The Effects of Adverse Childhood Events on COVID-19 Outlook at the Beginning of the Pandemic

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Abstract

Objective: We aimed to determine how different adverse childhood events influenced COVID-19 outlook at the beginning of the pandemic.

Methods: Our data was from the Boston College COVID-19 Sleep and Well-being Dataset (n = 356). We performed factor analysis using Kaisers criterion and oblimin rotation to identify four explanatory factors including *parent abuse*, *parent relationship*, *parent well-being*, and *victimization* as well as three response factors including *worry*, *seriousness*, and *expectation*, with *experience* being left as a measured variable. Next, we used structural equation modeling to identify significant effects between the adverse childhood events factors (ACE survey) and the COVID-19 outlook factors.

Results: We found that, during the beginning of the pandemic, a person who had unstable parents with poor mental health and well-being worried more about the pandemic, their health, and their family's health. Being abused as a child was a significant driver for a person believing the pandemic was more serious and would take longer to resolve. Being victimized or exposed to community crime was a significant driver for a person to believe the pandemic was less serious, would end sooner, and have a more positive experience during the beginning of the pandemic.

Conclusion: People who had been abused had the opposite outlook and expectation of COVID-19 to people who had been victimized at a young age. This reveals how different traumas can result in a different reaction and outlook when met with a crisis. More studies could be conducted to better understand the impacts of different types of traumas on a person and how the trauma affects them psychologically and emotionally long term. This includes a further study into different types of traumas and traumatic events leading to different types of PTSD.

Introduction

Background

Previous studies have shown that childhood adversity is associated with a variety of mental health difficulties (Finkelhor et al., 2015; Kessler et al., 2010; Lewis et al., 2019; Manyema & Richter, 2019) that include associations with behavioral problems (McLaughlin et al., 2012), depression (Tsehay et al., 2020), anxiety (Elmore & Crouch, 2020), post-traumatic stress disorder (Alisic et al., 2014), substance misuse (Carliner et al., 2016), and suicidal ideation (Björkenstam et al., 2017). Furthermore, the restrictions placed due to the COVID-19 pandemic have resulted in various psychological, cognitive, and emotional consequences such as depression, stress, and anxiety (O'Connor et al., 2020). Therefore, it is necessary to study whether people who have faced childhood adversity are predisposed to emotional and cognitive changes during COVID-19.

Studies have found that stress during infancy or childhood is associated with increased chances of atypical outcomes (Green et al., 2010; McLaughlin et al., 2010). Adverse conditions during these key phases of development have contributed to 30% of child-onset and 45% of adult-onset mental health disorders (Green et al., 2010; McLaughlin et al., 2010).

On a neurophysiological basis, one of the most influential and well-studied trajectories is the hypothalamic-pituitary-adrenal axis (HPA axis) (Green et al., 2010; McLaughlin et al., 2010). The HPA axis enables the secretion of cortisol (stress hormone) in response to external threats of sufficient intensity to appropriately shape brain systems in anticipation of future threats (McEwen et al., 2015). However, through the study of animal models, it has been found that chronic stress has also been associated with the shrinking of dendrites in rat hippocampus and has shown a relatively inhibited activity in the pituitary, hypothalamus, hippocampus, and amygdala (Hill & McEwen, 2010; McEwen et al., 2015; Treccani et al., 2014). Similarly, these effects were reported in humans; chronic stress exposure, especially during childhood, may have several detrimental effects on various brain regions. Various neurobiological mechanisms have also established the impact of early life stressors on neural systems supporting emotional processing.

In terms of the impact of early life stressors on behavior, studies on adolescents have found a decrease in executive function skills and an increase in attention towards social-threat stimuli in a dot-probe task (Hill & McEwen, 2010; McEwen et al., 2015; Treccani et al., 2014). Furthermore, individuals with PTSD display a comparatively decreased efficiency in information processing (Hill & McEwen, 2010; McEwen et al., 2015; Treccani et al., 2014).

In the light of the COVID-19 pandemic, countries placed several restrictions on the public to ensure their safety. These restrictions have had several positive and negative psychological and behavioral effects on people (Tull et al., 2020; see Brooks et al., 2020 for review). While some experienced academic improvements, improved relationships, and better work/life balance, other people experienced conflicts in relationships, social isolation, academic hardships, anxiety, stress, and depression. Since there are many views on the effects of the

pandemic on psychological and social well-being, individual personality is likely a variable impacting the overall opinion of the pandemic.

Childhood experience is a critical contributor to the development of personality. Even though no significant effects of adverse childhood experience on extraversion were found, a substantial association with neuroticism was found (Rosenman & Rodgers, 2006).

Therefore, it is important to understand the relationship between childhood experiences and perceptions of the impact of the COVID-19 pandemic on social and emotional well-being.

Hypotheses

We chose to explore the idea of how adverse childhood events affect how someone perceives COVID-19. To measure how much of an adverse childhood a person had, the ACE survey was used, which asks questions regarding a person's experience before their 18th birthday including abuse, their parents' well-being, if they were exposed to crime, if they experienced dysfunction or neglect, etc (Starecheski, 2015). COVID-19 surprised everyone, and nobody knew how to react, some feared leaving the house and believed that COVID-19 would never truly end. Everyone had different outlooks on how seriously they should treat it, how worried they were, and how they envisioned the future.

Our first hypothesis is that someone who has experienced an adverse childhood event is less worried about the pandemic and takes the pandemic less seriously. With adversity during childhood, there is a strong correlation with depression later in life (Panagou & MacBeth, 2021). There is also an association between adverse childhood events and stress. A model was created revealing how children that were adopted were associated with early life stress. The idea of this model is that children in foster homes were deprived of proper caregiving as they are treated in an assembly line fashion. The results showed that they had atypical reward processing meaning they had hypo responsivity when something was linked with a reward (Herzberg & Gunnar, 2022). Fostered children are also concordant with an early maturation in emotional processing (Herzberg & Gunnar, 2022). Fostered children are proven to avoid losses despite resulting in less reward because of not wanting to take the risk (Herzberg & Gunnar, 2022). Fostered children have altered responses to how they handle situations that can result in loss and that often includes not putting themselves in that situation by not taking risks. Not taking risks often leads to less worry. So, we believe that a person who has suffered from an adverse childhood would worry less about the pandemic. Individuals who experience abuse or violence do not promote strong differentiation of aversive and non-aversive cues during fearful situations (Herzberg & Gunnar, 2022). This could make a person who suffered from adverse childhood events misinterpret the fearfulness of the pandemic and take it less seriously.

Our second hypothesis is that someone that has experienced adverse childhood events has a more negative experience with the pandemic. How someone responds to events can be associated with early life stress. The early life is crucial to the development physically, cognitively, and emotionally, so it is no surprise that fluctuated patterns of stress cause atypical outcomes in how someone would respond to situations (Herzberg & Gunnar, 2022). There have been tests run on animals that model how stress affects brain structure. Findings have found that

stress leads to dendritic shrinkage in the hippocampus as well as reduced cell proliferation in subcortical structures (Herzberg & Gunnar, 2022). Shrinkage in the hippocampus has been linked to depression (Sapolsky RM, 2001). Similar effects have been reported in humans with adverse childhood events such as physical abuse, neglect, and lower financial status (Herzberg & Gunnar, 2022). There is also an increased attention toward social events. However, when these social events are happening, they have a poorer, cloudier recognition of the situation (Herzberg & Gunnar, 2022). With increased attention and poorer recognition of situations, there is an increased chance of thinking the worst will happen. Because of the potential of people who have suffered from an adverse childhood to have depression as well as a chance to believe the worst will happen during situations, they would have a negative look at the pandemic.

Our third hypothesis is that someone who has suffered from an adverse childhood is expecting the pandemic to last longer and take more time before things go back to normal. Individuals that have experienced an adverse childhood event often have trouble responding to rewarded situations which means that they spend less time thinking of the positive outcomes of situations. Risk models have proven that exposure to one adversity as a child showed no serious impact on development, but as the adversities increase the risk of development suffering also increases (Herzberg & Gunnar, 2022). Exposure to childhood abuse is related to a more positive emotional connectivity, however, it is also associated with a poorer conflict regulation and memory (Herzberg & Gunnar, 2022). Because adverse childhood events could lead to less time thinking of positive outcomes and poorer conflict regulation, a person who had an adverse childhood could have a tougher time seeing the pandemic resolve and go away.

Methodology

Data

The raw data came from the Boston College COVID-19 Sleep and Well-being Dataset in which a long-term international study was conducted on English-speaking adults ranging between 18-90 years old (Cunningham et al., 2021). These adults were recruited online through various social media postings and direct emails. To filter down the scale of this dataset, it was decided to only focus on data from the beginning of the pandemic. The time frame selected was from March 2020-June 2020. All the participants of the study in this time frame completed an initial demographic survey followed by a series of daily surveys having two versions: a Full Version and a Short Version. For the first three days following a participant's enrollment, they completed the Full Survey. After that, participants randomly received the Full Survey on two days every week, with the remaining five days being the Short Survey. Following May 20, 2020, the Short Survey was discontinued and only the Full Survey was sent two days a week. Multiple one-time assessments were also launched throughout this time frame, with the first being depicted as Round 1 Assessment, the second as Round 2 Assessment, and so on. For the purposes of this study, it was decided to only include participants who completed the Round 2, Round 3, and Round 5 assessments, bringing the total to 356 people.

Sample

Our population of interest was everyone 18 years and older. Our sample ended up consisting of 356 people involved in the study. Of these 356 people, the median age was 34. Approximately 82.9% of these participants were from the United States, with the next two largest being 4.8% from Canada and 2.2% from Australia. Of those from the United States, a large percentage (27.5%) were from Massachusetts, with the next two largest being 5.6% from Pennsylvania and 4.5% from California. Participants identified as White (86%), Asian (10.7%), Hispanic/Latinx (2.5%), African American (1.4%), Native Hawaiian or Other Pacific Islander (0.3%), American Indian/Alaska Native (0.3%), and more than one race/other (2%). The overwhelming majority of the sample's reported preferred gender was female (81.2%), followed by 16% male and 1.1% non-binary/third gender. 0.6% also reported being transgender. 79.8% of participants identified as straight, 13.8% as bisexual, 3.7% as gay/lesbian, and 1.35% as other. Approximately 42.7% of the sample were married, 27.8% were single, 22.5% were in a relationship, 5.3% were separated/divorced, and 1.7% were widowed. 8.4% reported having at least one serious medical problem and 1.7% reported being a veteran. The sample included both students (20.2%) and non-students, of which 57.6% of the non-students reported being employed. Of those employed, 36.8% worked full-time from home, 11% worked part-time from home, and 9.8% were not working from home. Of those unemployed, 6.2% reported COVID directly affected their employment status. Finally, 78.9% of the sample reported having zero dependents, 11.5% had one, 6.7% had two, and 2.9% had three or more.

Response Variables

The response data contains variables from the daily survey, the Round 3 exit survey, and the Round 2 COVID memory survey. The questionnaires and data can be found on the Boston College COVID-19 Sleep and Well Being dataset website (Cunningham et al., 2021). Variables from the daily survey that were used included *worry_health*, *family_health*, *community_1health*, and *national_health*. All survey entries from March 2020 to the end of June 2020 were kept in the daily survey dataset, entries from July 2020 and after were eliminated. Using Excel (Microsoft Corporation, 2022), the variable *todays_date* was filtered to only March, April, May, and June 2020. Then, the filtered dataset was exported from Excel (Microsoft Corporation, 2022) to R (R Core Team, 2022). These variables were used in hopes to explain how much a person worries for their own health, their family's health, the community's health, and for COVID-19 as a national health crisis in the first few months of the pandemic. The variables *worry_health*, *family_health*, *community_1health*, and *national_health* are each ordinally scaled from 1-7 with a value of one meaning completely consumed by worry and seven meaning not worried at all.

Our second group of variables are *experience*, *soc_serious*, *mask_serious*, and *pandemic_serious*. These variables are from the Round 3 exit survey. This survey was given out at the end of June 2020. The data entries for this survey were answered from June 2020-August 2020. So, here the data is looking back at the first months of the pandemic and how serious participants found social distancing guidelines, mask mandates, the pandemic in general, and how their experience during the pandemic had been. The variables *soc_serious*, *mask_serious*, and *pandemic_serious* are ordinally scaled from 1-4, with a value of one indicating not serious at

all and four indicating very serious. The variable *experience* is ordinally scaled from 1-7, where a value of one indicates entirely negative, four indicates neutral, and seven indicates entirely positive.

According to Table 1, the mean values of *soc_serious*, *mask_serious*, and *pandemic_serious* show that most often participants believe that social distancing, the mask mandates, and the pandemic are very serious and very few participants believe that the pandemic is less serious. This is a problem because there is not very much variation in the data. However, there is enough variation to continue with the analysis. There could also be a few explanations for these entries. One is that since this data was taken at the beginning of the pandemic, many people did not know what to expect and thought the pandemic was very scary and serious. It could also be because of the wording of the questions, leading the participants to feel like they needed to say they believed the pandemic to be very serious. If this survey had been taken a few months later, the data could have looked very different. The data here speaks to the time it was taken, which is the goal of the model.

Our third group of variables included were *normal_days*, *mask_days*, *meetings_days*, *big_events_days*, and *shake_hands_days*. These variables were calculated from their original variables; *normal_date*, *mask_date*, *meetings_date*, *big_events_date*, and *shake_hands_date* from the Round 2 COVID memory survey. This assessment was given out in mid-June 2020 and responses were produced between June 2020 and August 2020. These variables were open-ended responses where participants wrote the date (yyyy/mm/dd) they expected life would go back to normal, they would feel comfortable without a mask, they would return to in-person meetings, big events would resume, and people would shake hands again. To calculate *normal_days*, *mask_days*, *meetings_days*, *big_events_days*, and *shake_hands_days*, the number of days between the date listed in *normal_date*, *mask_date*, *meetings_date*, *big_events_date*, and *shake_hands_date* and the day the survey was recorded. The Round 2 dataset was put into Excel (Microsoft Corporation, 2022) and the variable *date_time_rd2*, which was the date and time the Round 2 survey was completed, was converted from date-time format to date and put into a new column named *date*. Then another new column, *normal_days*, was made by subtracting *normal_date* by *date*. That way, *normal_days* was in the form of days until things will be normal again. This was repeated for the rest of the date variables. After the new variables were created, extreme values were eliminated to improve the extreme right skew of each of the variables. Using Excel (Microsoft Corporation, 2022), observations with values smaller than -200 were believed to be mistakes and filtered out from each of the variables. Negative values larger than -200 were allowed because participants could have believed that things were already back to normal, or that things hadn't ever been not normal in their lives depending on where they live, work, and their community. Observations with values larger than 1000 days were filtered out from *meetings_days*, *big_events_days*, *mask_days*, and *normal_days*. Observations with values larger than 2000 were filtered out from *shake_hands_days*. After filtering for extreme values, the dataset was exported into R (R Core Team, 2022).

Explanatory Variables

Our explanatory variables came from the Round 5 dataset ACE survey. This survey was given out in February of 2021; however, the questions were pertaining to the participants' past

childhood and had nothing to do with the time at hand. The ACE survey, or the Adverse Childhood Events survey is meant to understand the types of adverse events a person has gone through before they turned 18. There is not a set questionnaire, but most surveys are around 10 questions asking if the participant dealt with neglect, abuse, disfunction, victimization, etc (Starecheski, 2015). The ACE survey in the Round 5 assessment contained 18 questions (*ace_1-18*). These variables are binomial and scaled as a zero or a one, with zero indicating the participant responded "NO" to the prompt and one indicating the participant responded "YES" to the prompt, so the more ones a participant answered, the more adverse of a childhood they had.

Statistics

Using R (R Core Team, 2022) and the *psych* package (Revelle, 2021) exploratory factor analysis was performed to extract explanatory and response variables and combine measured variables that are strongly correlated into latent variables. Kaisers criterion was used to identify four explanatory factors and three response factors. Oblimin rotation was used to minimize variable complexities within factors. Next, structural equation modeling was performed, using R (R Core Team, 2022) and the *lavaan* package (Rosseel, 2012) to measure the relationships between our explanatory latent variables and how a person views COVID-19.

Results

Exploratory Factor Analysis

Exploratory factor analysis revealed a potential four latent variables among the 18 original measured explanatory variables (*ace_1-18*). The variables *ace_6*, *ace_7*, *ace_10*, *ace_11*, *ace_14*, *ace_16*, and *ace_18* loaded onto two or more of the latent variables and did not add any additional information to be considered as single measured variables, so they were removed from the analysis. Variables *ace_1*, *ace_2*, and *ace_4* loaded primarily onto the first latent variable labeled *parent relationship*. The second latent variable was loaded onto by *ace_13* and *ace_15* and was labeled *victimization*. Variables *ace_9*, *ace_12*, and *ace_17* loaded onto the third latent variable as *parent well-being*. The last latent variable, *parent abuse*, was obtained by *ace_3*, *ace_5*, and *ace_8*. The factor loading matrix is shown below as Figure 3. Explanations and summaries of each measured variable are shown below as Table 2.

Exploratory factor analysis on the original 13 measured response variables revealed three potential latent variables. Variables *worry_health*, *family_health*, *community_1health*, *national_health*, and *experience* loaded primarily onto the first latent variable. However, according to the loading matrix located at the bottom as Figure 2, *experience* had a weak correlation of .298, so it was left on its own as a single measured variable. So, the first latent variable, with *worry_health*, *family_health*, *community_1health*, and *national_health*, was labeled *worry*. The calculated variables *normal_days*, *mask_days*, *meetings_days*, *big_events_days*, and *shake_hands_days* loaded onto the second latent variable as *expectation*. Variables *soc_serious*, *mask_serious*, and *pandemic_serious* loaded primarily onto the third

latent variable as *seriousness*. The factor loading matrix is shown below as Figure 2. Explanations and summaries of each measured variable are shown below as Table 1.

Structural Equation Model

As shown as computer output as Figure 4 and as a path diagram as Figure 1, structural equation modeling revealed that *parent relationship* has a negative relationship with *worry* and a negative relationship with *expectation*. This indicated that for a person with a negative relationship with their parents we would expect them, at the beginning of the pandemic, to worry less about the health of themselves, family, and community, and the pandemic (-0.074) and believe the pandemic will end and the world will go back to normal sooner (-0.078).

The second result of structural equation modeling revealed that *parent well-being* has a positive relationship with *worry*, a positive relationship with *expectation*, and a negative relationship with *experience*. Indicating that for a person with parents with poor mental health/well-being, we would expect them, at the beginning of the pandemic, to worry a lot about the health of themselves, family, and community, and the pandemic (0.316), believe it will take longer for the pandemic to end and the world to go back to normal (0.083), and have a more negative experience during the pandemic (-0.187).

Structural equation modeling also revealed that *parent abuse* has a positive relationship with *seriousness* and a positive relationship with *expectation*. Indicating that for a person who dealt with abuse from their parents or others, we would expect them, in the beginning of the pandemic, to believe the pandemic and its guidelines to be more serious (0.282) and believe it will take longer for the pandemic will end and the world will go back to normal (0.387).

Lastly, structural equation modeling revealed that *victimization* has a negative relationship with *worry*, a negative relationship with *seriousness*, a negative relationship with *expectation*, and a positive relationship with *experience*. Indicating that for a person who was victimized by their community or exposed to crime, we would expect them, at the beginning of the pandemic, to worry less about the health of yourself, family, community, and the pandemic (-0.106), believe the pandemic and its guidelines to be less serious (-0.259), believe the pandemic will end and the world will go back to normal sooner (-0.361), and have a more positive experience during the pandemic (0.303).

Note: Each of the regression coefficients with *worry* were flipped in direction from negative to positive and vice versa, due to the difference in scale of *worry* variables. For variables associated with the factor *worry*, a smaller value meant more worry and a higher number meant less worry. For each of the factors including *seriousness*, *expectation*, and *experience*, a smaller value meant less/worse, and a higher number meant more/better. So, for each of the response variables to go the same way directionally, the *worry* regression coefficients were flipped. Therefore, a positive regression coefficient means more worry and a negative regression coefficient means less worry.

The strongest results, measured by an effect less than -0.2 or greater than 0.2, from structural equation modeling came from *parent well-being* and *worry*, *parent abuse* and

seriousness, *parent abuse* and *expectation*, *victimization* and *seriousness*, *victimization* and *expectation*, and *victimization* and *experience*.

Discussion

Parent Well-being and Worry

The relationship between *parent well-being* and *worry* was a strong result from structural equation modeling. The results signify that a person who had a parent or parents who had poor mental health, argued a lot, and/or had a hard time finding work worried more, at the beginning of the pandemic, about their own health, family's health, communities' health, and the pandemic in general. This result differs from our original hypothesis that a person with an adverse childhood would worry less about the pandemic. We propose two potential explanations for this objection: people with unstable parents could be more uneasy with change and worried about things in life in general, they could also be worried about how their parents would cope with COVID-19 and/or if they would be able to support themselves.

Parent Abuse and Seriousness and Expectation

The relationships between *parent abuse* and *seriousness* and *expectation* were also highly significant through structural equation modeling. The results signify that a person who has dealt with abuse, not been cared for by adequate parents, and/or had a parent abuse substance, believed that the pandemic and its guidelines were more serious and expected the pandemic to last longer. These conclusions slightly differ from our original hypothesis of a person who suffered from an adverse childhood will think the pandemic is less serious and thinks it will take longer for things to go back to normal. We were correct in thinking that people with adverse childhoods would expect the pandemic to last longer. We believe this could be because exposure to childhood abuse is related to a more positive emotional connectivity, however, it is also associated with a poorer conflict regulation and memory (Herzberg & Gunnar, 2020). This could explain a person who has dealt with abuse has a harder time with conflict resolution and believes that the pandemic and its guidelines will take a long time to go away.

In terms of *seriousness*, we were wrong in our original thinking that people who have dealt with adverse childhood events would not think the pandemic is serious. A possible explanation as to why we got the results we did is a person with unstable parents who abused them and were not supported or protected, could be unable to rationalize situations and are programmed to think the worst in a bad situation. So, with a national crisis like the pandemic, they think it is very serious.

Victimization and Seriousness, Expectation, and Experience

The relationships between *victimization* and *seriousness*, *expectation*, and *experience* were also highly significant through structural equation modeling. The results signify that a person who has experienced property victimization or been exposed to community crime

believed that the pandemic and its guidelines were less serious, expect the pandemic to end sooner, and had a more positive experience during the pandemic. Unlike parent abuse, people who have suffered from victimization in their childhood believed that the pandemic was not that serious, which is what we originally hypothesized. The reason we thought would contribute to a person who suffered from an adverse childhood to believe the pandemic is less serious is because individuals that experience abuse or violence do not promote strong differentiation of aversive and non-aversive cues during fearful situations (Herzberg & Gunnar, 2022). This could lead to the misinterpretation of a fearful situation like the pandemic as not serious.

Another reason for this result could be because people that have been victimized or exposed to community violence could have a poor relationship with authority or government. So, they may not trust the government as much when they say that the pandemic is very serious, and everyone must wear masks and social distance. Another possible explanation could be that when the pandemic hits, a person who has been victimized or exposed to crime, could think that they have been through worse, so the pandemic is not that big of a deal to them and not that serious.

Because the variables *seriousness*, *expectation*, and *experience* all have significant relationships with each other, as shown in Figure 1, we can assume that they are all interrelated. So, if a person who has been victimized believes the pandemic and its mandates to not be as serious, they probably believe that they will go away sooner. Consequently, if a person believes the pandemic to not be as serious and thinks it will end sooner, they would most likely have had a better, more positive experience at the beginning of the pandemic.

Complex PTSD vs. PTSD

Our results revealed a difference in COVID-19 outlook between people who have been abused versus victimized. Since being abused and being victimized are both forms of trauma, it could be assumed they would have similar effects on COVID-19 outlook, however, they had the opposite. If a person had been abused, they found the pandemic to be more serious and thought it would last longer. If a person had been victimized or exposed to community crime, they found the pandemic to be less serious and believed it would end sooner. A potential reason for these differences in COVID-19 outlook could be due to the effects of complex PTSD versus PTSD. Complex PTSD refers more to abuse because it typically comes from traumatic events, mostly interpersonal in nature, prolonged in duration and mainly of early life onset (Giourou et al., 2018). PTSD refers more to victimization because it is mostly a result of a single traumatic event or traumatic events during a short amount of time (Giourou et al., 2018). Complex PTSD and PTSD have shared symptoms including sense of threat, avoidance, and re-experiencing. However, complex PTSD has other symptoms including interpersonal disturbances, negative self-concept, and affect dysregulation. These symptoms related to complex PTSD could be a reason for the opposite COVID-19 outlook between abuse and victimization.

Limitations

Analyzing the COVID-19 responses of early childhood adversity is supplemented by possible limitations. The data from our study came from volunteers who wanted to be a part of the study. So, this could lead to voluntary response bias where people who feel strongly about

the subject choose to join. This also leads to non-response bias, where a large group of people in our desired sample do not choose to respond and participate. The surveys also have a lot of ambiguity as they are based on voluntary responses with a choice to answer each question. This could lead to a voluntary response bias where people choose to answer questions they feel strongly about. Everyone has a different subjective scale on how they judge a question and answer. So, when asked a question involving a Likert scale of satisfaction from 1-7, one being not satisfied and seven being very satisfied, different people could have a different interpretation of what a two compared to a three means. The responses to the surveys were optional if the surveyor had health issues so some of the daily surveys were missing responses. The survey contained a few potentially implausible responses. There were a few questions that contained errors where the participants interpreted the questions incorrectly or used a different scale than directed. These ambiguous or impossible results were replaced with a missing value rather can guessing what the individual's correct response was.

The demographics of the surveys had very little variation in race and reported gender as it was a majority white (86%) and female (81.2%). The surveys were given online only through social media/email, so it was limited to people with access to the internet. A large amount of the survey was given to U.S. citizens only, limiting the responses from other countries. So, a large part of the population of interest was missing, including people of other genders, races, and or countries.

A final limitation we found was that the *seriousness* variables do not have much variation in the responses. The responses were skewed left with most people answering that they believed the pandemic, wearing masks, and social distancing were very serious.

Future Research

The diversity found in responses associated with worry, seriousness, anxiety, stress, etc., and their strong correlations found with childhood trauma and early life stressors suggest a great level of importance in future directions investigating neuropsychological impacts due to childhood trauma and early life stressors.

As is clear from findings cited in this paper in relation to the impact of childhood adversity on stress onset in adulthood and its possible correlation with COVID-19 experiences, analysis of differences in brain regions via animal models or FMRI studies to understand stress levels in a variety of COVID-related situations becomes even more important.

Since surveys only assess perceived experiences and the quantification of variables such as worrying, seriousness, anxiety, childhood trauma, stress, etc., are subjective. Neuroimaging techniques could be used to assess the activation of brain structures when participants are asked questions related to childhood traumas, stress, etc. for better quantification.

Furthermore, culture and the dynamics of early life environment are often confounding in studies associated with individual perception of the variables, a study encompassing a greater variety of cultures could enable greater external validity of the findings.

Conclusion and Implications

Our findings revealed a link between having a parent with poor mental or physical well-being and worrying more about the pandemic. This finding could imply how having an unstable parent with poor mental health impacts a child's worry and anxiety. Our results also revealed questions about the difference in the effects of being abused versus being victimized as a child. Our results showed that a person who has been abused believes the pandemic is more serious and will take longer to resolve. For a person who has been victimized, they believe the pandemic is less serious, it will resolve sooner and have a better pandemic experience. This implied the difference in how a person who has suffered from a different type of trauma reacts to a crisis. Because trauma often leads to PTSD, that could be a potential factor driving the difference in the perception of a crisis. Complex PTSD, according to the definition, would be a product of being abused and PTSD would most likely be the result of being victimized. So, further research on the impact of complex PTSD and PTSD could be done to further examine this effect. Also, more studies could be conducted to further investigate the effects of different types of trauma or traumatic events and how they impact a person's long-term emotional and cognitive processing.

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Tables

Table 1 - **Response Variables Table**
Three latent variables and one measured variable were used to define the participants' overall outlook on COVID-19. Each variable has a description, a scale, and a numerical summary including the mean and standard deviation (in parenthesis) listed in the table.

Variable Name and Description	Scale	Mean and Standard Deviation
1. Worry		
• How worried are they about own health (worry_health)	1 = Completely consumed with worry, 7= Not Worried at all	4.65 (1.60)
• How worried are they about health of family and friends (family_health)	1 = Completely consumed with worry, 7= Not Worried at all	3.55 (1.54)
• How worried are they about the health of those in their community (community_1health)	1 = Completely consumed with worry, 7= Not Worried at all	3.60 (1.51)
• How worried are they about COVID-19 being a national/global public health crisis (national_health)	1 = Completely consumed with worry, 7= Not Worried at all	3.06 (1.50)
2. Seriousness		
• How seriously do you believe you need to follow the social distancing and shelter-in-place guidelines? (soc_serious)	1, Not serious at all | 2, Mildly serious | 3, Moderately serious, | 4, Very serious	3.78 (0.48)
• How seriously do you believe you need to follow mask and other PPE guidelines to be? (mask_serious)	1, Not serious at all | 2, Mildly serious | 3, Moderately serious, | 4, Very serious	3.82 (0.50)
• In general, how serious do you believe the pandemic is? (pandemic_serious)	1, Not serious at all | 2, Mildly serious | 3, Moderately serious, | 4, Very serious	3.84 (0.43)
3. Expectation		
• How many days until you expect things to feel "normal" again? (normal_days)	Calculation: Difference between the days the survey was taken until the date from (normal_date)	288.60 (184.13)
• When do you expect that you will first feel comfortable going to the grocery store without wearing a mask? (mask_days)	Calculation: Difference between the days the survey was taken until the date from (mask_date)	254.8 (187.24)
• When do you expect that you will return to having mostly in-person meetings? (meetings_days)	Calculation: Difference between the days the survey was taken until the date from (meetings_date)	191.90 (153.71)

• When do you expect large events (concerts, sporting events, conferences) to resume? (big_events_days)	Calculation: Difference between the days the survey was taken until the date from (big_events_date)	264.70 (176.73)
• When do you expect that people will be shaking hands again? (shake_hands_days)	Calculation: Difference between the days the survey was taken until the date from (shake_hands_date)	326.80 (290.21)
4. Experience		
• My experience during the COVID-19 pandemic has been... (experience)	1 = Entirely Negative | 2 | 3 | 4 =Neutral | 5 | 6 | 7 = Entirely Positive	3.68 (1.26)

Table 2 - **Explanatory Variables Table**
Four latent variables were used to define the participants' adverse childhood events. Each variable has a description, scale, and a numerical summary including frequency and percent of the amount of "YES" (1) answers for that variable.

Variable Name and Description	Scale	Frequency and Percent
1. Parent Relationship		
• Did a parent or other adult in the household often or very often... Swear at you, insult you, put you down, or humiliate you? or Act in a way that made you afraid that you might be physically hurt? (ace_1)	1 = YES, 0 = NO	112 (25.6%)
• Did a parent or other adult in the household often or very often... Push, grab, slap, or throw something at you? or Ever hit you so hard that you had marks or were injured? (ace_2)	1 = YES, 0 = NO	54 (12.3%)
• Did you often or very often feel that No one in your family loved you or thought you were important or special? or Your family didn't look out for each other, feel close to each other, or support each other? (ace_4)	1 = YES, 0 = NO	103 (23.5%)
2. Parent Abuse		
• Did an adult or person at least 5 years older than you ever... Touch or fondle you or have you touch their body in a sexual way? or Attempt or actually have oral, anal, or vaginal intercourse with you? (ace_3)	1 = YES, 0 = NO	55 (12.6%)
• Did you often or very often feel that You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? or Your parents were too drunk or high to take care of you or take you to the doctor if you needed it? (ace_5)	1 = YES, 0 = NO	21 (4.8%)
• Did you live with anyone who was a problem drinker or alcoholic or who used street drugs? (ace_8)	1 = YES, 0 = NO	110 (25.1%)
3. Parent Well-being		

• Was a household member depressed or mentally ill, or did a household member attempt suicide? (ace_9)	1 = YES, 0 = NO	150 (34.2%)
• Was there a time in your life when your parents were always arguing? (ace_12)	1 = YES, 0 = NO	201 (45.9%)
• Did one of your parents ever lose their job or couldn't find work? (ace_17)	1 = YES, 0 = NO	125 (28.5%)
4. Victimization		
• Did you experience property victimization (experience of a robbery, theft, or vandalism by a non-sibling perpetrator)? (ace_13)	1 = YES, 0 = NO	79 (18.0%)
• Were you exposed to community violence (including witnessing an assault, experiencing a household theft, having someone close murdered, witnessing a murder, experiencing a riot, or being in a war zone)? (ace_15)	1 = YES, 0 = NO	44 (10.0%)

Figures

Figure 1 – **Path Diagram**
The path diagram for the structural equation model used to describe the effects of the participants' adverse childhood events on their overall outlook on COVID-19. The latent variables are depicted as circles and the measured variable is depicted as a square, with the response variables being colored gray and the explanatory variables being colored white. The green arrows represent a positive significant effect, the red arrows represent a negative significant effect, and the gray arrows represent a non-significant effect. The width of each arrow corresponds with the magnitude of that effect and the numbers on each arrow depict the estimate regression coefficients that represent the relationship between those two variables. The black arrows on the outsides represent the significant effects that the explanatory variables have on one another and that the response variables have on one another respectively.

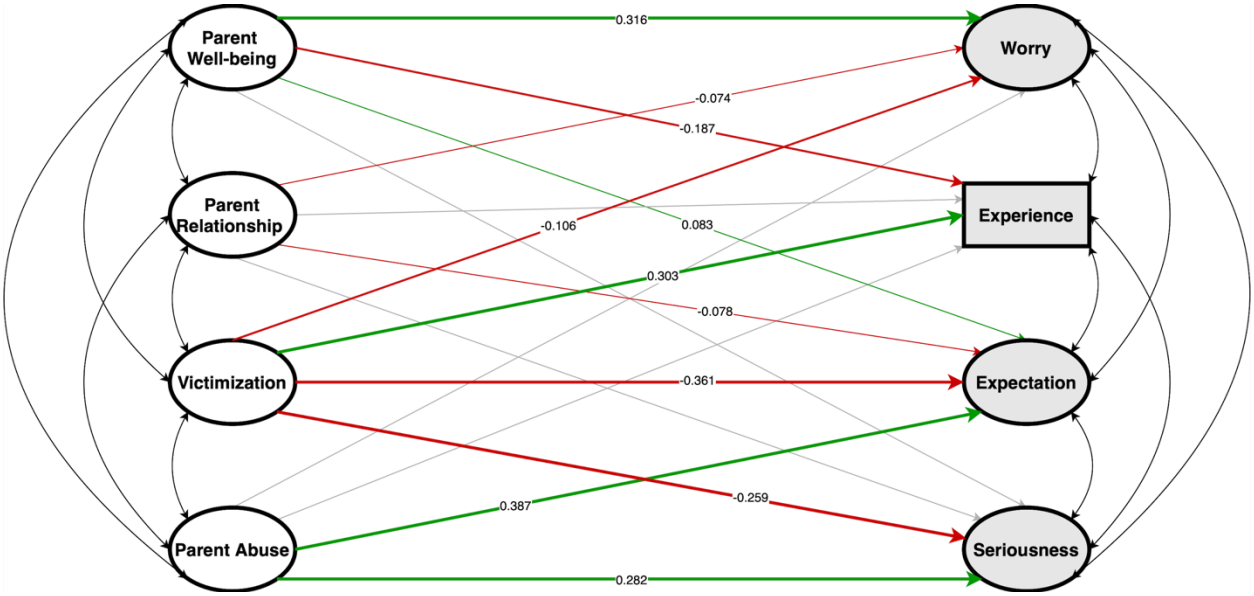

Figure 2 – **Response Variables Factor Loading Matrix**
The loading matrix for how the response variables load onto each of the three factors (output from R). The higher the positive number (and the lower the negative number), the stronger the variable loads onto that factor. The variables *worry_health*, *family_health*, *community_1health*, and *national_health* all load strongly onto the first factor (TC1). The variables *normal_days*, *meetings_days*, *big_events_days*, *shake_hands_days*, and *mask_days* all load strongly onto the second factor (TC2). The variables *soc_serious*, *mask_serious*, and *pandemic_serious* all load strongly onto the third factor (TC3). Finally, *experience* doesn't load strongly onto any factor

and is thus left separate as a single measured variable.

	TC1	TC2	TC3
worry_health	0.73005444	-0.008741412	-0.021840894
family_health	0.88445193	0.032089199	0.013876013
community_1health	0.89855429	-0.009972767	0.002256156
national_health	0.83031281	-0.024795050	-0.024141524
soc_serious	-0.04936775	-0.022546489	0.832934312
mask_serious	0.04896951	0.038658349	0.841111583
pandemic_serious	-0.04757299	-0.009822070	0.783007400
normal_days	0.02694518	0.748163500	0.074976547
meetings_days	0.03294303	0.731958897	-0.012517012
big_events_days	-0.04840772	0.773046168	-0.107398588
shake_hands_days	-0.05461794	0.730489565	-0.137411766
mask_days	0.03001930	0.737194594	0.216392166
experience	0.29760849	-0.027440235	-0.111062121

Figure 3 – **Explanatory Variables Factor Loading Matrix**
The loading matrix for how the explanatory variables load onto each of the four factors (output from R). The higher the positive number (and the lower the negative number), the stronger the variable loads onto that factor. The variables *ace_1*, *ace_2*, and *ace_4* all load strongly onto the first factor (TC1). The variables *ace_9*, *ace_12*, and *ace_17* all load strongly onto the third factor (TC3). The variables *ace_3*, *ace_5*, and *ace_8* all load strongly onto the fourth factor (TC4). Finally, the variables *ace_13* and *ace_15* load strongly onto the second factor (TC2).

	TC1	TC3	TC4	TC2
ace_1	0.79921893	0.14330029	0.007858744	-0.053026119
ace_2	0.75231234	-0.16214260	0.150388937	0.043690438
ace_3	0.07798411	-0.12947714	0.720876969	0.006240792
ace_4	0.75464071	0.11312015	-0.076274534	0.018118790
ace_5	0.22577124	-0.09995032	0.611442328	0.249690677
ace_8	-0.12428914	0.29978541	0.726538263	-0.106962136
ace_9	0.29128281	0.63641606	-0.032391087	-0.027522667
ace_12	0.21842386	0.66596326	0.036583200	0.079872101
ace_13	-0.05062933	0.12868743	-0.045484614	0.802355477
ace_15	0.01371194	-0.06064508	0.033647185	0.793541556
ace_17	-0.20543112	0.67626287	0.107680245	0.092718273

Figure 4 – **Structural Equation Model Output**
This structural equation model output from R reveals the estimates or effects (est) of the relationships between each response variable (lhs) and each explanatory variable (rhs) as well the p-value (pvalue) determining if the effect is significant at the .05 level. The standard error (se), z-value (z), upper confidence interval limit (ci.upper), and lower confidence interval limit (ci.lower) is also shown.

lhs <chr>	op <chr>	rhs <chr>	est <dbl>	se <dbl>	z <dbl>	pvalue <dbl>	ci.lower <dbl>	ci.upper <dbl>
WORRY	~	PARENTRELATIONSHIP	0.074	0.013	5.676	0.000	0.049	0.100
WORRY	~	PARENTWELLBEING	−0.316	0.027	−11.622	0.000	−0.369	−0.263
WORRY	~	PARENTABUSE	0.061	0.050	1.217	0.224	−0.037	0.159
WORRY	~	VICTIMIZATION	0.106	0.032	3.365	0.001	0.044	0.168
SERIOUSNESS	~	PARENTRELATIONSHIP	−0.020	0.019	−1.027	0.304	−0.057	0.018
SERIOUSNESS	~	PARENTWELLBEING	0.030	0.037	0.813	0.416	−0.042	0.103
SERIOUSNESS	~	PARENTABUSE	0.282	0.076	3.695	0.000	0.132	0.432
SERIOUSNESS	~	VICTIMIZATION	−0.259	0.048	−5.376	0.000	−0.354	−0.165
EXPECTATION	~	PARENTRELATIONSHIP	−0.078	0.018	−4.434	0.000	−0.113	−0.044
EXPECTATION	~	PARENTWELLBEING	0.083	0.034	2.434	0.015	0.016	0.150
EXPECTATION	~	PARENTABUSE	0.387	0.072	5.345	0.000	0.245	0.529
EXPECTATION	~	VICTIMIZATION	−0.361	0.046	−7.799	0.000	−0.451	−0.270
EXPERIENCE	~	PARENTRELATIONSHIP	0.011	0.022	0.532	0.595	−0.031	0.054
EXPERIENCE	~	PARENTWELLBEING	−0.187	0.042	−4.449	0.000	−0.270	−0.105
EXPERIENCE	~	PARENTABUSE	−0.076	0.085	−0.900	0.368	−0.242	0.090
EXPERIENCE	~	VICTIMIZATION	0.303	0.054	5.583	0.000	0.197	0.409