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Profiles of historical loss and childhood trauma as predictors of mental and cardiometabolic health in American Indian adults

Neha A. John-Henderson[a,*], **Annie T. Ginty**[b]

[a]Department of Psychology, Montana State University, Bozeman, MT, United States

[b]Department of Psychology and Neuroscience, Baylor University, Waco, TX, United States

Abstract

Cardiometabolic disease and mental health conditions are two major contributors to persistent inequities in health and life expectancy for American Indian adults. The atrocities associated with European colonization are linked to intergenerational psychological and emotional wounding (i.e., historical trauma) and high incidence of childhood trauma. Prior work has examined the independent relationships of childhood trauma and thoughts about historical loss with cardiometabolic and mental health in American Indians. In the current work, we used a data-driven approach to identify profiles of childhood trauma and frequency of thoughts about historical loss, and then examined how these profiles related to cardiometabolic and mental health in a sample of American Indian adults from across the United States (N = 727). We found that a profile characterized by high levels of childhood trauma and high frequency of thoughts about historical losses was associated with the greatest risk for mental health conditions. The profile characterized by the highest levels of childhood trauma and by moderate frequency of thoughts about historical losses was associated with the largest risk of cardiometabolic conditions. The findings represent an important first step towards understanding how childhood trauma and thoughts about historical loss may simultaneously inform enduring inequities in American Indian health.

Keywords

Historical trauma; Childhood trauma; American Indians; Cardiometabolic health; Mental health

In the United States, compared to other racial and ethnic groups, American Indians have among the worst health inequities (Adakai et al., 2018; Espey et al., 2014). These inequities include high incidence of chronic mental and physical health conditions including

*Corresponding author. Montana State University, 319 Traphagen Hall, Bozeman, MT, 59718, United States., neha.johnhenderson@montana.edu (N.A. John-Henderson).

Author statement

NJH worked with a community advisory board comprised of American Indian adults to select culturally appropriate measures and methodologies. cleaned and analyzed the data, interpreted the results, and wrote the manuscript.ATG cleaned and analyzed the data, interpreted the results, and wrote the manuscript.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

depression, cardiovascular disease (CVD), and diabetes. These health inequities must be contextualized in American Indian history.

Following contact with European colonizers, American Indians experienced genocide and ethnic cleansing (Whitbeck et al., 2004). There was a massive loss of life resulting from genocide, warfare, and intentional spreading of infectious diseases. This time-period has been referred to as the "American Indian Holocaust (Thornton, 1987)." Following military defeat, many American Indians were forcibly moved to locations that were entirely foreign and far removed from their homes. The tribal reservations initially established were much like concentration camps, with residents depending on the government for their basic needs. Traditional means of life and survival were not permitted and many American Indians were largely forced to adapt to Western practices and approaches (e.g., European styles of farming). The systematic ethnic cleansing of American Indians had no identifiable end and was legally sanctioned by the United States government.

These atrocities contribute to *Historical Trauma*, which can be described as a merged product of both psychological trauma and historical oppression (Hartmann and Gone, 2014). In contrast to traumas which occur at the level of an individual (e.g., physical abuse), historical trauma is collective, affecting not only those who directly experienced these atrocities, but rather the larger community. Historical trauma also impacts subsequent generations through a variety of pathways including shared stories, learned histories, epigenetic changes, transmission of maternal stress, disruptions or modulations of the development of physiological systems, effects on parenting and attachment styles, and learned responses to stress and trauma (Brave Heart, 2003; Mohatt et al., 2014; O'Neill et al., 2018; Whitbeck et al., 2004; Yehuda and Lehrner, 2018).

1. Historical loss

For many American Indians, historical trauma is inextricably linked to loss, which is often referred to as *historical loss*. However, these losses are not 'historical' in the sense that many American Indians are constantly reminded of these losses as they are reflected in their current economic conditions, ongoing systemic discrimination, and continued threat to their culture and traditions (Whitbeck et al., 2004). Based on the findings from focus groups with American Indian elders, Whitbeck and colleagues developed a scale to measure the frequency with which American Indians think about these losses, *The Historical Loss Scale* (HLS; Whitbeck et al., 2004). The losses in the HLS were selected based on the frequency with which elders mentioned them during discussion, and the initial study found that thoughts about these losses provoked negative feelings in American Indian elders (Whitbeck et al., 2004). Examples of the losses included in the scale are loss of land, language, spiritual ways, culture, and family ties (due to boarding schools).

The constellation of behavioral and psychological responses associated with thoughts about historical trauma and associated losses are described as the Historical Trauma Response (HTR; Brave Heart, 2003). The HTR can include depression, self-destructive behavior, suicidal thoughts, anxiety, anger, difficulty regulating emotions, and substance use. A significant body of work documents relationships between thoughts about historical

losses and mental health in American Indians (Evans-Campbell, 2008; Gone et al., 2019; Grayshield et al., 2015), and more recently research studies in American Indian tribal communities have provided evidence of a relationship between thoughts about historical loss and outcomes linked to cardiometabolic health (John-Henderson et al., 2022, 2023). Thoughts about historical loss may contribute to the HTR and increase risk for poor mental and physical health by affecting levels of psychological stress. For example, previous work has found that in American Indian adults, thoughts about historical loss relate to increases in psychological stress in response to a life-event (John-Henderson and Ginty, 2020) and relate to levels of reported psychological stress experienced in daily life (John-Henderson et al., 2022).

2. Links between historical trauma, historical loss, and childhood trauma in American Indians

Similar to American Indian health inequities, childhood trauma in American Indian communities must also be understood and discussed within the context of structural inequalities, historical trauma, and historical loss. In the late 1800's, to force assimilation and sever ties with American Indian culture, the United States government put forth a federal policy that all American Indian children should attend boarding schools. As a result of this policy, thousands of American Indian children were forcibly removed from their families and placed in these schools (Cross et al., 2000). By 1930, nearly half of all American Indian children were enrolled in these institutions (U.S. Department of Health and Human Services, 2001). Once there, they were generally forbidden to engage in American Indian traditions or speak in their language, and in many cases were subject to physical, emotional, and sexual abuse (Adams, 1998).

In addition to historical trauma, compared to other racial/ethnic groups, American Indians also have disproportionately high levels of childhood trauma (Giano et al., 2021; Richards et al., 2021). In previous literature, it is noted that these boarding schools led to a dual loss of both identity and family connection, likely leading to future challenges with forming secure attachments in close relationships (Olson and Dombrowski, 2020). If and when children were returned to their homes and families, they were unfamiliar with their culture and traditional ways, and the loss of stable family units meant that traditional parenting practices were not possible (Horejsi et al., 1992). Since they were exposed to dysfunctional practices in the boarding schools such as severe punishment and child abuse (Horejsi et al., 1992), these individuals were more likely to have interpersonal trauma within their own families, including physical, emotional, or sexual abuse (Freyd, 1996), and these patterns of dysfunction, abuse and trauma can be passed down from one generation to the next (Walls and Whitbeck, 2012).

As further evidence of this relationship between historical trauma and childhood trauma, a recent study found that American Indian adults whose mother or father attended a boarding school had significantly higher levels of childhood trauma compared to those whose mother or father did not attend a boarding school (Moon-Riley et al., 2019). Much of the research on the impacts of boarding school attendance on future outcomes focuses on behavioral,

psychological, and emotional health (Heart et al., 2011; Evans-Campbell et al., 2012), however, some prior work reports relationships between boarding school attendance and poor physical health in adulthood (Bear et al., 2018, 2019).

3. Childhood trauma and health

A substantial body of work documents a strong link between childhood trauma (as measured by the Adverse Childhood Experience (ACEs) Scale (Felitti et al., 1998) and poor health in adulthood (Hughes et al., 2017). While American Indians are vastly underrepresented in large epidemiological studies, there is evidence of a relationship between childhood trauma and poor physical, mental, and behavioral health in adulthood for American Indian adults (Koss et al., 2003; Thayer et al., 2017; Warne et al., 2017). For example, the experience of childhood trauma in American Indians has previously been linked to anxiety and depression (Easton et al., 2019; McCullen et al., 2022), and in other racial/ethnic groups, childhood trauma relates to incidence of cardiometabolic conditions and mental health (Goncalves Soares et al., 2021; Horwitz et al., 2001; Jakubowski et al., 2018; Salas et al., 2019; Xiao et al., 2021). However, to date, childhood trauma and thoughts about the losses associated with historical trauma have not been examined simultaneously as predictors of health outcomes in American Indians.

4. Risk factors for mental and cardiometabolic health in American Indians

While American Indians are at increased risk for cardiometabolic disease and poor mental health, their representation in large-scale epidemiological studies focused on risk factors for such outcomes is limited. One recent study, which focused exclusively on American Indian and Alaska Native adults, found a relationship between generalized psychological stress and cardiometabolic health (Nikolaus, et al., 2021). Related to this finding, a recent paper put forth a conceptual model highlighting the important role of psychosocial stress and trauma in cardiometabolic disease risk in American Indians (Lewis et al., 2021).

There is a significant body of work indicating links between thoughts about historical loss, historical oppression, racism, family problems, and substance misuse with mental health in American Indians (Gone et al., 2019; Ka'apu & Burnette, 2019; King et al., 2009). However, most of the extant work on risk factors for cardiometabolic health in American Indians focuses on behavioral and biological risk factors, including substance misuse, cigarette smoking, physical inactivity, hypertension, and renal function (Breathett et al., 2020). As acknowledged previously, some recent work does indicate links between thoughts about historical loss in American Indians and risk for cardiometabolic disease (John--Henderson et al., 2022, 2023). Finally, it is important to note that all acknowledged risk factors for poor mental and cardiometabolic health may be further exacerbated by HTR (Brave Heart, 1999; Robin et al., 1996).

5. Additive effects of childhood trauma and thoughts about historical loss

To date, prior work has largely considered independent effects of childhood trauma and historical loss on health in American Indians, while there is little understanding how these

factors cluster together, or if they indeed cluster. Given enduring American Indian health inequities it is imperative to elucidate relationships between clusters of these factors and the health outcomes which most commonly contribute to reduced life expectancy in this population to identify groups who are at the greatest risk for poor health. In the current work, in a sample of American Indian adults from across the United States, we aimed to 1) identify clusters of individuals based on childhood trauma and frequency of thoughts about historical loss and 2) examine whether membership to a particular cluster increased/decreased likelihood of reporting cardiometabolic and/or mental health conditions over the past year.

6. Methods

Community Based Participatory Research (CBPR) emphasizes the equitable involvement of community members, researchers, and other stakeholders in the entirety of the research process and recognizes the value of contributions from all team members (Wallerstein and Duran, 2006). This research was inspired by discussions with a long-standing Community Advisory Board (CAB) comprised of community members of an American Indian tribe. The CAB members reviewed all measures utilized in the current study to provide feedback on the cultural appropriateness and relevance of measures. While the current research benefited from having some oversight and input from American Indians, it should be acknowledged that the experience and feedback from members of one tribe does not generalize to all American Indians and is a significant limitation of the study design.

The current study was approved by the Montana State University Institutional Review Board. All subjects provided informed consent before participation in the study. Qualtrics recruited a convenience sample of 727 American Indian adults (aged 18 and over) living in the United States. Qualtrics draws participants from managed research panels for groups that are harder to reach, including American Indians through niche panels, which are developed through targeted recruiting. To be eligible for the study, participants had to self-identify as American Indian, currently live within the United States, and be at least 18 years old. All data was collected and screened for quality by Qualtrics. All deidentified data was sent in an excel file to the principal investigator and was subsequently transferred to SPSS (IBM V 28) for statistical analyses.

6.1. Transparence and openness

The current study design and analyses plan were not preregistered. All research materials and raw and processed data are available on request.

6.2. Measures

6.2.1. Historical loss—Historical loss (i.e., the frequency in which participants thought about losses to their culture, land, and people as a result of European colonization) was assessed using the Historical Loss Scale (HLS; Whitbeck et al., 2004). Participants are asked to rate the frequency (1 = several times a day to 6 = never) with which they think about the described losses. The scale consists of 12 items and each item is reversed-scored and a total score is calculated as the sum of each response (possible score range = 12–72), with

higher scores indicating greater levels of historical loss. Previous research has demonstrated that the HLS can be adequately explained by a single latent factor (Whitbeck et al., 2004). Cronbach's alpha for the HLS in the present sample was .963.

6.2.2. Childhood adversity—Exposure to adverse experiences during childhood were assessed using the 10-item Adverse Childhood Experiences (ACEs) scale (Felitti et al., 1998). The ACEs assesses abuse, neglect, and household dysfunction experienced in the first 18 years of life. Participants respond to each statement in a dichotomous format (1 = yes, 0 = no). Sum scores were created by adding each "yes" response (possible score range = 0–10), with higher scores indicating greater childhood adversity. Cronbach's alpha for ACEs in the present sample was .877.

6.2.3. Cardiometabolic and mental health condition outcomes—Participants responded to a checklist of 30 items (e.g., high blood pressure, asthma) to indicate how many chronic conditions they experienced in the past 12 months. Participants who responded "yes" to any of the following items: "*high blood pressure or hypertension,*" "*diabetes or high blood sugar,*" or "*stroke,*" were coded as having a cardiometabolic condition (1 = cardiometabolic condition; 0 = no cardiometabolic condition). Participants who responded "yes" to any of the following items: "*anxiety, depression, or some other emotional disorder*" or "*alcohol or drug problems*" were coded as experiencing adverse mental health conditions(1 = experiencing adverse mental health; 0 = not experiencing adverse mental health). The checklist has previously been used to access chronic conditions in adult samples (Allen et al., 2019; Elliot and Chapman, 2016; Friedman and Herd, 2010; Urban-Wojcik et al., 2022).

6.2.4. Data analysis—There were no missing data on any of the variables used in our analyses. Data examined for normality, skewness, and kurtosis were below 1 for historical loss and childhood adversity, indicating acceptable ranges of normality (Kim, 2013). Cluster analysis has been identified as a useful tool in health psychology to elucidate subgroups comprised of individuals that are at risk of poor outcomes or developing conditions (e. g., Clatworthy et al., 2005). More specifically, cluster analysis can take heterogenous data (i.e., subjects in a single large cohort) and form groups based on their statistical similarity using *a priori* determined variables (Romesburg, 1984; Clatworthy et al., 2005). In present context, cluster analysis is ideal 1) if groups exist based on historical loss and childhood trauma and 2) if such groups differentially relate to health outcomes. Cluster analysis was carried out using Ward's method (Ward, 1963). To ensure the cluster analysis was not influenced by the scale of individual variables, raw scores for the HLS and ACEs were converted to standardized z-scores (Brindle et al., 2016). No *a priori* assumptions about the number of clusters were made. Ward's method begins with the same number of clusters as cases and each step, cases are combined, resulting in one less cluster than before. Euclidean distances between individual scores and the mean of each respective variable are calculated. The smaller the sums of squares; the greater the similarity between individuals in a cluster. A total sum of squares is calculated across all clusters and, at each step. Ward's method determines which two clusters can be merged to produce the smallest increase in total sum squares. The 'natural solution' to the clustering process is the cluster outcome just prior

to a merger of two dissimilar clusters (i.e., resulting in a substantial increase in the total sums of squares). Differences between clusters on demographic variables, historical loss, and childhood adversity were examined using one-way ANOVA and chi-square analyses. Post-hoc analyses were conducted using the Bonferroni correction. Chi-square analyses were used to identify the cluster with the lowest prevalence of cardiometabolic conditions and adverse mental health conditions and this cluster was used as the reference cluster for binary logistic regressions. In two separate analyses, an uncontrolled binary logistic regression was used to assess whether cluster membership was associated with experiencing cardiometabolic or adverse mental health conditions in the past 12 months. Next, the same binary logistic regressions were revisited, adjusting for biological sex, age, annual household income, and smoking status.

7. Results

7.1. Participant characteristics

In total, 727 participants completed the entire survey. All participants self-identified as American Indian. Participants were between 18 and 95 years old (mean age = 37.01 years; standard deviation [SD] = 15.10 years) and 266 (36.6%) identified as female. Most of the sample did not live on a reservation (84.7%), and there were over 90 tribal affiliations reported (the most common affiliations reported were: Cherokee = 114 participants; Blackfeet = 20 participants, Choctaw = 19 participants, Navajo = 17 participants, Apache = 11 participants). The mean household income for participants was $33,178 (SD = $16,328). Four hundred and ninety-one participants reported never smoking, 53 participants reported previously smoking, and 183 participants reported being current smokers.

7.2. Cluster analyses

Following the procedures described above for selecting the appropriate number of clusters, total ACEs and historical loss were found to create four distinct clusters. The means and standard errors for total ACEs and historical loss for each cluster can be found in Table 1. One-way ANOVA (historical loss: $F(3, 723) = 213.89$, $p < .001$, $\eta^2_p = 0.470$; childhood trauma: $F(3, 723 = 736.77$, $p < .001$, $\eta^2_p = 0.754$) and post-hoc analyses demonstrated that all clusters were statistically significantly different from one another for both historical loss and ACEs (p's < 0.02). Individuals in cluster 1 exhibited low levels of frequency of thoughts about historical loss and low levels of ACEs (Low HL/Low ACE). Individuals in cluster 2 exhibited high levels of frequency of thoughts about historical loss and low levels of ACEs (High HL/Low ACE). Individuals in cluster 3 had high levels of frequency of thoughts about historical loss and high levels of ACEs (High HL/High ACE) and individuals in cluster 4 reported average levels of thoughts about historical loss and high levels of ACEs (Average HL/High ACE).

There were no statistically significant differences between clusters on biological sex or smoking status. There was a statistically significant difference between clusters based on age, $F(3, 723) = 4.36$, $p = .005$, $\text{eta}^2_p = 0.018$. Post-hoc analyses indicated that, on average, participants in the Low HL/Low ACE cluster (mean age = 39.23, SD = 16.72 years) were

older than participants in the High HL/Low ACE cluster (mean age = 34.48, SD = 14.36 years). There was a statistically significant difference between clusters on income, $F(3, 723) = 9.02$, $p < .001$, $_p eta^2 = 0.036$. Post-hoc analyses indicated that, on average, participants in Low HL/Low ACE cluster had a statistically significant lower income compared to all other clusters (mean income: Low HL/Low ACE = $29,939, SD = $14,291; High HL/Low ACE = $36,371, SD = $18,907; High HL/Low ACE = $32,136, SD = $17,986; Average HL/High ACE = $36,222, SD = $14,364). Chi-square analyses indicated that the Low HL/Low ACE had the lowest incidence of mental health conditions and cardiometabolic conditions. Therefore, the Low HL/Low ACE cluster was used as the reference cluster in subsequent analyses.

7.3. Cluster membership and mental health conditions over past 12 months

In all, 318 (43.7%) participants reported having experienced adverse mental health conditions over the past 12 months. Binary logistic regression demonstrated a relationship between all clusters and a statistically significant increased risk of having experienced adverse mental health conditions over the past 12 months compared to the cluster low in Low HL/Low ACE (reference cluster). Results remained statistically significant after controlling for age, biological sex, and income (see Table 2).

7.4. Cluster membership and cardiometabolic conditions over past 12 months

In all, 245 (33.70%) participants reported having experienced a cardiometabolic condition over the past 12 months. Binary logistic regression demonstrated a relationship between the clusters High HL/High ACE and Average HL/High ACE and statistically significant increased risk of having experienced a cardiometabolic condition over the past 12 months compared to the Low HL/Low ACE (reference cluster). Results remained statistically significant after controlling for age, biological sex, income, and smoking status (see Table 3). Smoking status was adjusted for the cardiometabolic outcome analysis given the association between smoking and CVD (Benowitz, 2003).

8. Discussion

A robust literature focused on the general United States population documents the relationship between psychological stress and cardiometabolic disease risk (Dimsdale, 2008; Gebreab et al., 2018; Winning et al., 2015). This relationship is posited to be a product of the effects of acute and chronic stress on physiological systems and responses (Dich et al., 2015; Gianaros and Jennings, 2018), behavioral mediators (Jackson et al., 2010; Raposa et al., 2014; Suvarna et al., 2020), and patterns of affect and emotion regulation (Appleton and Kubzansky, 2014; Roy et al., 2018; Sapolsky, 2007). Existing data indicates a similar relationship in American Indians, with those who report greater stress burdens exhibiting more metabolic risk factors (Sawchuk et al., 2005) and greater incidence of CVD (Jiang et al., 2008). In addition to the stressors that affect the general population, American Indians must manage the psychosocial stress associated with colonist-induced trauma (i.e., historical trauma and associated historical loss).

In a previous study which reported that American Indians have higher ACEs than any other racial/ethnic group in the United States, it was noted that the observed high rates of ACEs are likely linked to historical loss. As a result, the investigators emphasized the need for future research on American Indian health inequities to measure both ACEs and historical loss as independent constructs (Richards et al., 2021). Given that cardiometabolic disease and mental health conditions are leading contributors to early mortality for American Indians (Adakai et al., 2018; Breathett et al., 2020; Sarche and Spicer, 2008), and given the high rates of childhood trauma and relevance of historical trauma for this population, the importance of elucidating these relationships cannot be understated. To our knowledge, the current research is the first to examine the association between profiles of trauma (i.e., historical loss and childhood trauma) and cardiometabolic and mental health outcomes in a sample of American Indian adults.

In this sample, four distinct profiles emerged 1) individuals with low frequency of thoughts about historical loss and low levels of ACEs, 2) individuals with high frequency of thoughts about historical loss and low levels of ACEs, 3) individuals with high frequency of thoughts about historical loss and high levels of ACEs, and 4) individuals with average frequency of thoughts about historical loss and high levels of ACEs. Those with the lowest levels of both historical and childhood trauma had the least risk for both mental health and cardiometabolic health conditions. The profile characterized by high levels of thoughts about historical loss and childhood trauma exhibited the greatest risk (12x increased risk compared to the reference group) for mental health conditions over the past year. The profile characterized by average levels of thoughts about historical losses and the highest levels of childhood trauma had the greatest increased risk (3x greater than reference group) for cardiometabolic conditions over the past year.

Our cluster analyses indicate that thoughts about historical loss in American Indian adults may be a particularly potent driver of risk for poor mental health. This finding is in line with a body of theoretical and empirical work highlighting the likely role of historical loss in enduring American Indian health inequities. A recent systematic review highlighted 32 empirical investigations of the relationship between historical loss and health in American Indians (Gone et al., 2019). All the studies included in this review focused on mental health outcomes or behavioral outcomes (e.g., smoking, suicide intent), and did not investigate whether thoughts about historical loss relate to risk for cardiometabolic health or other physical health conditions.

The inclusion of a measure of cardiometabolic health in the current work was motivated by the high incidence of cardiometabolic disease in American Indians (Breathett et al., 2020), and our previous work indicating a link between thoughts about historical loss and outcomes linked to cardiometabolic health including ambulatory blood pressure, immune system inflammation, and physical activity (John-Henderson et al., 2022, 2023). While all of these outcomes are implicated in the risk, onset, and progression of cardiometabolic disease, the current investigation allowed us to investigate the role of thoughts about historical loss's association with cardiometabolic health (as measured by number of self-reported conditions in the last 12 months). Our profile analyses indicate that while thinking of historical losses may increase risk for cardiometabolic conditions, childhood trauma appears

to be the stronger driver of risk for cardiometabolic health. Overall, the current work extends previous work on the links between historical loss and health in American Indian adults in important ways. First, by using cluster analyses, we were able to consider additive risk for poor health associated with high frequency of thoughts about historical loss and childhood trauma exposure. Second, in addition to simultaneous consideration of these risk factors, we also consider implications of these risk factors for both cardiometabolic and mental health. As noted earlier, the link between psychological stress and poor health is well-documented. Based on this relationship, it is possible that the additive risk for poor health associated with high frequency of thoughts and high childhood trauma may be a product of related high levels of psychological stress. This possibility should be investigated in future longitudinal studies.

9. Limitations and conclusion

Our reliance on self-report measures of cardiometabolic and mental health over the past 12-months is a clear limitation of this work. Indeed, participants may underreport stigmatizing conditions. However, self-report of chronic conditions is a commonly used approach in large studies (i.e., Allen et al., 2019; Smith et al., 2016) and this is the first study to simultaneously measure indicators of both mental and physical health along with childhood and historical trauma in American Indians. Nevertheless, future research should aim to include biological and physical measures of health. Second, we did not control for participants who were on medication for these disorders. The aim was to identify if specific clusters were related to having a cardiometabolic or mental health condition and not the severity of the condition. Third, we do not have information about the timing of childhood trauma exposure, a factor which could impact the degree to which these trauma exposures affect adult cardiometabolic and mental health. Future research should aim to examine to childhood trauma both retrospectively and prospectively and obtain information regarding timing of trauma exposures. Fourth, the study used the Adverse Childhood Experiences scale to obtain childhood trauma and used a summary score. While the ACEs measures if the event occurred, it does not fully access if the event meets DSM-V criteria for trauma (DSM-5-TR, American Psychiatric Association, 2022). Similarly, the summary score of the ACEs assumes all traumatic events are equal (i.e., each endorsement receives a score of 1). However, research suggests that the types of ACEs may differentially impact outcomes (Briggs et al., 2021). Fifth, the present study does not examine resilience factors that may be protective for health outcomes among those with high levels of historical trauma and childhood adversity. Previous work indicates that identification with American Indian culture and engaging in cultural traditions may protect against the risk associated with trauma (Gone, 2013; Gone and Looking, 2011; Hartmann et al., 2019), and our own work indicates that social connectedness may also reduce risk associated with both childhood and historical trauma (John-Henderson and Ginty, 2020; John-Henderson et al., 2019, 2020). Future inquiries in this area should consider whether levels of cultural or social connectedness moderate the observed relationships. Finally, participants reported over 90 tribal affiliations. While this could be seen as a limitation because of heterogeneity of the sample, it could also be viewed as a strength because of diverse representations of American Indian tribes from across the United States. Finally, while we appreciate the

feedback and oversight of the study from our CAB comprised of community members of an American Indian tribe, we acknowledge that their input does not necessarily reflect that of all American Indians. In future work which includes American Indians from across the United States and across numerous tribes, it would be ideal to acquire feedback from American Indians from different tribes, states, and communities.

The current research makes a novel empirical contribution to our understanding of psychosocial contributors to inequities in cardiometabolic and mental health in American Indian adults and extends prior theoretical work highlighting the importance of trauma and stress exposures in understanding the disproportionately high incidence of cardiometabolic disease and poor mental health in American Indians (Lewis et al., 2021). Specifically, our data-driven creation of profiles of historical and childhood trauma allowed us to test whether and how these two highly relevant trauma exposures are linked to cardiometabolic disease and poor mental health in American Indians. While prior work indicates independent links between childhood trauma and health and thoughts about historical loss and health in American Indians, the current research is the first to consider additive effects of both factors on mental and cardiometabolic health in this population. Understanding the cumulative effect of these risk factors is essential to inform tailored interventions to reduce risk for these conditions.

There are several important future directions for this research. First, it will be important to develop a more nuanced understanding about the relationship between childhood trauma and thoughts about historical loss. In line with the stress sensitization model (Stroud, 2020), it is possible that the experience of trauma during childhood sensitizes American Indian adults to the stressors associated with historical trauma. In addition, it will be important to understand whether the stress associated with childhood trauma and historical trauma affect mental health through shared or divergent biological, behavioral, social, and emotional pathways. Elucidating these pathways will be critical to informing the development of interventions which strive to reduce the degree to which these trauma exposures affect these health outcomes. Finally, as described in previous work (Gone and Looking, 2011), interventions which work to restore the loss of culture, traditions and indigenous knowledge could address the psychological and emotional wounding associated with historical trauma and downstream mental and physical health outcomes. The current work extends upon this idea in suggesting that such interventions could have a more pronounced positive effect on American Indian cardiometabolic and mental health by targeting the psychological, behavioral, emotional, and social sequelae of both historical and childhood trauma.

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References

Adakai M, Sandoval-Rosario M, Xu F, Aseret-Manygoats T, Allison M, Greenlund KJ, Barbour KE, 2018. Health disparities among American Indians/Alaska natives - Arizona, 2017. In: MMWR.

Morbidity and Mortality Weekly Report, 67, pp. 1314–1318. 10.15585/mmwr.mm6747a4, 47. [PubMed: 30496159]

Adams DW, 1998. Education for extinction: American Indians and the boarding school experience, 1875–1928 [Review of Education for extinction: American Indians and the boarding school experience, 1875–1928]. Harv. Educ. Rev 68 (2), 263–264 (Harvard Graduate School Education).

Allen JO, Watkins DC, Chatters L, Geronimus AT, Johnson-Lawrence V, 2019. Cortisol and racial health disparities affecting black men in later life: evidence from MIDUS II. Am. J. Men's Health 13 (4), 1557988319870969. 10.1177/1557988319870969.

American Psychiatric Association, 2022. Diagnostic and Statistical Manual of Mental Disorders, fifth ed. 10.1176/appi.books.9780890425787 text revision).

Appleton AA, Kubzansky LD, 2014. Emotion regulation and cardiovascular disease risk. In: Gross JJ (Ed.), Handbook of Emotion Regulation. The Guilford Press, pp. 596–612.

Bear UR, Beals J, Kaufman CE, Manson SM, AI-SUPERPFP Team, 2018. Boarding school attendance and physical health status of northern plains tribes. Appl. Res. in Q. of Life 13 (3), 633–645. 10.1007/s11482-017-9549-0.

Bear UR, Thayer ZM, Croy CD, Kaufman CE, Manson SM, AI-SUPERPFP Team, 2019. The impact of individual and parental American Indian boarding school attendance on chronic physical health of northern plains tribes. Fam. Community Health 42 (1), 1–7. 10.1097/FCH.0000000000000205. [PubMed: 30431464]

Benowitz NL, 2003. Cigarette smoking and cardiovascular disease: pathophysiology and implications for treatment. Prog. Cardiovasc. Dis 46 (1), 91–111. 10.1016/s0033-0620(03)00087-2. [PubMed: 12920702]

Brave Heart MY, 1999. Gender differences in the historical trauma response among the Lakota. J. Health Soc. Pol 10 (4), 1–21. 10.1300/J045v10n04_01.

Brave Heart MYH, 2003. The historical trauma response among natives and its relationship with substance abuse: a Lakota illustration. J. Psychoact. Drugs 35 (1), 7–13. 10.1080/02791072.2003.10399988.

Breathett K, Sims M, Gross M, Jackson EA, Jones EJ, Navas-Acien A, Taylor H, Thomas KL, Howard BV, American Heart Association Council on Epidemiology and Prevention; Council on Quality of Care and Outcomes Research; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; and Council on Lifestyle and Cardiometabolic Health, 2020. Cardiovascular health in American Indians and Alaska natives: a scientific statement from the American Heart association. Circulation 141 (25), e948–e959. 10.1161/CIR.0000000000000773. [PubMed: 32460555]

Briggs EC, Amaya-Jackson L, Putnam KT, Putnam FW, 2021. All adverse childhood experiences are not equal: the contribution of synergy to adverse childhood experience scores. Am. Psychol 76 (2), 243–252. 10.1037/amp0000768. [PubMed: 33734792]

Brindle RC, Ginty AT, Jones A, Phillips AC, Roseboom TJ, Carroll D, Painter RC, de Rooij SR, 2016. Cardiovascular reactivity patterns and pathways to hypertension: a multivariate cluster analysis. J. Hum. Hypertens 30 (12), 755–760. 10.1038/jhh.2016.35. [PubMed: 27334523]

Clatworthy J, Buick D, Hankins M, Weinman J, Horne R, 2005. The use and reporting of cluster analysis in health psychology: a review. Br. J. Health Psychol 10 (Pt 3), 329–358. 10.1348/135910705X25697. [PubMed: 16238852]

Cross TA, Earle KA, Simmons D, 2000. Child abuse and neglect in Indian country: policy issues. Fam. Soc 81 (1), 49–58. 10.1606/1044-3894.1092.

Dich, Lange T, Head J, Rod NH, 2015. Work stress, caregiving, and allostatic load: prospective results from the whitehall II cohort study. Psychosom. Med 77 (5), 539–547. 10.1097/PSY.0000000000000191. [PubMed: 25984826]

Dimsdale JE, 2008. Psychological stress and cardiovascular disease. J. Am. Coll. Cardiol 51 (13), 1237–1246. 10.1016/j.jacc.2007.12.024. [PubMed: 18371552]

Easton, Roh S, Kong J, Lee Y-S, 2019. Childhood sexual abuse and depression among American Indians in adulthood. Health Soc. Work 44 (2), 94–102. 10.1093/hsw/hlz005.

Elliot AJ, Chapman BP, 2016. Socioeconomic status, psychological resources, and inflammatory markers: results from the MIDUS study. Health Psychol. 35 (11), 1205–1213. 10.1037/hea0000392. [PubMed: 27280368]

Espey DK, Jim MA, Cobb N, Bartholomew M, Becker T, Haverkamp D, Plescia M, 2014. Leading causes of death and all-cause mortality in American Indians and Alaska natives. Am. J. Publ. Health 104 (6), S303, 1971.

Evans-Campbell, 2008. Historical trauma in American Indian/native Alaska communities: a multilevel framework for exploring impacts on individuals, families, and communities. J. Interpers Violence 23 (3), 316–338. 10.1177/0886260507312290. [PubMed: 18245571]

Evans-Campbell T, Walters KL, Pearson CR, Campbell CD, 2012. Indian boarding school experience, substance use, and mental health among urban two-spirit American Indian/Alaska natives. Am. J. Drug Alcohol Abuse 38 (5), 421–427. 10.3109/00952990.2012.701358. [PubMed: 22931076]

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS, 1998. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am. J. Prev. Med 14 (4), 245–258. 10.1016/s0749-3797(98)00017-8. [PubMed: 9635069]

Freyd JJ, 1996. Betrayal Trauma: the Logic of Forgetting Childhood Abuse. Harvard University Press, Cambridge, MA.

Friedman EM, Herd P, 2010. Income, education, and inflammation: differential associations in a national probability sample (The MIDUS study). Psychosom. Med 72 (3), 290–300. 10.1097/PSY.0b013e3181cfe4c2. [PubMed: 20100883]

Gebreab SZ, Vandeleur CL, Rudaz D, Strippoli MF, Gholam-Rezaee M, Castelao E, Lasserre AM, Glaus J, Pistis G, Kuehner C, von Känel R, Marques-Vidal P, Vollenweider P, Preisig M, 2018. Psychosocial stress over the lifespan, psychological factors, and cardiometabolic risk in the community. Psychosom. Med 80 (7), 628–639. 10.1097/PSY.0000000000000621. [PubMed: 29965943]

Gianaros PJ, Jennings JR, 2018. Host in the machine: a neurobiological perspective on psychological stress and cardiovascular disease. Am. Psychol 73 (8), 1031–1044. 10.1037/amp0000232. [PubMed: 30394781]

Giano, Camplain RL, Camplain C, Pro G, Haberstroh S, Baldwin JA, Wheeler DL, Hubach RD, 2021. Adverse childhood events in American Indian/Alaska native populations. Am. J. Prev. Med 60 (2), 213–221. 10.1016/j.amepre.2020.08.020. [PubMed: 33223364]

Goncalves Soares A, Zimmerman A, Zammit S, Karl A, Halligan SL, Fraser A, 2021. Abuse in childhood and cardiometabolic health in early adulthood: evidence from the avon longitudinal study of parents and children. J. Am. Heart Assoc 10 (24), e021701 10.1161/JAHA.121.02170118. [PubMed: 34873916]

Gone JP, Hartmann WE, Pomerville A, Wendt DC, Klem SH, Burrage RL, 2019. The impact of historical trauma on health outcomes for indigenous populations in the USA and Canada: a systematic review. Am. Psychol 74, 20–35. [PubMed: 30652897]

Gone JP, 2013. Redressing First Nations historical trauma: theorizing mechanisms for indigenous culture as mental health treatment. Transcult. Psychiatr 50 (5), 683–706. 10.1177/1363461513487669.

Gone JP, Looking PE, 2011. American Indian culture as substance abuse treatment: pursuing evidence for a local intervention. J. Psychoact. Drugs 43 (4), 291–296. 10.1080/02791072.2011.628915.

Grayshield, Rutherford JJ, Salazar SB, Mihecoby AL, Luna LL, 2015. Understanding and healing historical trauma: the perspectives of native American elders. J. Ment. Health Counsel 37 (4), 295–307. 10.17744/mehc.37.4.02.

Hartmann WE, Gone JP, 2014. American Indian historical trauma: community perspectives from two great plains medicine men. Am. J. Community Psychol 54 (3–4), 274–288. 10.1007/s10464-014-9671-1. [PubMed: 25160987]

Hartmann WE, Wendt DC, Burrage RL, Pomerville A, Gone JP, 2019. American Indian historical trauma: anticolonial prescriptions for healing, resilience, and survivance. Am. Psychol 74 (1), 6–19. 10.1037/amp0000326. [PubMed: 30652896]

Heart MY, Chase J, Elkins J, Altschul DB, 2011. Historical trauma among Indigenous Peoples of the Americas: concepts, research, and clinical considerations. J. Psychoact. Drugs 43 (4), 282–290. 10.1080/02791072.2011.628913.

Horejsi C, Craig BH, Pablo J, 1992. Reactions by Native American parents to child protection agencies: cultural and community factors. Child Welfare 71 (4), 329–342. [PubMed: 1638907]

Hughes K, Bellis MA, Hardcastle KA, Sethi D, Butchart A, Mikton C, Jones L, Dunne MP, 2017. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. Lancet Public Health 2 (8), e356–e366. 10.1016/S2468-2667(17)30118-4. [PubMed: 29253477]

Horwitz, Widom C, McLaughlin J, White H, 2001. The impact of childhood abuse and neglect on adult mental health: a prospective study. J. Health Soc. Behav 42 (2), 184–201. 10.2307/3090177. [PubMed: 11467252]

Jackson JS, Knight KM, Rafferty JA, 2010. Race and unhealthy behaviors: chronic stress, the HPA axis, and physical and mental health disparities over the life course. Am. J. Publ. Health 100 (5), 933–939.

Jakubowski, Cundiff JM, Matthews KA, 2018. Cumulative childhood adversity and adult cardiometabolic disease: a meta-analysis. Health Psychol. 37 (8), 701–715. 10.1037/hea0000637. [PubMed: 30024227]

Jiang L, Beals J, Whitesell NR, Roubideaux Y, Manson SM, AI-SUPERPFP Team, 2008. Stress burden and diabetes in two American Indian reservation communities. Diabetes Care 31 (3), 427–429. 10.2337/dc07-2044. [PubMed: 18070997]

John-Henderson NA, Ginty AT, 2020. Historical trauma and social support as predictors of psychological stress responses in American Indian adults during the COVID-19 pandemic. J. Psychosom. Res 139, 110263 10.1016/j.jpsychores.2020.110263. [PubMed: 33038816]

John-Henderson NA, Henderson-Matthews B, Ollinger SR, Racine J, Gordon MR, Higgins AA, Horn WC, Reevis SA, Running Wolf JA, Grant D, Rynda-Apple A, 2020. Adverse childhood experiences and immune system inflammation in adults residing on the Blackfeet reservation: the moderating role of sense of belonging to the community. Ann. Behav. Med 54 (2), 87–93. 10.1093/abm/kaz029. [PubMed: 31282543]

John-Henderson NA, Palmer CA, Thomas A, 2019. Life stress, sense of belonging and sleep in American Indian college students. Sleep Health 5 (4), 352–358. 10.1016/j.sleh.2019.04.001. [PubMed: 31153800]

John-Henderson NA, Oosterhoff B, Kampf TD, Hall B, Johnson LR, Laframboise ME, Malatare M, Salois E, Carter JR, Adams AK, 2022. Historical loss: implications for health of American Indians in the Blackfeet community. Ann. Behav. Med 56 (2), 193–204. 10.1093/abm/kaab032. [PubMed: 33969868]

John-Henderson NA, Grant VM, Johnson LR 3rd, Lafromboise ME, Malatare M, Salois EM, Oosterhoff B, 2023. Historical loss: implications for physical activity levels in American Indian adults. J. Rural Health 367–373. 10.1111/jrh.12673, 10.1111/jrh.12673. Advance online publication. [PubMed: 35508763]

Ka'apu K, Burnette CE, 2019. A culturally informed systematic review of mental health disparities among adult indigenous men and women of the USA: what is known? Br. J. Soc. Work 49 (4), 880–898. 10.1093/bjsw/bcz009. [PubMed: 31308574]

Kim HY, 2013. Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. Restor. Dent. & Endod 38 (1), 52–54. 10.5395/rde.2013.38.1.52.

King M, Smith A, Gracey M, 2009. Indigenous health part 2: the underlying causes of the health gap. Lancet 374 (9683), 76–85. 10.1016/S0140-6736(09)60827-8. [PubMed: 19577696]

Koss MP, Yuan NP, Dightman D, Prince RJ, Polacca M, Sanderson B, Goldman D, 2003. Adverse childhood exposures and alcohol dependence among seven Native American tribes. Am. J. Prev. Med 25 (3), 238–244. 10.1016/s0749-3797(03)00195-8. [PubMed: 14507531]

Lewis ME, Volpert-Esmond HI, Deen JF, Modde E, Warne D, 2021. Stress and cardiometabolic disease risk for indigenous populations throughout the lifespan. Int. J. Environ. Res. Publ. Health 18 (4), 1821. 10.3390/ijerph18041821.

McCullen JR, Counts CJ, John-Henderson NA, 2022. Childhood adversity and emotion regulation strategies as predictors of psychological stress and mental health in American Indian adults during the COVID-19 pandemic. Emotion. 10.1037/emo0001106, 10.1037/emo0001106. Advance online publication.

Mohatt NV, Thompson AB, Thai ND, Tebes JK, 2014. Historical trauma as public narrative: a conceptual review of how history impacts present-day health. Soc. Sci. Med 106, 128–136. 10.1016/j.socscimed.2014.01.043. [PubMed: 24561774]

Moon-Riley KC, Copeland JL, Metz GAS, Currie CL, 2019. The biological impacts of Indigenous residential school attendance on the next generation. SSM - Popul. Health 7 10.1016/j.ssmph.2018.100343, 100343–100343.

Nikolaus, Sinclair K, Buchwald D, Suchy-Dicey AM, 2021. Association of stress and resilience with cardiometabolic health among American Indian and Alaska Native adults. Prev. Med. Reports 24 10.1016/j.pmedr.2021.101517, 101517–101517.

Olson MD, Dombrowski K, 2020. A systematic review of Indian boarding schools and attachment in the context of substance use studies of native Americans. J. Racial and Ethnic Health Disparities 7 (1), 62–71. 10.1007/s40615-019-00634-4.

O'Neill L, Fraser T, Kitchenham A, et al. , 2018. Hidden burdens: a review of intergenerational, historical and complex trauma, implications for indigenous families. J. Child Adolesc. Trauma 11, 173–186. 10.1007/s40653-016-0117-9. [PubMed: 32318148]

Raposa EB, Bower JE, Hammen CL, Najman JM, Brennan PA, 2014. A developmental pathway from early life stress to inflammation: the role of negative health behaviors. Psychol. Sci 25 (6), 1268–1274. [PubMed: 24760142]

Richards TN, Schwartz JA, Wright E, 2021. Examining adverse childhood experiences among Native American persons in a nationally representative sample: differences among racial/ethnic groups and race/ethnicity-sex dyads. Child Abuse Negl. 111, 104812 10.1016/j.chiabu.2020.104812. [PubMed: 33220946]

Robin RW, Chester B, Goldman D, 1996. Cumulative trauma and PTSD in American Indian communities. In: Marsella AJ, Friedman MJ, Gerrity ET, Scurfield RM (Eds.), Ethnocultural Aspects of Posttraumatic Stress Disorder: Issues, Research, and Clinical Applications. American Psychological Association, pp. 239–253. 10.1037/10555-009.

Romesburg HC, 1984. Cluster Analysis for Researchers. Lifetime Learning Publications, Belmont, CA.

Roy B, Riley C, Sinha R, 2018. Emotion regulation moderates the association between chronic stress and cardiovascular disease risk in humans: a cross-sectional study. Stress 21 (6), 548–555. 10.1080/10253890.2018.1490724. [PubMed: 30084712]

Salas J, van den Berk-Clark C, Skiöld-Hanlin S, Schneider FD, Scherrer JF, 2019. Adverse childhood experiences, depression, and cardiometabolic disease in a nationally representative sample. J. Psychosom. Res 127 10.1016/j.jpsychores.2019.109842, 109842–109842. [PubMed: 31671348]

Sarche M, Spicer P, 2008. Poverty and health disparities for American Indian and Alaska Native children: current knowledge and future prospects. Ann. N. Y. Acad. Sci 1136, 126–136. 10.1196/annals.1425.017. [PubMed: 18579879]

Sapolsky RM, 2007. Stress, stress-related disease, and emotional regulation. In: Gross JJ (Ed.), Handbook of Emotion Regulation. The Guilford Press, pp. 606–615.

Sawchuk CN, Roy-Byrne P, Goldberg J, Manson S, Noonan C, Beals J, Buchwald D, 2005. The relationship between post-traumatic stress disorder, depression and cardiovascular disease in an American Indian tribe. Psychol. Med 35 (12), 1785–1794. [PubMed: 16300692]

Smith AE, Molton IR, Jensen MP, 2016. Self-reported incidence and age of onset of chronic comorbid medical conditions in adults aging with long-term physical disability. Disabil. and Health J 9 (3), 533–538. 10.1016/j.dhjo.2016.02.00. [PubMed: 27009420]

Stroud CB, 2020. The stress sensitization model. In: Harkness KL, Hayden EP (Eds.), The Oxford Handbook of Stress and Mental Health. Oxford University Press, pp. 349–370.

Suvarna B, Suvarna A, Phillips R, Juster R-P, McDermott B, Sarnai Z, 2020. Health risk behaviors and allostatic load: a systematic review. Neurosci. Biobehav. Rev 108, 694–711. 10.1016/j.neubiorev.2019.12.020. [PubMed: 31846655]

Thayer Z, Barbosa-Leiker C, McDonell M, Nelson L, Buchwald D, Manson S, 2017. Early life trauma, post-traumatic stress disorder, and allostatic load in a sample of American Indian adults. Am. J. Hum. Biol 29 (3) 10.1002/ajhb.22943.

Thornton, 1987. American Indian Holocaust and Survival: a Population History since 1492, first ed. University of Oklahoma Press.

Urban-Wojcik EJ, Mumford JA, Almeida DM, Lachman ME, Ryff CD, Davidson RJ, Schaefer SM, 2022. Emodiversity, health, and well-being in the Midlife in the United States (MIDUS) daily diary study. Emotion 22 (4), 603–615. 10.1037/emo0000753. [PubMed: 32271048]

U.S. Department of Health and Human Services, 2001. Administration on Children, Youth and Families. Child Maltreatment: 1999. U.S. Government Printing Office, Washington, DC.

Wallerstein NB, Duran B, 2006. Using community-based participatory research to address health disparities. Health Promot. Pract 7 (3), 312–323. 10.1177/1524839906289376. [PubMed: 16760238]

Walls ML, Whitbeck LB, 2012. The intergenerational effects of relocation policies on indigenous families. J. Fam. Issues 33 (9), 1272–1293. 10.1177/0192513X12447178. [PubMed: 23024447]

Ward JH, 1963. Hierarchical grouping to optimise an objective function. J. Am. Stat. Assoc 58, 236–244.

Warne D, Dulacki K, Spurlock M, et al. , 2017. Adverse childhood experiences (ACE) among American Indians in south Dakota and associations with mental health conditions, alcohol use, and smoking. J. Health Care Poor Underserved 28 (4), 1559–1577. 10.1353/hpu.2017.0133. [PubMed: 29176114]

Whitbeck, Adams GW, Hoyt DR, Chen X, 2004. Conceptualizing and measuring historical trauma among American Indian people. Am. J. Community Psychol 33 (3–4), 119–130. 10.1023/B:AJCP.0000027000.77357.31. [PubMed: 15212173]

Winning, Glymour MM, McCormick MC, Gilsanz P, Kubzansky LD, 2015. Psychological distress across the life course and cardiometabolic risk findings from the 1958 British birth cohort study. J. Am. Coll. Cardiol 66 (14), 1577–1586. 10.1016/j.jacc.2015.08.021. [PubMed: 26429083]

Xiao, Baldwin MM, Meinck F, Obsuth I, Murray AL, 2021. The impact of childhood psychological maltreatment on mental health outcomes in adulthood: a protocol for a systematic review and meta-analysis. Syst. Rev 10 (1), 1–224. 10.1186/s13643-021-01777-4. [PubMed: 33388080]

Yehuda R, Lehrner A, 2018. Intergenerational transmission of trauma effects: putative role of epigenetic mechanisms. World Psychiatr. 17 (3), 243–257. 10.1002/wps.20568.

Table 1

Means (standard deviation) of thoughts about historical loss and adverse childhood experiences for the overall sample and individual clusters.

	Historical Loss	Adverse Childhood Experiences
Low HL/Low ACE (n = 315)	18.71 (7.60)	1.07 (1.29)
High HL/Low ACE (n = 161)	45.39 (8.68)	2.24 (1.90)
High HL/High ACE (n = 75)	61.39 (5.67)	6.84 (2.18)
Average HL/High ACE (n = 176)	34.63 (11.61)	7.50 (1.57)
Overall (N = 727)	32.88 (16.85)	3.48 (3.26)

Note: All clusters were statistically significantly different from one another for both thoughts about historical loss and adverse childhood experiences. HL = frequency of thoughts about historical loss measured by the Historical Loss Scale; ACE = Adversity childhood experiences measured by the Adverse Childhood Experiences Scale.

Table 2

Hazard ratio of reporting an adverse mental health condition over past 12 months by historical loss and adverse childhood experiences cluster.

	HR[a] (95% CI), *p*-value	**HR[b] (95% CI), *p*-value**
Low HL/Low ACE	1.00 (reference)	1.00 (reference)
High HL/Low ACE	**2.74 (1.83–4.10), < .001**	**2.62 (1.72–3.99), < .001**
High HL/High ACE	**11.60 (6.30–21.34), < .001**	**12.25 (6.58–22.77), < .001**
Average HL/High ACE	**5.00 (3.35–7.44), < .001**	**4.91 (3.25–7.42), < .001**

Bold indicated statistically significant hazard ratio.

[a] = HR, unadjusted.

[b] HR, adjusted for biological sex, age, and income. HL = frequency of thoughts historical loss measured by the Historical Loss Scale; ACE = Adversity childhood experiences measured by the Adverse Childhood Experiences Scale.

Table 3

Hazard ratio of reporting cardiometabolic condition over past 12 months by historical loss and adverse childhood experiences cluster.

	HR[a] (95% CI), *p*-value	**HR[b] (95% CI), *p*-value**
Low HL/Low ACE	1.00 (reference)	1.00 (reference)
High HL/Low ACE	1.10 (0.72–1.67), .66	1.54 (0.98–2.44), .64
High HL/High ACE	**2.09 (1.25–3.52), .005**	**2.74 (1.58–4.74), < .001**
Average HL/High ACE	**2.17 (1.47–3.19), < .001**	**3.07 (2.00–4.71), < .001**

Bold indicated statistically significant hazard ratio.

[a] = HR, unadjusted.

[b] HR, adjusted for biological sex, age, income, and smoking status. HL = Frequency of thoughts about historical loss measured by the Historical Loss Scale; ACE = Adversity childhood experiences measured by the Adverse Childhood Experiences Scale.