

DO ACES MODERATE EXPRESSIVE WRITING OUTCOMES? EXAMINING
THE RELATIONSHIP BETWEEN EXPOSURE TO ADVERSE CHILDHOOD
EXPERIENCES AND EXPRESSIVE WRITING OUTCOMES

By

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Abstract

DO ACES MODERATE EXPRESSIVE WRITING OUTCOMES? EXAMINING THE RELATIONSHIP BETWEEN EXPOSURE TO ADVERSE CHILDHOOD EXPERIENCES AND EXPRESSIVE WRITING OUTCOMES

Nick Vasquez

Repeated exposure to adverse childhood experiences (ACEs) increases risks for various physical and mental health problems during adulthood. While research and policy decisions have focused primarily on early interventions and preventions, less research to date has looked at treatment options for adults with high exposure to ACEs. Cognitive behavioral therapies are viewed as an effective alternative; however, the high costs of therapy and limited efficacy for physical health problems warrant research into alternatives. Expressive writing is a well studied alternative to traditional talk-based therapies with limited demographic moderators. However, no research to date has looked at the role of ACEs as a potential moderating factor on the impact of expressive writing. The current study addresses this gap by examining the role of exposure to ACEs on expressive writing outcomes.

A 2x3 and 2x2x3 mixed model ANOVA was used to compare an expressive writing group to a neutral writing control group on outcomes commonly associated with high ACEs: depression, anxiety, physical health, trauma, and health related quality of

life. High and low ACE scores served as moderators. Although the current study yielded an underpowered sample for statistical effects testing, trend data and clinical significance testing suggest ACE scores may play a moderating role in physical health outcomes but not depression, anxiety, trauma, or health related quality of life. Future research with adequately powered samples may yield more insight into this area.

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Table of Contents

Abstract	ii
Acknowledgements	iv
Table of Contents	v
List of Tables	vii
List of Figures	viii
Appendices	ix
Introduction	1
Literature Review	5
Expressive Writing	5
Adverse Childhood Experiences	14
Expressive Writing and ACEs	20
The Current Study	24
Research Questions and Hypotheses	25
Methods	27
Design	27
Participants	31
Procedure	33
Measures	34
Results	39
Baseline Data	39
Assumptions	41

Research Question 1: Does expressive writing result in greater positive outcomes than neutral writing?	41
Research Question 2: Do ACE scores moderate expressive writing outcomes?	43
Research Question 3: Do different categories of ACEs respond differently to expressive writing?	50
Clinical Significance.....	52
Discussion	64
Limitations	71
Conclusions and Implications for Future Research	75
References	79
Appendices.....	100
Appendix A. Informed Consent.....	100
Appendix B. Safety Protocol	103
Appendix C. Writing Prompts	104
Appendix D. BRFSS ACEs Survey	108
Appendix E. Patient Health Questionnaire	110
Appendix F. PCL-5	112
Appendix G. Pennebaker Post-Writing Questionnaire	113
Appendix H. Healthy Days Core Module.....	114

List of Tables

Table 1. <i>Baseline correlations between mean scores and ACE items</i>	51
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List of Figures

Figure 1. Score changes by ACE score.....	45
Figure 2. Score changes by condition	46
Figure 3. Changes in treatment group mean scores by ACE level ($n = 12$).	47
Figure 4. Changes in control group scores by ACE level ($n = 10$).....	48
Figure 5. Individual change scores on the PHQ-15, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$)	54
Figure 6. Individual change scores on the PHQ-15 grouped by ACE score.....	55
Figure 7. Individual change scores on the PHQ-9, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$).....	56
Figure 8. Individual change scores on the PHQ-9 grouped by ACE score.....	57
Figure 9. Individual change scores on the GAD-7, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$).....	58
Figure 10. Individual change scores on the GAD-7 grouped by ACE score.....	59
Figure 11. Individual change scores on the PCL-5, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$)	60
Figure 12. Individual change scores on the PCL-5 grouped by ACE score	61
Figure 13. Individual change scores on the Healthy Days Core Module, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$).....	62
Figure 14. Individual change scores on the Healthy Days Core Module grouped by ACE score.	63

Appendices

Appendix A. Informed Consent.....	100
Appendix B. Safety Protocol	103
Appendix C. Writing Prompts	104
Appendix D. BRFSS ACEs Survey	108
Appendix E. Patient Health Questionnaire	110
Appendix F. PCL-5	112
Appendix G. Pennebaker Post-Writing Questionnaire	113
Appendix H. Healthy Days Core Module.....	114

Introduction

Exposure to adverse childhood experiences (ACEs) can increase risk for a plethora of physical and mental health problems in adulthood, with risk rising as a function of the total number of ACEs. Exposure to four or more ACEs is considered the highest risk for physical and mental health problems, such as alcoholism, substance use, depression, obesity, and PTSD. Since the initial 1998 Kaiser-ACEs study (Felitti et al, 1998), public health and research has shifted towards the development and implementation of preventative measures, with the emphasis on childhood interventions to reduce or prevent the long-term impact of ACEs in adulthood.

This emphasis has resulted in limited attention on interventions for adults who already struggle with the health challenges caused by exposure to past ACEs, and thus research into interventions for adults with high ACE scores is limited. A systematic review of interventions for adults by Korotana et al., (2016) identified cognitive behavioral therapies (CBT) as having the strongest evidence base demonstrating its effectiveness in improving psychological and physical health (Korotana et al., 2016). While CBT may be a promising intervention, significant barriers exist to accessing treatment and are often exacerbated by socioeconomic inequality.

The costs of attending therapy can be prohibitive for people in low-income communities and among people who do not have adequate mental health coverage through insurance plans. Rural and low-income communities may lack adequate numbers of mental and physical health providers to meet demand, further limiting access to

treatment (Douthit, Kiv, Dwolatzky, & Biswas, 2015; Randolph & Pathman, 2001).

Finally, people in low income and rural communities may be disproportionately affected by higher ACE scores compared to wealthier or urban communities (Chanlongbutra et al., 2018).

Regarding access to services, a substantial disparity exists between exposure to ACEs in affluent and low-income communities. Affluent communities typically have more mental and physical healthcare options available to individuals, families, schools, and the broader community. These programs can help reduce the risk of exposure to ACEs and can protect against the long-term impact of ACEs when encountered (Iniguez & Stankowski, 2016).

In contrast, low-income communities typically have less mental and physical healthcare options available to individuals, families, schools, and the community. Available options are often understaffed and underfunded which can reduce their effectiveness (Chanlongbutra et al., 2018). However, people from these communities are more likely to experience higher levels of ACEs than their affluent counterparts. Together, this puts low-income individuals at greater risk for physical and mental health problems without the benefit of adequate services to reduce these risks (Iniguez & Stankowski, 2016).

Just as it is well established that exposure to ACEs is strongly correlated with poverty, community, peer, and family violence, and less access to education or healthcare (e.g., Iniguez & Stankowski, 2016; Metzler et al., 2017), it is also established that these environments can also inhibit the development of emotional regulation, which can make

it difficult to identify and process emotions in adulthood (Chapman et al., 2004). By contrast, less exposure to ACEs tends to correlate with higher socioeconomic status, less community, peer, and family violence, and more access to education and healthcare, the latter of which may include resources for early interventions during childhood. This can help to facilitate the development of emotional regulation, which can make it easier to identify and process one's emotions. These factors can limit the efficacy of traditional, talk-based therapies like CBT, with people exposed to fewer ACEs and greater access to community resources in childhood being more likely to benefit (Iniguez & Stankowski, 2016). These limitations warrant alternatives to treatment that are affordable, accessible, and effective for people who experienced multiple ACEs and/or who struggle to identify and process emotionally upsetting events.

One such alternative is expressive writing, which is the use of writing to process emotionally upsetting events. Since its inception by James Pennebaker in the 1980s (Pennebaker & Beal, 1986), research has consistently shown expressive writing to have a positive impact on people's lives, often leading to improved physical and mental health, decreased stress, and improved quality of life (Arigo & Smyth, 2016). Unlike traditional psychotherapies, expressive writing can be done with or without the guidance of a professional counselor or therapist, making it more accessible to wide groups of people.

Korotana (2016) identifies expressive writing as a promising alternative to traditional therapies, though cautions that more research is needed before it can be established as an evidence-based practice. One nascent area of expressive writing research is understanding the moderating influence of exposure to childhood adversity on

outcomes. The current study addresses this gap by examining this relationship. This research can contribute to the literature which can, in turn, help guide future research, policy, and practice.

Literature Review

Expressive Writing

Expressive writing is a nonclinical intervention which posits that writing about traumatic or emotionally upsetting events can improve physical and psychological well-being, decrease stress, and improve quality of life (Arigo & Smyth, 2016; Pennebaker, 1997). The standard procedure used by Pennebaker and Beall (1986) asks participants to write about a previously undisclosed traumatic event for 15 minutes a day for four consecutive days. The results of the Pennebaker and Beall (1986) study found that expressive writing resulted in decreased physician visits and improved mood during a 6-month follow-up period. Subsequent studies using the same or amended procedures have generally found similar results. Emotional inhibition theory and emotional processing theory are two theories that have been proposed to explain these results.

Emotional inhibition theory posits that not talking about or disclosing traumatic or upsetting events may lead to psychological and physiological distress due increased activation of the sympathetic nervous system, similar to the process of allostatic load discussed in the ACEs section. Long term or chronic activation of this system can increase the risk for negative physical and psychological outcomes (Sloan & Marx, 2004a). Emotional inhibition theory therefore states that writing about previously undisclosed upsetting or traumatic events leads to a reduction in stress, which deactivates the sympathetic nervous system, thereby improving physical and mental health.

Emotional processing/exposure theory posits that expressive writing may allow an individual to process previously avoided events and in doing so, may see reduced or extinguished fear responses to traumatic or upsetting stimuli. This has its origins in Mowrer's learning theory of behavior (Mowrer, 1960). Mowrer posits that an aversive unconditioned stimulus (UCS) elicits an unconditioned response (fear, activation of sympathetic nervous system and HPA-Axis, etc.). Neutral stimuli that pairs a conditioned stimulus (CS) with the UCS can thus elicit the same fear response. This may transfer to other stimuli through the processes of secondary conditioning, higher-order conditioning, and stimulus generalization. The resulting conditioned fear response generates behavior whose function is to avoid or escape the situations or stimuli that produces the conditioned fear response, such as talking about or processing the upsetting event (Mowrer, 1960).

Exposure techniques are designed to break this UCS-CS association by exposing the individual to the feared CS without the UCS (Foa & Kozak, 1986). This reduces or in some cases extinguishes the fear response by activating the fear response through exposure to the feared stimuli (indicated by high initial levels of emotional arousal) and providing corrective information about the stimuli, responses, and their meanings (indicated by habituation to stimuli between sessions) (Foa & Kozak, 1986).

Expressive writing may create the necessary conditions that allow an individual to be exposed to a feared stimulus that has been previously avoided. Repeated exposure through several writing sessions may allow for the extinction of UCS-CS associations and/or activate the fear structure and provide corrective information to the individual

about the stimuli responses, and meanings. Thus, expressive writing can help alleviate distress by overcoming a person's tendency to avoid or suppress distressing memories, emotions, thoughts, or physiological sensations.

Taken together, emotional inhibition theory and emotional processing theory may help to explain why expressive writing may be particularly effective for people who struggle to talk about emotionally upsetting events and why physiological changes tend to be more prominent among people with high levels of chronic stress. For example, when compared to traditional talk therapies, expressive writing has been found to be more effective at facilitating emotional processing for alexithymic individuals (Baikie, 2008). This may result from expressive writing providing a medium for processing one's emotions without having to name or identify them. Gender differences in expressive writing may also be partially explained by these theories. Among studies that find men are more likely to benefit from expressive writing (e.g. Smyth 1998, , it may be that expressive writing provides an outlet for men to write about their feelings privately and without having to identify or name their emotions. These two issues may stem from cultural and social attitudes towards masculinity that start in childhood and can inhibit the development of emotional processing in adulthood.

Expressive Writing and Physical Health Outcomes. Research into physical health outcomes has looked at two different categories of variables: health care utilization and physical health symptoms. Regarding health care utilization, a meta-analysis by Harris (2006) sought to identify the relationship between expressive writing and healthcare utilization. Thirty randomized controlled trials (combined $N = 2,294$) were

identified. Effects were then combined within 3 homogeneous groups: healthy samples (13 studies), samples with preexisting medical conditions (6 studies), and samples prescreened for psychological criteria (10 studies). Using random effects modeling, the combined effect sizes were 0.16, 0.21, and 0.06, respectively. From these results, the author concluded that expressive writing may reduce healthcare utilization in healthy samples, but not in those with preexisting medical conditions or with psychological health issues. The effects for individual health were not identified, however further research may assist in drawing conclusions about individual health.

For example, a nationwide randomized control trial of breast-cancer patients ($n = 507$) by Jensen-Johansen et al., (2018) found that expressive writing did not lead to a decrease in health care utilization, as measured by visits to their general practitioner ($d = 0.09$). These results are consistent with previous research showing expressive writing is unlikely to be a generally applicable intervention to improve health outcomes among cancer patients (e.g., Zachariae & O'Toole, 2015). Deters and Range (2013) found a decrease in health care visits among PTSD survivors, consistent with prior research (Greenberg et al., 1996; Pennebaker & Beall, 1986; Smyth et al., 1999), while undergraduate students with somatic symptoms of distress showed greater utilization after the expressive writing intervention (Lumley et al., 1999). Finally, studies of expressive writing on healthcare utilization showed fewer infirmity visits among prison inmates (Richards et al., 2000), and fewer illness-related medical visits in prostate cancer (Rosenberg et al., 2002), breast cancer (Stanton et al., 2002), and fibromyalgia (Gillis et al., 2006).

Expressive writing has also been found to improve physical health symptoms associated with different illnesses. Most of the studies in this area have either been in an experimental, secondary care, or at-home setting, with primary care settings seldom represented. These results are promising, especially since many of the symptoms or illnesses are often managed within primary care settings.

For many of the physical symptoms or illnesses where expressive writing has been found effective, stress can be a causal or exacerbating factor. The effects of long-term stress on the immune system are well documented. Long-term or chronic stress has been shown to suppress or dysregulate immune responses by altering the Type 1–Type 2 cytokine balance, inducing low-grade chronic inflammation, and by suppressing the function of immunoprotective cells (Dhabhar, 2014). Chronic stress may thus suppress protective immune responses and/or exacerbate pre-existing pathological immune responses which can increase the severity of symptoms associated with physical illnesses. When looking at potential causal mechanisms to explain why expressive writing can improve physical health, there does appear to be empirical support for a moderated effect by way of improved immune system function as a result of decreased stress.

A study by Esterling et al. (1994) observed better immune functioning after expressive writing among healthy students exposed to the Epstein-Barr virus compared to students in the neutral writing condition. Another study by Petrie et al. (1995) examined the effect of expressive writing on hepatitis B antibodies in medical students after vaccination, with the students in the expressive writing condition showing a greater immune response to the vaccination than students in the neutral writing condition. Other

studies have found improved lung function for students with asthma (Hockemeyer and Smyth, 2002), faster wound healing in healthy older adults (Koschwanetz et al., 2013), and decreased complications associated with high blood pressure after myocardial infarction (Willmott et al., 2011). Finally, healthy students showed better immune function at 3-month follow-up after expressive writing than students in the neutral writing condition (Pennebaker et al., 1988). The results of the Pennebaker study were moderated by previous disclosure, with students who had not previously discussed their writing topic showing the greatest improvements in immune function.

Expressive Writing and Mental Health Outcomes. Evidence for positive effects of expressive writing on mental health outcomes has also been mixed, with anxiety, depression, and PTSD generally showing the most benefit from expressive writing. Studies with student populations have found that expressive writing reduced depressive symptoms at 6-month follow-up relative to the control condition (Gortner et al., 2006), protected against intrusive or unwanted thoughts about stressful experiences (Lepore, 1997) and rumination about such experiences (Sloan et al., 2008), and reduced symptom severity among college women who had previously experienced trauma (Sloan & Marx, 2004b). Further studies drawing from non-student samples have found that it may decrease stress reactivity in people with PTSD (Smyth et al., 2008), improve PTSD symptoms following a car accident (Sloan et al., 2012), and reduce PTSD, anxiety, and depressive symptoms among women with HIV (Ironson et al., 2013).

These mental health benefits have been found cross-culturally in samples outside of the United States, with studies consisting of samples of Iranian women

(Mohammadian, et al., 2011), German adults (Herbert, et al., 2019), and Filipino adolescents (Brillantes-Evangelista, 2013) showing similar results. Given that demographic variables are not thought to affect expressive writing outcomes, it may be that expressive writing has a broad, cross-cultural applicability, however further research should be done in this area before drawing any definitive conclusions.

Other areas of mental health outcomes have been more mixed. A study by Baikie (2008) found that expressive writing may improve coping in alexithymic individuals by providing an opportunity to process emotional material without worrying about accurately identifying the emotions involved (Baikie, 2008), although this finding was challenged in a study that looked at expressive writing for treating eating disorders, in which the authors found expressive writing to have no effect on eating disordered behavior relative to the control group and hypothesized that this finding may be due to high rates of alexithymia among eating disordered populations (Gamber et al., 2013).

Studies drawing from sexual abuse survivors have also found limited support for expressive writing. In a study of expressive writing for childhood sexual abuse, Batten et al., (2002) found that the experimental group's levels of psychological distress and depressive symptoms remained virtually the same over the course of the study, concluding that expressive writing had no effect on depressive symptoms among women who had experienced childhood sexual abuse. However, this finding is contradicted by Meston et al., (2013) which found that women reported significant reductions in depressive and PTSD symptoms and recovery from sexual dysfunction at the conclusion of the study and at 6-month follow-up. However, this study offered participants an

optional discussion with a therapist following each session, which may have contributed to differences observed between this study and the Batten et al., (2002) study.

Moderators of Expressive Writing. A meta-analysis by Frattaroli (2006) is perhaps the most comprehensive analysis of expressive writing's moderating variables. The study included one hundred and forty-six randomized trials of expressive writing and analyzed the data using random effects modeling. Moderating variables included the research setting (i.e. using homogeneous samples, a lack or presence of inclusion/exclusion criteria, and disclosure conditions), participant variables (i.e. demographics such as age, race, or gender, participant well-being, physical and mental health status, and personality traits), methodological variables (i.e. warning participants in advance, timing of follow-up, sample size, and incentives), and treatment variables (i.e. number and duration of sessions, time between sessions, and the valence, time since, and previous disclosure of the topic).

The results of this meta-analysis identified participants who improved the most from expressive writing tended to display the following baseline characteristics: (1) higher stress levels, (2) poorer physical health, and (3) greater reported optimism towards improvement. Demographic variables such as age, gender, or race were not found to have a moderating effect on expressive writing outcomes. Variations in the research setting were found to have moderate effect sizes. A private setting (i.e., without other participants in the room) and homogenous sampling were found to have a positive moderating influence on expressive writing outcomes. However, homogenous sampling

was correlated with inclusion/exclusion criteria such that studies with inclusion/exclusion criteria tended towards homogeneity more often than studies without criteria.

Finally, the effect of methodological variables was also mixed, with the type of incentives and warning participants in advance of the potential for harm having only a small moderating influence. Larger moderating influences were found in studies with larger sample sizes or shorter follow-up periods for data collection, with a one-month follow-up typically generating a larger effect size compared to 3 month or 6-month follow-up periods. However, the timing of follow-up was not found to have an effect on treatment outcomes. The number of participants was not related to health impact, although it was slightly related to psychological health, with larger sample sizes generating smaller effect sizes. The average sample size was 78 (Frattaroli, 2006).

Taken together, these results suggest that the people who may benefit the most from expressive writing are somewhat worse off at the start of the study. However, these results are difficult to generalize due to the age of the meta-analysis and increased body of literature since its publication. Subsequent research into the moderating variables of expressive writing has come to similar and also contradictory conclusions regarding moderating variables.

Research into demographic variables for example, has consistently shown a lack of moderating effects for most categories except gender, with studies showing mixed or inconclusive results about whether men or women are more likely to benefit (e.g., Arigo & Smyth, 2016; Baikié & Wilhelm, 2005; Epstein et al., 2005; Klapow et al., 2001; Smyth, 1998). However, stigmatized or marginalized groups may derive specific benefits

from expressive writing related to managing and identifying their thoughts and feelings about their group identity. For example, among gay male college students, expressive writing about stressful experiences related to being gay resulted in greater openness about sexual orientation at 3-month follow-up, relative to neutral writing (Pachankis and Goldfried, 2010). Other studies have looked at HIV status and found improved psychological well-being among HIV-positive women (but not men) (Ironson et al., 2013), HIV-positive adults (Wagner et al., 2010), and gay women who were less open about their sexuality prior to writing (Lewis et al., 2005). Thus, while demographic variables may not moderate the effect of expressive writing in general, individuals may still derive demographic specific effects from expressive writing when the intervention is tailored to them.

Many of the mental and physical health problems that are improved by using expressive writing are also associated with high exposure to adverse childhood experiences. Because of this overlap, it may be that past exposure to ACES moderates expressive writing outcomes.

Adverse Childhood Experiences

Adverse Childhood Experiences (ACEs) are traumatic or emotionally upsetting events that occur in childhood such as abuse, witnessing violence happen to a parent, and substance use by caregivers. A groundbreaking study by Felitti et al., (1998) found that people who had experienced four or more ACEs had increased risks for alcoholism, substance abuse, depression, suicide, sexually transmitted diseases, and obesity.

Subsequent studies have since replicated the results of the Felitti study, with the most common physical health problems being obesity, diabetes, STIs, cancer, and heart disease (Felitti et al., 1998; Hughes et al., 2017) and the most common mental health problems being anxiety, PTSD, and depression (Merrick et al., 2017). These results have also been shown to be dose-responsive, meaning that the risk for and severity of mental and physical health problems increases as exposure to ACEs increase. Different theories have been generated to explain this correlation.

The biopsychosocial model reflects the development of illness as a result of interactions between biological factors (e.g., genes, biochemical changes), psychological factors (e.g., mood, personality, behavior) and social factors (e.g., culture, socioeconomic status) (Engel, 1977). In this model, exposure to high levels of ACEs affects an individual at different levels. Influenced by the biopsychosocial model, ecological systems theory addresses the larger systemic, institutional, and cultural issues that are unexplained by the biopsychosocial model. In this model, lack of adequate healthcare, socioeconomic status, and community violence constitute broader systemic and cultural issues that influence the relationship between exposure to ACEs and negative mental and physical health outcomes (Bronfenbrenner & Morris, 2007).

At the biological level, exposure to adverse childhood experiences can alter the structural development of neural networks and the biochemistry of neuroendocrine systems (Anda et al., 2006; Danese & McEwen., 2012; Kolassa, 2016) and may have long-term effects on the body, including compromised immune systems (Moffitt, 2013; Rogosch et al., 2011). These changes may occur through allostatic load, a process in

which exposure to chronic or repeated stress can increase wear and tear on the body, increasing the risk for health complications throughout the lifespan (Danese & McEwen., 2012).

At the psychological level, exposure to adverse childhood experiences alters the development of emotional regulation and positive affect (Chapman et al., 2004) and may increase the risk of engaging in risky or self-harming behaviors such as smoking, substance abuse, and suicide (Dube et al., 2001; Hughes et al., 2017). At the social level, exposure to adverse childhood experiences can inhibit the development of social relationships, decrease quality of life, and increase the risk of poverty (Metzler, 2017).

A combination of these different factors at different levels may mediate the relationship between ACEs and health outcomes. For example, a person may have a genetic predisposition for depression but social factors such as chronic stress and psychological factors such as emotional inhibition may be needed to trigger this genetic code for depression. Depending on the context in which depression develops, a person may be at a greater risk for lower life expectancy due to the risk factors associated with depression, such as smoking, alcohol use, cardiovascular disease, and suicidality. Research into the role of epigenetics, neurochemistry, and evolutionary biology have helped to shape contemporary understanding of these complex interactions.

ACEs and Mental Health Risks. People with exposure to childhood stress may be at greater risk for mental health problems in adulthood. A meta-analysis by Hughes (2017) found that exposure to four or more ACEs increased mental health risks, with the

strongest associations found between ACEs and poor mental health (odds ratios of +3-6) and problematic drug use (odds ratios of 7+) (Hughes et al., 2017).

Further research has linked exposure to different types of childhood stress and depression, with the strongest relationships being found in exposure to emotional abuse, followed by neglect (Mandeli et al., 2015) and a retrospective cohort study of 9,460 adults in San Diego, California found a strong, dose–response relationship between ACE scores and the probability of lifetime and recent depressive disorders, with higher ACE scores correlating with greater risk of depression (Chapman, et al., 2004).

Another retrospective cohort study of 17, 337 San Diego adults looked at the relationship between suicide attempts and ACEs using a self-report measure of suicide attempts and the Kaiser ACEs survey. Results found that 3.8 percent of participants (roughly 659 people) had attempted suicide at least once and that ACE score had a graded relationship to attempted suicide, with people exposed to four or more ACEs being at greater risk for suicidal ideation. The researchers found that people with high ACE scores and greater depression severity were at greater risk for suicidal ideation, suggesting that severity of depression may mediate the relationship between ACEs and suicidality (Dube et al, 2001).

Among individuals with bipolar disorder, childhood trauma was found to predict greater manic, depressive, and psychotic symptom severity, increased risk of comorbid trauma, anxiety, and substance use disorders, a higher number of manic and depressive episodes, and increased risk of suicide compared to those with bipolar without childhood trauma (Agnew-Blais & Danese, 2016). These results are consistent with prior findings

that exposure to high numbers of ACEs increase risks for depressive and trauma disorders and support the idea that depression may mediate suicidality.

The results of these findings may be at least partially mediated by perceived life satisfaction and quality of life. A study by Mosley-Johnson et al. (2019) investigated perceived life satisfaction and quality of life among people with exposure to high ACEs and compared the results to people without an ACE score. The researchers found a graded relationship, with higher numbers of ACEs being associated with lower levels of life satisfaction, psychological well-being, and social well-being. Experiencing abuse and household dysfunction had the strongest associations with lower life satisfaction (Mosley-Johnson et al., 2019).

ACEs and Physical Health Risks. The relationship between exposure to childhood trauma and physical health risks is well documented. Felitti et al (1998) first identified this relationship over 20 years ago. The results of this study found that people with exposure to four or more ACEs had increased risks for smoking, poor self-rated health, STDs, physical inactivity, and obesity. Their findings also showed a graded relationship to heart disease, cancer, lung disease, skeletal fractures, and liver diseases (Felitti et al., 1998).

Research into health risks associated with ACEs has generally supported the findings of the Felitti study. For example, exposure to high levels of ACEs may increase the risk for smoking relapse due to elevated levels of adrenocorticotrophic hormone (ACTH) and cortisol stress response found in high adversity relapsers but not in low adversity relapsers. (Al'Absi et al., 2017). A study of rural populations found that people

who had experienced one or more ACEs reported poorer general health, greater activity limitations, and increased risks of heart disease. Heart attack risks were higher for rural peoples reporting between two and four ACEs. Diabetes risks were higher for those with three or more ACEs, and asthma history was higher for those with three or more ACEs. (Chanlongbutra et al., 2018), and diagnoses of hypertension, hypercholesterolemia, myocardial infarction, and skin and other cancers have been found to be inversely related to ACE score (Iniguez & Stankowski, 2016).

A systematic review and meta-analysis by Hughes (2017) found weak associations between ACEs, physical inactivity, being overweight or obese, and diabetes (odds ratios of <2). Because diabetes can be mediated by obesity, which can be mediated by physical inactivity, these three variables may be highly correlated with each other. Therefore, if ACEs has a limited effect on physical inactivity, it would be reasonable to assume a limited effect on obesity and diabetes as well. It is also possible that exposure to high levels of ACEs is less predictive of physical inactivity and that contextual factors in the environment that promote or discourage physical activity may be better predictors.

Interventions and Treatment. Given the longitudinal nature of adverse childhood experiences on mental and physical health, research and policy emphases have focused primarily on early interventions and preventative measures that can reduce the risks of health problems during adulthood. Examples include implementing policies and programs to help improve school performance for at-risk youth (Björkenstam et al., 2016), broadening public and professional understanding of the relationship between early adversity and poverty (Metzler et al., 2017), and tailoring interventions for specific

risks in adolescents by distinguishing between different types of trauma (Beal et al., 2019).

A review by Moffitt (2013) identified cognitive behavior therapies, especially Trauma-Focused CBT, as being most effective at preventing long term negative health outcomes among children, adolescents, or adults. The review also noted that interventions that work with the family as a unit and with the parents as a couple can be helpful, as these intend to reduce exposure to violence and trauma by educating and supervising parents of young children. In the case of working the parents as a couple, the aim is to reduce the risk of domestic violence.

In one of the most comprehensive reviews of interventions to date, Korotana et al., (2016) looked at interventions for adults who had exposure to high levels of ACEs. The researchers noted that, while early intervention is important, many individuals are unable to access support until adulthood, by which point the health risks and health problems associated with ACEs may be more ingrained. Cognitive behavioral therapies had the strongest evidence base for managing health problems. Expressive writing was highlighted as showing promise. The researchers also noted that intervention research primarily focuses on social, cognitive, and emotional outcomes, and that research examining neurobiological and physical health outcomes is limited.

Expressive Writing and ACEs

Expressive writing outcomes are moderated by a variety of different factors, however exposure to ACEs has not been explored as a moderating variable. ACEs are

linked with higher levels of chronic and repeated stress, which can put additional strain on the body, increasing the risks for physical health problems in adulthood. Additionally, exposure to ACEs is linked with environmental factors such as poverty, prevalence of community, peer, and family violence, and access to education, which can affect the development of emotional regulation and emotional processing.

Expressive writing research has demonstrated its effectiveness for people who have difficulty identifying, naming, or processing emotions, possibly because it provides an outlet for expression and processing upsetting events that does not require the participant to name or identify the emotions present. In doing so, one may expect to derive mental health and physical health benefits from expressive writing due to a diminished fear response associated with exposure to the upsetting event and from a reduction in stress related effects on the body.

Additionally, expressive writing is more likely to benefit people when they write about a previously undisclosed or unprocessed topic. People who find it easier to identify, name, and process emotions may be less likely to benefit from expressive writing because they are more likely to process an upsetting event, either on their own or with social support. When writing about previously undisclosed topic, it is possible that said topic may already be partially or fully processed. If ACEs have a moderating effect, it is likely that people with exposure to more ACEs would have a more difficult time processing, identifying, and naming emotions and have less opportunities to process emotionally upsetting events than people with exposure to less ACE scores. This effect would lend

further support to the emotional processing and emotional inhibition theories guiding expressive writing research.

To date, three studies have looked at the relationship between expressive writing and adverse childhood experiences, though not as a moderating variable. In one trial, female survivors of childhood sexual abuse ($n = 61$) were randomly assigned to write about their childhood sexual abuse experiences or about time management (Batten et al., 2002). Overall, women who wrote about their childhood sexual abuse demonstrated no improvement in physical or psychological health outcomes and no reduction in illness visits at 12-week follow-up. There were no significant differences between conditions and the small observed group differences favored women who wrote about time management.

A larger ($n = 97$) randomized controlled trial of expressive writing included women with a wider range of ACEs (Greenberg et al., 1996). Women were assigned to one 30-minute session that focused on writing about a real past trauma, an imaginary trauma, or a trivial, non-emotional event. At one-month follow-up, women who wrote about either a real or imaginary trauma reported fewer illness visits over the past month than women who wrote about a trivial event. However, women who wrote about a real childhood trauma also reported more fatigue and avoidance symptoms than both comparison conditions.

In a more recent trial, women with childhood sexual abuse ($n = 91$) were instructed to write about either (1) their deepest thoughts and feelings about a past trauma, the impact of the trauma on personal beliefs, and maladaptive beliefs related to

the trauma, or (2) the impact of their sexual abuse experience on thoughts, feelings, and beliefs about sexuality (Meston et al., 2013). Women in both conditions reported significant and equal reductions in depression and PTSD at post-treatment. At 6-month follow-up, improvements in PTSD symptomology were maintained, whereas depressive symptoms worsened slightly in both conditions. Women in the sexual schema-focused condition were more likely to report recovery from sexual dysfunction than women in the trauma condition, suggesting an added benefit of sexual schema-focused expressive writing.

The results of these studies may suggest that expressive writing can be used to varying degrees of success among people with ACEs. However, the generalizability of these findings should be questioned. The Meston et al. (2013) and Batten et al. (2002) studies focused exclusively on childhood sexual abuse, which is one subcategory the Abuse category of ACEs. Among populations with high ACE scores, it may be that expressive writing works better for people who have experienced childhood sexual abuse rather than other types of ACEs. The Greenburg et al. (1996) study asked people to write about a childhood trauma without specifying which traumas participants wrote about. As it was run prior to the Kaiser ACE study, its applicability to understanding the expressive writing-ACEs connection may be limited. Finally, none of these studies included an ACEs measure. Therefore, they are ungeneralizable to a wider population of individuals who have experienced ACEs.

When screening for ACEs it is important to consider that not everyone with high ACE scores will develop mental health or physical health problems. Interventions with

broad applicability may help to reduce the risk of developing future problems among these populations. Among people who have already developed health problems, a broadly applicable intervention could serve as an intermediary between screening and developing a specific intervention suitable to the individual's needs, or as an intervention in its own right for people who lack the resources, either individually or communally, needed for their current health problems.

While expressive writing meets these criteria, its suitability for people with high ACE scores is uncertain. Prior to testing it as an intervention in this demographic, research must first identify the relationship between high ACE scores and health outcomes associated with expressive writing. Identifying the relationship between the two can inform future researchers of where to concentrate their research and health care providers on the merits of incorporating expressive writing into their practice.

The Current Study

The current study tested the relationship between exposure to ACEs and expressive writing outcomes. Physical health, anxiety, depression, trauma, and quality of life are commonly associated with improvement as a result of expressive writing and are commonly impacted by exposure to ACEs, and therefore will be used as outcome variables in this study.

Research Questions and Hypotheses

Question 1: Does expressive writing result in greater positive outcomes than neutral writing?

- *Hypothesis 1a:* Participants in the expressive writing condition will show greater improvement of physical health symptom severity than participants in the neutral writing condition at four-week follow-up compared to baseline scores.
- *Hypothesis 1b:* Participants in the expressive writing condition will show greater improvement of mental health symptom severity than participants in the neutral writing condition at four-week follow-up compared to baseline scores.
- *Hypothesis 1c:* Participants in the expressive writing condition will show greater improvement of trauma symptom severity than participants in the neutral writing condition at four-week follow-up compared to baseline scores.

Hypothesis 1d: Participants in the expressive writing condition will show greater improvement of perceived quality of life than participants in the neutral writing condition at four-week follow-up compared to baseline scores.

Question 2: Do ACE scores moderate expressive writing outcomes?

- *Hypothesis 2a:* Participants with high ACE scores will show greater improvement in physical health symptom severity than participants with low ACE scores at four-week follow-up compared to baseline scores.

- *Hypothesis 2b:* Participants with high ACE scores will show greater improvement in mental health symptom severity than participants with low ACE scores at four-week follow-up compared to baseline scores
- *Hypothesis 2c:* Participants with high ACE scores will show greater improvement in trauma symptom severity than participants with low ACE scores at four-week follow-up compared to baseline scores.
- *Hypothesis 2d:* Participants with high ACE scores will show greater improvement in perceived quality of life than participants with low ACE scores at four-week follow-up compared to baseline scores.

Question 3: Do different categories of ACEs respond differently to expressive writing?

This study looked at changes in physical health and mental health symptom severity using the Patient Health Questionnaire (PHQ) (Spitzer et al., 1999), changes in trauma symptom severity using the PCL-5 (Blevins, et al., 2015), and perceived quality of life using the Healthy Days Core Module (Centers for Disease Control, 2000) by comparing scores at baseline, post-test, and follow-up. The BRFSS ACEs Survey was used to categorize ACEs and calculate ACE scores at baseline.

Methods

Design

The current study used a 2x3 mixed-model repeated measures ANOVA for the first research question and a 2x2x3 mixed-model repeated measures ANOVA for the second research question. The first factor is a between-groups variable: treatment condition with two levels: expressive writing (treatment) and time management writing (control). The second factor is a within-groups variable: time, with three levels: baseline, post-test, and four-week follow-up. In the second research question, a third factor is included: ACE score with two levels (high/low). The third research question was addressed using a post-hoc analysis which resulted in a correlational table that looked at correlations between baseline scores on each measure and each ACE item.

The four dependent variables were: a) physical health symptom severity, b) mental health symptom severity, c) trauma symptom severity, and d) perceived quality of life. The independent variable was expressive writing and the moderating variable was ACE score. This design incorporated a between-groups aspect by making comparisons of the dependent and moderating variables at each timepoint. This design also incorporated a within-groups aspect, as participants were tested at the same timepoints and with the same moderating variable.

A modified intention-to-treat protocol was adopted for data analysis. Per the intention-to-treat protocol, all participant scores were included in the computation of

baseline scores, the correlational table in Research Question 3, and in the Jacobson-Truax test, and outliers were not removed from the data, regardless of whether or not the participant completed the study. However, participants who dropped from the study prior to completion were removed from the ANOVA models using listwise deletion due to ANOVA's incompatibility with missing data.

Clinical significance is the practical importance of a treatment effect. It measures whether, and to what extent, the treatment had a noticeable effect on an individual's functioning (Hsu, 1999). Its emphasis on individual rather than group change makes it a useful tool used in conjunction with statistical significance testing, and makes it an ideal test in small n designs where statistical power is limited (Maric et al., 2015; Zahra & Hedge, 2010).

The Jacobson-Truax test (Jacobson & Truax, 1991) was run to determine if individual change scores in the participants at four-week follow-up were clinically significant. The test calculates a cutoff for clinically significant change and then calculates a reliable change index (RCI) which determines if posttreatment change scores in an individual are psychometrically sound. An RCI larger than 1.96 is unlikely to occur ($p < .05$) without actual change (Jacobson & Truax, 1991). The sample means and standard deviations in the current study were used to calculate this information, with the dysfunction cutoff for each measure being established at two standard deviations above the pretest mean for that measure. The cutoff and RCI were then used to place participants into one of four categories: recovered, improved, unchanged, or deteriorated,

depending on the directionality of the RCI and whether or not the cutoff score was passed (Jacobson & Truax, 1991).

While the measures used in this study have their own cutoffs for clinically significant change, relying on these cutoffs can be problematic for a few reasons. First, each measure has its own degree of test-retest reliability. This introduces the possibility of measurement error affecting change scores at follow-up which can increase the risk of false positives (concluding improvement when no improvement occurred) and false negatives (concluding no improvement when improvement occurred) (Jacobson & Truax, 1991; Zahra & Hedge, 2010). Clinical significance testing addresses this issue by factoring in test-retest reliability into calculating the RCI.

Second, each measure was validated and tested in different populations using different criteria for symptom severity which makes standardized comparisons between measures difficult (Jacobson & Truax, 1991; Zahra & Hedge, 2010). Studies with larger sample sizes can typically address this issue by running additional statistical tests, such as ANCOVA, chi squares, equivalence tests, or moderated regression. Clinical significance testing can also be used to address this issue, as its calculations provide the same standardized index of change for each measure.

Finally, cutoff points are often interpreted in research as a binary option: passing the cutoff results in recovery. Not passing the cutoff means no recovery. While this can be appropriate for evaluating group changes, it misses the individual nuances involved in evaluating a treatment effect. For example, a person may not pass the cutoff but still experienced improved symptoms. The RCI helps measure these nuances by providing

multiple categories of change that are based on an individual's change scores relative to an established cutoff (Zahra & Hedge, 2010).

The Jacobson-Truax test is limited in that it does not factor regression to the mean in its calculations and uses *observed* scores (i.e., the scores obtained in applying psychological measurements to clients, which in general contain some measurement error) rather than close approximations of the *true* score (i.e., scores obtained in applying psychological measurements with corrections made for measurement error, regression to the mean, etc.).

Other tests such as the Gulliksen-Lord-Novick (Hsu, 1999), Edwards-Nunnally (Speer, 1992), and Hageman-Arrindell (Hageman & Arrindell, 1999) address these limitations. However, these tests require population information such as means, standard deviations, and effect sizes that are not always known to the researcher. Of further consideration, results from a simulation study by Atkins and colleagues (2005) comparing the reliabilities, effect sizes, and pre-post test correlations between the four tests noted that "...in the absence of population-based information, the methods performed similarly, and thus, no one method can be preferred over any other for statistical reasons" (Atkins, et al., 2005).

The Jacobson-Truax test was thus the preferred test for the current study for two reasons. The first was parsimony: With no comparable differences in the four methods, the simpler test should be chosen. The second reason was due to statistical power: In the presence of an underpowered study, it cannot be determined if the sample statistics are

representative of the population from which they are drawn, and therefore the population statistics needed for more rigorous tests would not be useful in the present study.

Participants

An *a priori* power analysis with a Bonferroni correction for multiple testing and moderation effect was run for each measure run for each measure using G*Power. Samples ranged from a minimum sample of 40 participants for adequate power on the PHQ-15 to a maximum sample of 62 participants for adequate power on the PCL-5 to test all hypotheses at $\alpha = .001$ and with a power of .90.

The current study attempted to recruit the minimum recommended sample using a conservative estimated attrition rate of 30% (Sloan et al., 2011), resulting in a minimum sample of 52 participants needed for adequate power, with the intention to conduct a *post hoc* power analysis to determine if sufficient power had been obtained. In the event sufficient power was not obtained, the study would reopen recruitment efforts in an attempt to reach the maximum recommended sample using the same estimated 30% attrition rate.

In total, 27 participants met eligibility for the current study resulting in insufficient statistical power to accurately interpret the results. To qualify for participation, participants needed to be 18 years or older and score below clinically significant scores on the PCL-5 (33 or more) (Bovin et al., 2016), the PHQ-9 (15 or more), and the GAD-7 (15 or more) (Kroenke et al., 2010) on a screening survey administered via Qualtrics.

A safety protocol was developed in consultation with professional clinical psychologists to minimize the risk of harm. This was developed independently of the informed consent (see Appendix A). The full protocol may be found in Appendix B.

Recruitment. Recruitment took place between June and November 2020 in three waves. The first wave occurred between June and August 2020. The study and link to the screening survey were advertised exclusively to residents in a rural California county via social media and direct outreach to community organizations serving the area. The second wave occurred between August and November 2020. The study and link to the screening survey were advertised at a local university using a list of 300 randomly selected emails given to the researcher through the university's administrative data tracking office, and through advertising to different classes across academic disciplines. These were done in addition to continuing the recruitment strategies discussed in the first wave. The third wave of recruitment took place between October and November 2020. The study and link to the screening survey were advertised to community organizations serving foster youth in the states of California, Pennsylvania, Oklahoma, and Missouri, and occurred concurrently with the recruitment strategies of the previous two waves.

Between June and November 2020, 157 people responded to the screening survey. Eligible participants were contacted to set up the writing sessions. Five responses were excluded from consideration for eligibility: Two were excluded due to being from outside the United States, one was excluded due to being under 18, and one was excluded as a duplicate survey response. Of the remaining 152 respondents, 47 were eligible to

participate in the study based on their responses to the survey. Of the 47 eligible, 27 people (57%) agreed to participate in the study.

Participants were randomly assigned to either the treatment group ($n = 14$) or the control group ($n = 13$). Women made up most of the sample at 67% while men made up 33% of the sample (18 and 9, respectively). In the treatment group, 11 participants were female and three were male. In the control group, seven participants were female and five were male. The sample ages ranged from 19 to 68 ($M = 28.78$, $SD = 10.94$). Ages in the treatment group ranged from 19 to 38 ($M = 25.29$, $SD = 6.03$) and ages in the control group ranged from 21 to 68 ($M = 32.54$, $SD = 13.79$).

Five participants indicated having been in the foster care system. Due to the underpowered nature of the current study, no separate analyses were run on this subsample.

Five participants dropped from the study prior to the fourth writing session. There was no drop out at four-week follow-up, resulting in a final sample size of $n = 22$ (12 experimental condition, 10 control condition). This resulted in an 18% attrition rate, far less than the estimated 30% previously discussed. An attrition analysis on this group was not run due to the underpowered sample.

Procedure

Participants took part in a series of four weekly writing sessions via Zoom. The researcher read a prompt at the start of each writing session asking participants to write about either their deepest emotions and thoughts if they were in the treatment condition

or time management strategies if they were in the control condition (see Appendix C). Participants were then given 20 minutes to write, with the option to leave their camera on or turn it off. The researcher turned off his own camera after reading the prompt and starting the participant's time. This was done to give participants privacy during their writing sessions.

At the end of each writing session, participants were instructed to complete the post-writing questionnaire. Upon completion, the researcher read a follow-up prompt, thanked the participant for their time, and emailed them a list of resources if they were in the treatment condition. At the start of the fourth writing session, participants were asked to retake the PHQ-15, PHQ-9, GAD-7, PCL-5, and Healthy Days Core Module. At the end of the fourth session, participants were informed of the follow-up date and a reminder email was sent out at the conclusion of the Zoom call. At four-week follow-up, participants were sent a Qualtrics link and asked to retake the PHQ-15, PHQ-9, GAD-7, PCL-5, and Healthy Days Core Module.

Participants were given \$10 at the conclusion of each writing session and upon completion of the follow-up survey, for a maximum compensation of \$50.

Measures

BRFSS ACEs Survey. The BRFSS ACEs survey is an 11-item survey that asks about exposure to two categories of ACEs, Abuse and Household Dysfunction. Questions 1 through 6 ask about Household Dysfunction. Questions 7 through 11 ask about Abuse. Questions are scored as either a 1 (*Yes*) or 0 (*No*) with the total score being the sum of all

11 items. The total score ranges from 0 (no ACEs experienced) to 11 (11 ACEs experienced). A score between 0 and 3 is considered a low ACE score and a score of 4 or more is considered a high ACE score. This scale has good test-retest reliability ($r = 0.81$) and internal consistency ($\alpha = 0.78$) (Ford et al., 2014).

This survey was modified to include a 12th question “Were you ever in foster care, orphaned, or adopted?” This question was adapted from the Shelby County ACEs survey as a stand-alone item, not a part of the two ACE categories. This brought the total ACEs score to 12, giving a range of scores from 0 to 12. This measure was administered as part of the initial screening survey, but only to respondents who were eligible to participate.

For research question 3, survey items 1-5 and item 12 were dichotomously coded for 1 (*Yes*) and 0 (*No*) responses. Survey items 6-11 were dichotomously coded as follows: responses with “Once” and “More than Once” were collapsed into a single category, “At Least Once” and coded as (1). Responses with “Never” or “Don’t Know” were collapsed into a single category, “Never” and coded as (0) (Ford et al., 2014; Merrick et al., 2018).

Mental and Physical Health (Patient Health Questionnaire). The Patient Health Questionnaire (PHQ) is the self-report version of the Primary Care Evaluation of Mental Disorders (PRIME-MD), a diagnostic tool developed by Pfizer in the mid-1990s. It is a multiple-choice, self-report inventory composed of modules for Depression (PHQ-9), Anxiety (GAD-7), and physical health (PHQ-15) symptoms in addition to questions about alcohol and eating disorders (Spitzer et al., 1999). Each of the three modules can be

used on their own, with other modules, or as part of the full PHQ. Each module has good internal consistency ($\alpha = 0.80-0.92$) (Löwe et al., 2004), interrater reliability ($k = 0.64-0.83$) (Persoons et al., 2003), and excellent discriminant validity ($rs = 0.89$ to 0.92) (Löwe, et al., 2004). Cutoff points are established as 0-4 (minimal), 5-9 (mild), 10-14 (moderate), and ≥ 15 (severe) on each module PHQ with a score of 15 or more on the PHQ-9 or GAD-7 considered a “red flag” for clinically significant symptoms that may require active treatment (Kroenke et al., 2010). Each module was administered at baseline, post-test, and four-week follow-up. The questions about alcohol use and eating disorders were not administered.

Trauma (PCL-5). The PCL-5 is a 20-item self-report measure that assesses PTSD symptoms using DSM-5 criteria (i.e., Criterion A: Stressor; Criterion B: Intrusive Symptoms; Criterion C: Avoidance; Criterion D: Negative Alterations in in Cognitions and Mood; and Criterion E: Alterations in Arousal and Reactivity) (Blevins et al., 2015) on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*extremely*). The PCL-5 has a variety of purposes, including (a) monitoring symptom change during and after treatment, (b) screening for PTSD, and (c) making a provisional PTSD diagnosis. For the purposes of this study, the PCL-5 was used to monitor changes in symptom severity at baseline, post-test, and follow-up. It has strong test-retest reliability ($r = 0.82$), convergent validity ($rs = 0.74-0.85$), and discriminant validity ($rs = 0.31-0.60$) (Blevins, et al., 2015). A cutoff score of 33 is established as the lowest score required for a provisional PTSD diagnosis (Bovin et al., 2016, Geier et al., 2018). This measure was administered at baseline, post-test, and four-week follow-up.

Health Related Quality of Life (Healthy Days Core Module). Health related quality of life is defined by the United States Centers for Disease Control as “an individual’s or group’s perceived physical and mental health over time.” (Centers for Disease Control, 2000). The Healthy Days Core Module is a standardized 4-item set of questions adapted from the Centers for Disease Control’s Health Related Quality of Life (HRQoL-14) survey. It measures in the number of unhealthy days experienced by an individual or group, defined as the number of days that an individual rated their physical health and mental health as not good within the last 30 days.

It includes the following components: 1) self-rated health, from poor to excellent; 2) number of days when physical health was not good during the past 30 days; 3) number of days when mental health was not good during the past 30 days; and 4) number of activity limitations due to either physical or mental health illness (combined).

The total number of unhealthy days is obtained by adding the responses to questions 2 and 3, with a range of scores from 0 to 30. Scores in excess of 30 are assigned the maximum value of 30. The total number of healthy days is the difference obtained from subtracting the number of unhealthy days from 30. Poor health related quality of life is determined by 14 or more unhealthy days (Centers for Disease Control, 2000). The measure has good construct validity (Hennessy et al., 1994; Centers for Disease Control, 1998) and criterion validity (Newschaffer, 1998). It also has excellent test-retest reliability ($r = 0.75$) (Andresen et al., 2003). This measure was administered at baseline, post-test, and four-week follow-up.

Pennebaker Post-Writing Questionnaire. The Pennebaker Post-Writing Questionnaire is a self-report measure adapted from James Pennebaker's *Expressive Writing: Words that Heal*. It asks participants to rank on a scale of 0 (*not at all*) to 10 (*a great deal*): a) the degree to which they expressed their deepest thoughts and feelings, b) the degree to which they currently feel sad or upset, c) the degree to which they currently feel happy, d) the degree to which the writing was valuable and meaningful, and e) to briefly describe how their writing went. For the current study, this fifth question was optional for participants. There is no current psychometric data for this measure. This measure was administered at the end of each writing session as a manipulation check.

Full measures and coding procedures can be found in the appendices.

Results

Twenty-seven participants took part in the current study, resulting in insufficient power to draw meaningful conclusions. Statistical results were interpreted as potential trend data due to the underpowered nature of the study and should not be interpreted as evidence of sufficient findings. Clinical significance tests are sufficient enough to be interpreted as trend data. Statistical results presented here should not be interpreted as implying statistical significance. However, the data offer a small pilot study design that could be replicated with a larger sample. Clinical significance tests are provided to contextualize the statistical findings across each individual and can inform future research questions and hypotheses.

All data were analyzed using R statistical software and RStudio (RStudio Team, 2015).

Baseline Data

Due to the underpowered nature of the study, it was not feasible to run statistical tests to compare the groups at baseline or the sample to the overall responses. A fully powered study would have allowed the use of independent samples t-tests to compare group means and chi-square analyses to compare ACE scores.

ACE Score. ACE scores ranged from 0 to 11, ($M = 4.56$, $SD = 2.95$). ACE scores in the experimental group ranged from 0 to 11 ($M = 4.64$, $SD = 3.22$). ACE scores in the control group ranged from 1 to 8 ($M = 4.46$, $SD = 2.75$).

PHQ-15. Overall baseline scores on the PHQ-15 ranged from 0 to 17 ($M = 5.89$, $SD = 3.8$). PHQ-15 scores in the experimental group ranged from 2 to 14 ($M = 5.64$, $SD = 3.12$) and ranged from 0 to 17 ($M = 6.15$, $SD = 4.54$) in the control group.

Mental Health. Mental health was a composite score created by summing each individual's total score on the PHQ-9 and GAD-7, giving a potential range of scores from 0 to 48 (Chicot et al 2018; Kroenke et al 2016). Cutoffs of 10, 20, and 30 were established for mild, moderate, and severe symptom severity, with lower scores representing better mental health (Chicot et al 2018; Kroenke et al 2016). Mental health composite scores ranged from 2 to 27 at baseline ($M = 12.63$, $SD = 6.27$). Scores in the experimental group ranged from 2 to 27 at baseline ($M = 11.00$, $SD = 7.37$) and ranged from 4 to 19 ($M = 12.90$, $SD = 5.13$) in the control group.

PHQ-9. Overall baseline scores on the PHQ-9 ranged from 0 to 13 ($M = 6.26$, $SD = 3.30$). PHQ-9 scores in the experimental group ranged from 0 to 13 ($M = 5.57$, $SD = 3.79$) and ranged from 3 to 10 ($M = 7.00$, $SD = 2.61$) in the control group.

GAD-7. Overall baseline GAD-7 scores ranged from 1 to 14 ($M = 6.37$, $SD = 3.57$). GAD-7 scores in the experimental group ranged from 1 to 14 ($M = 5.57$, $SD = 3.41$) and ranged from 1 to 14 ($M = 7.23$, $SD = 3.67$) in the control group.

PCL-5. Overall baseline PCL-5 scores ranged from 0 to 30 ($M = 14.52$, $SD = 10.05$). PCL-5 scores in the experimental group ranged from 1 to 30 ($M = 16.07$, $SD = 10.76$) and ranged from 0 to 30 ($M = 12.85$, $SD = 9.35$) in the control group.

Healthy Days Core Module. Health related quality of life ranged from 0 (*high quality of life*) to 30 (*low quality of life*), ($M = 15.85$, $SD = 10.92$). Scores in the

experimental group ranged from 0 to 30 ($M = 16.50$, $SD = 12.05$) and ranged from 0 to 30 ($M = 15.15$, $SD = 10.02$) in the control group.

Assumptions

Data were screened for outliers and normality prior to running the analyses. Outliers were identified on each of the measures at each timepoint, however, they were not removed in line with intention to treat protocols. Testing the normality assumption found only slight issues with kurtosis on the Healthy Days Core Module at baseline. Square root transformations fixed the kurtosis problem. Because normality was met at post-test and follow-up, and due to limitations caused by an underpowered sample, data were analyzed using the untransformed values. Variance and sample ratios were acceptable for each measure at less than 4:1 and 2:1, respectively.

Violations of the sphericity assumption varied: some ANOVA models violated the assumption and other models met the assumption. A more detailed description and the processes taken for corrections are provided in the analyses below.

Research Question 1: Does expressive writing result in greater positive outcomes than neutral writing?

This question was examined using a 2x3 repeated measures ANOVA to compare the results of the control group to the experimental group at baseline, post-test, and follow-up on each of the measures. It was hypothesized that participants in the treatment

condition would see greater improvement than participants in the control condition on each of the measures.

Hypothesis 1a: Physical Health (PHQ-15). A 2x3 repeated measures ANOVA was run to determine if group means differed at baseline, post-test, and follow-up. Results of the ANOVA suggested that follow-up scores in the treatment group ($M = 4.0$, $SD = 3.54$) did not differ significantly from the follow-up scores in control group ($M = 5.40$, $SD = 2.87$), $F(2, 40) = 2.67$, $p = .08$, ($\eta_p^2 = 0.007$), 95% CI $[-0.83, 0.84]$. Data met the sphericity assumption with a Greenhouse-Geisser value of 0.93. Results suggest that the treatment condition did not have a significant effect on physical health outcomes as measured by changes in scores on the PHQ-15. Simple effects tests were not run due to the lack of an interaction effect.

Hypothesis 1b: Mental Health. A 2x3 repeated measures ANOVA was run to determine if between group means differed at baseline, post-test, and follow-up. Results of the ANOVA suggested that follow-up scores in the treatment group ($M = 9.92$, $SD = 7.29$) did not differ significantly from the follow-up scores in control group ($M = 10.90$, $SD = 4.01$), $F(2, 40) = 0.11$, $p = .89$, ($\eta_p^2 = 0.0004$), 95% CI $[-0.83, 0.83]$. Data did not meet the sphericity assumption with a Greenhouse-Geisser value of 0.78. Corrections using the Huynh-Feldt Adjustment yielded $df = 1.56, 31.20$, and $p = 0.85$. Results suggest that the treatment condition did not have a significant effect on mental health outcomes as measured by changes in the composite scores. Simple effects tests were not run due to a lack of an interaction effect.

Hypothesis 1c: Trauma (PCL-5). Results of the ANOVA suggested that follow-up scores in the treatment group ($M = 10.0$, $SD = 7.79$) did not differ significantly from the follow-up scores in control group ($M = 11.30$, $SD = 6.29$), $F(2, 40) = 0.57$, $p = .56$, ($\eta_p^2 = 0.003$), 95% CI $[-0.83, 0.84]$. Data did not meet the sphericity assumption with Greenhouse-Geisser value of 0.69. Corrections using the Huynh-Feldt Adjustment yielded $df = 1.38, 27.6$ and $p = .51$. Results suggest that the treatment condition did not have a significant effect on changes in trauma severity as measured by changes in scores the PCL-5. Simple effects tests were not run due to the lack of an interaction effect.

Hypothesis 1d: Health Related Quality of Life. Results of the ANOVA suggested that follow-up scores in the treatment group ($M = 10.75$, $SD = 11.33$) did not differ significantly from the follow-up scores in control group ($M = 9.60$, $SD = 9.45$), $F(2, 40) = 2.24$, $p = .12$, ($\eta_p^2 = 0.014$), 95% CI $[-0.825, 0.853]$. Data met the sphericity assumption with a Greenhouse-Geisser value of 0.88. Results suggest that the treatment condition did not have a significant effect on changes to quality of life as measured by changes in scores on the Healthy Days Core Module. Simple effects tests were not run due to the lack of an interaction effect.

Research Question 2: Do ACE scores moderate expressive writing outcomes?

This question was examined using a 2x2x3 repeated measures mixed-model ANOVA to compare the results of the control group to the experimental group at baseline, post-test, and follow-up on each of the measures with the possible moderating influence ACE scores may have had on the outcomes. It was hypothesized that ACE

score would have a moderating effect on expressive writing outcomes, with those reporting a high number of ACEs (≥ 4) benefiting more from expressive writing than those reporting a low number of ACEs (< 4) at four-week follow-up compared to baseline scores.

Hypothesis 2a: Physical Health (PHQ-15). The three-way interaction between condition, ACE score, and time was significant, $F(2, 36) = 4.01, p = .03, (\eta_p^2 = 0.009)$ (see Figures 1 and 2). However, the confidence interval did not indicate a significant effect at 95% CI $[-0.83, 0.84]$. Furthermore, the interaction between condition and ACE score was not significant, $F(1, 18) = 0.41, p = .53, (\eta_p^2 = 0.005)$, suggesting that ACE scores did not affect treatment outcomes observed in the first research question. Data met the sphericity assumption with a Greenhouse-Geisser value of 0.92.

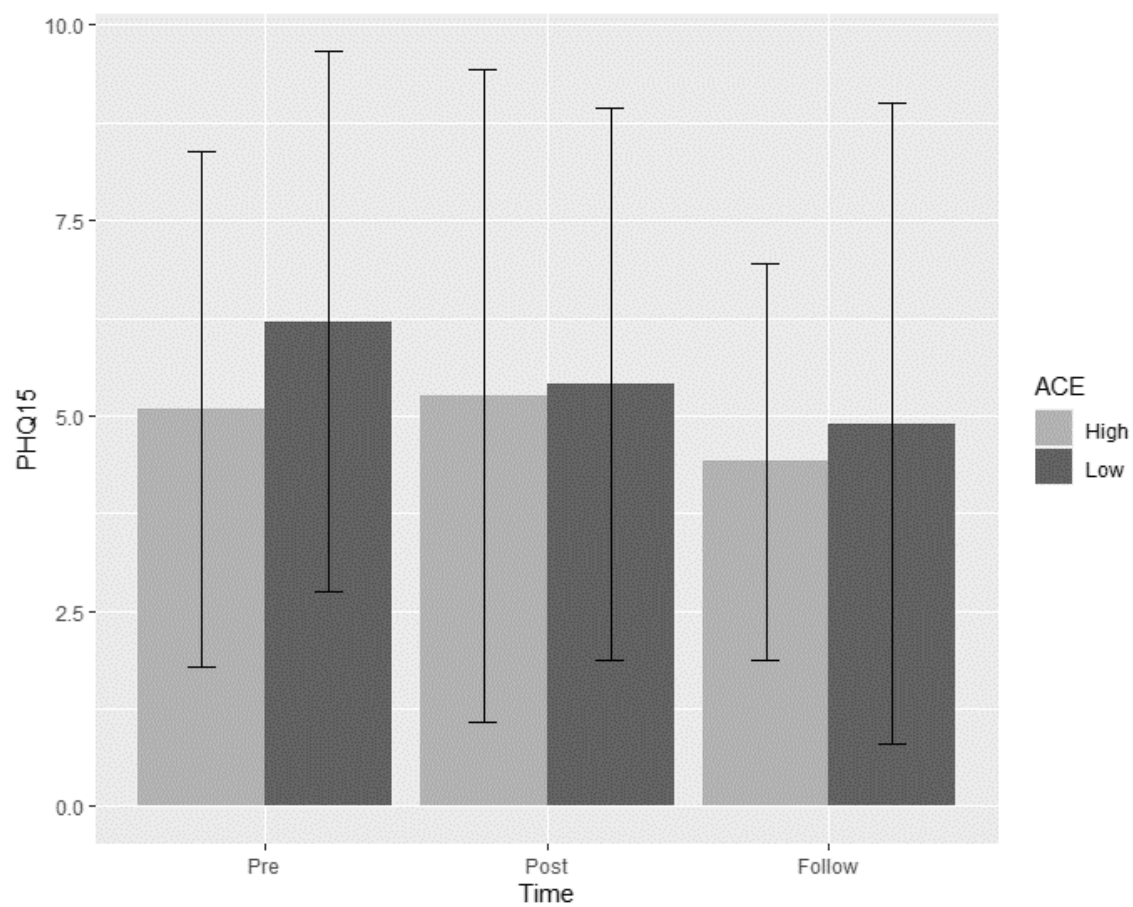


Figure 1. Score changes by ACE score

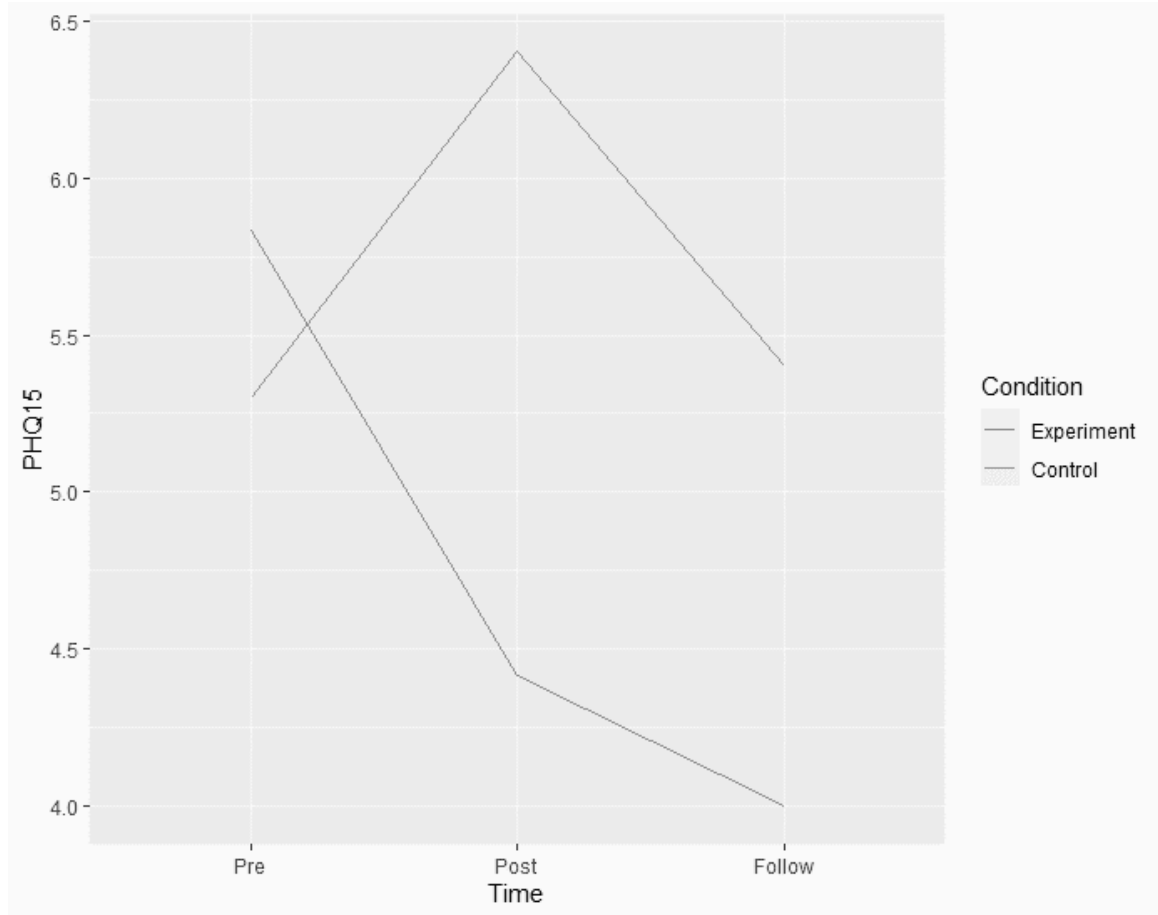


Figure 2. Score changes by condition

Simple effects tests clarified the interaction effect. Results for the treatment group found no significant effect of ACE score on outcomes (see Figure 3), $F(1, 10) = 0.48$, $p = .50$, ($\eta_p^2 = 0.04$). Time was found to have a significant effect, $F(2, 20) = 5.83$, $p = 0.01$, ($\eta_p^2 = 0.066$). No significant interaction effect was found between time and ACE score, $F(2, 20) = 2.82$, $p = 0.08$, ($\eta_p^2 = 0.03$). It was assumed that the sphericity assumption was violated with a Greenhouse-Geisser value of 0.852 for both the ACE x time interaction and for time. Corrections with a

Huynh-Feldt Adjustment, yielded $df = 1.70, 17$ and $p = 0.08$ for the ACE x time interaction and yielded $df = 1.70, 17$ and $p = 0.01$ for time.

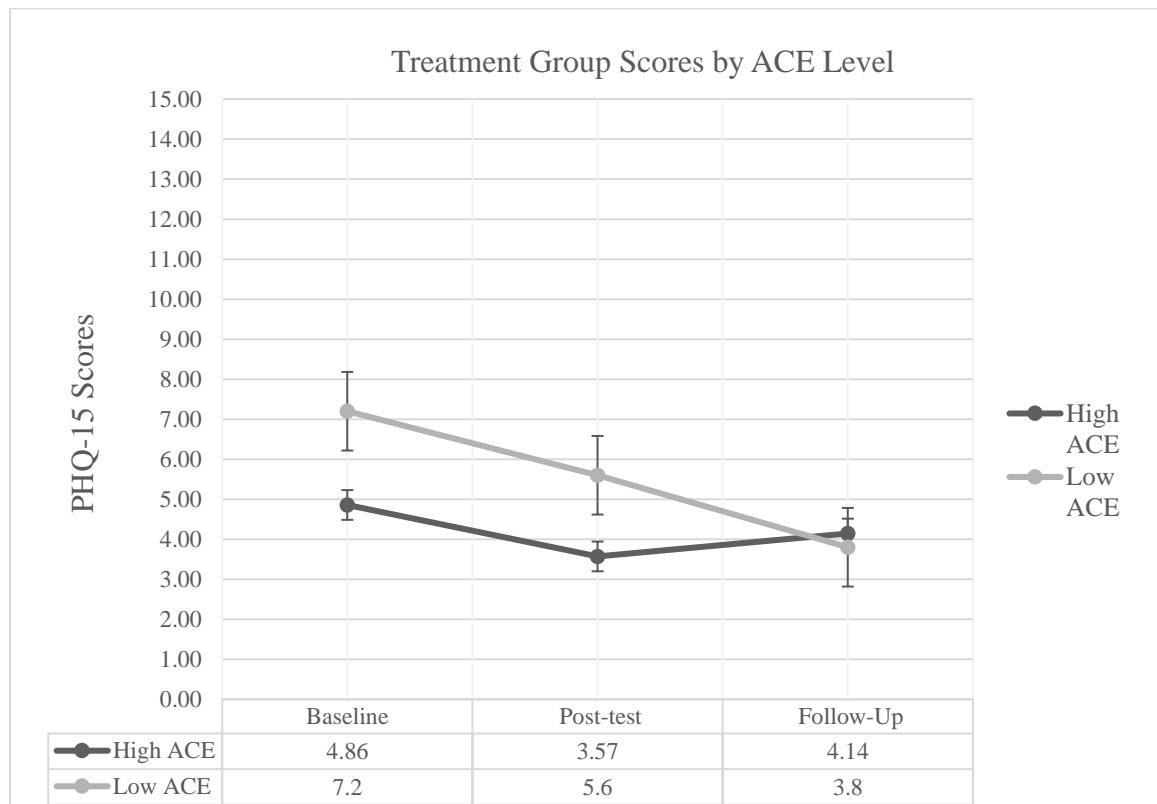


Figure 3. Changes in treatment group mean scores by ACE level ($n = 12$).

Simple effects tests for the control group found no significant effect of ACE score on outcomes (see Figure 4), $F(1, 8) = 0.05$, $p = 0.82$, ($\eta_p^2 = 0.005$). Time had no effect, $F(2, 16) = 0.86$, $p = 0.43$, ($\eta_p^2 = 0.02$). The interaction between ACE score and time was not significant, $F(2, 16) = 1.93$, $p = 0.17$, ($\eta_p^2 = 0.05$). The ACE x time interaction and time both met the sphericity assumption with a Greenhouse-Geisser value of 0.904.

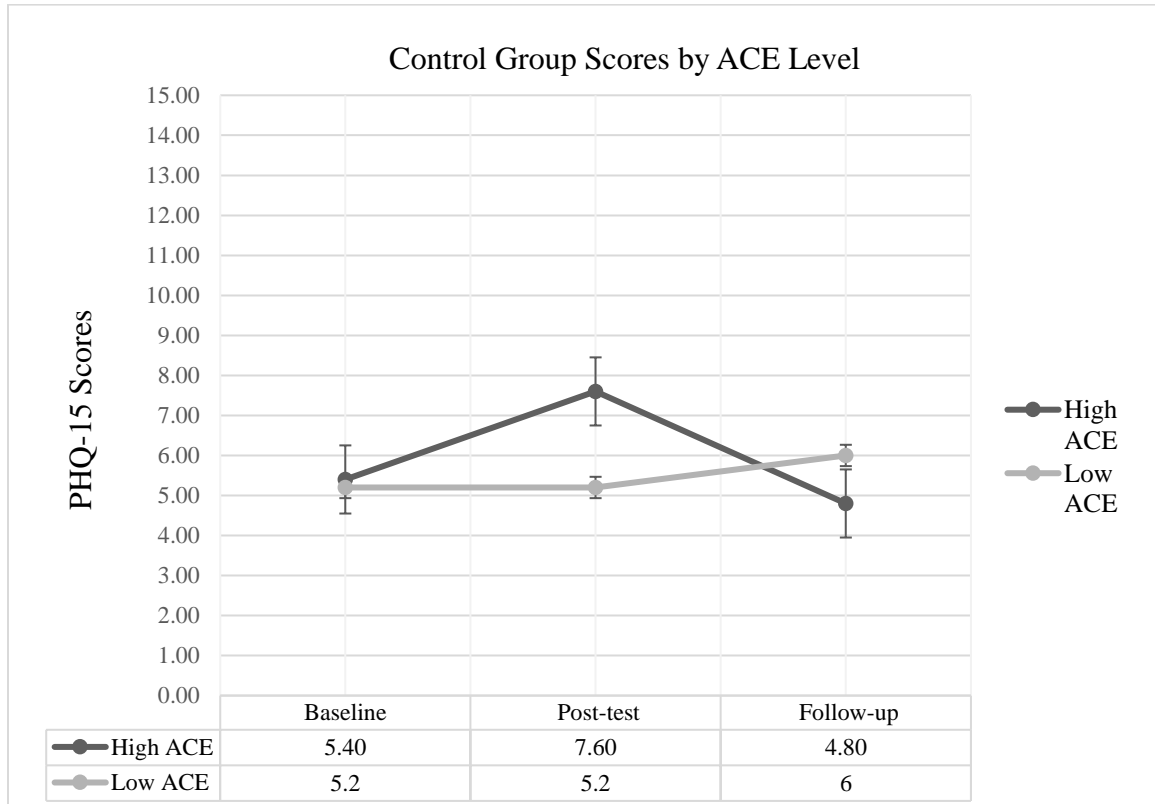


Figure 4. Changes in control group scores by ACE level ($n = 10$)

Results suggest that ACE score did not have a moderating effect on changes in physical health outcomes associated with expressive writing.

Hypothesis 2b: Mental Health. Testing the three-way interaction between Condition, ACE score, and Time did not find a statistically significant main effect, $F(2, 36) = 1.63$, $p = 0.20$, ($\eta_p^2 = 0.005$), 95% CI $[-0.83, 0.84]$. There was no statistically significant interaction effect between Condition and ACE score, $F(1, 18) = 0.14$, $p = 0.71$, ($\eta_p^2 = 0.001$). The interaction effect for ACE score and time was significant, $F(2,$

36) = 3.76, $p = .03$, ($\eta_p^2 = 0.012$), however, this was not probed further due to lack of adequate power.

Data did not meet the sphericity assumption, with a Greenhouse-Geisser value of 0.83. Corrections using the Huynh-Feldt Adjustment yielded $df = 1.66$, 29.88, and $p = .038$ for the ACE x Time interaction, $df = 1.66$, 29.88 and $p = .21$ for the three-way interaction, and $df = 0.83$, 14.94 and $p = .84$ for the Condition x ACE interaction.

Results suggest that ACE scores did not have a significant moderating effect on changes in mental health outcomes associated with expressive writing. Simple effects were not run due to the lack of an interaction effect.

Hypothesis 2c: Trauma (PCL-5). Testing the three-way interaction between Condition, ACE score, and Time did not find a significant main effect, $F(2, 36) = 2.22$, $p = .12$, ($\eta_p^2 = 0.01$), 95% CI [-0.827, 0.85]. No significant effect was found for the interaction between Condition and ACE score, $F(1, 18) = 0.77$, $p = 0.34$, partial ($\eta_p^2 = 0.01$). Data did not meet the sphericity assumption with a Greenhouse-Geisser value of 0.72. A Huynh-Feldt Adjustment yielded a corrected $df = 1.44$, 25.92 and $p = .13$ for the three-way interaction.

Results of the ANOVA suggested that ACE scores did not have a significant moderating effect on changes of trauma symptom severity associated with expressive writing. Simple effects tests were not run due to the lack of an interaction effect.

Hypothesis 2d: Health Related Quality of Life. Testing the three-way interaction between Condition, ACE score, and Time did not find a significant main effect, $F(2, 36) = 1.82$, $p = .18$, ($\eta_p^2 = 0.01$), 95% CI [-0.828, 0.85]. No significant effect

was found for the Condition and ACE interaction, $F(1, 18) = 0.01$, $p = .92$, ($\eta_p^2 = 0.0001$).

Testing the sphericity assumption found a Greenhouse-Geisser value of 0.85. It was assumed that the assumption was violated and a Huynh-Feldt Adjustment was used to correct the results. Corrections yielded $df = 1.7, 30.6$, $p = 0.17$ for the three-way interaction and $df = 0.85, 15.3$, $p = .50$ for the Condition and ACE interaction effect.

Results suggest that ACE scores did not have a significant moderating effect on changes in quality of life associated with expressive writing. Simple effects tests were not run due to the lack of an interaction effect.

Research Question 3: Do different categories of ACEs respond differently to expressive writing?

This question was explored using a post-hoc analysis. A correlational table was created to examine correlations between baseline mean scores on each measure and each of the 12 ACE items (see Table 1). Because the results of the first two research questions did not find significant differences between the experimental and control groups at four-week follow-up, the analysis used the overall mean for each measure instead of comparing means between the control and experimental groups.

Baseline scores on the PHQ-15, PHQ-9, and GAD-7 did not correlate with any of the 12 ACE items suggesting that ACE scores did not affect physical health, depression, or anxiety symptom severity (see Table 1).

Table 1. *Baseline correlations between mean scores and ACE items*

Variable	<i>M</i>	<i>SD</i>	1. PHQ15	2.PHQ9	3.GAD7	4.PCL5	5.HRQoL
1. ACE Score	4.56	2.95	.10 [-.29, .46]	.04 [-.34, .42]	-.10 [-.46, .29]	.33 [-.06, .63]	.22 [-.17, .55]
2. ACE 1	0.78	0.42	.29 [-.10, .61]	.24 [-.16, .56]	.11 [-.28, .47]	.19 [-.20, .53]	.22 [-.18, .55]
3. ACE 2	0.48	0.51	-.23 [-.56, .17]	.06 [-.33, .43]	-.14 [-.50, .25]	.16 [-.23, .51]	-.27 [-.59, .12]
4. ACE 3	0.22	0.42	.02 [-.37, .39]	.23 [-.16, .56]	.12 [-.27, .48]	.28 [-.11, .60]	-.09 [-.46, .30]
5. ACE 4	0.22	0.42	-.06 [-.43, .33]	-.26 [-.58, .13]	.10 [-.29, .46]	.02 [-.37, .39]	-.06 [-.43, .33]
6. ACE 5	0.33	0.48	-.11 [-.47, .29]	.19 [-.21, .53]	-.03 [-.41, .35]	-.04 [-.41, .35]	-.16 [-.51, .24]
7. ACE 6	0.52	0.58	.36 [-.03, .65]	.03 [-.36, .40]	-.02 [-.40, .36]	.45* [.09, .71]	.23 [-.17, .56]
8. ACE 7	0.41	0.50	-.12 [-.48, .28]	.03 [-.36, .40]	-.07 [-.44, .32]	.09 [-.30, .45]	.11 [-.28, .47]
9. ACE 8	0.63	0.49	.06 [-.33, .43]	.04 [-.35, .41]	-.20 [-.54, .19]	.13 [-.26, .49]	.02 [-.36, .40]
10. ACE 9	0.37	0.49	.23 [-.17, .56]	-.11 [-.47, .28]	-.17 [-.52, .23]	.27 [-.12, .59]	.43* [.06, .70]
11. ACE 10	0.30	0.47	.19 [-.20, .53]	-.05 [-.42, .33]	.02 [-.36, .40]	.35 [-.03, .65]	.70** [.43, .85]
12. ACE 11	0.15	0.36	-.10 [-.46, .29]	-.19 [-.53, .20]	-.13 [-.49, .26]	-.18 [-.52, .21]	.34 [-.05, .64]
13. ACE 12	0.19	0.40	.29 [-.10, .61]	.14 [-.25, .49]	-.16 [-.51, .24]	.37 [-.01, .66]	.08 [-.31, .44]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. * $p < .05$. ** $p < .01$.

The PCL-5 had a significant positive correlation with ACE item 6 (*How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?*) at $r_s = 0.45$, 95% CI [.09, .71], which would suggest that witnessing violence between parents in childhood may increase trauma symptom severity in adulthood. However, further testing would be needed due to the wide confidence interval range.

The Healthy Days Core Module had a significant positive correlation with ACE item 9 (*How often did anyone at least 5 years older than you or an adult, ever touch you sexually?*), $r_s = 0.43$, 95% CI [.06, .70] and a strong positive correlation with ACE item 10 (*How often did anyone at least 5 years older than you or an adult, try to make you touch sexually?*) at $r_s = 0.70$, 95% CI [.43, .85], suggesting that people who have experienced childhood sexual abuse may experience lower health-related quality of life. However, as with the PCL-5, further testing would be needed given the wide confidence interval ranges.

Due to these limitations and the underpowered sample size, it was deemed unfeasible to run any further post-hoc tests on baseline, post-test, or follow-up scores.

Clinical Significance

All tests were calculated using an online reliable change calculator (Reliable change and Jacobson-Truax indices dashboard, 2019). The calculator is a Shiny app hosted by the RStudio cloud server and available through GitHub (Jacobson-Truax & reliable change indices, 2019). A clinically significant cutoff was established separately for each measure using the pretreatment means and standard deviations from the current

study. A decrease in scores was associated with improvement and an increase in scores was associated with deterioration. Therefore, a negative cutoff value was used for each measure. An RCI was calculated for each individual using the difference between pretest and posttest scores divided by the standard error of the difference. An RCI greater than 1.96 is considered statistically meaningful ($p < .05$) (Jacobson & Truax, 1991).

Individuals who had a decrease in scores and an RCI greater than 1.96 were considered improved. Individuals who had an increase in scores and an RCI greater than 1.96 were considered deteriorated. Results are provided to contextualize the statistical findings, with the caveat that meaningful inferences cannot be made without adequate statistical power. Collectively, the statistical and clinical significance tests can help generate future research questions and hypotheses.

Physical Health (PHQ-15). A clinically significant cutoff of -1.1 was established for the measure. Three out of 12 participants in the treatment group had an RCI of greater than 1.96 and decreased scores, suggesting improvement in symptoms. One out of 10 participants in the control group had an RCI of greater than 1.96 and a decreased score, suggesting improvement in symptoms (see Figure 5). When grouped by ACE score, the three improved participants in the treatment group each had a low ACE score and the improved participant in the control group had a high ACE score (see Figure 6).

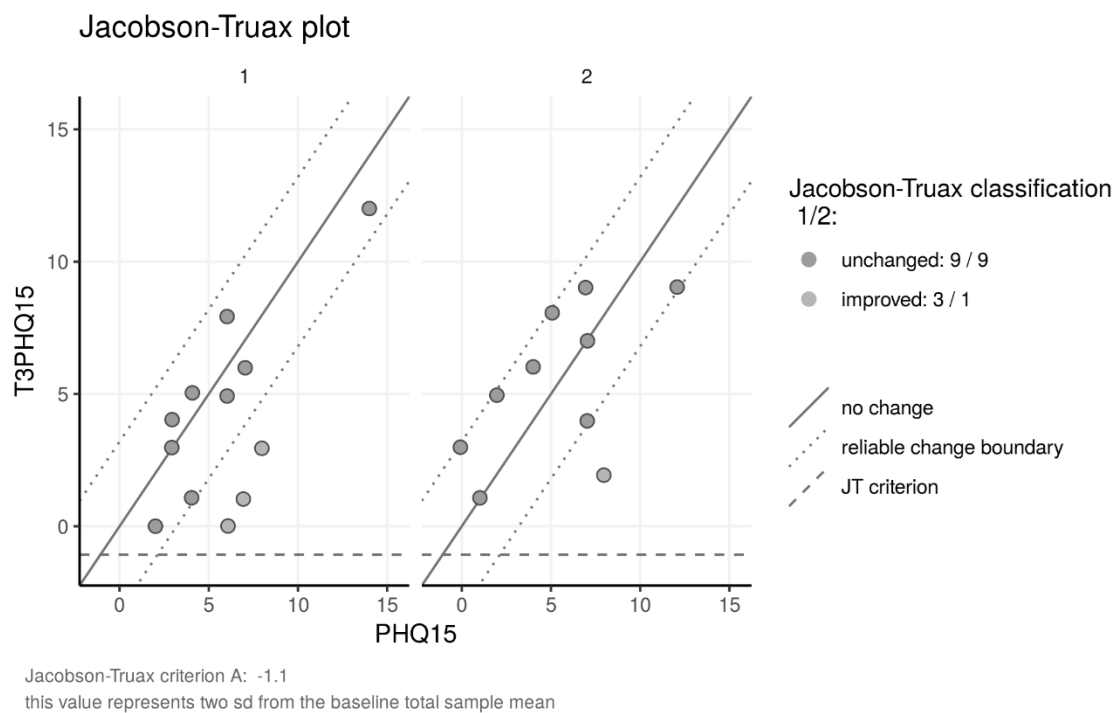


Figure 5. Individual change scores on the PHQ-15, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$)

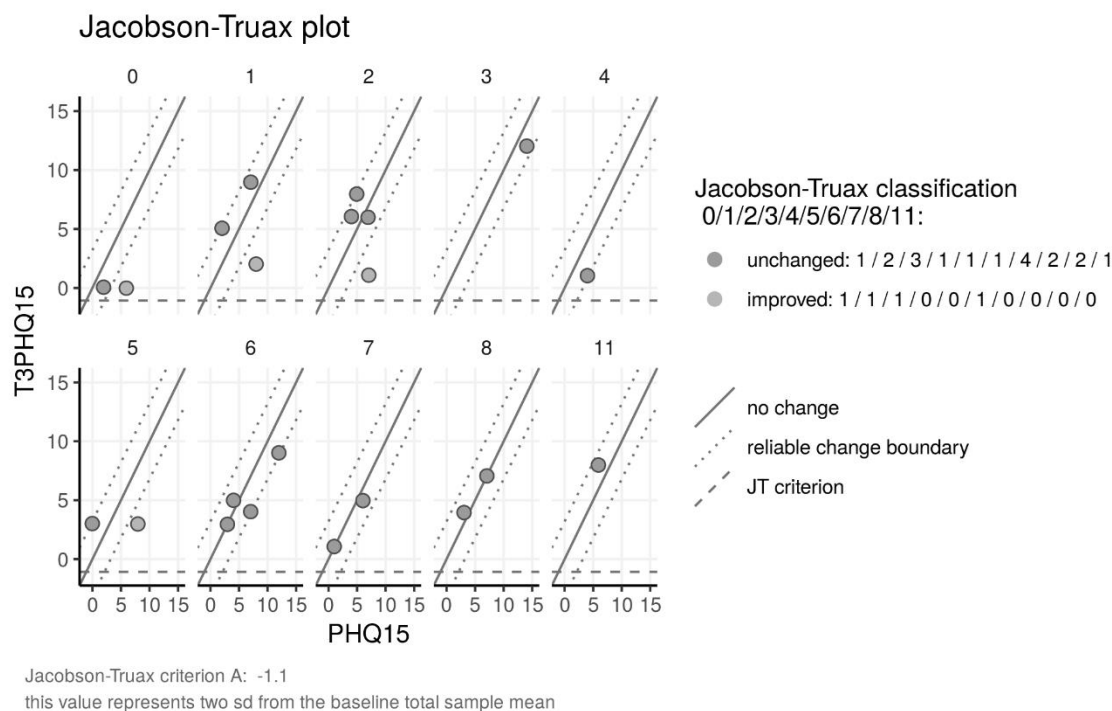


Figure 6. Individual change scores on the PHQ-15 grouped by ACE score.

Depression (PHQ-9). A clinically significant cutoff of -1 was established for the measure. Three out of 12 participants in the treatment group had an RCI of greater than 1.96 and decreased scores, suggesting improvement but not recovery. Another three participants in the treatment group had an RCI of greater than 1.96 and had an increase in scores at follow-up, suggesting deteriorating symptoms. In the control group, one out of 10 participants had an RCI greater than 1.96 and a decreased score, suggesting improvement. Another person had an RCI greater than 1.96 and an increased score, suggesting deteriorating symptoms (see Figure 7).

Of the four deteriorating participants, three had a high ACE score and one had a low ACE score. Of the four improved participants, three had a low ACE score and one had a high ACE score (see Figure 8).

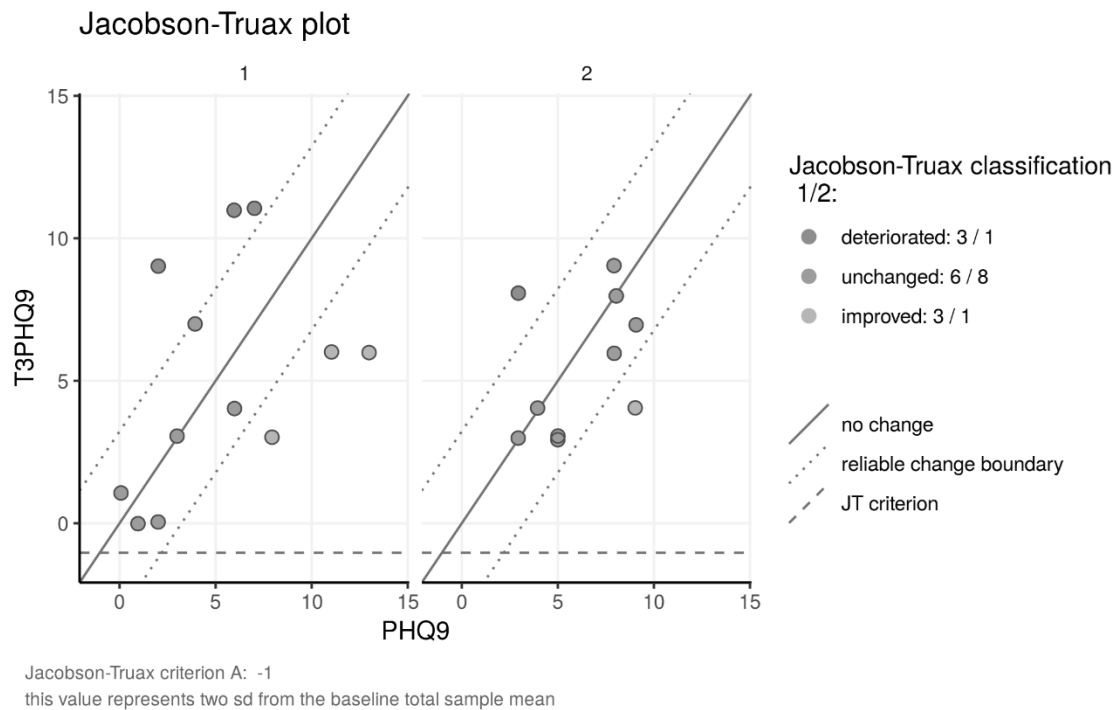


Figure 7. Individual change scores on the PHQ-9, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$).

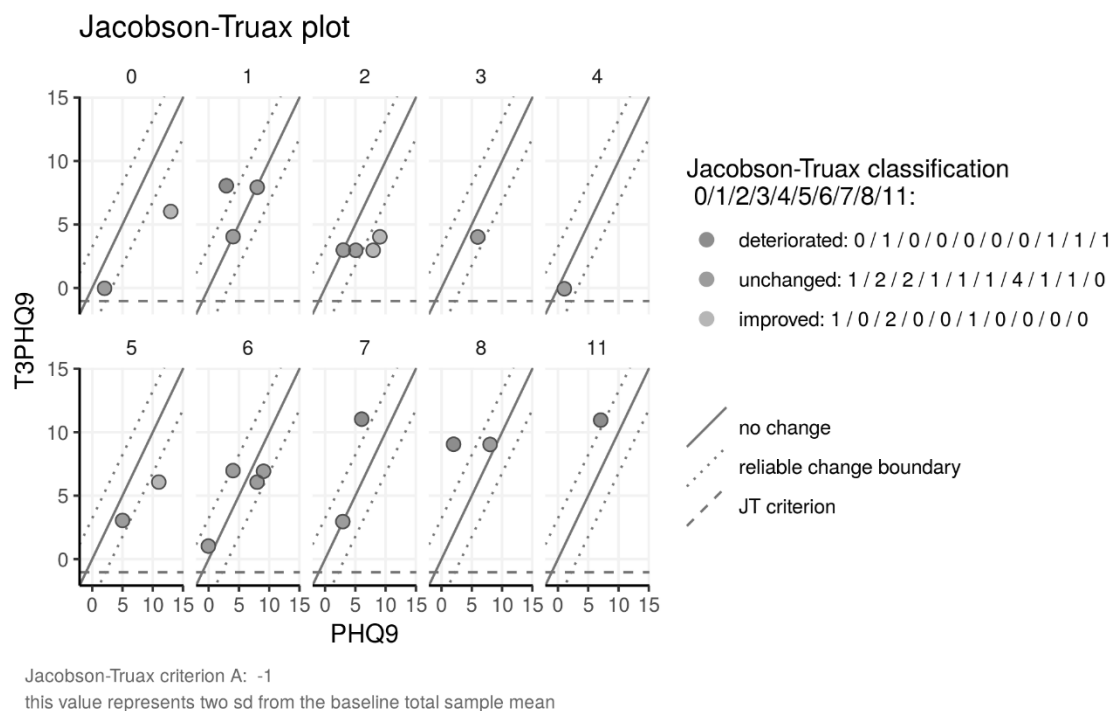


Figure 8. Individual change scores on the PHQ-9 grouped by ACE score.

Anxiety (GAD-7). A clinically significant cutoff of -1 was established for the measure.

Three out of 12 participants in the treatment condition had an RCI greater than 1.96 and decreased scores, suggesting improvement. One person in the treatment group had an RCI greater than 1.96 and an increased score, suggesting deterioration. In the control group, two out of 10 participants had an RCI of greater than 1.96 and decreased scores, suggesting improvement. One person had an RCI greater than 1.96 and an increased score, suggesting deteriorating symptoms (see Figure 9). The three participants in the treatment group who improved each had low ACE scores, and

the two participants in the control group who improved had high ACE scores. Both participants who had deteriorating symptoms had high ACE scores (see Figure 10).



Figure 9. Individual change scores on the GAD-7, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$).

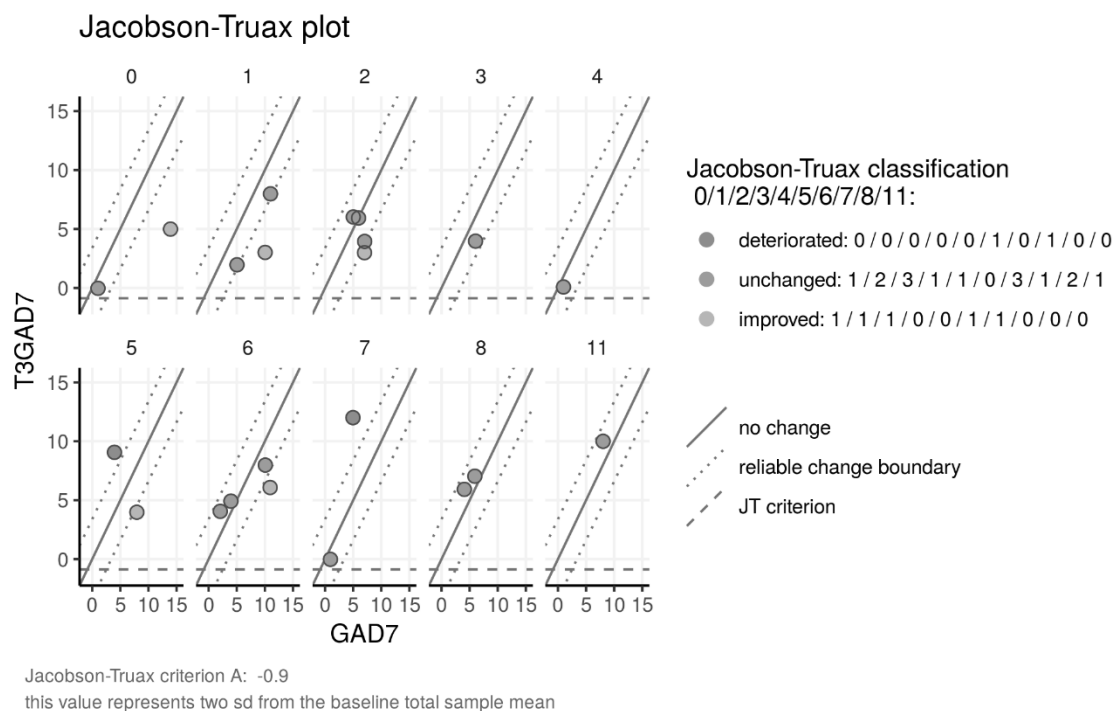


Figure 10. Individual change scores on the GAD-7 grouped by ACE score.

Trauma (PCL-5). A clinically significant cutoff of -6.3 was established for this measure. One out of 12 participants in the treatment group and one out of 10 participants in the control group each had an RCI greater than 1.96 and lower scores, suggesting improvement (see Figure 11). One of these participants had a low ACE score and one had a high ACE score (see Figure 12).

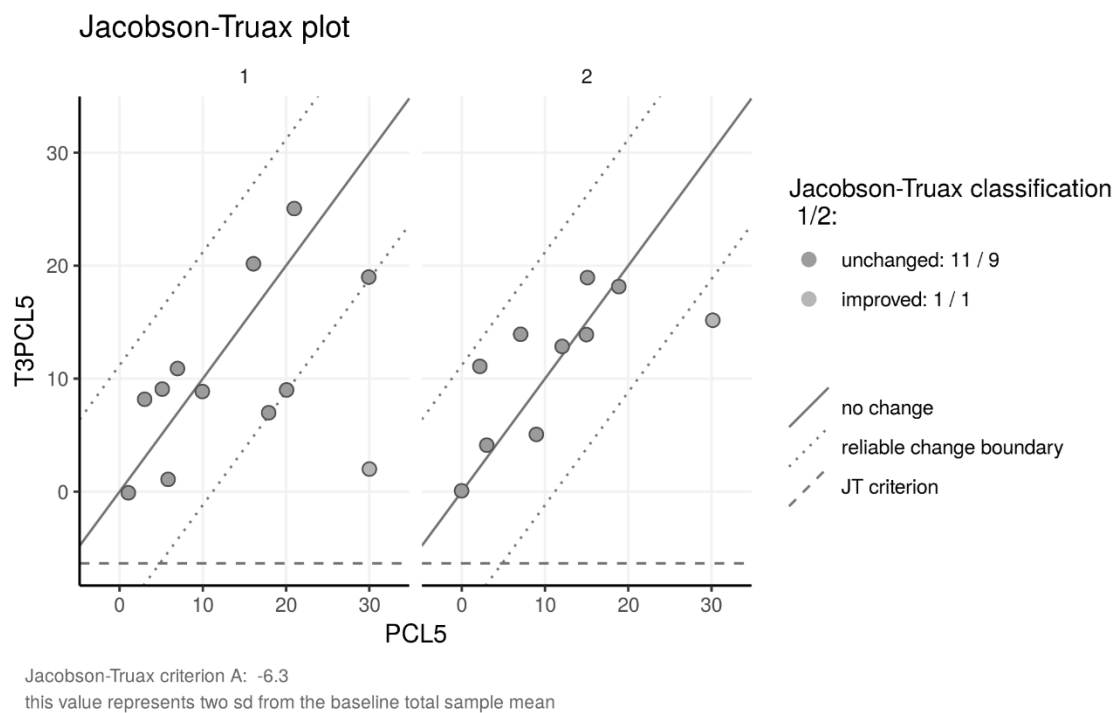


Figure 11. Individual change scores on the PCL-5, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$)

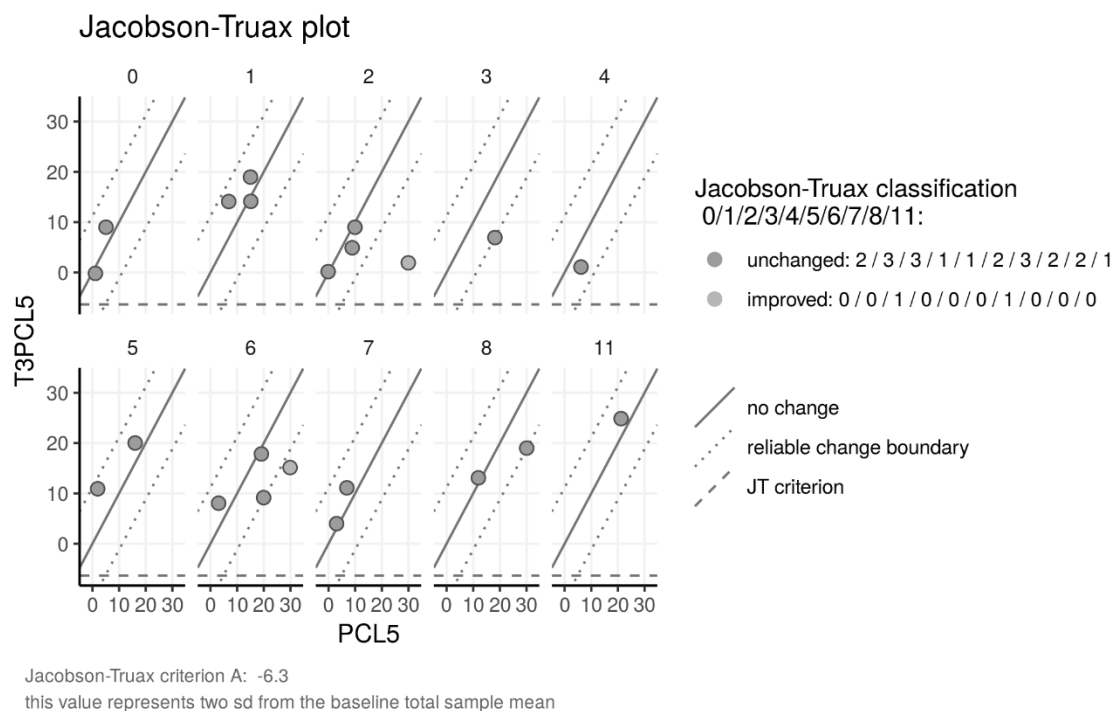


Figure 12. Individual change scores on the PCL-5 grouped by ACE score

Health Related Quality of Life. A clinically significant cutoff of -6.4 was established for this measure. Three out of 12 participants in the treatment group had an RCI of greater than 1.96 and lower scores, suggesting improvement. Two out of 10 participants in the control group had an RCI of greater than 1.96 and lower scores, suggesting improvement. One participant in the control group had an RCI of greater than 1.96 and higher scores, suggesting deterioration (see Figure 13). Each of the participants in treatment group had a high ACE score and each of the participants in the control group had a low ACE score (see Figure 14).

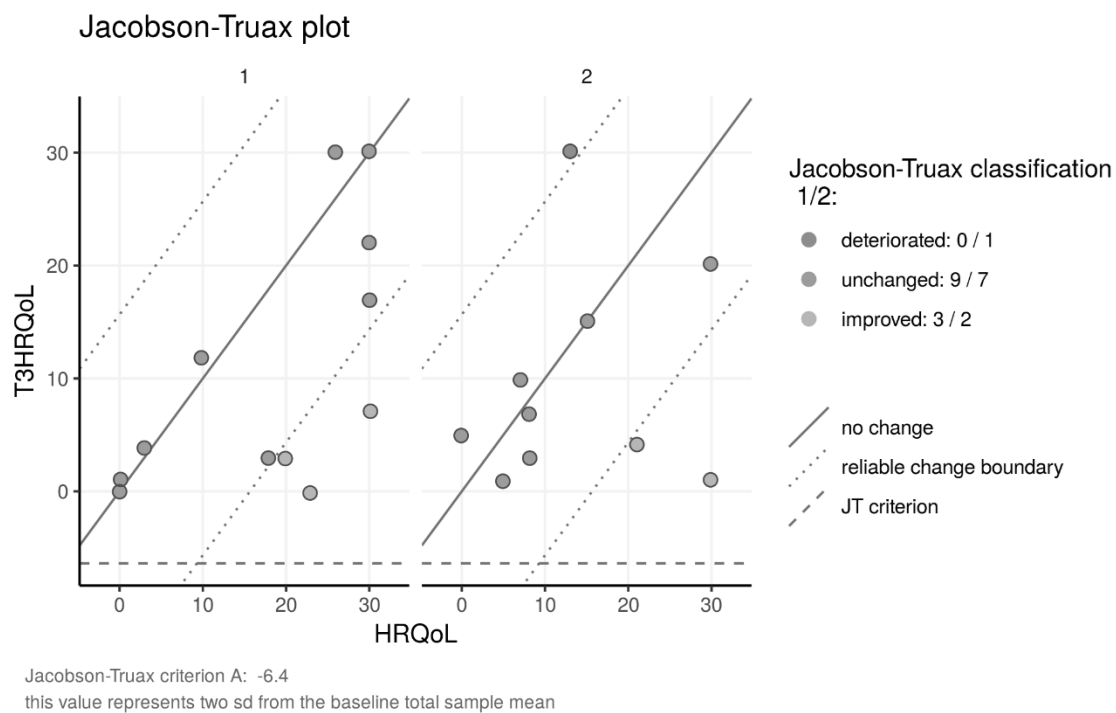


Figure 13. Individual change scores on the Healthy Days Core Module, grouped by treatment condition (Group 1, $n = 12$) and control condition (Group 2, $n = 10$)

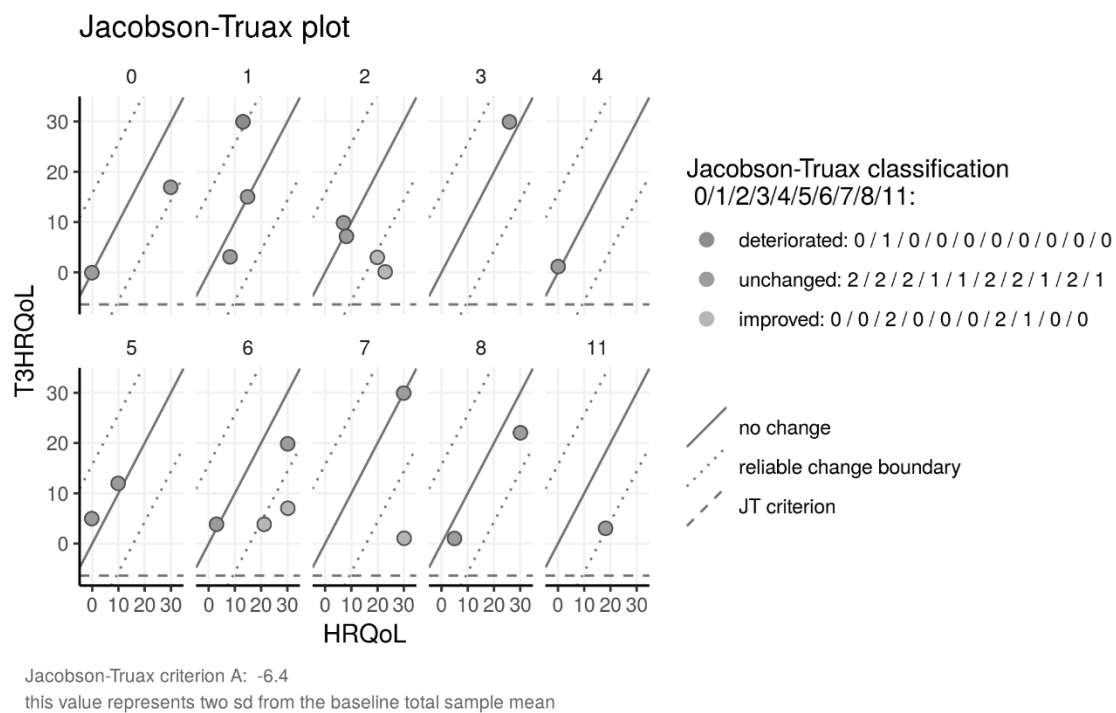


Figure 14. Individual change scores on the Healthy Days Core Module grouped by ACE score.

Discussion

Results of the present study did not support the hypotheses in the first research question that participants in the expressive writing condition would show greater improvement on physical health, mental health, trauma, or quality of life than participants in the control group. Results also did not support the hypotheses in the second research question that ACE scores would have a moderating effect on expressive writing outcomes, or that participants with higher ACE scores would show greater improvement in physical health, mental health, trauma, or quality of life than participants with low ACE scores. This lead to the conclusion that there was no significant difference between the treatment and control groups and that ACE scores did not have a moderating effect on expressive writing outcomes.

It was hypothesized that people with higher ACE scores would see greater improvement in physical health, trauma severity, mental health, and quality of life, due to the impact of adverse childhood experiences on emotional expressiveness and the moderating role of this relationship in emotional processing. However, the results of the current study suggest that the opposite may have occurred: People with lower ACE scores seemed to fare better on physical health, depression, and anxiety, with no major differences on trauma, and people with high ACEs faring only marginally better than people low ACEs.

Clinical significance tests suggest that expressive writing may have had a positive effect on physical health in people with low ACE scores. This finding is supported by the

statistically significant interaction between ACE score, treatment condition, and time found in the second research question. Although simple effects tests did not find a statistically significant interaction between ACE score and treatment condition, it is possible that the number of participants in the control group ($n = 10$) and experimental group ($n = 12$), when divided between high and low ACE score, was too small for the simple effects test to detect change. Additionally, results of the confidence interval did not find a statistically significant effect of ACE score or condition on physical health outcomes.

It is possible that this interpretation is a Type II error. Prior research has noted a small but significant effect for physical health outcomes as a result of expressive writing (e.g., Frattaroli 2006; Frisina, Borod, & Lepore, 2004), which is supported by the findings of the Jacobson-Truax test in the current study. It is therefore possible that a fully powered study could yield similar findings to the ones observed in the current study and provide a more accurate statistical effect. However, until a fully powered study can be run to test this finding, it should be concluded that no effect was found.

There were no statistically significant differences between the treatment and control groups on depression, anxiety, or trauma; however, clinical significance tests suggest expressive writing may have had a greater impact on depression and anxiety among people with low ACE scores than the neutral writing condition. The presence of deteriorating symptoms among people with high ACE scores may also suggest a greater risk-benefit ratio when using expressive writing for depressive or anxiety symptoms. This warrants further research.

The mixed findings in the current study are consistent with previous expressive writing research which tends to find larger but less consistent treatment effects for mental health problems. Higher ACE scores tend to correlate with greater symptom severity for depression, anxiety, and PTSD, which may be one of the reasons for mixed findings in the literature, especially if some studies account for regression to the mean and others do not.

Participants with higher ACE scores may have also struggled with emotional processing or identification, which could limit the treatment effect. Likewise, it is possible that the participants with lower ACE scores who fared better had an easier time processing and identifying the emotional content in their writing exercise. While this would contradict previous research in alexithymic individuals that suggests expressive writing is helpful for people who struggle with emotional processing and identification, this finding could be unique to alexithymia and unrelated to adverse childhood experiences.

Expressive writing may have had an effect on quality of life. Statistical testing found no significant difference between groups or a statistically significant moderating effect. Clinical significance tests yielded a clinically significant change cutoff of -6.4, suggesting a decrease of at least six unhealthy days in the last 30 days was needed to be considered meaningful. This is more stringent than the Healthy Days Core Module criteria of a one day decrease. This suggests that quality of life may have improved among people with high ACE scores in the treatment condition and low ACE scores in the control condition.

Of further consideration is the relationship between quality of life and sexual abuse. The correlational table the third research question suggested that exposure to sexual abuse correlated with lower health related quality of life at baseline, which is consistent with previous research that has found strong correlations between low health related quality of life and childhood sexual abuse (Dickinson et al., 1999). Previous expressive writing research has found mixed results when used in populations of CSA survivors, although quality of life was not an outcome variable in those studies (e.g. Batten, et al., 2002; Greenberg et al., 1996; Meston et al., 2013). Based on the correlational table and clinical significance findings, it may be that expressive writing can improve quality of life, but not trauma, anxiety, or depression, among populations with high ACE scores who have experienced childhood sexual abuse. As with the physical health findings, further research is warranted.

When contextualizing the current findings in relationship to the theoretical framework, it is possible that participants with lower ACE scores in the current study had greater access services and community care in childhood that helped them develop healthy coping strategies as adults, thus resulting in greater improvement. It is also possible that having lower ACE scores could have resulted in better physical health and better perceptions of quality of life at baseline. For example, if a participant with low ACE scores was able to regularly process and cope with high levels of stress in a healthy manner, this would lessen the impact of stress on physical health problems (e.g. inflammation, fatigue, illness, etc). Finally, people with lower ACEs may have been more

likely or more willing to reach out to support networks during the study to help process the content of their writing which could have affected the results.

As pilot data, statistical results and clinical significance testing suggest that expressive writing may have a greater positive impact on physical health than on depression, anxiety, trauma, or quality of life. There may be a relationship between ACE scores and expressive writing on physical health outcomes with people with low ACE scores potentially being more likely to benefit from expressive writing. Further testing with an adequately powered sample could yield further insight into these results.

One final note is the perceived benefit by people in the control group. Over the course of the study, there were individuals in the control group who noted on the post-writing questionnaire or confided to the researcher that they thought the writing exercises were helpful. Of particular interest was the responses to the question “to what degree did you express your deepest thoughts and feelings,” with several participants rating unexpectedly high despite their writing prompt explicitly stating to be as objective as possible.

It could be that the wording of the question may have primed participants in the control group to utilize more emotional content in their writing in each subsequent session. Alternatively, it could be that some of the participants struggled with time management in their daily lives and therefore found the writing prompts beneficial. Social desirability, cognitive dissonance, and placebo effects cannot be ruled out either. Unfortunately, without psychometric data on this measure this can only be considered speculative. Nevertheless, future studies will need to consider carefully the prompt used

for the neutral writing condition and consider ways to measure the perceived benefit of people in the control group.

Impact of Covid-19. The present study was designed prior to the start of the Covid-19 pandemic and was approved with modifications as the pandemic started in the United States. The presence of a global pandemic introduces strong potential for cohort and period effects that would affect the internal validity of the results.

The Covid-19 pandemic has had a profound economic, cultural, social, and political impact on the world, the effects of which will certainly be researched for years to come. Quarantines, social distancing, and health concerns about exposure to the virus are all just some of the various factors that have been correlated with deteriorating mental health (Centers for Disease Control, 2021). Additional concerns such as access to childcare, employment status, job security, education, housing, and the added stress caused by general uncertainty have also been correlated with deteriorating physical and mental health during the pandemic (Centers for Disease Control, 2021).

While expressive writing has been demonstrated to help reduce psychological distress associated with Covid-19 in Italian healthcare workers ($n = 55$) (Procaccia, Segre, Tamanza, & Manzoni, 2021) and increased emotional expression and processing among Italian citizens ($n = 64$) (Negri, Andreoli, Barazzetti, Zamin, & Christian, 2020), an online parallel randomized controlled trial of Serbian participants ($n = 120$) found expressive writing actually increased and worsened psychological distress in the treatment group with no significant group differences on depression, anxiety, or quality of life.

This suggests that expressive writing may not be beneficial and may even be harmful within the context of a global pandemic or other instances of catastrophic stress (Marković, Bjekić, & Priebe, 2020). Trend data from the current study may potentially lend support to this finding, as there were no statistically significant differences between the treatment or control groups on measures of depression or anxiety, with some participants showing a clinically significant deterioration in symptom severity.

Timing of the Follow-Up Surveys. Participants in the first wave of recruitment had their four-week follow-ups coincide with the California wildfires, resulting in dangerously poor air quality in the local county. Health concerns, county plans for evacuations, and living within the proximity of several fires may have exacerbated already existing mental and physical health problems which could have reduced the potential benefits of the expressive writing intervention. Participants in the second and third waves of recruitment had post-test and follow-ups around the Thanksgiving and Christmas holidays. While this can be a time of increased stress for people, the combined simultaneous impact of a global pandemic, quarantines, isolation, wildfires, and other historical phenomena may have also contributed to the lack of a significant effect of the expressive writing intervention.

In considering the increased stress caused by social, cultural, and environmental factors, it is possible increased stress levels may have limited or undone the treatment efficacy of expressive writing. The combined impact of Covid-19 and timing of the follow-up surveys may have captured instances where individual stress levels at baseline were elevated beyond normal levels, such that improved symptoms may be a return to

one's normal baseline. However, for participants who did not improve, it is possible that the combined impact of Covid-19 and follow-up timing resulted in chronic activation of the stress response system that overwhelmed the potential impact of expressive writing. Using a measure of Covid-19 related stress such as the Covid-19 Related Stress Scale (Taylor et al., 2020) would have provided important empirical data to further explore this potential confound and may have allowed for additional statistical tests such as moderated regression or ANCOVA to be used.

Limitations

There are several limitations to the study that need to be considered when interpreting the findings. The biggest limitation to the study is the lack of statistical power.

Statistical Power. As noted throughout, lack of power must qualify all of the conclusions for tests of statistical and clinical significance. Due to the small sample size and intention to treat design, outliers were not removed and data were left untransformed in the final analysis. However, the outliers on each measure and the kurtosis on the quality of life variable may have had an effect on the results that would otherwise not occur in a larger sample that allows for transformations and alternatives to the mean score. While some of the results did appear to trend towards statistical significance, most notably a significant interaction effect between ACE score and physical health, these could potentially be a result of alpha errors as evidenced by 0 falling within the confidence intervals and simple effects tests not finding an effect.

Finally, the underpowered sample size combined with testing multiple hypotheses would have increased the risk of Type I and Type II errors in the final analysis. This was modeled in this data by setting alpha to .001 using a Bonferroni adjustment in the initial power analysis, using more conservative tests to analyze the data, and using an intention to treat design to bring the final sample size as close as possible to the recommended number for power. While with an underpowered sample these corrections are potentially irrelevant; they may be applied to future studies to help minimize the risk of false positives and false negatives.

It is important to note that prior expressive writing studies have found statistically meaningful results with sample sizes and study designs similar to those reported in the current study. These studies typically report a confidence of 0.85 and $\alpha = .05$ in their power analyses. It was decided to use more stringent criteria in the present study due to the number of research questions and hypotheses tested across multiple timepoints. However, two separate *post hoc* power analyses, one using the reported sample sizes, means, standard deviations, and effect sizes from the current study, and one using the *a priori* power analysis data, both with confidence set to 0.85 and $\alpha = .05$ and no corrections for repeated testing *did not* find evidence of sufficient power for any of the measures in the current study.

This discrepancy may result from a variety of different reasons. First, it is possible that the aforementioned studies calculated their sample size using the reported effect sizes, means, and standard deviations from the measures used in those studies,

rather than from specific expressive writing studies using those measures. This would yield different sample requirements when the measures are different.

It is also possible that the power analyses were conducted using reported effect sizes, means, and standard deviations from one sample that may not be applicable to a different sample (e.g. comparing treatment efficacy of expressive writing in a non-clinically depressed sample using data from a clinically depressed sample). In a similar respect, using different effect sizes can also yield different results even when the samples do not differ. This gets into a broader issue around the lack of agreed upon criteria for how large or small an effect size needs to be to be considered useful or meaningless.

Of course, the most obvious implication and the one that will perhaps most likely be accepted is that the power analyses in the current study was conducted by an amateur researcher and are therefore inaccurate. After all, previous expressive writing studies were conducted by professional researchers with years of research experience and statistical training that far exceeds that of a Master's student. It is so obviously unthinkable that a professor in an academic field would publish an underpowered study and have the audacity to claim statistically significant findings that it should not even be considered. After all, what could a researcher hope to gain from such doing such a thing?

Changes to Online Design. The study's planned design involved in-person writing sessions. Due to the impact of Covid-19 the study was switched to an online format using Zoom. Expressive writing research has shown mixed results when administered online, with several studies finding no effect and others finding small effects. Participants were given the option to write by hand or by using word processing

software like Microsoft Word or Google Docs. Writing samples were not collected from the participants, and so the numbers of participants who wrote by hand versus those who wrote electronically is unknown.

Another obstacle presented is that participants may have felt isolated or disconnected from the researcher when doing the writing exercises and were thus less likely to really engage with the writing prompts. Conversely, the absence of an in-person interaction may have benefited the study limiting social desirability effects, potentially allowing participants to feel more open and honest in their writing.

Finally, the online format presents both an ease of access and barrier to participants. It is likely that being able to log into the Zoom room from home instead of driving to the university campus contributed to the low drop-out rate observed in the present study. At the same time, unfamiliarity with Zoom or concerns about the software's lack of privacy features, or a lack of reliable internet service may have deterred potential participants.

Conclusions and Implications for Future Research

Overall, this study offers pilot data that can be used to inform future expressive writing research. The low dropout rate and ease of design show that this study is both feasible for researchers and practical for participants. The sampling methods used required more effort and resources but resulted in a more diverse sample compared to more readily accessible college student populations. The online nature of the study may have contributed to this phenomenon.

Using an online study can help improve generalizability by recruiting a wider sample of participants that is more representative of larger populations. Evidence based practices like cognitive behavioral therapies have overcome this barrier through testing in large, multi-site, randomized control clinical trials with dysfunctional and functional samples representative of their respective populations. While there are expressive writing studies that have used similar methods and designs, the bulk of the research has used smaller sample sizes, typically recruiting from already clinically dysfunctional samples and college students.

If expressive writing is to be considered an evidence-based practice, future research will need to address these limitations. Running an expressive writing study online can help to overcome this obstacle. Although previous online expressive writing studies have resulted in mixed or null findings, the potential to reduce social desirability and improve privacy warrants further investigation.

Another implication from the recruitment efforts is the ability to recruit understudied samples. The current study attempted to recruit foster youth for a subsample analysis that would compare foster youth outcomes to non-foster youth. This would have helped evaluate treatment efficacy in an understudied and underserved population and established normative data for foster youth samples on each of the measures. These both could then inform future studies that wanted to test expressive writing in this population. While the current study could not do this due to the lack of power, recruitment efforts show that this is a reasonable and obtainable goal and future studies should consider recruitment strategies that can reach this population.

It should be noted that eligible participants scored below clinically significant thresholds on the PHQ-9, GAD-7, and PCL-5, based on cutoff values established by the measures. This resulted in a sample that ranged from no symptoms to moderate symptom severity. This may potentially limit the generalizability to nonclinical populations. However, this could reduce the effect of regression to the mean, which becomes more likely as scores fall further away from the normative mean. Future studies should consider this in their recruitment strategies and use clinical significance tests that account for regression to the mean.

Regarding clinical significance testing, results suggested some reliable improvement in physical health as a result of the intervention. This shows promise for future researchers who want to examine the effect of expressive writing on physical health and lends support for previous research that has identified small statistical effects. In addition, expressive writing research that has used clinical significance testing is still

very limited (e.g., Sloan et al., 2012; Sloan & Marx, 2004b; Sloan, Marx, & Epstein, 2005). Results of the present study demonstrate the feasibility of using clinical significance testing in expressive writing research, echoing calls by Sloan & Marx (2004b) for future research in this area.

Additionally, while the statistical and clinical significance testing generally did not point towards improvement, they did not suggest that harm had occurred either. On the one hand, this suggests that treatment providers may not need to consider an individual's ACE score when determining if expressive writing is appropriate for a certain client. However, as there were participants with high ACE scores who showed worsening depressive and anxiety symptoms, it is possible that there could be an increased risk of harm for people with high ACE scores when using this intervention for these specific mental health disorders. Future studies that wish to look at the moderating role of ACEs will need to consider this in their study designs.

Finally, the underpowered nature of the study, lack of statistically significant findings, and limited clinically significant findings should not be interpreted as a lack of benefit to participants. Over the course of the study, there were participants in the treatment and control groups who confided in the researcher that they found the writing exercises helpful, meaningful, and important. Written responses on the post-writing questionnaire noted similar experiences. With any intervention study, it is possible for individuals to experience improvement and benefit from the intervention even if no statistical or clinical effect is identified. Given the already existing evidence for expressive writing, the fact that participants in the current study perceived some benefit

from the writing exercises should be taken into consideration by clinicians and healthcare providers when evaluating the use of this intervention.

The freedom to tell the story of one's own mental health challenges, in one's own words, is the hallmark of expressive writing. Since its inception in the 1980s, it has established itself as a promising intervention to improve physical and mental health. Over 35 years later, there is still much to be learned about this intervention. Although the current study did not yield new insight into the mechanisms of its treatment outcomes, it did lay foundations for future research to breath new light into this fascinating and enriching intervention.

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Appendices

Appendix A. Informed Consent

You are invited to participate in a research study which will look at the role of adverse childhood experiences (ACEs) on expressive writing. My name is Nick Vasquez and I am a graduate student at Humboldt State University's Master's in Academic Research program. The purpose of this study is to determine if expressive writing can serve as a useful intervention for people who have experienced ACEs and its limitations. If you decide to participate, you will be asked to partake in a 4 session study where you will write about your deepest thoughts and feelings about an emotionally charged event that has influenced your life and complete five different surveys over the course of the study.

There are some possible risks involved for participants. Due to the self-reflective nature of expressive writing, the first risk is the possibility of emotional distress. The second risk is increased stress or anxiety which may negatively affect academic or occupational performance, or negatively affect your relationships with friends and family. In anticipation of these risks, information regarding university and community resources for counseling and crisis support will be provided in this document and at the conclusion of each writing session. The benefits to this research are that you may see improved physical and mental health, find new coping mechanisms, and an increase in emotional awareness and expression. In the broader sense, the findings of this research will guide

the development of low-cost and easily accessible community resources for individuals who have experienced ACEs.

Your participation in this project is voluntary. You have the right not to participate at all or to leave the study at any time without penalty or loss of benefits to which you may otherwise be entitled. Should you decide to withdraw at any time, you will be asked to send an email to either myself or my faculty advisor, Dr. Benjamin Graham, stating your intent to withdraw. Data collected from your participation will still be used to inform the final results unless, in your email, you clarify that you do not want your data included in the final results. All participants will be compensated for their time, regardless of whether or not they withdraw from the study.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will not be disclosed without your written permission. In order to ensure your confidentiality all participant, survey, and writing data will be stored on a dual-encrypted and password protected USB-drive kept in a secured and locked location. The encryption key will be secured and locked separately from the USB-drive. Finally, backups of all participant, survey, and writing data will be printed and kept in a secured file cabinet. Access to the USB-drive and physical documents will be limited to Nick Vasquez and Dr. Benjamin Graham. The data obtained will be maintained in a safe location and will be destroyed three years after the study is completed. This consent form will be maintained in a safe location and will be destroyed after a period of three years after the study is completed.

If you have any questions about this research at any time, please email me at njv52@humboldt.edu or my faculty advisor, Dr. Benjamin Graham at Benjamin.Graham@humboldt.edu. If you have any concerns with this study or questions about your rights as a participant, contact the Institutional Review Board for the Protection of Human Subjects at irb@humboldt.edu or (707) 826-5165. If you agree to voluntarily participate in this research as described, please sign and date below. A copy will be provided for your records.

Name

Date

Appendix B. Safety Protocol

The following protocol was developed to minimize the risk of harm and ensure the safety and well-being of the participants. These steps were developed through consultations with the university's counseling and psychological services and with another expressive writing researcher (Smyth, J.M., Personal communication, October 23rd, 2019) and were approved by the university's institutional review board.

1. Participants were asked to write about an “extremely important emotional issue” rather than a “traumatic or emotionally upsetting event.” This was intended to give participants flexibility in interpretation so that they may choose to write about non-traumatic events.
2. Participants were provided a list of resources available to them in their community. This was emailed to the participants as a part of their informed consent and at the end of each writing session.
3. When administering the PCL-5, participants were asked to complete the checklist, which asks about “problems that people sometimes have in response to a very stressful experience.” Participants were not provided with the Criterion A form, which asks about exposure to specific traumas, or the LEC form which asks about exposure to various traumatic events. This was done to minimize the risk of priming effects that could potentially influence participants to specifically write about trauma.

Appendix C. Writing Prompts

Session 1:

Experimental Group: “Thank you for participating. For this session and for the following three session, I would like for you to write about your very deepest thoughts and feeling about an extremely important emotional issue that has affected you and your life. For the purposes of this study, I would like for you to write about the same topic or experiences on all days of the writing. In your writing, I’d like you to really let go and explore your very deepest emotions and thoughts. Don’t worry about spelling, sentence structure, or grammar. The only rule is that once you begin writing, continue to do so until your time is up. And never forget that this writing is for you and you alone. Do you have any questions?”

Control Group: Control: “Thank you for participating. For this session and for the following three session, I would like for you to write about time management. For this session, I would like for you to write about your plans for the past week, how you managed your time, and obstacles you encountered. In your writing, I’d like you refrain from including emotional information such as “It felt” statements. Don’t worry about spelling, sentence structure, or grammar. The only rule is that once you begin writing, continue to do so until your time is up. Do you have any questions?”

Session 2:

Experimental Group: “Today is the second of four writing sessions. In your last writing session, you were asked to explore your thoughts and feelings about an extremely

important emotional event that has affected you and your life. In today's writing, your task is to *really* examine your very deepest emotions and thoughts. The writing instructions today are similar to those of your last writing session. Today, try to link the event you wrote about in the previous session to other parts of your life. Remember that emotionally important events can often influence every aspect of your life. In today's writing, begin thinking how this upheaval is affecting your life in general. As before, write continuously for the entire twenty minutes and don't worry about spelling, sentence structure, or grammar. At the conclusion of your writing, we would like you to complete the post-writing questionnaire."

Control Group: "Today is the second of four writing sessions. In your last writing session, you were asked to write about your time management strategies over the past week. In today's writing session, your task is to write about your time management strategies over the past 72 hours. Write about your plans, how you managed your time, and obstacles you encountered. Refrain from including emotional information such as "It felt" statements. As before, write continuously for the entire twenty minutes and don't worry about spelling, sentence structure, or grammar. At the conclusion of your writing, we would like you to complete the post-writing questionnaire."

Session 3:

Experimental Group: "You have made it through two days of writing. After today, you will have only one more day of writing. Today, continue to explore your deepest thoughts and emotions about the topic you have been writing about so far. Your primary goal is to focus on your emotions and thoughts about that event and how it is

affecting your life right now. It is important that you don't repeat what you have already written in your past exercises. As you write about this emotional upheaval, what are you feeling and thinking? How has this event shaped your life and who you are? In today's writing, allow yourself to explore those deep issues about which you may be particularly vulnerable. As before, write continuously for the entire twenty minutes and don't worry about spelling, sentence structure, or grammar. At the conclusion of your writing, we would like you to complete the post-writing questionnaire."

Control Group: "You have made it through two days of writing. After today, you will have only one more day of writing. In today's writing session, your task is to write about your time management strategies over the past 24 hours. Write about your plans, how you managed your time, and obstacles you encountered. Refrain from including emotional information such as "It felt" statements. As before, write continuously for the entire twenty minutes and don't worry about spelling, sentence structure, or grammar. At the conclusion of your writing, we would like you to complete the post-writing questionnaire."

Session 4:

Experimental Group: "This is the final writing exercise. As with the previous days' writings, explore your deepest emotions and thoughts about the topics you have previously written about. Stand back and think about events, issues, thoughts, and feelings that you have disclosed. In your writing, try to tie up anything that you haven't yet confronted. What are your emotions and thoughts at this point? What things have you learned, lost, and gained as a result of this upheaval in your life? How will these past

events guide your thoughts and actions in the future? Really let go in your writing and be honest with yourself about this upheaval. Do your best to wrap up the entire experience into a meaningful story that you can take with you into the future. As before, write continuously for the entire twenty minutes and don't worry about spelling, sentence structure, or grammar. At the conclusion of your writing, we would like you to complete the post-writing questionnaire.”

Control Group: ‘This is the final writing exercise. As with the previous days’ writings, you are tasked with writing about time management. In today’s writing session, your task is to write about your time management strategies for the upcoming week. Write about your plans, how you plan to manage your time, and obstacles you may encounter. Refrain from including emotional information such as “I feel” statements. As before, write continuously for the entire twenty minutes and don't worry about spelling, sentence structure, or grammar. At the conclusion of your writing, we would like you to complete the post-writing questionnaire.”

Appendix D. BRFSS ACEs Survey

- 1) Did you live with anyone who was depressed, mentally ill, or suicidal?
- 2) Did you live with anyone who was a problem drinker or alcoholic?
- 3) Did you live with anyone who used illegal street drugs or who abused prescription medications?
- 4) Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?
- 5) Were your parents separated or divorced?
- 6) How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?
- 7) Before age 18, how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking. Would you say—
- 8) How often did a parent or adult in your home ever swear at you, insult you, or put you down?
- 9) How often did anyone at least 5 years older than you or an adult, ever touch you sexually?
- 10) How often did anyone at least 5 years older than you or an adult, try to make you touch sexually?
- 11) How often did anyone at least 5 years older than you or an adult, force you to have sex?
- 12) *Were you ever in foster care, orphaned, or adopted?*

Response Options and Coding**Questions 1-4 and Question 12**

1=Yes

2=No

7=Don't Know/Not Sure

9=Refused

Question 5

1=Yes

2=No

8=Parents not married

7=Don't Know/Not Sure

9=Refused

Questions 6-11

1=Never

2=Once

3=More than once

7=Don't know/Not sure

9=Refused

Appendix E. Patient Health Questionnaire

Name _____ Age _____ Sex: ☐ Female ☐ Male Today's Date _____

1. During the <u>last 4 weeks</u>, how much have you been bothered by any of the following problems?	Not bothered	Bothered a little	Bothered a lot
a. Stomach pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Back pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Pain in your arms, legs, or joints (knees, hips, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Menstrual cramps or other problems with your periods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Pain or problems during sexual intercourse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Headaches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Chest pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Dizziness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Fainting spells	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Feeling your heart pound or race	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. Shortness of breath	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. Constipation, loose bowels, or diarrhea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. Nausea, gas, or indigestion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Over the <u>last 2 weeks</u>, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
a. Little interest or pleasure in doing things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Feeling down, depressed, or hopeless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Trouble falling or staying asleep, or sleeping too much	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Feeling tired or having little energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Poor appetite or overeating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Trouble concentrating on things, such as reading the newspaper or watching television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Thoughts that you would be better off dead or of hurting yourself in some way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1. Questions about anxiety.

	NO	YES
a. In the last 4 weeks, have you had an anxiety attack — suddenly feeling fear or panic?		
If you checked "NO", go to question #5.		
b. Has this ever happened before?		
c. Do some of these attacks come suddenly out of the blue — that is, in situations where you don't expect to be nervous or uncomfortable?		
d. Do these attacks bother you a lot or are you worried about having another attack?		

4. Think about your last bad anxiety attack.

	NO	YES
a. Were you short of breath?		
b. Did your heart race, pound, or skip?		
c. Did you have chest pain or pressure?		
d. Did you sweat?		
e. Did you feel as if you were choking?		
f. Did you have hot flashes or chills?		
g. Did you have nausea or an upset stomach, or the feeling that you were going to have diarrhea?		
h. Did you feel dizzy, unsteady, or faint?		
i. Did you have tingling or numbness in parts of your body?...		
j. Did you tremble or shake?		
k. Were you afraid you were dying?		

5. Over the last 4 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days
a. Feeling nervous, anxious, on edge, or worrying a lot about different things.			
If you checked "Not at all", go to question #6.			
b. Feeling restless so that it is hard to sit still.			
c. Getting tired very easily.			
d. Muscle tension, aches, or soreness.			
e. Trouble falling asleep or staying asleep.			
f. Trouble concentrating on things, such as reading a book or watching TV.			

Appendix F. PCL-5

Below is a list of problems that people sometimes have in response to a very stressful experience. Keeping your worst event in mind, please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

In the past month, how much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "superalert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

Appendix G. Pennebaker Post-Writing Questionnaire

For this and all future writing exercises, please respond to the following questions. Put a number between 0 and 10 by each question.

0	1	2	3	4	5	6	7	8	9	10
Not at all				Somewhat			A great deal			

____ A. To what degree did you express your deepest thoughts and feelings?

____ B. To what degree do you currently feel sad or upset

____ C. To what degree do you currently feel happy?

____ D. To what degree was today's writing valuable and meaningful for you?

Optional: E. Briefly describe how your writing went today so you may refer to this later

Appendix H. Healthy Days Core Module

1. Would you say that in general your health is:
 - a. Excellent
 - b. Very good
 - c. Good
 - d. Fair
 - e. Poor
 - f. Don't know/Not sure
 - g. Decline to state

2. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
 - a. Number of Days: _____
 - b. None
 - c. Don't know/Not sure
 - d. Decline to state

3. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
 - a. Number of Days: _____
 - b. None
 - c. Don't know/Not sure
 - d. Decline to state

4. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?
 - a. Number of Days: _____
 - b. None
 - c. Don't know/Not sure
 - d. Decline to state

Coding**Question 1**

- a. Excellent: 1
- b. Very good: 2
- c. Good: 3
- d. Fair: 4
- e. Poor: 5
- f. Don't know/Not sure: 7
- g. Decline to state: 9

Questions 2-4

- a. None: 8
- b. Don't know/Not sure: 7
- c. Decline to state: 9