5-6-2021

Does Duration Matter?: Assessing the Role of Duration in Adverse Childhood Experiences

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by

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Honors Thesis

Submitted to:

Psychology Department

University of Richmond

Richmond, VA

May 6, 2021

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Acknowledgements

I would first like to express my deepest gratitude to my advisor and mentor, Dr. Laura Knouse, whose guidance has been invaluable in completing this research over the past year. Her dedication to the project every step of the way has been greatly appreciated.

I would also like to extend my thanks to Dr. Kristjen Lundberg, who first allowed me the opportunity to explore this topic. Her constant support throughout this project has been a very real source of inspiration. On a similar note, I would like to give my sincerest thanks to my family and friends who have been such valuable sounding boards every step of the way on this project.

Finally, I would like to thank my funding sources: The John. F. Neasmith Dickinson Award and the University of Richmond Arts & Sciences Undergraduate Research Grant. Thank you to members of their committees for awarding me these grants, as I could not have been able to complete this work without them.

Abstract

Introduction: Adverse childhood experiences (ACEs) are associated with several negative physical and mental health outcomes in adulthood (Felitti et al., 1998). However, a criticism of the ACEs measure is that it does not account for the duration of these events (McLennan et al., 2020). Thus, I aim to replicate previous ACE findings and determine whether an ACEs measure accounting for duration is a better predictor of mental health outcomes.

Methods: 244 adult participants reported on their ACEs with duration and their mental and physical health. Three ACE scales were formulated: the traditional ACEs scale, and two duration-based scales, ACEs Years Total and Years with Trauma.

Results: The traditional ACEs measure was significantly associated with all of the tested mental and physical health outcomes, while most duration-accounting measures did not reach significance. A test of difference between two dependent correlations revealed that the traditional ACEs measure is a better predictor of all mental health outcomes than the duration-accounting measures ($p < .05$). An exploratory analysis of those with non-zero amounts of ACEs revealed that more ACEs duration was associated with less negative mental health symptoms, the opposite pattern than expected.

Conclusion: Associations between ACEs traditional and the mental and physical health outcomes is consistent with previous literature. This work provides evidence that the traditional ACEs scale is more effective at predicting outcomes than measures that account for duration, which may be due to validity problems in duration measures. Future research should aim to further evaluate the role of duration in ACEs.

Does Duration Matter?: Assessing the Role of Duration in Adverse Childhood Experiences

Childhood, while encompassing only the beginning years of one's life, has a massive potential to shape the course of the rest of life. This is especially the case for negative experiences, also known as childhood stressors. Such events can lead to trauma based on subjective appraisal of the event, leading to severe emotional and mental stress without resolution (Finkelhor et al., 2013). According to the American Psychological Association (2017), trauma "involves events that pose significant threat (physical, emotional, or psychological) to the safety of the victim or loved ones/friends and are overwhelming and shocking," (ES-3). Such experiences can result in long-term effects on the mental and physical health outcomes of the person who experienced the event (Krupnik, 2018). These events may occur any time over the course of one's life, but of particular interest in the current study is experiences that occur during childhood. Some, but not all, of the events that have these effects are encompassed by adverse childhood experiences (ACEs).

Adverse childhood experiences include a variety of negative experiences that occur prior to the age of 18, including several types of abuse as well as parental substance use, incarceration, divorce/separation, and mental illness (Whitfield, 1998). Such events have been previously correlated with several undesirable physical and mental health outcomes. In the first study to characterize the conventional ACEs, a massive study of over 14,000 adults, it was found that persons with a self-report of more than four ACEs had an increased risk for outcomes such as depression (4.6x), suicide attempts (12x), smoking (2x), sexually transmitted infections (2.5x), drug (4.7x) and alcohol abuse (7.4x) severe obesity (1.6x), and more compared to those with no ACEs (Felitti et al., 1998).

In addition to ACEs overall being correlated with negative outcomes, they can be described by two dimensions: household dysfunction and abuse, both of which have been individually associated with undesirable outcomes as an adult. For instance, childhood physical, sexual, and psychological/emotion abuse, which comprise the abuse dimension of ACEs, have each been individually associated with an increased risk for depression in adulthood (Ferguson & Dacey, 1997; Goldberg, 1994). Within the category of household dysfunction is household alcohol abuse, household substance abuse, parental domestic violence, parental separation/divorce, household mental illness, and household member incarceration. Previous research has provided significant evidence that many of the ACEs is this category are also associated with negative outcomes. For instance, research has shown that children of those who abuse drugs and/or alcohol have decreased behavioral control, increased neuroticism, and increased psychiatric distress compared to children who were raised in households with no alcohol or drug abuse (Sher et al., 1991). These categories allow for more discrete characterization of outcomes, but ACEs regardless of subcategory are still highly and directly correlated with an increased risk of depression over the course of one's life (Chapman et al., 2004).

But *how* do ACEs contribute to these adverse outcomes in adulthood? This falls under the conceptual framework of ACEs being experienced early in life and leading to a lifetime of dysfunction, ultimately leading to disease and earlier death compared with those with fewer ACEs (Felitti et al., 1998). Specifically, the proposed model states that adverse childhood experiences lead to social, emotional, and cognitive impairment, then leading to the adoption of health-risk behaviors that result in disease and ultimately earlier death than those with fewer ACEs. For example, adverse childhood experiences have been associated with an increased risk

of smoking, which then can cause outcomes such as lung cancer and other smoking-related diseases, which may cause an early death in that smoker (Felitti et al., 1998). And this is not the only way that this model has been supported in literature. Other research has shown that childhood trauma such as ACEs disrupt emotional processing leading to emotion regulation difficulties, thus causing social and emotional impairment that persists into adulthood (Marusak et al., 2015). Depression is thought to be a disorder of impaired emotion regulation, and those with depression have been showed to adopt behaviors that are riskier to overall health (Asarnow et al., 2014; Joormann & Gotlib, 2010; Katon et al., 2010). All of these health risk behaviors then can lead to an earlier death compared to those who had fewer adverse events during childhood.

Unfortunately, these outcomes are not seen in only a small sect of the population. At the time of the original study, over half of the participants reported experiencing at least one ACE, with more recent large-scale studies reporting that more than 60% of participants have experienced at least one ACE (Felitti et al., 1998; Merrick et al., 2018). Moreover, nearly a quarter of the sampled population in the more recent study reported three or more ACEs, with a disproportional number of ACEs found in minority, disabled, and high poverty participants (Merrick et al., 2018). Given the high prevalence of ACEs in the United States, understanding the outcomes associated with them and the factors that may exacerbate or mitigate these outcomes is of extreme importance to both the physical and mental wellbeing of adults across the country, especially those in already marginalized communities.

One of the primary fields that ACE research has been utilized is in intervention science (Fortson et al., 2016). By better understanding adverse childhood outcomes and the specific factors that make them so damaging, better interventions can be implemented in order to either prevent ACEs from occurring in the first place or to alleviate their effects in adults. For instance,

recent work has focused on coping processes that contribute to health improvement in those with many adverse childhood events. Such work not only presents advantage on the individual and community level, but also presents significant economic savings on a national level (Larkin et al., 2014). Thus, the better we measure and understand adverse childhood experiences, the better these interventions can become, directly increasing personal and community outcomes as a result.

Despite the promise that the ACE questionnaire has shown in predicting a plethora of adult mental and physical health outcomes, a few critiques have been made of the scale. One such criticism addresses the response format in which ACE questionnaires are most commonly administered and assessed. Traditionally, the ACE questionnaire asks about experiences in a dichotomized "yes/no" format, with a final "ACE score" being the sum of nine childhood experiences (McLennan et al., 2020). By assessing potentially traumatic experiences in a dichotomous manner, there is a potential to lose valuable information that may better predict outcomes, such as the duration or intensity of the experiences. For example, the Conflict Tactic Scales, from which many ACE questions were adapted, allows for responses that captured the frequency of exposure to those events (McLennan et al., 2020). By removing the nuance of these original questions, it calls into question whether the ACEs scale is as valid as the scales from which many ACEs were adapted. Despite this potentially consequential deviation, little ACE literature has focused on whether the duration of these experiences throughout childhood matters.

Research evaluating the relationship between duration and intensity of trauma exposure and post-traumatic stress disorder (PTSD) provides support for such a hypothesis. For instance, Buydens-Branchey et al. (1990) found a significant relationship between duration of combat

exposure and the persistence of PTSD symptoms in Vietnam War veterans. A later meta-analysis examining post-traumatic stress symptoms (PTSSs) in survivors of mass shootings also found that greater exposure to the potentially traumatic event was associated with increased PTSSs (Wilson, 2014). These studies, along with a number of other studies evaluating PTSD, provide strong support for a dose-response relationship between duration of exposure to an event and its outcomes, where more exposure to an event (in duration or intensity) is associated with an increased risk for the later development of negative outcomes.

At this point, it is important to define dose-response relationships in relation to both ACEs literature and PTSD literature. ACEs literature has traditionally characterized ACEs and outcomes as having a dose-response relationship, where a higher number of distinct ACEs is correlated with an increased risk for negative outcomes such as depression (Felitti et al., 1998). However, literature on PTSD had traditionally characterized the duration and intensity of an event (or series of events) as the "dose," where increased exposure in either time or intensity corresponds to an increased risk of PTSD (Kaysen et al., 2010). As aforementioned, both of these dose-response relationship models have been empirically supported. However, there is little work examining a duration-related dose-response relationship in relation to adverse childhood experiences.

With all of this in mind, I formulated two primary research aims. The first aim was to replicate previously studied relationships between adverse childhood experiences and their related mental and physical health outcomes. Accordingly, I predicted that there would be a positive correlation between traditional ACEs, depression, anxiety, and difficulties and emotion regulation. Furthermore, I predicted that having four or more ACEs would be associated with an increased odds of developing heart disease, severe obesity, cancer, stroke, and diabetes with an

increased risk of smoking. Secondly, I aimed to determine whether an ACEs measure that accounts for the duration of exposure to the ACE events better predicts those outcomes. As a part of this aim, I expected that duration ACEs measures would also correlate positively with depression, anxiety, and difficulties in emotion regulation, but I did not make *a priori* predications about which measure I expected to be the best predictor of these outcomes. To examine these research aims, I recruited participants to take a brief online survey on their mental and physical wellbeing as well as their ACE prevalence (in occurrence and number of years experienced during childhood). Responses were used to formulate two new duration-accounting ACE measures to compare to the traditional ACE measure.

Methods

Participants

Participants were recruited through Amazon Mechanical Turk (MTurk) for a study entitled "Childhood Experiences and Mental Health." All recruited participants were required to have a 95% or higher acceptance rate of previously submitted work and reside in the U.S. 247 participants were recruited for the study, but 3 participants were removed from analysis due to failure to correctly pass the first attention check (see below). The final participant pool included 244 American adults between the ages of 21 and 77 (M = 38.38, SD = 10.98). 58.2% identified as male (N = 142), 41.0% identified as female (N = 100), and 0.80% (N = 2) identified as genderqueer or gender non-conforming. The sample included 59.4% of participants self-reporting as Caucasian, 20.1% reporting as African American, 4.5% reporting as Asian, 11.1% reporting as Hispanic or Latinx, and 4.9% reporting a different ethnic or racial identity.

Procedure

Prior to survey administration, the study was approved by the University of Richmond Intuitional Review Board (IRB). All participants provided informed consent before their participation in the study. Before completing the survey, participants were given an attention check in which they were instructed to select a specific response from a list of possible responses. If they failed the first attention check, they were instructed to re-read the instructions and given another chance to complete the attention check. Participants could proceed after the second attention check regardless of pass status, but those who failed were again instructed to read the questions more carefully moving forward. Each participant then completed a battery of self-report measures assessing their childhood experiences and current emotional and physical health outcomes. Detailed information on each measure can be found below, as well as in Figure 1.

Mental health measures included those probing for depression, difficulties in emotion regulation and anxiety. Physical health outcomes included smoking and alcohol use as well as the occurrence of heart attack, heart disease, stroke, asthma, cancer, COPD, kidney disease, diabetes, and obesity. Demographic information was collected regarding household income, employment status, educational attainment (self and parental), age, gender identity, and race/ethnicity. After this information was collected, participants were provided with an introduction to ACEs and asked to complete a sample question with a specified answer, which served as the second attention check for this study. This question asked participants the question, “Before the age of 18, did you attend school?” Regardless of actual experience, they were asked to select “Yes.” Then, a follow up question asked participants to indicate the childhood years in which they attended school. Again, regardless of actual experience, they were instructed to select the years, “Younger than 1,” “8,” and “15.” If they did not select these responses, they were

indicated to have failed this attention check. Participants then completed the Adverse Childhood Experiences measure as adapted from Ford et al. (2014), along with a measure specifically probing for the years during childhood when each specific ACE occurred (Figure 1). Following study completion, participants read a debriefing statement and entered a code on Mechanical Turk to receive $3.00 in compensation for their time.

Measures

The specific constructs of interest for this study were adverse childhood experiences (Adverse Childhood Experiences questionnaire; ACE), depression (Center for Epidemiologic Studies-Depression scale; CES-D), anxiety (GAD-7 scale), difficulties in emotion regulation (Difficulties in Emotion Regulation Scale – Short Form; DERS-SF), and physical health (adapted from the Behavioral Risk Factor Surveillance System; BRFSS).

Depression. The CES-D uses 14 items to measure depressive symptoms in the past week on a 4-point Likert scale with scores ranging from 0 (rarely or none of the time) to 3 (most or all of the time) (Carleton et al., 2013). Sample questions include, “I had trouble keeping my mind on what I was doing,” and “I enjoyed life [reverse coded].” Previous studies have shown this measure to have good internal consistency, test-retest stability, and concurrent validity with other measures of depression (Cosco et al., 2017). After reverse-scoring necessary items, responses were averaged to create a composite score where a higher average indicated higher depressive symptoms. Internal consistency in this sample pool was excellent (α = .91).

Anxiety. The GAD-7, from Spitzer et al. (2006), uses 7 items to assess how often a participant was bothered by a number of anxiety symptoms over the past two weeks on a 4-point Likert scale with scores ranging from 0 (not at all) to 3 (nearly every day). This scale has shown

good reliability and validity (Spitzer et al., 2006). Sample items include "feeling nervous, anxious, or on edge," and "feeling afraid as if something awful might happen." Responses were summed to create a total anxiety score ranging from 0 to 21, where a higher score indicated higher anxiety symptoms. Internal consistency in this sample pool was excellent (α = .92).

Emotion Regulation. The DERS-SF, from Kaufman et al. (2016), uses 18 items to measure emotion regulation, specifically six subscales of emotional regulation: access to emotion regulation strategies, non-acceptance of feelings, impulse control, goal interference, emotional awareness, and emotional clarity. Responses were scored on a five-point scale ranging from Almost Never (1) to Almost Always (5). Sample questions include "When I'm upset, it takes me a long time to feel better," and "I pay attention to how I feel [reverse coded]," (Kaufman et al., 2016). After reverse-scoring necessary items, responses were averaged to create a composite score where a higher average indicated more difficulties in emotion regulation. Previous research by Kaufman et al. (2016) has found this to be a reliable and valid scale, with excellent internal consistency in this sample pool as well (α = .94).

Physical Health. A subset of questions were adapted from the Behavioral Risk Factor Surveillance System (BRFSS) to probe for physical health status (Centers for Disease Control and Prevention (CDC), 2019). The BRFSS is an annual telephone survey that is conducted nationally to gather information on health and health-related behaviors in U.S. residents. Questions included those relating to the occurrence of heart disease, stroke, asthma, cancer, COPD, kidney disease, diabetes, and smoking and alcohol use. Questions relating to health conditions were asked in a yes/no format, with yes indicating the presence of such a condition. Smoking and alcohol use asked participants to report on the extent that they partake in smoking

and drinking behaviors. If participants indicated that they smoked, they were asked about the age at which they began to smoke, whether they currently smoke, and how many cigarettes they consume a day if they currently smoke. For alcohol use, participants were asked to indicate how many days per month/week they drink, how many drinks they have when they drink, and days of heavy drinking in the previous 30 days.

Adverse Childhood Experiences. The ACE Questionnaire, as adapted from Ford et al., (2014) contains 11 items that correspond to nine types of adverse childhood experiences, including household mental illness, household alcohol and substance abuse, household incarceration, parental separation or divorce, physical abuse, domestic violence, emotional abuse, and sexual abuse. Participants were first asked if they have experienced any of the indicated events before the age of 18 in a yes/no format. Sample questions include "Did you live with anyone who was a problem drinker or alcoholic?" and "Were your parents separated or divorced?" Unlike previous ACE measures, this study added that if participants indicated that they had a particular experience, they were then asked to check a box for each of the ages in which they had that experiences from younger than 1 to 17 (see Figure 1).

Plan of Analysis

Pre-registered methods and analyses can be found at https://osf.io/p23y8. As indicated in my pre-registration, I planned to exclude data based on failure to complete one of the two attention checks within the study. However, this procedure unexpectedly screened out nearly one half of the sample pool (120 of 247 participants). Most participants who failed an attention check failed the second check (see Procedure). Further analysis indicated that there were very few differences in the pattern of results between the fully screened participant pool and the

participant pool that contained only those who failed the second attention check (see Tables 2 and 3). As such, the results reported below include the larger sample pool (of 244 participants) in order to increase statistical power.

The ACE measure was used to calculate three separate composite scores, each with different components of the experience emphasized. The first measure replicated the traditional way method of summarizing ACEs. This method summarized the items into a dichotomous occurrence score (Yes/No) and a sum of events was taken, which I refer to here as a "Traditional ACEs" Score. The second measure emphasized a combination of the experience occurring and the amount of time during childhood that each ACE occurred. To calculate this measure, a total number of years that a participant experienced ACEs was summed, where the final value was the sum of the number of years each ACE was experienced, giving a possible range of scores between 0 and 162 (Since each of the 9 ACEs could be experienced between 0 and 18 years during childhood). The measure is referred to as "ACEs Years Total." A final measure adapted from this scale was "Years with Trauma," which indicated how many years during childhood (out of 18 possible years) that a person had experienced at least one ACE.

I examined scatterplots of bivariate relationships between continuous variables, which supported the presence of a linear relationships between variables. However, in accordance with the study pre-registration, both Pearson's R Coefficients and Spearman Rank Order Correlations were calculated for the relationship between ACEs (each of the three scores) and depression, anxiety, and difficulties in emotion regulation. While not specified in the pre-registration, the traditional measure of ACEs was further refined into categories based on whether the participant had 0, 1, 2, 3, or 4+ ACEs, in order to precisely replicate the analyses conducted by Feletti, et al. (1998). A logistic regression was conducted using this measure with reported health outcomes to

calculate adjusted odds ratios controlling for age, gender, race, and educational attainment and to replicate previous findings. Finally, an r-to-z transformation for two dependent correlations was used to compare the correlation coefficients between the depression, anxiety, and difficulties in ER with the various ACE measures (Lee & Preacher, 2013).

Results

Primary Findings

Approximately 28% of this sample population had no ACE exposures with nearly 35% of participants having four or more ACEs (Table 1). The most common experiences included emotional abuse (42.2%), parental mental illness (36.1%), and divorce (35.7%), although all of the ACEs were prevalent across participants. These three were followed by 35.2% of participants experiencing parental alcohol abuse, 32.4% experiencing physical abuse, 28.3% witnessing parental domestic abuse, 24.2% experiencing sexual abuse, 18.4% witnessing parental drug use, and 17.6% experiencing parental incarceration. Replicating previous findings, the traditional ACE measure was significantly correlated with depression ($r = .38$, $p < .001$), anxiety ($r = .43$, $p < .001$), and difficulties in emotion regulation ($r = .41$, $p < .001$). Furthermore, those with 4 or more ACEs faced an increased likelihood of smoking (aOR, 6.56; 95% CI, 2.93-14.70), heart disease (aOR, 24.60; 95% CI, 3.13-193.07), cancer (aOR, 6.36; 95% CI, 1.69-23.98), stroke (aOR, 7.71; 95% CI, 1.97-30.28), and diabetes (aOR, 21.29; 95% CI, 2.66-170.51) compared to those with no ACEs (Table 4). of the findings for the mental health variables were consistent in the fully screened sample as well. Because the sizes of cells were too low to calculate an adjusted odds ratio using the data from the fully screened sample pool, I was not able to replicate these analyses in that smaller sample.

The traditional measure of ACEs was also strongly correlated with the ACEs Years Total measure (r = .55, p < .001) and Years with Trauma (r = .41, p < .001), as seen in Table 2. These measures were also significantly correlated with each other (r = .85, p < .001). However, ACEs years total was not significantly correlated with depression (r = .05, p = .43), anxiety (r = -0.02, p = .74), or difficulties in emotion regulation (r = -0.11, p = .08) using a Pearson's R correlation. However, using a Spearman's rank order correlation, ACEs years total was correlated with both depression (r_s = 0.16, p = .01) and anxiety (r_s = 0.14, p = .03), but these correlations were smaller in magnitude than the correlations with the traditional ACES measure (r_s = 0.40 and .44, respectively). The Years with Trauma measure was not significantly correlated with depression using either a Pearson (r = -.01, p = .83) or a Spearman (r_s = 0.11, p = .10) correlation. This is also true of Years with Trauma and anxiety for both a Pearson (r = -0.10, p = .11) and Spearman correlation (r_s = 0.08, p = .20). Years with Trauma is significantly correlated with difficulties in emotion regulation using a Pearson's R (r = -0.16, p = .01) but not a Spearman (r_s = 0.02, p = .74) correlation. These results are consistent with those found in the fully screened sample except for one notable exception. In the fully screened sample pool, the relationship between Years with Trauma and difficulties in emotion regulation did not reach significance (r = -.12, p = .20).

A test of difference between two dependent correlations was calculated for any mental health outcomes in which both a duration measure (ACES Years Total or Years with Trauma) and traditional ACEs were significantly correlated with it. As expected given the pattern of the results described above, a test of difference between two dependent correlations revealed that the traditional ACE measure is a significantly better predictor of depression than total years of trauma (z = 6.27, p < .001). The traditional ACE measure was also a significantly better predictor of anxiety than total years trauma (z = 7.95, p < .001). Finally, traditional ACEs was also a

significantly better predictor of difficulties in emotion regulation than Years with Trauma (z = 10.00, $p < .001$).

Exploratory Analyses

Due to the unexpected finding in which some of the duration ACEs measures did not correlate with mental health outcomes, an exploratory analysis of the larger sample pool examined depression, anxiety, and difficulty in emotion regulation outcomes in those with a non-zero ACEs years total and years with trauma score. This analysis was aimed at ruling out any possible effects that may have been masked by those with no ACEs, thus allowing me to focus on only those with at least one ACE and their outcomes. In those with non-zero responses to Years with Trauma (N = 176), more Years with Trauma was associated with *less* depression (r = -0.31, $p < .001$), anxiety (r = -0.41, $p < .001$), and difficulties in emotion regulation (r = -0.50, $p < .001$). In those with non-zero ACEs years total, more ACEs years total was also associated with *less* difficulties in emotion regulation (r = -0.34, $p < .001$) and anxiety (r = -0.24, p = .003), but was unrelated to depression (r = -0.14, p = .07). This negative correlation is the opposite of what is expected based on previous literature regarding the relationship between ACEs and these outcomes, which have been previously shown to be positively correlated (Felitti et al., 1998). Importantly, in those with a non-zero ACEs traditional score, ACEs traditional continued to be significantly related to higher levels of depression (r = 0.31, $p < .001$), anxiety (r = 0.37, $p < .001$), and difficulties in emotion regulation (r = 0.35, $p < .001$) as expected.

ACEs Across Race and Gender. In an additional attempt to replicate previous ACE findings, I wanted to explore possible differences in proportion of those who had four or more ACEs across the dimensions of gender and race (Merrick et al., 2018). It was found that the proportion of ACEs experienced did not differ by gender, X^2 (8, N = 244) = 10.46, $p > .05$. There

was a significant relationship between number of ACEs experienced and race. African American and Hispanic/Latinx participants were more likely to have four or more ACEs than White, Asian, Middle Eastern and Native American participants X^2 (20, N = 244) = 42.97, $p < .01$.

Discussion

My first research aim to replicate previously found associations between ACEs and related mental and physical health outcomes produced the expected findings. Specifically, having four or more ACEs was associated with a significantly increased risk for smoking, heart disease, cancer, stroke, and diabetes compared to those with no ACEs. The only tested physical health outcome that was noted to have a significantly increased risk of development with four or more ACEs that was not replicated in this sample was that of severe obesity. Similarly, the traditional ACEs measure was significantly and positively correlated with depression, anxiety, and difficulties in emotion regulation, which is in line with previous research.

My second research aim to determine whether an ACEs measure that accounted for duration would be a better predictor of outcomes than the traditional ACEs measure yielded findings that were much more unexpected. Specifically, this work provides evidence that the traditional ACE measure is more effective at predicting mental health outcomes than measures that account for duration in the case of depression, anxiety, and difficulties in emotion regulation. This is especially the case given that some of the duration ACE measures did not significantly correlate to the mental health outcomes examined. In fact, the exploratory analyses found that both ACEs Years Total and Years with Trauma were negatively correlated with depression, anxiety, and difficulties in emotion regulation in those with a non-zero number of ACEs, which is the exact opposite pattern of results from traditional ACE findings. From this, it may be concluded that it may not be necessary to include duration information in an ACEs

questionnaire. A possible reason that duration measures may not be as useful in predicting future outcomes as the traditional ACEs measure may be that duration information compromises the validity of the measure. For example, asking about the specific years during childhood that an ACE event may have occurred can introduce the opportunity for false reporting based on poor memory.

This concern regarding poor memory of events is especially pressing in light of research regarding trauma and memory. Elliott and Briere (1995) found that in a survey of those who reported sexual abuse during childhood, nearly half of respondents indicated a time in which they had decreased memory of the event(s) than at the time of the survey. It follows, then, that some participants in this study may also have had decreased recall of the events, especially regarding the exact timeline that the event(s) occurred. It is unclear whether this is a concern for all possible ACE questions that examine duration or duration-adjacent constructs (frequency, for example) or specifically for the duration information collected as a part of this study. Future research should aim to determine the reliability and validity of duration measures in the context of ACEs, including test-retest reliability among other measures. The Traditional ACEs scale has been shown to have strong test-retest reliability, but the question remains as to whether the duration measures will have this same pattern of results (Dube et al., 2004).

In light of my exploratory findings, future research should aim to further examine the role of duration in adverse childhood experiences. Given the unexpected finding of a negative correlation between the duration ACEs measures and the examined mental health outcomes in those with a non-zero number of ACEs, there may be more to uncover relating to the role duration of exposure has on outcomes. For instance, it may be the case that those with a longer duration of ACE exposure have developed coping mechanisms in the form of post-traumatic

growth to deal with trauma that those with shorter ACE exposure duration have not. Post-traumatic growth refers to the concept that people show positive mental health growth when faced with traumas or other challenging life circumstances, which a high number of ACEs may initiate (Jayawickreme & Blackie, 2014).

Secondly, we must also consider the possibility that this survey methodology does not fully capture the true depth of experience for those with high numbers of ACEs. For instance, it may be the case that those with higher ACEs in this sample pool were those who have developed coping mechanisms to enhance functionality while their peers with similar numbers of ACEs did not and, thus, were unlikely to elect to take a survey like this one. Similarly, since participants were made aware that the questions asked could potentially be traumatic, those who had especially traumatic childhoods and poor social-emotional functioning as an adult as a result of that trauma may have elected to skip the survey to prevent the rehashing of negative experiences or emotions. Future work should aim at determining the best methods of capturing those who may be especially impaired as a result of their childhood traumas. Furthermore, strategies aimed at intervention for those who have experienced many adverse childhood experiences may help to reduce the consequences of those events.

Yet, there was evidence that participants in my study did experience a substantial level of ACEs. Approximately 72% of the adults in this sample population had experienced at least one ACE during their childhoods, which is slightly higher than in other previous ACE studies, who have reported rates of around 50-60% (Bomysoad & Francis, 2020; Felitti et al., 1998; Merrick et al., 2018). Furthermore, the number of participants who experienced four or more ACEs was higher in this sample pool than in other ACE studies (35% compared to 15.6%) (Merrick et al., 2018). Finally, the overall prevalence of many of the ACEs experienced was higher than in other

research, which is in line with an overall higher rate of having one or more ACEs in this sample pool. One possible explanation for the heightened number of ACEs within this subject pool may be that this pool is more racially diverse than many other ACE studies. Previous research has found disproportionate ACE prevalence in minority populations, which has been partially replicated here for Black and Hispanic/Latinx participants compared to other racial groups. Importantly, this study found no significant difference in ACE prevalence based on gender identity despite previous research noting an increased prevalence in ACEs in women (Merrick et al., 2018).

This work, like that of all ACE studies, is subject to a number of limitations, some of which I have already touched on. One important limitation is recall, both of the events themselves and the specific times in which the events occurred, which may cause either over- or under- estimation of the prevalence of ACEs and their duration. Secondly, social desirability may influence whether someone reports an adverse childhood experience, thus decreasing the true validity of the results. An additional limitation to these results is that I did not control for factors such as childhood socioeconomic status and other non-ACE related events that may have also contributed to these outcomes. It is also important to note that this research is correlational and has not directly tested any causal links between ACEs and the noted experiences for either traditional ACEs or duration-based ACEs. Finally, this research faced a methodological problem of initially having a large portion of my sample screen out due to a failed screening procedure. While there were ultimately few differences between the fully screened sample pool and the wider sample pool that used only my first screening criteria, this issue may have been indicative of a larger issue in participant attention and ability to follow instructions.

Despite these limitations, the present study has served to enhance our understanding of the ACEs scale and addresses its possible shortcomings. Future research should aim to replicate these findings and further tease out the role of duration in adverse childhood experiences. Specifically, research should look at alternative measures of duration of these experiences. Additionally, this work may also want to look at other possible areas of childhood trauma such as peer victimization and community violence, both of which have begun to be explored as other possible adverse childhood experiences, and the role that duration may play in those constructs (Finkelhor et al., 2013). Furthermore, future work should explore possible coping mechanisms in those with many ACEs (in both number and duration) in order to examine whether those with many ACEs develop coping strategies to deal with these potential traumas, especially in light of our exploratory finding of more ACE duration being associated with less depression, anxiety, and difficulties in emotion regulation for those with a non-zero amount of ACEs.

To summarize, I have replicated previous literature that has found associations between ACEs and several mental and physical health outcomes in adulthood while also providing evidence that the traditional ACEs scale is the most effective tool for predicting those outcomes as compared to an ACEs scale that accounts for duration. I hope that this research will promote further exploration into concerns regarding the ACEs scale to determine all of the possible limitations. Overall, having a thorough understanding of what ACEs are and how they contribute to adult outcomes is crucial for designing and implementing possible interventions aimed at reducing the prevalence of these outcomes. Adverse childhood experiences remain a major concern across the country for their associated negative outcomes, and so additional work that aims to better understand these events will ultimately lead to improved mental and physical well-being for adults across the population.

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Table 1. Descriptive information by ACE score

Characteristic	Overall Sample (N = 244)	ACE Score				
		0 (N = 68, 27.87%)	1 (N = 36, 14.75%)	2 (N = 36, 14.75%)	3 (N = 19, 7.79%)	4+ (N = 85, 34.83%)
Age, mean years (SD)	38.38 (10.98)	38.19 (12.05)	39.89 (11.79)	40.25 (12.40)	34.32 (6.80)	38.01 (9.72)
Gender Identity, no. (%)						
Male	142 (58.2)	44 (64.70)	17 (47.22)	21 (58.33)	13 (68.42)	47 (55.29)
Female	100 (41)	24 (35.29)	19 (52.78)	15 (41.67)	5 (26.32)	37 (43.52)
Gender non-conforming	2 (0.80)	0 (0)	0 (0)	0 (0)	1 (5.26)	1 (1.18)
Race, no. (%)						
White	145 (59.4)	48 (70.59)	28 (77.78)	27 (75)	10 (52.63)	32 (37.65)
Black or African American	49 (20.1)	7 (10.29)	4 (11.11)	5 (13.89)	4 (21.05)	29 (34.12)
Asian	11 (4.5)	3 (4.41)	2 (5.56)	2 (5.56)	1 (5.26)	3 (3.53)
Hispanic or Latinx	27 (11.1)	9 (13.24)	0 (0)	0 (0)	3 (15.79)	15 (17.65)
Middle Eastern or North African	2 (0.08)	0 (0)	1 (2.78)	0 (0)	0 (0)	1 (1.18)
Native American	10 (4.1)	1 (1.47)	1 (2.78)	2 (5.56)	1 (5.26)	5 (5.88)

Table 2. Descriptive statistics and correlations among study variables (full participant pool)

	Traditional ACEs	ACEs Years Total	Years with Trauma	Depression	Anxiety	Difficulties in ER
Traditional ACEs	.83	.80**	.69**	.40**	.44**	.41**
ACEs Years Total	.55**	.69	.96**	.16*	.14*	.08
Years with Trauma	.41**	.85**	.93	.10	.08	.02
Depression	.38**	.05	-.01	.91	.83**	.79**
Anxiety	.43**	-.02	-.10	.81**	.92	.86**
Difficulties in ER	.41**	-.11	-.16*	.77**	.85**	.94
n	244	244	244	244	244	244
M	2.70	11.63	5.90	14.03	6.95	2.36
SD	2.66	15.51	6.30	9.37	5.76	0.90

*Note: Values on diagonal are Cronbach's α. Bottom half of chart are Pearson's R Correlations, Top half are Spearman Correlations; *p<.05; **p<.001*

Table 3. Descriptive statistics and correlations among study variables (fully screened pool)

	Traditional ACEs	ACEs Years Total	Years with Trauma	Depression	Anxiety	Difficulties in ER
Traditional ACEs	.83	.80**	.67**	.43**	.44**	.40**
ACEs Years Total	.59**	.69	.94**	.24**	.17*	.10
Years with Trauma	.42**	.84**	.96	.17	.10	.05
Depression	.38**	.13	.06	.92	.85**	.77**
Anxiety	.42**	.04	-.06	.81**	.94	.84**
Difficulties in ER	.39**	-.08	-.12	.73**	.84**	.93
n	127	127	127	127	127	127
M	2.70	13.17	6.54	13.10	6.50	2.26
SD	2.63	16.75	6.52	9.37	5.70	0.90

*Note: Values on diagonal are Cronbach's α. Bottom half of chart are Pearson's R Correlations, Top half are Spearman Correlations; *p<.05; **p<.001*

Table 4. Adjusted odds ratio of health conditions by ACE score: Full participant pool

Health Problem	Number of categories	Sample size (N)	Prevalence (%)	Adjusted Odds Ratio*	95% confidence interval
Severe Obesity (BMI > 35)	0	3	1.23	1	Referent
	1	1	0.04	0.58	(0.05-6.90)
	2	4	1.64	3.54	(0.66-18.96)
	3	1	0.04	0.97	(0.09-10.80)
	4+	4	1.64	1.43	(0.27-7.52)
	Total	13	5.33	-	-
Smoking	0	24	9.84	1	Referent
	1	13	5.33	1.29	(0.51-3.20)
	2	22	9.02	4.22	(1.71-10.41)
	3	10	4.10	2.51	(0.82-7.66)
	4+	63	25.82	6.56	(2.93-14.70)
	Total	132	54.10	-	-
Heart Disease	0	1	0.04	1	Referent
	1	2	0.08	4.86	(0.41-58.31)
	2	3	1.23	7.29	(0.71-74.92)
	3	1	0.04	8.54	(0.70-104.11)
	4+	26	10.66	24.60	(3.13-193.07)
	Total	33	13.52	-	-
Cancer	0	3	1.23	1	Referent
	1	0	0.00	0	-
	2	2	0.08	1.77	(0.26-11.96)
	3	3	1.23	4.40	(0.73-26.41)
	4+	23	9.43	6.36	(1.69-23.98)
	Total	31	12.70	-	-
Stroke	0	3	1.23	1	Referent
	1	4	1.64	5.54	(0.95-32.22)
	2	4	1.64	3.10	(0.55-17.48)
	3	5	2.05	11.70	(1.98-69.36)
	4+	27	11.07	7.71	(1.97-30.28)
	Total	43	17.62	-	-
Diabetes	0	1	0.04	1	Referent
	1	1	0.04	5.46	(0.45-66.52)
	2	5	2.05	12.37	(1.31-117.33)
	3	3	1.23	21.22	(2.04-220.78)
	4+	24	9.84	21.29	(2.66-170.51)
	Total	34	13.93	-	-

*odds ratio adjusted for age, gender, race, and educational attainment

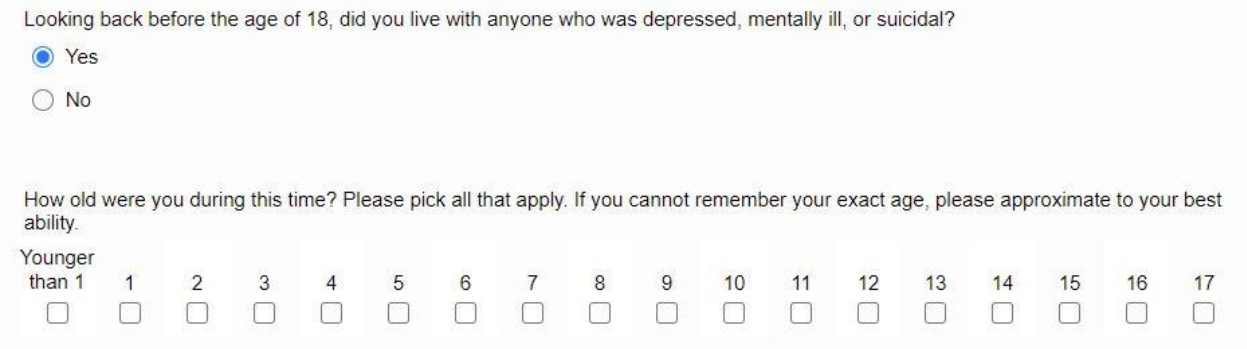

Figure 1. An example of the format of the modified ACE questionnaire. All responses asked the traditional yes/no, but displayed a question asking the years that the event occurred if they indicated that they had experienced the ACE.