants with a high number of ACEs and a low number of ACEs.

However, the difference in Intrinsic Religiosity suggests trauma may change an individual's view of and relationship with God. Previous research has demonstrated traumatic experiences can significantly decrease or increase religious beliefs and activities depending on an individual's religiosity prior to the traumatic event, the use of religion as a coping mechanism, and the individual's current religious environment. Overall, it was more likely for individuals to experience a decrease in religiosity following a traumatic event (ter Kuile & Ehring, 2014). While research demonstrates mixed findings on the relationship between religiosity and trauma, most findings suggest there is a bidirectional nature to the relationship. While traumatic events can change one's perception of the world, other people, and religion, religious beliefs can also facilitate how traumatic events alter an individual's perceptions and internal struggles. The current study suggests there is likely a decreased connection to one's internal spirituality as a result of childhood trauma. More research is necessary to investigate the possible effect of trauma on internal religiosity.

Our study failed to demonstrate significant differences between groups in any of the EDA measures. Previous research has shown evidence of refugees with recent trauma having significant skin conductance responses after a trauma interview (Grasser et al., 2022). Additionally, a study examined galvanic skin response in active-duty soldiers during prolonged exposure therapy and found significant interactions (Gramlich et al., 2021). Studies have also found associations between skin conductance measures and the degree of trauma exposure in children (Wiltshire et al., 2022). These studies and past research into electrodermal activity have

supported it as a reliable measure of autonomic reactivity. However, these studies also examined participants who had experienced their traumas relatively recently, whereas our study focused on past events, which may have impacted our results. Additionally, these studies collected data from participants with active symptoms of trauma. The current study did not examine if the participants were still experiencing traumatic stress related to events in their childhood. This difference may support using physiological measures to determine if an individual is experiencing active posttraumatic stress. The results of the current study do not suggest any psychological concerns with administering the ACE questionnaire in a controlled environment.

Limitations

The current study faces limitations in the participants' demographics as they are not likely representative of the population. The students all attended a private Christian university, and many identified as White and Christian. There is some evidence that religious individuals are less physiologically reactive to stressors which may have impacted our participants' data (Haney & Lane, 2023; Schnell et al., 2020). All participants were between the ages of 18 and 23 years. Another limitation is the ACE questionnaire as it does not specify the severity, repetition, or current impact of childhood adverse events. Additionally, our study utilized the total ACE questionnaire score and did not examine how specific items on the questionnaire impacted an individual's EDA.

Another limitation of the current study is the confounding factors that may affect EDA data. These factors include temperature, physical activity, and stress. Furthermore, collecting accurate EDA data can be difficult because measurements are affected by the participant's hand motions, muscle activity, dry electrodes, and other environmental factors (Coffman et al., 2020). While EDA does inform us about an individual's level of distress, it can be difficult to attribute

the distress to a single factor such as completing a survey. To control for temperature and environmental factors, data was collected in the same room at similar times each day. Physical activity and stress may have affected our data as we were unable to control for these factors. Data was examined and appropriately excluded prior to conducting analyses to ensure only the participants with valid data were included in the study. For each participant, there was about a 5-min period at the beginning of data collection to ensure an appropriate baseline SCL was established. EDA data is vulnerable to non-normal distributions and has small values that can make statistical analyses more difficult. The data was manipulated to perform the analyses with larger values.

Of the 46 participants, only six fell into the high number of ACEs group. Due to this small sample size, the sample was more vulnerable to sampling bias. There were also limitations in detecting smaller effects between groups because one group had significantly less participants than the other group. As demonstrated in our high standard deviation scores, there is likely increased variability due to random variability. Some of these students likely attended mental health treatment in the past and developed skills to cope with their childhood trauma. It is very likely our high number of ACEs group does not accurately represent the typical autonomic dysregulation found in individuals with active posttraumatic stress. Due to the effects of the limited sample size, the findings from the current study have limited generalizability. On the whole, the sample is young, relatively well-educated, generally in good health, and likely has access to above-average resources. Due to the participants' demographics, the limited number of participants, and the education level of our participants, this study is limited in its generalizability.

Areas for Future Research

Further research into the physiological effects of completing the ACE questionnaire with a more diverse population may be useful in determining the questionnaire's psychological safety with traumatized populations. Other areas of research could include examining how religiosity affects physiological reactivity in traumatized individuals. The current study is comprised mostly of religious individuals which may have affected their physiological reactivity. Some research demonstrates that religiosity can be a protective factor for physiological stress responses. One study found that religious coping acts served as a protective buffer against physiological stress responses prior to a stressor (Haney & Lane, 2023). Another preliminary study found lower cardiovascular stress responses in religious individuals when compared to atheist, spiritual, and agnostic individuals (Schnell et al., 2020). For the current study, it is possible the participants' religious involvement at their school lessened their physiological response to the stressor of completing the ACE questionnaire. Examining physiological responses to the ACE questionnaire with a more diverse sample of participants may provide more insight into how the questionnaire affects an individual's stress response. Another area of research could examine physiological changes to specific questions on the ACE questionnaire. More severe childhood traumas may have a more lasting impact on the ANS when compared to less severe events. Lastly, conducting the study with more diverse individuals who are not as well-adapted and successful as college students may yield different results than the current study and improve its generalizability.

Summary and Conclusion

The current study did not determine significant differences in the three primary research questions. The findings did not support our hypothesis that completing the ACE questionnaire would illicit a significant physiological reaction compared to completing a benign task.

However, the current study faced several limitations, such as the small sample size and the demographics of the sample, and it is limited in its generalizability. Despite the absence of EDA differences, there was a significant difference in measures of religiosity between the two groups. The significant difference in religiosity scores between the high ACEs group and the low ACEs group suggests childhood trauma has a significant impact on an individual's religious beliefs and involvement. Specifically, the current study suggests childhood trauma decreases an individual's Intrinsic Religiosity, a measure of an individual's values and personal meaning found in their religious beliefs. This finding could suggest individuals with past trauma are more likely to participate in religious pursuits as a means of cultivating safety, community, and comfort rather than a system of beliefs by which to live their lives. Trauma often impacts a person's view of themselves and their perceptions of safety and the world around them. Adverse childhood events likely alter people's perceptions of God due to these changes in their internal beliefs and expectations of themselves, others, and the world.

References

Ali, N., Tschenett, H., Nater, U. M. (2023). Biomarkers of stress and disease. In H.S. Friedman & C. H. Markey (Eds.), *Encyclopedia of mental health* (2nd ed. pp. 221–231). Academic Press. https://doi.org/10.1016/B978-0-323-91497-0.00231-9

Ankney, A. S., Baker, R. T., Pickering, M. A., Carr-Chellman, D. J., Holyoke, L. B., & Larkins, L. W. (2022). Psychometric evaluation of the Acceptance and Action Questionnaire-II (AAQ-II) with special operations forces soldiers. *Journal of Contextual Behavioral Science, 26*, 69–84. https://doi.org/10.1016/j.jcbs.2022.08.010

Bond, F. W., Hayes, S. C., Baer, R. A., Carpenter, K. M., Guenole, N., Orcutt, H. K., Waltz, T., & Zettle, R. D. (2011). Preliminary psychometric properties of the Acceptance and Action Questionnaire–II: A revised measure of psychological inflexibility and experiential avoidance. *Behavior Therapy*, *42*(4), 676–688. https://doi.org/10.1016/j.beth.2011.03.007

Brindle, R. C., Pearson, A., & Ginty, A. T. (2022). Adverse childhood experiences (ACEs) relate to blunted cardiovascular and cortisol reactivity to acute laboratory stress: A systematic review and meta-analysis. *Neuroscience and Biobehavioral Reviews*, *134*. https://doi.org/10.1016/j.neubiorev.2022.104530

Campbell, J. A., Walker, R. J., & Egede, L. E. (2016). Associations between adverse childhood experiences, high-risk behaviors, and morbidity in adulthood. *American Journal of Preventative Medicine, 50*(3), 344–352.

Coffman D.L., Cai X., Li R., & Leonard N. R. (2020). Challenges and opportunities in collecting and modeling ambulatory electrodermal activity data. *JMIR Biomedical Engineering*, *5*(1). doi: 10.2196/17106. Epub 2019 Nov 19. PMID: 34888487; PMCID: PMC8653913.

Danese, A., & McEwen, B. S. (2012). Adverse childhood experiences, allostasis, allostatic load, and age-related disease. *Physiology and Behavior, 106*(1), 29–39. doi:10.1016/j.physbeh.2011.08.019

De Bellis, M. D., & Zisk, A. (2014). The biological effects of childhood trauma. *Child and Adolescent Psychiatric Clinics of North America, 23*(2), 185–222. doi:10.1016/j.chc.2014.01.002

Ditto, B., Eclache, M., & Goldman, N. (2006). Short-term autonomic and cardiovascular effects of mindfulness body scan meditation. *Annals of Behavioral Medicine, 32*(3), 227–234. doi:10.1207/s15324796abm3203_9

Edwards, V. J., Holden, G. W., Felitti, V. J., & Anda, R. F. (2003). Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: Results from the adverse childhood experiences study. *The American Journal of Psychiatry, 160*(8), 1453–1460. https://doi.org/10.1176/appi.ajp.160.8.1453

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., Koss, M. P., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The adverse childhood experiences (ACE) study. *American Journal of Preventive Medicine, 14*(4), 245–258. doi:10.1016/S0749-3797(98)00017-8

Gerin, M. I., Viding, E., Pingault, J. -., Puetz, V. B., Knodt, A. R., Radtke, S. R., Brigidi, B. D., Swartz, J. R., Hariri, A. R., & McCrory, E. J. (2019). Heightened amygdala reactivity and increased stress generation predict internalizing symptoms in adults following childhood maltreatment. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 60*(7), 752–761. doi:10.1111/jcpp.13041

Gilbert, L. K., Breiding, M. J., Merrick, M. T., Thompson, W. W., Ford, D. C., Dhingra, S. S., & Parks, S. E. (2015). Childhood adversity and adult chronic disease update from ten states and the District of Columbia, 2010. *American Journal of Preventive Medicine*, *48*(3), 345–349.

Gramlich, M. A., Smolenski, D. J., Norr, A. M., Rothbaum, B. O., Rizzo, A. A., Andrasik, F., Fantelli, E., & Reger, G. M. (2021). Psychophysiology during exposure to trauma memories: Comparative effects of virtual reality and imaginal exposure for posttraumatic stress disorder. *Depression and Anxiety*, *38*(6), 626–638. https://doi.org/10.1002/da.23141

Grasser, L. R., Saad, B., Bazzi, C., Wanna, C., Abu Suhaiban, H., Mammo, D., Jovanovic, T., & Javanbakht, A. (2022). Skin conductance response to trauma interview as a candidate biomarker of trauma and related psychopathology in youth resettled as refugees. *European Journal of Psychotraumatology*, *13*(1). https://doi.org/10.1080/20008198.2022.2083375

Haney, A. M., & Lane, S. P. (2023). Religious coping is differentially associated with physiological and subjective distress indicators: Comparing cortisol and self-report patterns. *Behavioral Medicine*. Advance online publication. https://doiorg.georgefox.idm.oclc.org/10.1080/08964289.2023.2277926

Harris, C., Dunkley, L. R., & Gardner, A. (2021). Understanding the link between childhood trauma and religious involvement in a sample of emerging young adults. *The Practitioner Scholar: Journal of the International Trauma Training Institute*, *3*, 31–38.

Hughes, K., Bellis, M. A., Hardcastle, K. A., Sethi, D., Butchart, A., Mikton, C., Jones, L., & Dunne, M. P. (2017). The effect of multiple adverse childhood experiences on health: A

systematic review and meta-analysis. *The Lancet Public Health, 2*(8), e356–e366. doi:10.1016/S2468-2667(17)30118-4

Koenig HG & Büssing A. (2010). The Duke University Religion Index (DUREL): A five-item measure for use in epidemological studies. *Religions, 1*(1),78–85. https://doi.org/10.3390/rel1010078

Kuras, Y. I., McInnis, C. M., Thoma, M. V., Chen, X., Hanlin, L., Gianferante, D., & Rohleder, N. (2017). Increased alpha-amylase response to an acute psychosocial stress challenge in healthy adults with childhood adversity. *Developmental Psychobiology, 59*(1), 91–98. doi:10.1002/dev.21470

Malarbi, S., Abu-Rayya, H. M., Muscara, F., & Stargatt, R. (2017). Neuropsychological functioning of childhood trauma and post-traumatic stress disorder: A meta-analysis. *Neuroscience and Biobehavioral Reviews, 72*, 68–86. doi:10.1016/j.neubiorev.2016.11.004

Makriyianis, H. M., Adams, E. A., Lozano, L. L., Mooney, T. A., Morton, C., & Liss, M. (2019). Psychological inflexibility mediates the relationship between adverse childhood experiences and mental health outcomes. *Journal of Contextual Behavioral Science*, *14*, 82–89. https://doi.org/10.1016/j.jcbs.2019.09.007

May, R. W., Bamber, M., Seibert, G. S., Sanchez-Gonzalez, M. A., Leonard, J. T., Salsbury, R. A., & Fincham, F. D. (2016). Understanding the physiology of mindfulness: Aortic hemodynamics and heart rate variability. *Stress*, *19*(2), 168–174. doi:10.3109/10253890.2016.1146669

Mersky, J. P., Topitzes, J., & Reynolds, A. J. (2013). Impacts of adverse childhood experiences on health, mental health, and substance use in early adulthood: A cohort study of an

urban, minority sample in the US. *Child Abuse & Neglect, 37*(11), 917–925. https://doi.org/10.1016/j.chiabu.2013.07.011

Metz, S., Duesenberg, M., Hellmann-Regen, J., Wolf, O. T., Roepke, S., Otte, C., & Wingenfeld, K. (2020). Blunted salivary cortisol response to psychosocial stress in women with posttraumatic stress disorder. *Journal of Psychiatric Research, 130*, 112–119. doi:10.1016/j.jpsychires.2020.07.014

Monteleone, A. M., Marciello, F., Cascino, G., Cimino, M., Ruzzi, V., Pellegrino, F., Giorno, C. D., Monteleone, P. (2020). Early traumatic experiences impair the functioning of both components of the endogenous stress response system in adult people with eating disorders. *Psychoneuroendocrinology, 115* doi:10.1016/j.psyneuen.2020.104644

Oláh, B., Fekete, Z., Kuritárné Szabó, I., & Kovács-Tóth, B. (2023). Validity and reliability of the 10-Item Adverse Childhood Experiences Questionnaire (ACE-10) among adolescents in the child welfare system. *Frontiers in Public Health*, *11*, 1258798. doi: 10.3389/fpubh.2023.1258798

Ortiz, R., & Sibinga, E. M. (2017). The role of mindfulness in reducing the adverse effects of childhood stress and trauma. *Children, 4*(3) doi:10.3390/children4030016

Porges, S. W. (2021). *Polyvagal safety*, W. W. Norton & Company.

Porges, S. W. (2007). The polyvagal perspective, *Biological Psychology*, *74*, 116–143.

Posada-Quintero, H. F. & Chon, K. H. (2020). Innovations in electrodermal activity data collection and signal processing: A systematic review. *Sensors (Switzerland)*, *20*(2) doi:10.3390/s20020479

Richardson, C. M. E. & Jost, S. A. (2019). Psychological flexibility as a mediator of the association between early life trauma and psychological symptoms. *Personality and Individual Differences, 141*, 101–106. https://doi.org/10.1016/j.paid.2018.12.029

Scavone, A., Kadziolka, M. J., & Miller, C. J. (2020). State and trait mindfulness as predictors of skin conductance response to stress. *Applied Psychophysiology Biofeedback, 45*(3), 221–228. doi:10.1007/s10484-020-09467-y

Schuurmans, A. A. T., Nijhof, K. S., Cima, M., Scholte, R., Popma, A., & Otten, R. (2021). Alterations of autonomic nervous system and HPA axis basal activity and reactivity to acute stress: A comparison of traumatized adolescents and healthy controls. *Stress: The International Journal on the Biology of Stress, 24*(6), 1–12. https://doi.org/10.1080/10253890.2021.1900108

Schnell, T., Fuchs, D., & Hefti, R. (2020). Worldview under stress: Preliminary findings on cardiovascular and cortisol stress responses predicted by secularity, religiosity, spirituality, and existential search. *Journal of Religion and Health*, *59*(6), 2969–2989. https://doi-org.georgefox.idm.oclc.org/10.1007/s10943-020-01008-5

ter Kuile, H., & Ehring, T. (2014). Predictors of changes in religiosity after trauma: Trauma, religiosity, and posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*, *6*(4), 353.

van der Mee, D. J., Gevonden, M. J., Westerink, J. H. D. M., & de Geus, E. J. C. (2021). Validity of electrodermal activity-based measures of sympathetic nervous system activity from a wrist-worn device. *International Journal of Psychophysiology, 168*, 52–64. doi:10.1016/j.ijpsycho.2021.08.003

Varese, F., Smeets, F., Drukker, M., Lieverse, R., Lataster, T., Viechtbauer, W., Read, J., van Os, J., & Bentall, R. P. (2012). Childhood adversities increase the risk of psychosis: A meta-analysis of patient-control, prospective-and cross-sectional cohort studies. *Schizophrenia Bulletin, 38*(4), 661–671. doi:10.1093/schbul/sbs050

Varvogli, L., & Darviri, C. (2011). Stress management techniques: Evidence-based procedures that reduce stress and promote health. *Health Science Journal, 5*(2), 74–89.

Weber, D. A. & Reynolds, C. R. (2004). Clinical perspectives on the neurobiological effects of psychological trauma. *Neuropsychology Review, 12*(2), 115–129.

Wiltshire, C. N., Wanna, C. P., Stenson, A. F., Minton, S. T., Reda, M. H., Davie, W. M., Hinrichs, R., Winters, S., France, J. M., & Jovanovic, T. (2022). Associations between children's trauma-related sequelae and skin conductance captured through mobile technology. *Behaviour Research and Therapy, 150*. https://doi.org/10.1016/j.brat.2022.104036

Wolgast, M. (2014). What does the Acceptance and Action Questionnaire (AAQ-II) really measure? *Behavior Therapy, 45*(6), 831–839. https://doi.org/10.1016/j.beth.2014.07.002

Tables

Table 1

Demographic Characteristics of Participants at Baseline

Baseline characteristic	Benign survey		ACE without prompt		ACE with prompt		Full sample	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Gender								
Female	7	50	11	68.8	11	68.8	29	63
Male	7	50	5	31.2	5	31.2	17	37
Marital status								
Single	13	92.9	10	62.5	12	75	35	76.1
Married	0	0	0	0	1	6.3	1	2.2
Partnered	1	7.1	6	37.5	3	18.7	10	21.7
Year of undergraduate								
1st year	9	64.3	12	75	10	62.5	31	67.4
2nd year	3	21.4	1	6.3	3	18.7	7	15.2
3rd year	1	7.1	0	0	2	12.5	3	6.5
4th year	1	7.1	3	18.7	1	6.3	5	10.9
Religious affiliation								
Agnostic	0	0	1	6.3	0	0	1	2.2
Catholic	0	0	1	6.3	1	6.3	2	4.3
Christian	14	100	14	87.5	13	81.3	41	89.1
Other/prefer not to say	0	0	0	0	2[a]	12.5	2	4.3
Race/ethnicity								
Asian	1	7.1	1	6.3	2	12.5	4	8.7
Black	0	0	0	0	1	6.3	1	2.2
Hispanic/Latino	3	21.4	4	25	3	18.7	10	21.7
White	10	71.4	10	62.5	9	56.3	29	63.1
White/Hispanic/Latino	0	0	1	6.3	1	6.3	2	4.3

[a] Participants' responses included one “prefer not to say” and one “Sikhism”

Table 2

EDA Score Differences by Test Type (ACE Questionnaire vs. Benign Control)

EDA evaluation	ACE	Benign (control)	*t*	*df*	*p*
EDA mean score	*M* = 3.64	*M* = 3.84			
	SD = 1.66	*SD* = 2.18	−.341	44	.735
	n = 32	*n* = 14			
EDA max score	*M* = 4.24	*M* = 4.26			
	SD = 1.99	*SD* = 2.29	−.027	44	.979
	n = 32	*n* = 14			
EDA max-min difference score	*M* = 0.98	*M* = 0.66			
	SD = 0.78	*SD* = 0.43	1.428	44	.160
	n = 32	*n* = 14			
EDA max-min (relaxation) difference score	*M* = 0.86	*M* = 0.92			
	SD = 0.67	*SD* = 0.72	−.315	44	.754
	n = 32	*n* = 14			

Note. EDA = electrodermal activity; ACE = Adverse Childhood Experiences questionnaire.

Table 3

EDA Score Differences by Test Type With Verbal Prompt (ACE Questionnaire With Verbal Warning, ACE Questionnaire, and Benign Control)

EDA evaluation	ACEs with prompt	ACEs without prompt	Benign	*F*	*df*	*p*
EDA mean score	*M* = 3.76	*M* = 3.52	*M* = 3.84			
	SD = 1.72	*SD* = 1.64	*SD* = 2.18	.122	2	.885
	n = 16	*n* = 16	*n* = 14			
EDA max score	*M* = 4.38	*M* = 4.10	*M* = 4.26			
	SD = 2.17	*SD* = 1.85	*SD* = 2.30	.071	2	.931
	n = 16	*n* = 16	*n* = 14			
EDA max-min difference score	*M* = 1.03	*M* = 0.94	*M* = 0.66			
	SD = 1.02	*SD* = 0.47	*SD* = 0.43	1.062	2	.355
	n = 16	*n* = 16	*n* = 14			
EDA max-min (relaxation) difference score	*M* = 0.74	*M* = 0.97	*M* = 0.93			
	SD = 0.53	*SD* = 0.79	*SD* = 0.72	.483	2	.620
	n = 16	*n* = 16	*n* = 14			

Note. EDA = electrodermal activity; ACE = Adverse Childhood Experiences questionnaire.

Table 4

EDA Score Differences by ACE Group Differences (High ACE vs Low ACE)

EDA evaluation	Low ACE	High ACE	*t*	*df*	*p*
EDA mean score	*M* = 3.80	*M* = 3.61			
	SD = 0.86	*SD* = 1.81	−.256	30	.799
	n = 26	*n* = 6			
EDA max score	*M* = 4.37	*M* = 4.21			
	SD = 0.95	*SD* = 2.17	−.168	30	.868
	n = 26	*n* = 6			
EDA max-min difference score	*M* = 0.92	*M* = 1.00			
	SD = 0.24	*SD* = 0.87	.223	30	.825
	n = 26	*n* = 6			
EDA max-min (relaxation) difference score	*M* = 0.83	*M* = 0.86			
	SD = 0.75	*SD* = 0.20	.105	30	.917
	n = 26	*n* = 6			

Note. EDA = electrodermal activity; ACE = Adverse Childhood Experiences questionnaire.

Table 5

Psychological Flexibility by ACE Group Differences (High ACE vs Low ACE)

AAQ-II score	Low ACE	High ACE	*t*	*df*	*p*
Mean score	*M* = 19.12	*M* = 26.83			
	SD = 9.58	*SD* = 6.43	−1.866	30	.072
	n = 26	*n* = 6			

Note. AAQ-II = Acceptance and Action Questionnaire–II; EDA = electrodermal activity; ACE= Adverse Childhood Experiences questionnaire.

Table 6

DUREL Scores and EDA Responses

DUREL score	Low ACE	High ACE	*t*	*df*	*p*
ORA mean score	*M* = 4.42	*M* = 3.50			
	SD = 1.30	*SD* = .55	1.686	30	.102
	n = 26	*n* = 6			
NORA max score	*M* = 3.77	*M* = 2.50			
	SD = 1.63	*SD* = 1.64	1.715	30	.097
	n = 26	*n* = 6			
Intrinsic religiosity	*M* = 11.73	*M* = 8.83			
	SD = 3.05	*SD* = 2.99	2.102	30	.044
	n = 26	*n* = 6			

Note. DUREL = Duke University Religion index; ORA = Organizational Religious Activity; NORA = Non-Organizational Religious Activity; ACE= Adverse Childhood Experiences questionnaire.

Appendix A

Adverse Childhood Experience Questionnaire

This Questionnaire will be asking you some questions about events that happened during your childhood; specifically the first 18 years of your life. The information you provide by answering these questions will allow us to better understand problems that may have occurred early in your life and allow us to explore how those problems may be impacting the challenges you are experiencing today. This can be very helpful in the success of your treatment.

While you were growing up, during your first 18 years of life:

1. Did a parent or other adult in the household often:

   Swear at you, insult you, put you down, or humiliate you?

   OR

   Act in a way that made you afraid that you might be physically hurt?

☐ Yes

☐ No

2. Did a parent or other adult in the household often:

Push, grab, slap, or throw something at you?

OR

Ever hit you so hard that you had marks or were injured?

☐ Yes

☐ No

3. Did an adult or person at least 5 years older than you ever:

Touch or fondle you or have you touch their body in a sexual way?

OR

Attempt or actually have oral, anal, or vaginal intercourse with you?

☐ Yes

☐ No

4. Did you <u>often</u> feel that:

No one in your family loved you or thought you were important or special?

OR

Your family didn't look out for each other, feel close to each other, or support each other?

☐ Yes

☐ No

5. Did you <u>often</u> feel that:

You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you?

OR

Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?

☐ Yes

☐ No

6. Were your parents <u>ever</u> separated or divorced?

☐ Yes

☐ No

7. Were any of your parents or other adult caregivers:

Often pushed, grabbed, slapped, or had something thrown at them?

OR

Sometimes or often kicked, bitten, hit with a fist, or hit with something hard?

OR

Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?

☐ Yes

☐ No

8. Did you live with anyone who was a problem drinker or alcoholic, or who used street drugs?

☐ Yes

☐ No

9. Was a household member depressed or mentally ill, or did a household member attempt suicide?

☐ Yes

☐ No

10. Did a household member go to prison?

☐ Yes

☐ No

Note. From “Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults: The Adverse Childhood Experiences (ACE) Study,” V. J. Felitti, R. F. Anda, D. Nordenberg, D. F. Williamson, A. M. Spitz, V. Edwards, M. P. Koss, & J. S. Marks, (1998). *American Journal of Preventive Medicine, 14*(4), pp. 245–258. (doi:10.1016/S0749-3797(98)00017-8). Copyright 1998 Elsevier Science Inc.

Appendix B

Consent Form

In this study, we will ask you to complete several surveys and engage in a relaxation exercise. Additionally, your heart rate and electrodermal activity will be recorded as you complete the surveys and exercise. All information and data you provide will remain confidential. Your participation is completely voluntary, and we appreciate your time and effort. Some of the surveys you complete today may be distressing. If for any reason during this study you do not feel comfortable, you may stop the study. Your participation in this study will require approximately 30 minutes. When the study is complete, you may reach out to us for the results of the study, as well as any questions you may have. If these questions bring up issues you would like to discuss further, the George Fox University Health and Counseling Center has professional counselors. Personal counseling is confidential, services are free to students on a short-term basis, and the contact information is listed below.

If you have any further questions concerning this study, please feel free to contact us through email: Nick Cherry at ncherry19@georgefox.edu.

If you have questions about your rights as a research participant, contact Dr. Ken Logan at klogan@georgefox.edu.

The Health and Counseling Center is at 200 N River St, Newberg, OR 97132, and can be reached Monday - Friday 8:30 a.m. to 4:00 p.m. at (503) 554-2340.

Appendix C

Demographics Questionnaire

1. How old are you?

   □ 18 – 25

   □ 25 -40

   □ 40+

2. What was your gender at birth?

   □ Male

   □ Female

   □ Prefer not to say

3. How would you describe your gender?

   □ Male

   □ Female

   □ Other (please specify) _____

   □ Prefer not to say

4. What is the highest level of education you have completed?

   □ High school diploma

   □ Bachelor's degree

   □ Master's degree

   □ Doctoral degree

   □ Trade School

   □ Prefer not to say

5. How many years have you been enrolled for your current degree?

□ 1st year

□ 2nd year

□ 3rd year

□ 4th year

□ 5th year

□ 6+ years

6. How would you identify your religion/spiritual beliefs?

□ Christianity

□ Judaism

□ Islam

□ Buddhism

□ Hinduism

□ Other (please specify) _____

□ None

□ Prefer not to say

7. How would you best describe your racial/ethnic identity?

□ Black/African American

□ White

□ Hispanic or Latino

□ Native Hawaiian and other Pacific Islander

□ Asian

□ American Indian

□ Alaskan Native

□ Other (please specify) _____

□ Prefer not to say

8. What best describes your employment status?

□ Unemployed

□ Part-time student

□ Part-time student, part-time employed

□ Part-time student, full-time employed

□ Full-time student, part-time employed

□ Full-time student, full-time employed

□ Full-time student

9. What is your father/guardian's occupation?

□ _____

10. What is your mother/guardian's occupation?

□ _____

11. How often do you exercise?

□ 0 times a week

□ 1-3 times a week

□ 4-7 times a week

12. Are you married?

□ Married

□ Partnered

□ Single

□ Prefer not to say

Appendix D

Survey

This Questionnaire will be asking you some questions about your childhood; specifically the first 18 years of your life.

While you were growing up, during the first 18 years of life:

1. Did you often participate in sports?

☐ Yes

☐ No

2. Did you often engage in artistic activities?

☐ Yes

☐ No

3. Did you often engage in outdoor activities?

☐ Yes

☐ No

4. Did you often play video games?

☐ Yes

☐ No

5. Did you often use social media?

☐ Yes

☐ No

6. Did you often read for pleasure?

☐ Yes

☐ No

7. Did you often play or practice music?

☐ Yes

☐ No

8. Did you participate in Boy Scouts or other youth groups?

☐ Yes

☐ No

9. Did you attend church or a church group?

☐ Yes

☐ No

10. Did you travel outside of the state where you were born?

☐ Yes

☐ No

Appendix E

AAQ-II

Below you will find a list of statements. Please rate how true each statement is for you by using the scale below to fill in your choice.

1	2	3	4	5	6	7
Never True	**Very Seldom True**	**Seldom True**	**Sometimes True**	**Frequently True**	**Almost Always True**	**Always True**

1. My painful experiences and memories make it difficult for me to live a life that I would value.

   1 2 3 4 5 6 7

2. I'm afraid of my feelings.

   1 2 3 4 5 6 7

3. I worry about not being able to control my worries and feelings.

   1 2 3 4 5 6 7

4. My painful memories prevent me from having a fulfilling life.

   1 2 3 4 5 6 7

5. Emotions cause problems in my life.

   1 2 3 4 5 6 7

6. It seems like most people are handling their lives better than I am.

   1 2 3 4 5 6 7

7. Worries get in the way of my success.

   1 2 3 4 5 6 7

Note. From “Preliminary Psychometric Properties of the Acceptance and Action Questionnaire-II: A Revised Measure of Psychological Inflexibility and Experiential Avoidance,” F. W. Bond, S. C. Hayes, R. A. Baer, K. M. Carpenter, N. Guenole, H. K. Orcutt, T. Waltz, & R. D. Zettle, (2011), *Behavior Therapy*, *42*(4), pp. 676–688. (https://doi.org/10.1016/j.beth.2011.03.007).

Appendix F

The Duke University Religion Index (DUREL)

Please mark the answer that best describes your religious involvement.

1. How often do you attend church or other religious meetings?

    1 – Never

    2 – Once a year

    3 – A few times a year

    4 – A few times a month

    5 – Once a week

    6 – More than once per week

2. How often do you spend time in private religious activities, such as prayer, meditation, or Bible study?

    1 – Rarely or never

    2 – A few times a month

    3 – Once a week

    4 – Two or more times per week

    5 – Daily

    6 – More than once a day

The following section contains 3 statements about religious belief or experience. Please mark the extent to which each statement is true or not true for you.

3. In my life, I experience the presence of the Divine (*i.e.*, God)

    1 – Definitely *not* true

    2 – Tends *not* to be true

    3 – Unsure

4 – Tends to be true

5 – Definitely true of me

4. My religious beliefs are what really lie behind my whole approach to life

   1 – Definitely *not* true

   2 – Tends *not* to be true

   3 – Unsure

   4 – Tends to be true

   5 – Definitely true of me

5. I try hard to carry my religion over into all other dealings in life

   1 – Definitely *not* true

   2 – Tends *not* to be true

   3 – Unsure

   4 – Tends to be true

   5 – Definitely true of me

Note. From "The Duke University Religion Index (DUREL): A Five-Item Measure for Use in Epidemological Studies," H. G. Koenig & A. Büssing, (2010). *Religions*, *1*(1), pp. 78–85. (https://doi.org/10.3390/rel1010078). Copyright 2010 by Koenig & Bussing, MDPI.

Nicholas Cherry
George Fox University
2311 SE Ankeny Street, Portland, OR 97214
(916) 626-0958
ncherry19@georgefox.edu

Education

Doctor of Psychology, Clinical Psychology 2024
George Fox University
APA Accredited
Dissertation: The Effect of Completing ACEs Questionnaire on the Sympathetic Nervous System Preliminary Defense: May 12, 2022
Final Defense: May 15, 2024

Master of Arts, Clinical Psychology 2021
George Fox University

Bachelor of Arts in Psychology 2019
Point Loma Nazarene University

Professional Experience

Predoctoral Intern June 2023 – June 2024
Wasatch Behavioral Health
Supervisors: Jennifer Rogers, PsyD; Derra Gullickson, PsyD
Conduct intake evaluations and provide empirically validated individual therapy to clients with low socioeconomic status in a community mental health setting, with a specific focus on training in Acceptance and Commitment Therapy and Motivational Interviewing. Administer psychological batteries and complete integrated reports for a variety of presenting issues, including ADHD, PTSD, ASD, and personality disorders. Perform disability evaluations for clients. Engage in weekly individual and group supervision with licensed psychologists focused on therapy and assessment cases. Provide weekly peer supervision. Attend weekly didactic training on various clinical topics. Connect clients with community resources to support their therapeutic treatment.

Practicum Therapist September 2022 – June 2023
Oregon State University CAPS
Supervisors: Ozge Akcali, PhD; Samuel Davis, PhD; Matthew Jones, PhD
Provide brief individual therapy to diverse students in a university setting. Experience and training utilizing Titanium software for intake and progress notes. Training on Collaborative Assessment and Management of Suicidality (CAMS) and APA Telehealth Best Practices. Receive individual and group supervision from a licensed

psychologist emphasizing diversity and case conceptualization from an Acceptance and Commitment Therapy framework.

Practicum Therapist July 2021 – August 2022
Hazelden Betty Ford Foundation
Supervisor: Dr. Brandi Schmeling Smith, PhD

Conducted clinical interviews and mental health assessments with new patients. Provided trauma-informed individual therapy with adults with severe substance abuse difficulties while in in-patient care. Led weekly psychoeducation and processing groups surrounding topics such as relationships, coping skills, and trauma. Received individual and group supervision from a licensed psychologist. Completed mental health reports including diagnoses and treatment plans for individual patients.

Behavioral Health Intern July 2020 – June 2021
Willamette Valley Medical Center – Bariatric Surgery/Senior Behavioral Health Unit
Supervisor: Dr. Luann Foster, PsyD

Evaluated behavioral change and mental health of individuals preparing for weight loss surgery. Administered, scored, and interpreted several assessments including the Personality Assessment Inventory, ACEs questionnaire, and Binge-Eating Scale. Provided individual therapy and psychoeducation to help patients make lifestyle changes necessary for surgery or cope with their severe mental health symptoms. Led psychoeducational groups for pre-and post-surgery patients. Received individual and group supervision from a licensed psychologist. Administered, scored, and wrote neuropsychological reports for geriatric patients.

Pre-Practicum Therapist January 2020 – April 2020
George Fox University
Supervisors: Jo Crowl, MA, QMHP; Dr. Glena Andrews, Ph.D., MSCP, ABPP

Developed skills in person-centered therapy and telehealth therapy. Received constructive video supervision from student supervisor. Performed clinical interviews and wrote concise intake reports. Completed ten sessions of individual therapy for two undergraduate students.

Intern September 2018 – May 2019
La Mesa Counseling/Rhombus Counseling
Supervisor: Dr. Julie Hayden, Psy.D., MRS, MACP

Shadowed licensed counselor in group sessions with court-ordered domestic violence clients and debriefed with therapist/counselor on insights from the sessions. Completed paperwork and administrative tasks to maintain an organized office. Used Excel and Google Docs/Sheets to create shortcuts for therapists, counselors, and psychologists in the office. Observed the administration and interpretation of psychological tests such as the WAIS-IV.

Small Group Counselor August 2018 – December 2018
Point Loma Nazarene University
Supervisor: Dr. Joel Sagawa, Ph.D.

Led weekly meetings with 11 freshman students to help them transition to college. Fostered a community of support among the group to proactively address common struggles such as adjusting to independence. Participated in biweekly supervision meetings with other small group leaders to further personal growth and counseling skills.

Research Experience

Researcher, Psychotherapy for Anxiety Changes Neurophysiological Activation in Athletes
George Fox University September 2019 - Present
Supervisor: Dr. Glena Andrews, Ph.D., MSCP, ABPP

- Trained to record EEG data for control group of student athletes
- Co-authored abstract summarizing findings of the study
- Poster presentation at National Academy of Neuroscience Annual Conference on October 14, 2020

Student Researcher, Advanced Research Course August 2018 – May 2019
Point Loma Nazarene University
Supervisor: Dr. Kim Schaeffer, Ph.D.

- Researched previous studies and information related to effects of political manipulation
- Designed study on the effects of political affiliation on people's reaction to political tweets
- Developed surveys using Qualtrics
- Analyzed data with Excel and JASP
- Prepared poster board to present at 2019 WPA convention

Student Researcher, Research Methods and Design Course January 2017 – December 2018
Point Loma Nazarene University
Supervisor: Dr. Kim Schaeffer, Ph.D.

- Conducted literature review on previous research on brands
- Cooperated with team members to design study on the power of brand marketing on choice
- Practiced using JASP and Excel to analyze sets of data
- Collected data needed to analyze for statistical significance
- Completed formal write-up for research study and present to PLNU faculty and students

Professional Training

- Schwartz, J. (May 7, 2021). Challenging myths about Autism – what assessors and therapists need to know: Lessons from the neurodiversity movement. The Chicago School of Professional Psychology Office of Continuing Education. https://tcsppofficeofce.com/courses/challenging-myths-about-autism-what-assessors-and-therapists-need-to-know-lessons-from-the-neurodiversity-movement/
- Maheu, M. M. (October, 2019). Telepsychology Best Practices 101. American Psychological Association Continuing Education in Psychology. https://apa.content.online/catalog/product.xhtml?eid=15132
- Jobes, D. (n.d.) Collaborative Assessment and Management of Suicidality, CAMS-Care. https://cams-care.com/
- Wendy Bourg, PhD. Intractable conflict in families and society: What do we know about healing the rifts, Colloquium, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. February 2, 2022.
- Chloe Ackerman, PsyD. Gender diverse clients: Therapy and intervention readiness assessments. Grand Rounds, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. March 10, 2021.
- Jason Stewart, PhD. Complex PTSD: Advanced case conceptualization, assessment, and treatment approaches in trauma populations. Colloquium, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. November 4, 2020.
- Justin Lee, PhD. Examining the role of neuropsychology within the pediatric cancer setting. Grand Rounds, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. October 14, 2020.
- Amy Stoeber, PhD. Child adverse events to adults with substance use problems. Grand Rounds, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. February 14, 2020.
- Kyler Murray, PsyD; Daniel Wendler, PsyD. George Fox University Leadership Workshop. Training, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. February 1, 2020.
- Cheryl Forster, PsyD. Intercultural prerequisites for effective diversity work. Colloquium, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. October 15, 2019.

Presentations

- Cherry, N.; Morgan, K.; Larson, K.; Andrews, G.; Shumway, K. (2020). “Sports Anxiety Scale-2: More sensitive to college athlete anxiety”. Poster presented virtually at National Academy of Neuropsychology.

- Cherry, N.; Carder, B.; Schaeffer, K.; Butterfield, M. (2019) "Personality or Policy: Do People Agree More with Who Said it or What They Said?". Poster presented at Western Psychological Association Conference, Pomona, CA.
- Guest Lecturer: Valiente-Neighbours, J.; Hojsack, D. (2019). "Cross-Campus, High-Impact Learning with a Diversity Focus: A Partnership between General Education Sociology and Community Ministries". [PowerPoint]. Council for Christian Colleges and Universities Diversity Conference, Newberg, OR.

Relevant Work-Related Experience

Teacher's Assistant: Substance Abuse August 2022 -- Present
George Fox University
Supervisor: Dr. Jory Smith, PsyD

- Help facilitate class discussion on the impact of trauma on the autonomic nervous system and addictive behaviors
- Organize resources for students and manage the Canvas page
- Grade assignments and provide constructive feedback on students' progress

Adolescent Group Counselor - Part Time June 2021 – January 2022
Madrona Recovery
Supervisor: Natalie Cain, BS

- Developed group curriculum for adolescents struggling with severe mental health or substance abuse difficulties
- Led several groups on a range of topics including psychoeducation, trauma, coping skills, emotional regulations, and others.
- Deescalated verbal and physical conflict between youth utilizing verbal de-escalation and Crisis Prevention Institute training
- Collaborated with fellow staff members on treatment planning and managing the psychological needs of patients
- Completed documentation regarding events of groups and any necessary interventions

Teacher's Assistant: Advanced Counseling August 2020 – December 2020
George Fox University
Supervisor: Dr. Kris Kays, PsyD

- Fostered a healthy learning environment where undergraduate students advanced their basic clinical skills
- Review mock counseling video sessions for three students and provided feedback to develop their understanding of building a therapeutic relationship
- Collaborated with students on learning goals for each class and facilitated discussions based on the objectives and topics

Homeless Ministry Leader August 2018 – May 2019
Point Loma Nazarene University
Supervisor: Dana Hojsack

- Managed groups of 15 students from the university in weekly trips to downtown San Diego to feed, engage, and encourage those in the unsheltered population
- Participated in leadership training to include such skills as diversity training, communication, stress management, and group dynamics
- Collaborated with co-leader in creating an effective ministry that represents and promotes the organization's values

Summer Sales Intern 2017
Crowd Hub Apps
Supervisor: Peter Hodgen

- Partnered with Vice President of Sales and developed lead strategies and identified future clients to contact via email marketing Crowd Hub's services
- Researched, canvassed, and cultivated leads utilizing various sources such as LinkedIn and Guidestar
- Connected with potential clients via email to introduce and market Crowd Hub's services including design and application development and brand awareness consulting

Honors and Awards

George Fox University

Student Wellness Committee	Fall 2019 -- Present
American Psychological Association Member	Fall 2019 – Present
Trauma Certificate	Fall 2022

Point Loma Nazarene University

President's Academic Scholarship	August 2016 – May 2019
Dean's List	August 2016 – May 2019