PATTERNS OF ADVERSE CHILDHOOD EXPERIENCES ACROSS MULTIPLE STATES: A LATENT CLASS ANALYSIS

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Abstract

Adverse childhood experiences (ACEs) have been shown to be associated with many negative psychosocial outcomes, including depression, lower quality of life, and substance use. Importantly, the associations between ACEs and negative outcomes have been shown to have a dose response relationship with many of these outcomes, such that higher numbers of ACEs endorsed has been associated with worse outcomes across a variety of domains. However, much of the previous research on this topic has focused solely on the number of types of ACEs experienced, rather than the severity and patterns of these experiences. Although some studies have attempted to explore in this direction, there has not yet been a clear consensus on how best to investigate patterns of ACEs. The current study assessed patterns of ACEs in a sample of individuals across multiple U. S. states using latent class analysis and found a 6-class solution: 1) High Trauma, 2) Substance Use, 3) Abuse and Conflict, 4) Moderate Level of Household Dysfunction, 5) Emotional Abuse, and 6) Low Trauma. The ideal class structure for each of the individual states included in the study was then determined, with multiple differences between the overall sample's classes and individual states' classes found for the Substance Use, Abuse and Conflict, and Emotional Abuse classes. All of the elevated risk categories were found to be associated with significantly worse perceived emotional and social support, life satisfaction, and health-related quality of life in adulthood than the Low Trauma class. Some of these elevated risk classes were also differentially related to outcomes when compared to each other. These findings underscore the importance of patterns of ACEs, above and beyond the raw number of ACEs domains experienced and have potentially useful implications for prevention and screening efforts.

Introduction

Adverse Childhood Experiences

Adverse childhood experiences (ACEs) are negative life events that an individual may encounter during childhood. Although specific definitions of what constitutes an ACE vary, ACEs are often considered to include childhood experience of abuse (physical, verbal/emotional, and sexual); measures of family dysfunction, such as growing up with an incarcerated parent; and neglect (Felitti et al., 1998). High numbers of ACEs have been found to be associated with a wide range of psychosocial and cognitive impairments, including depression, PTSD, and reduced quality of life (Anda et al., 2006; R. Sansone, Wiederman, & L Sansone, 2001; Remigio-Baker, Hayes, & Reyes-Salvail, 2014; Rogosch, Dackis, & Cicchetti, 2011; Skarupski et al., 2016; Widom, 1999). In addition, dose response relationships have been found for many of these negative health outcomes, such that higher numbers of experienced ACEs domains are associated with higher prevalence of negative health outcomes (de Ravello, Abeita, & Brown, 2008; Remigio-Baker, Hayes, Reyes-Salvail, 2014).

Research into the effects of ACEs began with Felitti and colleagues' 1998 seminal article. Their project organized adverse childhood experiences into seven broad categories: psychological abuse, physical abuse, sexual abuse, substance abuse, mental illness, mother treated violently, and criminal behavior in household (Felitti et al., 1998). The ACEs measure they designed consisted of seventeen items, with endorsement of any item within a domain being considered as an endorsement of that ACE domain. They found that individuals who retroactively reported experiencing 0 of the domains had significantly lower likelihood of experiencing negative health outcomes (e.g., alcoholism) in adulthood than individuals who had

experienced 1 or more of the domains. Furthermore, individuals who reported experiencing 4 or more of the domains had the worst outcomes, across all of the outcomes assessed. The findings of this study supported ACEs as an important construct for further investigation and has led to a large amount of interest in the topic in the years since. Although many later studies have included different questions and different domains of interest (e.g., parental divorce), the items and domains included in later studies have largely been influenced by those used in this original work.

In the United States, ACEs have been found to be prevalent, with about 4% of children having been subjected to either abuse or neglect (Sedlak et al., 2010). Approximately 50% of participants in numerous studies have indicated that they had experienced at least one ACE domain (Felitti et al., 1998; Lanier et al., 2017; Barboza 2018; McChesney, Adamson & Shevlin, 2015). The pervasiveness of exposure to ACEs appears to vary across states, as do the specific types of ACEs most likely to be experienced (Sacks, Murphey, & Moore, 2014). For example, experience of parental divorce has been found to have a prevalence rate of 15% in the District of Columbia while the prevalence rate in Oklahoma is 30%. One study found that while 50% of individuals in Hawaii reported experiencing no ACEs, 61% of individuals in Connecticut reported experiencing no ACEs. Similar differences in endorsement of the other individual ACEs items have been found across states and age groups and may differ as well in terms of severity and duration (Sacks, Murphey, & Moore, 2014).

Although much of the previous research on ACEs has investigated the associations between number of ACEs experiences and psychosocial outcomes in adulthood, Lacey and Minnis (2019) noted in a recent review that this focus on total number of ACEs experienced, although useful in some ways, leaves out potentially important information about patterns,

severity, and duration of ACEs. For example, as many of these studies looked at ACEs as dichotomous variables (i.e., did not assess for factors such as intensity or frequency) they may, by default, leave out information about how varying intensity of ACEs may be differentially associated with later outcomes. Lacey and Minnis (2019) noted that another direction that ACEs research should follow is that of using empirical approaches, such as factor analysis or latent class analysis, to investigate the importance of the specific domains of ACEs that an individual has experienced, as well as overall patterns of ACEs. For example, Lacey and Minnis suggested that future studies could attempt to elucidate if different combinations of ACEs exposure have different relationships to outcomes. Some work has already been conducted in this direction, such as a study that used factor analysis to separate ACEs questionnaire items into three categories: Household Dysfunction, Emotional/Physical Abuse, and Sexual Abuse (Ford et al., 2014). With the exception of parental divorce, each of the ACE items loaded onto one of these three factors. Organizing ACEs into factors allows for investigation into how different types of ACEs may be associated with different outcomes. In other words, the specific types of ACEs an individual experiences is likely a relevant consideration for future research. Given that traditional application of the ACEs considers each ACE domain to be functionally equivalent when calculating an individual's "ACE score," the type of approach used by Ford and colleagues adds important nuance to our understanding of the how different types of ACEs may be differentially associated with outcomes.

In addition to high prevalence, ACEs have also been found to be associated with negative psychosocial and health outcomes in adulthood. Higher ACEs scores have been found to be associated with being less able to obtain needed emotional and social support (Barile, Edwards, Dhingra, & Thompson, 2015; Brinker & Cheruvu, 2016). Quality of life in adulthood has also

been shown to be negatively associated with the number of ACEs domains an individual was exposed to in childhood, with this effect being partially mediated by social support (Barile, Edwards, Dhingra, & Thompson, 2015; Skarupski et al., 2016). That is, higher ACEs scores were associated with lower perceived social support, which was then associated with lower reported quality of life and health-related quality of life. Although this pathway has not been found to fully explain the relationship between number of ACEs domains experienced and quality of life in adulthood, this does lend evidence to the idea that ACEs likely have varied and complicated effects on later functioning.

Health-Related Quality of Life

Health-related quality of life (HRQoL) is a behavioral health construct that is often used to examine the impact of ACEs on individuals. HRQoL refers to life factors that directly contribute to an individual's perception of their health status and its effect on their ability to participate in their general tasks (Guyatt, Feeny, & Patrick, 1993). This stands in contrast to quality of life, which includes other factors that may not be directly related to health.

HRQoL has been measured in a variety of ways, including the Centers for Disease Control and Prevention (CDC)'s "Healthy Days" measure (Centers for Disease Control and Prevention, 2000). This measure uses self-report questions to assess how many days in the last 30 days, an individual describes their mental or physical health as "not good." "Healthy Days" and other HRQoL measures have been used to assess health outcomes for a variety of conditions, such as HIV/AIDs (Bekele et al., 2013), chronic heart failure (Obiegło, Siennicka, Jankowska, & Danel, 2017), and cerebral palsy (Eun-Young & Park, 2017). The "Healthy Days" measure has been found to have strong convergent validity with other measures used to assess HRQoL and

well-being and has been noted to be useful as a policy-informing tool, due to its ease of interpretability (Barile et al., 2013).

Social Support

While higher levels of perceived social support have been shown to provide a protective effect against negative risk factors for a variety of health outcomes, there remains a lack of information about this association. Specifically, social support refers to actions performed by people close to an individual that may help them deal with stressors, with perceived social support referring to the degree to which an individual believes they receive adequate social support. Although findings are mixed, social support is generally considered to be a valuable coping resource (Thoits, 1995). Higher perceived social support has been found to be related to higher mental and physical HRQoL for individuals who have experienced one or more ACEs (Dube & Rishi, 2017). That is, higher perceived social support has been associated with a variety of positive health outcomes.

In addition to the buffering effect shown in regard to HRQoL, perceived social and emotional support has also been found to be a protective factor against current depression among adults who had experienced ACEs as children (Brinker & Cheruvu, 2016). This study made use of data from the CDC's Behavioral Risk Factor Surveillance System (BRFSS) and found that participants who reported that they always received the social and emotional support they needed were 87% less likely to endorse being depressed, when compared to participants who reported not always receiving the social and emotional support they needed. As previously discussed, multiple studies have found that social support acts as a partial mediator between ACEs exposure and HRQoL, such that ACEs exposure is associated with lower social support in adulthood, which associated with lower HRQoL and general quality of life (Barile, Edwards, Dhingra, &

Thompson, 2015; Skarupski et al., 2016). It appears that, although higher levels of perceived social and emotional support are associated with more positive outcomes for individuals who have experienced ACEs, these individuals are also less likely to receive this support.

Latent Class Analysis

Latent class analysis (LCA) is a person-centered mixture modeling technique that can be useful for grouping individuals based on certain characteristics of interest. Individuals are assigned a probability of belonging to each determined class, based on their pattern of responding. Thus, LCA can be used as a person-centered approach that allows enumeration of well-defined groupings of participants based on their similarity on defined metrics. Although similar in some respects, LCA differs from factor analysis in that LCA groups individuals based on how they respond to a set of items, while factor analysis groups items based on how individuals respond to them.

Patterns of experience of ACEs have been investigated using LCA in several studies across a range of samples (Barra et al., 2015; Ballard et al., 2015; Brown et al., 2019; Cavanaugh et al., 2015). This approach allows for researchers to investigate how exposure to different combinations of ACEs domains (rather than strictly the raw number of ACEs domains endorsed) may be associated with differential outcomes. Although the relationship between raw ACEs scores and negative outcomes later in life has been supported by a large number of studies, there is potentially important nuance that may be lost by relying solely on raw ACEs scores. For example, individuals who have experienced different combinations of ACEs domains may respond differently to interventions, treatments, and other types of support. Additionally,

although two given individuals may be represented by equivalent ACEs scores, they could have extremely different histories of experiences, leading to very different consequences.

One study conducted by Lanier and colleagues (2018) found a seven-class structure for exposure to ACEs in their sample of 95,677 households. This study analyzed data collected by the 2011/2012 National Survey of Children's Health (NSCH), a national random-digit-dial survey. The seven classes that were derived were: 1) 0-1 ACE (75.8%); 2) 1-2 ACE (11.2%); 3) Domestic violence, no mental illness (3.3%); 4) Mental illness and poverty (1.3%); 5) Substance use and incarceration (2.3%); 6) Substance use, no incarceration (3.9%); and 7) High ACEs (2.2%). The results of the study indicated that children who were assigned to Class 4 (Mental illness and poverty) had worse outcomes (i.e., general health status, special healthcare needs, and chronic physical health condition) than children who were assigned to any other class, including the "High ACEs" class. This provides support for the idea that exposure to different combinations of ACEs may result in differential outcomes in adulthood, and that further research into this area is valuable above and beyond solely analyzing the effects of raw numbers of ACEs experienced. Given that the High ACEs class had better outcomes than the Mental illness and poverty class (despite having higher prevalence of all ACEs except for mental illness and poverty), it appears that some ACEs may be more detrimental on outcomes in adulthood, either due to their individual effects or the effects of specific ACEs combinations.

In contrast, a study using 2009-2012 data from the CDC's BRFSS found a five-class structure, including: 1) Normative class – no household dysfunction or abuse (56.3%); 2) Emotionally abused children living in alcoholic households (30.3%); 3) Emotionally abused children living in alcoholic households with relationship conflict and no sexual abuse (6%); 4)

Sexually abused children (4.3%); and 5) Highly abused children living in dysfunctional households (3.3%) (Barboza, 2018). Participants in each of the elevated risk classes (2-5) had differentially elevated risks of negative adult outcomes when compared to the normative class. However, there were no significant differences between any of the elevated risk classes on the study's outcome measures (depressive symptoms, HIV-risk taking, heavy drinking, and binge drinking). Considering that Classes 2-4 had similar levels of risk when compared to the more severe Class 5, these results indicate that certain patterns of ACEs exposure may be related to increased risk of negative outcomes in adulthood, even without experiencing a high number of ACEs domains.

One problem associated with interpreting the overall findings of studies that have conducted latent class analyses of ACEs exposure is the limited degree of convergence between studies. In addition to differences in the number of derived classes, these studies often differ in the sample under investigation, the domains of ACEs that are assessed, and the wording of individual questions that are meant to assess the same construct. Because of this, it can be difficult to apply the classes derived in useful ways across samples. Although two studies that used LCA to investigate patterns of ACEs have been discussed, there are many others that vary significantly in terms of sample size, location, and breadth. Therefore, it is hard to know what the most valid class structure is for experience of ACEs, and further investigation is necessary. The goal of this study is to find a class structure that applies to a sample from a diverse selection of states in the United States. Then, the overall sample's class structure will be compared to that found for the individual states in the sample, in order to determine if the model that best fits the overall sample is also sufficient to explain the variability found within each of the individual states in the model.

Current Investigation

The current study assessed the patterns of experiences of adverse childhood experiences, the stability of these patterns across a diverse set of states (i.e., District of Columbia, Hawaii, Nevada, Vermont, Washington, and Wisconsin), and how these patterns are related to HRQoL and perceived emotional/social support using the CDC's BRFSS-2010 data. The BRFSS is administered to more than 500,000 individuals annually and includes both individual-level data and state-level identifiers, which provide the opportunity to merge in state-level predictors. The included states represent a sub-set of the states that included the BRFSS ACE Module in 2010 and were selected due to their varied demographic profiles. Incorporating state-level predictors is of particular importance because individuals who experience ACEs as children may be more likely to live in disadvantaged states as adults; therefore, it is possible that they experience lower emotional support and worse health that is attributable to the social conditions of their state and not solely because of their experienced ACEs. To further our understanding of these associations, four research questions were identified.

Research Questions

1) What is the optimal number of classes to best organize individuals based on report of childhood exposure to adverse experiences?
2) Can the same class structure be replicated across each of the states in the sample?
3) Are different ACEs classes differentially associated with levels of perceived emotional/social support and/or life satisfaction?
4) Are different ACEs classes differentially associated with mental and physical health-related quality of life?

Methods

A series of LCAs were conducted to determine the patterns of adverse childhood experiences reported by adults in six states (District of Columbia, Hawaii, Nevada, Vermont, Wisconsin, and Washington). The goal of the LCAs were to determine the least number of classes necessary to adequately sort individuals based on their responses on the Behavioral Risk Factor Surveillance System's Adverse Childhood Experiences module.

Participants

Data for this study came from the Centers for Disease Control and Prevention's 2010 BRFSS. The BRFSS is a nation-wide random-digit dialed health survey conducted yearly in the United States with the goal of collecting information about behavioral risk factors and health outcomes at the state level. Individuals who agreed to participate in the survey were interviewed about their health and health-related behaviors. As the ACEs module is optional, it was only included in the data for only 10 states (i.e., Hawaii, Maine, Nebraska, Nevada, Ohio, Pennsylvania, Utah, Washington, Wisconsin, and Vermont) and the District of Columbia in 2010. Data from individuals residing in Hawaii, Nevada, Vermont, Washington, Wisconsin, and the District of Columbia were included in the analyses for this project, in order to include states that encompass much of the geographic and demographic variance present in the United States. The 2010 BRFSS was used for this study due to it being the most recent year that included both the ACEs module and the outcome measures of interest for the same states.

Measures

Adverse Childhood Experiences (ACEs): The optional ACE module of the BRFSS consists of 11 questions related to childhood experience of abuse, neglect, and household dysfunction. The module assesses exposure to 9 different types of ACEs: verbal abuse, physical abuse, sexual abuse, household mental illness, household alcohol abuse, household drug abuse, domestic violence, parental separation/divorce, and incarcerated family members. The questions related to household mental illness, household alcohol abuse, household drug abuse, incarcerated family members, and parental separation/divorce assess whether individuals were exposed to these experiences, while the physical abuse, verbal abuse, and sexual abuse items also assess if these experiences occurred more than once. For the purposes of this project, these items were interpreted as dichotomous (i.e., if participants reported that they experienced physical abuse more than once, that will be considered equivalent to report of a single occurrence). However, responses of "more than once" are also reported, as severity of exposure to ACEs may provide additionally relevant information for future study. Although retrospective reports of exposure to adverse childhood experiences should be interpreted with caution, Dube and colleagues have previously found that report of ACEs has good test-retest reliability, suggesting that these reports are stable across time (Dube et al., 2004). Previous research has suggested that these items are inter-related (Felitti et al., 1998; Straus, Hamby, Boney-McCoy, & Sugarman, 1996) and associated with a wide range of negative outcomes in adulthood (Felitti et al., 1998; Anda et al., 2006; R. Sansone, Wiederman, & L Sansone, 2001; Remigio-Baker, Hayes, & Reyes-Salvail, 2014; Rogosch, Dackis, & Cicchetti, 2011; Skarupski et al., 2016; Widom, 1999).

Social and Emotional Support and Satisfaction with Life: The Emotional Support and Life Satisfaction core section of the BRFSS includes two items related to life satisfaction and perception of emotional and social support received. The perceived social and emotional support that a participant receives was assessed by asking "How often do you get the social and emotional support you need?" This item was rated on a Likert-type scale, with the following rating options: 1 – Always, 2 – Usually, 3 – Sometimes, 4 – Rarely, 5 – Never. Life satisfaction was assessed by asking "In general, how satisfied are you with your life?" This item was rated on a Likert-type scale, with the following rating options: 1 – Very satisfied, 2 – Satisfied, 3 – Dissatisfied, 4 – Very dissatisfied. Responses to these questions were considered as continuous interval variables. These questions have been used in several studies that have utilized data from the CDC's BRFSS (Brinker & Cheruvu, 2017; Barboza, 2018; Dube & Rishi, 2017).

Health-Related Quality of Life (HRQoL): The Healthy Days – Health-Related Quality of Life core section of the BRFSS which includes items relating to a participant's physical and mental HRQoL. HRQoL related to physical health was assessed by asking "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 was your physical health not good?" while HRQoL related to mental health was assessed by asking "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 was your mental health not good?" The "Healthy Days" measure has been found to possess strong convergent validity with other HRQoL measures (Barile et. al., 2013). The Healthy Days questions have been found to be highly correlated with other measures of HRQoL (Mielenz et. al., 2006) and has been used in a variety of state and national level surveys.

Procedure

To assess research question one, a LCA was conducted using Mplus 8.2 (Muthén & Muthén, 1998–2017). The LCA began with a one-class unconditional model, using the entire sample. The number of classes was increased until the models no longer identified well due to overlapping or conceptually meaningless classes. The relative fit of each model was assessed by comparing multiple model fit indices (i.e., Bayesian information criterion, Akaike information criterion, and the approximate weight of evidence criterion). Models with smaller values on the fit indices were considered to have relatively better fit. Next, the approximate Bayes factor and the bootstrap likelihood ratio (BLRT) were examined to determine whether the model with an additional class represents a statistically significant improvement, which would be indicated by a significant p value. Classification diagnostics such as entropy and classification probabilities for the most likely class membership were also evaluated to ensure the extraction of substantively meaningful and distinct classes.

Research question two was assessed by using the number of classes selected for the full sample as the initial number of classes tested for responders from each individual state in the sample (i.e., District of Columbia, Hawaii, Nevada, Vermont, Washington, Wisconsin). In order to determine if this number of classes was the ideal choice for each state, state models were also tested using one fewer and one additional class than the number selected for the overall sample. The relative fit of these models were compared using the same fit indices as were used for the overall sample. For states that matched the overall sample's selected number of classes, these classes were graphically compared to the overall sample's class that the given class was most

similar to. This was defined as the overall sample's class that the state's class had the lowest discrepancy from, in terms of average item endorsement.

After the ideal numbers of latent classes for each state were determined, the relationships between each class from the full sample and levels of life satisfaction and perceived emotional and social support (research question 3) and mental & physical HRQoL. (research question 4) were then independently examined using multiple logistic regression, with demographic predictors (e.g., age, gender, race/ethnicity) added as covariates. Any missing data was handled using full information maximum likelihood (Graham, 2009).

Results

Descriptive Statistics

Table 1 describes the prevalence of each ACEs domain in this study's sample. Of the 9 categories of ACEs assessed in this study, the most commonly experienced ACE was emotional abuse (34.4%), followed by living with an adult alcoholic (23.5%), and having divorced or separated parents (20.9%). The other ACE categories, in order of prevalence, were physical abuse (16.7%), living with someone who was mentally ill or depressed (16.5%), intra-parental violence (16.0%), sexual abuse (12.2%), living with a prescription drug abuser or illicit drug user (8.1%), and living with a previously incarcerated person (4.6%).

Table 2 shows descriptive information regarding the variables used in analyses. The overall sample consisted of 60.0% women and 40.4% college graduates. 74.7% of the sample was White, 5.7% was Black, and 6.8% was Asian. The mean age of participants was 56.6 years old (SD = 16.1). Participants reported experiencing 3.9 physically unhealthy days and 3.1

mentally unhealthy days. in the last 30 days, on average. 8.1% of participants reported “rarely” or “never” receiving the social and emotional support they needed, while 5.2% of participants reported being “dissatisfied or “very dissatisfied” with their life.

Class Enumeration

Model fit indices were compared for each model that successfully converged (i.e., models that consisted of 1-10 classes). All information criteria indicated better model fit with each additional class, as evidenced by lower Akaike information criterion (AIC), Bayesian information criterion (BIC), and adjusted Bayesian information criterion (aBIC). Each model displayed an entropy value in the moderate range (.677 - .781). The value of the BIC for each model began to level-off after the five-class model, indicating that model fit did not substantially increase after this point. The six-class model was selected over the five-class model due to a lower BIC value (Table 3; Figure 1). The six-class model had an additional, distinct class associated with household substance use. The six-class model was selected over the seven-class model in part due to the BIC being similar. Additionally, the class added in the seven-class model did not substantially add to the overall interpretation of the model, as it added a second class with item endorsement probabilities in the moderate range. The overall entropy of the model was .704, suggesting between medium and high clearness in class delineation (Clark & Muthén, 2009).

ACE Risk Profiles

The final model consisted of six classes (Figure 2): Class 1 – High Trauma (4.4%); Class 2 – Substance Use (3.6%); Class 3 – Abuse and Conflict (7.3%); Class 4 – Moderate Level of

Household Dysfunction (11.51%); Class 5 – Emotional Abuse (8.61%); and Class 6 – Low Trauma (64.57%). Table 4 shows the item response probabilities for each item and the mean number of ACEs experienced for individuals assigned to each class.

Class 1 (High Trauma Class) – Class 1 made up 4.4% of the overall sample (n = 1650) and was characterized by high probability of endorsing each of the ACEs items. In addition, it was well separated from the other classes, with an average posterior probability of class membership of .814. Class 1 was denoted "High Trauma" due to it having the highest probability of endorsing all but one (household drug use) of the indicators.

Class 2 (Substance Use Class) – Class 2 made up 3.6% of the overall sample (n = 1354) and was characterized by 100% chance of endorsing the household drug use item, and high probability of endorsing the household alcohol abuse item. In addition, it was well separated from the other classes, with an average posterior probability of class membership of .808. Class 2 was denoted "Substance Use", due to it having high probability of endorsing the substance abuse items but only low to moderate risk of endorsing the other ACE domains.

Class 3 (Abuse and Conflict Class) – Class 3 made up 7.3% of the sample (n = 2740) and was characterized by high probability of endorsing the physical abuse, emotional abuse, and intra-parental violence items. In addition, it was well separated from the other classes, with an average posterior probability of class membership of .760. Class 3 was denoted "Abuse and Conflict" as, unlike the "High Trauma" class, this class had low to moderate risk of endorsing the other 6 ACE domains. This class is also distinct from the "Emotional Abuse" class, due to higher risk of endorsing the physical abuse and intra-parental violence items, in addition to lower endorsement of the emotional abuse item.

Class 4 (Moderate Levels of Household Dysfunction Class) – Class 4 made up 11.51% of the sample (n = 4322) and was characterized by moderate risk of endorsing the living with adult substance abuser, parent separation or divorce, and emotional abuse items, and low risk of endorsing the other 6 domains. Class 4 was moderately separated from the other classes, with an average posterior probability of class membership of .650. This class was denoted "Moderate Levels of Household Dysfunction" due to having moderate risk of endorsing the above-mentioned items, but low risk of endorsing the other items.

Class 5 (Emotional Abuse Class) – Class 5 made up 8.61% of the sample (n = 3234) and was characterized by high risk of endorsing the emotional abuse item. Class 5 moderately separated from the other classes, with an average posterior probability of class membership of .631. Class 5 was denoted "Emotional Abuse" due to this being the only item that had a high risk of being endorsed.

Class 6 (Low Trauma Class) – Class 6 made up 64.57% of the sample (n = 24242) and was characterized by low risk of endorsement for all of the ACEs domains. Class 6 was well separated from the other classes, with an average posterior probability of class membership of .875. Class 6 was denoted "Low Trauma" due to it having the lowest risk of endorsing each of the ACEs domains, with no indicator having a greater than 15% risk of endorsement.

State Comparisons to Model

In order to determine how well the overall class structure fit for the individual states in the sample, separate 6-class latent class analyses were conducted for each state in the sample. Classes found for each state were matched to a class from the overall sample, based on the class

that had the lowest average difference in item endorsement probabilities The Item Probability Plots for each class were then examined across all of the states (Figures 3-8), with Table 5 showing the percentage of individuals from each state who endorsed each ACE domain. The Item Probability Plots for Classes 1 (High Trauma Class), 4 (Moderate Level of Household Dysfunction), and 6 (Low Trauma Class) all suggested that these classes reflected similar patterns of ACEs across each of the states (Figures 3, 6, and 8).

For Class 2 (Substance Use Class), the Item Probability Plot (Figure 4) suggested that individuals from Nevada who were assigned to this class had moderate divergence from those from the overall sample, as evidenced by lower probability of endorsing the "Live with an Illegal Drug User" item. Individuals from Vermont who were assigned to this class had high divergence from those from the overall sample, as evidenced by much lower probability of endorsing the "Household Drug Use" item and reduced probability of endorsing the "Incarceration" item. This implies that this class may not be an accurate fit for individuals from Nevada and Vermont.

For Class 3 (Abuse and Conflict Class), the Item Probability Plot (Figure 5) suggested that individuals from Nevada who were assigned to this class had moderate divergence from those from the overall sample, as evidenced by lower probability of endorsing the "Domestic Violence", "Physical Abuse", and "Emotional Abuse" items. This implies that this class may not be an accurate fit for individuals from Nevada.

For Class 5 (Emotional Abuse), the Item Probability Plot (Figure 7) suggested that individuals from Hawaii who were assigned to this class had moderate divergence from those from the overall sample, as evidenced by higher probability of endorsing the "Mental Illness" item. Individuals from Nevada who were assigned to this class had high divergence from those

from the overall sample, as evidenced by much higher probability of endorsing the "Domestic Violence" and "Physical Abuse" items. Individuals from DC who were assigned to this class had high divergence from those from the overall sample, as evidenced by higher probability of endorsing the "Parents Not Married" item and much lower probability of endorsing the "Emotional Abuse" item. This implies that this class may not be an accurate fit for individuals from Hawaii, Nevada, and DC.

Association between Class Membership and Adult Outcomes

After determination of the most appropriate class structure for the overall sample, the associations of ACE class with the aforementioned outcome variables (i.e., emotional and social support, life satisfaction, number of physically healthy days, and number of mentally healthy days) were examined. Using Class 6, the Low Trauma class, as the reference group, membership in each of the elevated risk classes was found to be associated with worse outcomes for each of the target variables. Additionally, many of the elevated risk classes were differentially related to the outcome measures (Table 7).

Emotional and Social Support (Table 8) – Emotional and social support was rated on a 5-point Likert-type scale, with lower scores indicating a higher frequency of receiving needed levels of emotional and social support. The Low Trauma Class reported receiving the emotional and social support they needed significantly more frequently (M = 1.73) than each of the other 5 ACEs classes. The Moderate Level of Household Dysfunction (M = 1.86) class reported receiving the emotional and social support they needed significantly more often than the Abuse and Conflict (M = 2.03), Emotional Abuse (M = 2.03), and High Trauma (M = 2.07) classes. The

Substance Use (M = 1.94) class also reported receiving the emotional and social support they needed significantly more often than did the High Trauma class.

Life Satisfaction (Table 9) – Life satisfaction was rated on a 4-point Likert-type scale, with lower scores indicating greater life satisfaction. The Low Trauma class reported significantly higher life satisfaction (M = 1.53) than each of the other 5 ACEs classes. The Moderate Level of Household Dysfunction (M = 1.63) class indicated having significantly higher life satisfaction than the High Trauma (M = 1.81), Substance Use (M = 1.70), and the Abuse and Conflict and Emotional Abuse classes (both M = 1.76). The Substance Use class also reported significantly higher life satisfaction than the High Trauma class.

Physically Unhealthy Days (Table 10)– The Low Trauma class reported experiencing significantly fewer physically unhealthy days (M = 3.21) than each of the other 5 ACEs classes. The Moderate Level of Household Dysfunction (M = 4.12) class reported experiencing fewer physically unhealthy days than the High Trauma (M = 6.42), Abuse and Conflict (M = 5.36), and Emotional Abuse (M = 5.06) classes. The Substance Use (M = 4.55), Abuse and Conflict, and High Trauma classes all reported significantly fewer physically unhealthy days than the High Trauma class.

Mentally Unhealthy Days (Table 11) – The Low Trauma class reported experiencing significantly fewer mentally unhealthy days (M = 2.25) than each of the other 5 ACEs classes. The Moderate Level of Household Dysfunction (M = 3.38) class reported experiencing fewer mentally unhealthy days than the High Trauma (M = 6.33), Abuse and Conflict (M = 4.62), and Emotional Abuse (M = 4.70) classes. The Substance Use (M = 4.04), Abuse and Conflict, and

Emotional Abuse classes all reported significantly fewer mentally unhealthy days than the High Trauma class.

Discussion

This study investigated the class structure of the BRFSS's ACEs Module for individuals living across an array of states. The results indicate that a six-class solution both fit the data well and was interpretable in a meaningful way. This solution consisted of the following classes: High Trauma, Substance Use, Abuse and Conflict, Moderate Level of Household Dysfunction, Emotional Abuse, and Low Trauma. The elevated risk classes were found to have significantly worse outcomes than the Low Trauma class, across a variety of adult outcome domains (i.e., number of unhealthy days, life satisfaction, and social and emotional support). These classes also differed in the extent to which they were associated with worse outcomes, with the Moderate Level of Household Dysfunction class in particular having generally better outcomes than the other elevated risk classes.

The second aim of this study was focused on the degree to which the class structures of the individual states in the model were equivalent to the overall sample's class structure. The degree of similarities between the overall structure and those of the individual states varied by class. Specifically, the High Trauma, Moderate Level of Household Dysfunction, and Low Trauma classes all displayed similar shapes in their ideal class solution. Although there were some differences in level (i.e., some states had higher or lower endorsement probabilities for particular items within these classes), these appear to be due in part to differences between states regarding the percentage of individuals who endorsed each item. For the other 3 classes

(Substance Use, Abuse and Conflict, and Emotional Abuse), there appear to be more salient differences between the class structures of the states and the overall class structure.

For the Substance Use class, individuals from Vermont had much lower probability of endorsing the "Household Drug Use" item, which may be due in part to Vermont having the lowest percentage of individuals who endorsed that item. It is interesting that Nevada's Substance Use class had a lower probability of endorsing the "Household Drug Use" item than any state besides Vermont, as Nevada had the highest percentage of individuals who endorsed the "Household Drug Use" item. This is likely due to many of the individuals from Nevada who endorsed this item being placed into the High Trauma class, as Nevada's High Trauma class was the largest of the High Trauma classes, as a proportion of total responders. For the Abuse and Conflict class, Nevada's moderate divergence on the "Domestic Violence," "Physical Abuse," and "Emotional Abuse" items appear to be due to many of the individuals who endorsed these items being placed into Nevada's Emotional Abuse class.

For the Emotional Abuse class, Nevada's large divergence on the "Domestic Violence" and "Physical Abuse" items may be due to Nevada having the highest percentage of individuals endorsing those items, compared to the other states in the sample. It is interesting that Hawaii's Emotional Abuse class had a higher probability of endorsing the "Mental Illness" item, as Hawaii had the lowest percentage of individuals who endorsed this item. This is likely due in part to Hawaii's Emotional Abuse class being the smallest of the Emotional Abuse classes (as a proportion of total number of responders). Therefore, although Hawaii had fewer individuals who endorsed this item overall than the other states, it appears that many of those individuals who did endorse the "Mental Illness" item were then sorted into the Emotional Abuse class,

which, as a relatively small class, led to endorsement of this item being over-represented in this class. It is not clear as to why Washington's D. C.'s Emotional Abuse class had higher probability of endorsing the "Parents Not Married" item and much lower probability of endorsing the "Emotional Abuse" item. Although Washington D. C. had a lower percentage of individuals who endorsed the "Parents Not Married" item than Nevada or Washington, it appears that individuals who endorsed that item in those two states were more evenly distributed throughout several of the other classes (e.g., High Trauma, Abuse and Conflict), while individuals from Washington D. C. who endorsed this item were more concentrated in the Emotional Abuse class. It appears that individuals from Washington D. C. who endorsed the "Emotional Abuse" item were more likely to be placed in the High Trauma and Abuse and Conflict classes, which might be why Washington D. C.'s Emotional Abuse class has lower endorsement probability than any of the other states' Emotional Abuse classes.

As there were discrepancies between the class structure found for the overall sample and those found for three of the classes across a few of the states, any interpretations of the association between classes based on exposure to Adverse Childhood Experiences and outcomes in adulthood should be made with caution. However, it does appear that individuals who belonged to the High Trauma class (which had a fairly consistent structure across the different states) had worse outcomes than almost all of the other classes, while individuals in the Low Trauma class (which had a very consistent structure across the different states) had significantly better outcomes than each of the other states, even after controlling for multiple demographic variables. The aligns with much of the previous research that has been done on the effects of ACEs, as the class that had the highest number of ACEs on average (High Trauma) had the worst outcomes, while the class that had the fewest number of ACEs on average (Low Trauma) had the

best outcomes. The class with the second fewest average number of ACEs (Moderate Levels of Household Dysfunction) reported significantly better life satisfaction than every class except for the Low Trauma class, and significantly better emotional and social support, fewer mentally unhealthy days, and fewer physically unhealthy days than each class except for the Low Trauma and Substance Use classes. Interestingly, although the Substance Use class did not significantly differ from the Emotional Abuse class on any of outcome measures, individuals from the Substance Use class reported significantly better emotional and social support and life satisfaction than individuals from the High Trauma class, while individuals from the Emotional Abuse class did not. This is despite the Emotional Abuse class reporting fewer ACEs on average than the Substance Use class. This supports the idea that the specific types of ACEs that a given individual experiences may be differentially associated with outcomes in adulthood above and beyond the relationship that has been found between number of ACEs domains and adult outcomes.

Of particular note is the degree to which the percentages of individuals assigned to the High Trauma and Substance Use classes aligns with that found in other investigations. The Substance Abuse and Mental Health Services Administration's (SAMHSA) Center for Behavioral Health Statistics and Quality reported in 2017 that approximately 12.3% of children in the United States had lived in households with at least one caregiver who had a substance use disorder (Lipari & Van Horn, 2017), while approximately 9% of individuals in the current study's sample were assigned to the High Trauma or Substance Use classes, which had the highest likelihood of endorsing the alcoholism and substance use items. The Substance Use class's percentage of individuals in the current study (3.6%) was roughly equivalent to the

percentage of children in the United States living with a parent who had an illicit drug use disorder (2.9%), as reported by SAMHSA (Lipari & Van Horn, 2017).

Compared to previous investigations of patterns of exposure to ACEs, the results of this study differ in several important ways. For example, although Barboza's investigation found classes similar to the Low Trauma and High Trauma classes found in this study, it did not include any classes defined solely by substance use (Barboza, 2018). Rather, two classes were found that had high endorsement of the alcoholism item and emotional abuse items. Additionally, Lanier and colleagues (2019) found a class structure that differed from the current study's in several ways, including: 1) splitting individuals with low endorsement across the indicators into two categories (based on relative severity), 2) splitting individuals who endorsed the substance use items into two categories (based on parental incarceration), and 3) including a class defined by high endorsement of the mental illness and poverty items. This reflects in part the somewhat subjective nature of latent class analysis, as the number of classes decided upon is at the discretion of the researcher. However, the differences also reflect the variety of ACEs domains that are analyzed across different studies. For example, although Lanier and colleagues (2019) included indicators related to poverty and neighborhood violence that were not used in the current study, their investigation did not include items assessing physical, emotional, or sexual abuse. Although Barboza's (2018) investigation included the same indicators as the present study, the current study included the sexual abuse items as a single indicator, while Barboza's LCA treated each of the three items as their own indicator. These differences highlight the difficulty in comparing the results of previous ACEs research, as the domains incorporated are rarely consistent.

Limitations

One limitation of the current study is that all responses were based on retroactive self-report. At the most extreme end, some individuals were reporting about experiences that they had 80 years in the past. Previous research, however, has found that retrospective and prospective reports of abuse do not appear to significantly differ in their relationships to outcomes in adulthood (Jonson-Reid, Kohl, & Drake, 2012). Although some of the questions posed by this study are longitudinal in nature (i.e., how do experiences early in life affect individuals in adulthood), this study is not longitudinal in design. Another limitation is that this study only included individuals from Washington D. C. and five states. Although these states do represent much of the regional and demographic diversity of the United States as a whole, this does somewhat limit the generalizability of the findings beyond the included states. As the BRFSS is conducted over the phone, some disadvantaged groups may have been excluded from data collection (e.g., individuals who were experiencing homelessness).

Another important limitation to consider is that the response patterns analyzed in this study were collected 10 years ago. Since then, there are a variety of socio-cultural factors that may have affected experience of ACEs, such as social norms and policy changes. Specifically, although individual criteria for endorsement of ACEs could have been affected by societal changes in the last 10 years (e.g., the prevailing opinion regarding the degree of severity needed for endorsement of an item occurring may have changed), these changes would not have affected actual experience of ACEs. Rather, societal changes from 1993-2002 may have affected experience (or patterns of experience) of ACEs, as individuals born in these years would not have been included in this study's sample but could be included in a similar study today. Another

weakness of this study is that there are many categories of ACEs that were not assessed (e.g., family poverty, state-level factors, neglect) and could potentially have affected the results. Future work should focus on determining what the most relevant categories of ACEs may be, in order to include all of the most important domains in future investigations.

Implications and Future Directions

The results of this study suggest that further research into how different domains and combinations of domains of ACEs may have differential effects on outcomes later in life. Specifically, considering that the Substance Use class appeared to have better outcomes than may have been predicted by the number of ACEs individuals in that class had been exposed to, it could be illuminative to further investigate the effect of parental substance use on later outcomes, particularly when that substance use is not accompanied by physical or emotional abuse. As there were large differences between classes in terms of the percentage of individuals who endorsed experiencing the "Domestic Violence," "Physical Abuse," "Emotional Abuse," and "Sexual Abuse" items more than once (Table 6), it could also be important to investigate how the intensity and frequency of experiencing these ACEs may have differential effects on later outcomes.

As the results of this study indicate that somewhat distinct patterns of experiences of ACEs exist within this sample, this could provide information regarding future prevention efforts. Specifically, if individual patterns are related to a common cause (or set of causes), initiatives that focus on reducing the frequency of these causal factors could have particularly positive results. Future research in this area could be conducted to determine common temporal patterns of both ACEs and potential early causal factors, in order to better inform prevention

efforts. It would also be interesting to determine if different ACEs groups respond differentially to treatment or support initiatives. Although, as a screening tool, the ACEs measure is not likely to be sufficient for informing specific treatment decisions, developing our knowledge regarding the most common patterns and their associations with outcomes could potentially help organizational efforts predict the expected level of investment needed for treatment success, as well as potentially preferable treatment modalities.

Although there were some discrepancies between the classes found for the individual states in the sample and the classes found for the overall sample, that does not necessarily mean that the model found for the overall sample does not fit well for the individual states. Rather, when left unconstrained, the ideal class structure that included 6 classes for several of the states did not match the ideal class structure that included 6 classes for the full sample. Future efforts should look into how well the overall sample's model fits the individual states when the parameters are constrained (i.e., when the probabilities of item endorsement for each class and the percentage of the sample that each class makes up are constrained to match the full sample). This could help determine if the overall sample's class structure remains an adequate fit for each of the states in the model, despite some of the states' ideal class structures potentially being discrepant.

Although this study has multiple limitations and there remain many related areas that warrant future study, the results of this study provide further insight into how different combinations of ACEs are differentially related to outcomes, above and beyond looking solely at the commonly-used metric of number of ACEs domains experienced. These findings suggest

promising next steps that may help elucidate ACEs class structures that better generalize across states.

Table 1

Behavioral Risk Factor Surveillance System 2010 Adverse Childhood Experiences Module

All questions refer to time period prior to 18 years of age			
Question	n (% yes)	Response Options	Coding Scheme
Did you live with anyone who…			
Was depressed, mentally ill, or suicidal?	37,166 (.165)	1 = yes; 2 = no; 7 = DK/NS; 9 = refused	0 = no; 1 = yes; 7, 9 = missing
Was a problem drinker or alcoholic?	37,329 (.235)		
Used illegal street drugs or who abused prescription medications?	37,348 (.081)		
Served time or was sentenced to serve time in a prison, jail, or other correctional facility?	37,440 (.046)		
Were your parents separated or divorced?	37,224 (.209)	1 = yes; 2 = no; 8 = parents not married; 7 = DK/NS; 9 = refused	0 = not divorced, separated, or never married; 1 = separated divorced, parents not married; 7, 9 = missing
How often did your parents or adults in your home ever…		1 = never; 2 = once; 3 = more than once; 7 = DK/NS; 9 = refused	0 = never; 1 = one or more times; 7, 9 = missing
Slap, hit, kick, punch, or beat each other up?	36,940 (.160)		
Hit, beat, kick, or physically hurt you in any way? Do not include spanking	37,249 (.167)		
Swear at you, insult you, or put you down?	36,974 (.344)		
How often did anyone at least 5 years older than you or an adult…			
Ever touch you sexually?	37,142 (.118)		
Try to make you touch them sexually?	37,151 (.080)		
Force you to have sex?	37,219 (.043)		

Note. DK = Don't know; NS = Note sure.

Table 2

Sociodemographic Characteristics

Characteristic	Overall	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Demographic Factors							
Sex (n = 37,534)							
Male	40.0%	31.7%	42.7%	40.0%	38.6%	34.4%	41.4%
Female	60.0%	68.3%	57.3%	60.0%	61.4%	65.6%	58.6%
Age (n = 37,544)							
18-30 years old	6.7%	15.5%	18.1%	5.5%	7.0%	5.4%	5.7%
31-50 years old	27.3%	44.2%	42.4%	32.7%	29.3%	29.6%	24.0%
51-65 years old	35.5%	32.9%	32.0%	41.0%	37.1%	43.7%	33.8%
66+ years old	30.5%	7.3%	7.5%	20.8%	26.6%	21.2%	36.4%
Race (n = 37,544)							
White	74.7%	69.8%	68.2%	72.0%	75.8%	81.6%	74.5%
Black	5.7%	7.1%	9.8%	5.5%	7.4%	3.1%	5.5%
Asian	6.8%	0.7%	3.4%	3.8%	3.1%	4.2%	8.7%
Educational Attainment (n = 37,479)							
No College Degree	59.6%	75.7%	63.9%	66.4%	63.2%	53.0%	42.2%
College Degree	40.4%	25.3%	36.1%	33.6%	36.8%	47.0%	57.8%
Income (n = 33,378)							
Less than US$10,000	3.7%	8.6%	4.9%	5.8%	3.8%	3.6%	3.0%
Between US$10,000 and US$15,000	4.3%	7.7%	4.0%	5.5%	4.6%	5.1%	3.8%
Between US$15,000 and US$20,000	6.3%	8.8%	5.3%	6.3%	6.7%	6.4%	6.1%
Between US$20,000 and US$25,000	9.5%	13.4%	9.6%	10.8%	9.8%	9.7%	9.0%
Between US$25,000 and US$35,000	12.4%	12.2%	12.0%	11.6%	12.0%	11.0%	12.8%
Between US$35,000 and US$50,000	15.7%	13.4%	13.9%	16.5%	16.3%	14.2%	16.0%
Between US$50,000 and US$75,000	17.7%	14.6%	18.5%	18.2%	17.6%	18.0%	17.8%
US$75,000 or more	30.4%	21.3%	31.9%	25.2%	29.2%	32.1%	31.6%
Life Satisfaction (n = 37,302)							
Very satisfied/satisfied	94.8%	84.4%	91.7%	89.7%	93.8%	90.3%	97.0%
Dissatisfied/very dissatisfied	5.2%	15.6%	8.3%	10.3%	6.2%	9.7%	3.0%
Emotional and Social Support (n = 37,045)							
Always/usually/sometimes	91.9%	88.3%	92.8%	89.7%	93.2%	92.1%	92.2%
Rarely/never	8.1%	11.7%	7.2%	10.3%	6.8%	7.9%	7.8%

Note. Class 1 (4.4%) = High Trauma; Class 2 (3.6%) = Substance Use; Class 3 (7.3%) = Abuse and Conflict; Class 4 (11.5%) = Moderate Levels of Household Dysfunction; Class 5 (8.6%) = Emotional Abuse; Class 6 (64.7%) = Low Trauma.

Table 3

Latent Class Analysis Fit Statistics

No. of classes	AIC	BIC	aBIC	Log likelihood	No. of free parameters	Entropy
1	292358.562	292435.361	292406.759	-146170.281	9	
2	259396.401	259558.532	259498.150	-129679.200	19	0.789
3	257160.422	257407.885	257315.723	-128551.211	29	0.701
4	255167.488	255500.283	255376.341	-127544.744	39	0.718
5	254682.483	255100.610	254944.888	-127292.241	49	0.730
6	254301.916	254805.376	254617.874	-127091.958	59	0.704
7	254160.842	254749.634	254530.352	-127011.421	69	0.704
8	254075.428	254749.552	254498.490	-126958.714	79	0.679
9	254011.627	254771.083	254488.241	-126916.813	89	0.677
10	253982.350	254827.138	254512.516	-126892.175	99	0.686

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = adjusted Bayesian information criterion.

Table 4

Item Response Probabilities for ACEs Items and Mean Number of ACEs by Class

Items	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Lived with mentally ill adult	.724	.440	.291	.243	.344	.038
Lived with alcoholic	.872	.657	.525	.540	.264	.060
Lived with illicit drug user	.671	1.000	.040	.000	.066	.010
Lived with incarcerated adult	.375	.306	.048	.066	.005	.006
Parents separated or divorced	.721	.428	.445	.435	.171	.103
Intra-parental violence	.758	.201	.766	.256	.043	.018
Physical abuse	.821	.070	.766	.016	.419	.026
Emotional abuse	.974	.438	.869	.374	.865	.123
Sexual abuse	.541	.190	.281	.157	.261	.048
Mean # of ACEs	6.75	3.66	4.36	2.62	2.78	0.43

Note. Class 1 (4.4%) = High Trauma; Class 2 (3.6%) = Substance Use; Class 3 (7.3%) = Abuse and Conflict; Class 4 (11.5%) = Moderate Levels of Household Dysfunction; Class 5 (8.6%) = Emotional Abuse; Class 6 (64.7%) = Low Trauma.

Table 5

Percent of Individuals who Endorsed ACEs Item by State

Items	DC	Hawaii	Nevada	Vermont	Washington	Wisconsin
Lived with mentally ill adult	16.0%	12.9%	17.8%	18.6%	17.7%	13.0%
Lived with alcoholic	20.2%	20.3%	29.4%	25.8%	26.4%	22.8%
Lived with illicit drug user	8.7%	8.3%	11.1%	6.4%	8.2%	6.9%
Lived with incarcerated adult	6.4%	4.6%	6.1%	3.0%	4.4%	4.5%
Parents separated or divorced	24.1%	19.0%	28.8%	18.2%	25.2%	18.4%
Intra-parental violence	15.0%	16.3%	18.9%	14.1%	15.5%	15.8%
Physical abuse	13.2%	16.1%	20.8%	15.3%	17.1%	16.8%
Emotional abuse	32.0%	31.6%	38.1%	32.0%	35.7%	35.7%
Sexual abuse	10.5%	11.1%	14.4%	12.2%	15.0%	11.7%

Table 6

Percent of individuals who endorsed experiencing each ACE "More than once" by Class

Items	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Intra-parental violence	66.1%	12.4%	68.0%	23.1%	0.0%	0.7%
Physical abuse	73.0%	1.7%	66.9%	0.0%	42.6%	1.2%
Emotional abuse	93.3%	36.5%	79.7%	37.3%	80.6%	8.7%
Any sexual abuse	41.8%	11.3%	19.6%	7.5%	22.4%	1.9%
Forced sexual touch	40.3%	10.8%	19.1%	7.1%	20.9%	1.9%
Forced to sexually touch	32.2%	6.7%	13.6%	4.4%	13.5%	1.0%
Forced intercourse	21.3%	3.6%	8.5%	2.1%	7.0%	0.4%

Note. Class 1 (4.4%) = High Trauma; Class 2 (3.6%) = Substance Use; Class 3 (7.3%) = Abuse and Conflict; Class 4 (11.5%) = Moderate Levels of Household Dysfunction; Class 5 (8.6%) = Emotional Abuse; Class 6 (64.7%) = Low Trauma.

Table 7

Overall Significance Tests for Overall Mean and Pairwise Differences on Adult Outcomes

Outcome	Class 1: High Trauma	Class 2: Substance Use	Class 3: Abuse and Conflict	Class 4: Moderate Levels of Household Dysfunction	Class 5: Emotional Abuse	Class 6: Low Trauma	Mean Pairwise Differences Significant at p <.05
Emotional and Social Support	2.07 (0.03)	1.94 (.03)	2.03 (0.02)	1.86 (0.02)	2.03 (0.02)	1.73 (0.01)	6 < 1, 2, 3, 4, 5; 4 < 1, 3, 5; 2 < 1;
Life Satisfaction	1.81 (0.02)	1.70 (0.02)	1.76 (0.01)	1.63 (0.01)	1.76 (0.01)	1.53 (0.004)	6 < 1, 2, 3, 4, 5; 4 < 1, 2, 3, 5; 2 < 1;
Mentally Unhealthy Days	6.33 (0.20)	4.04 (0.21)	4.62 (0.15)	3.38 (0.12)	4.70 (0.13)	2.25 (0.05)	6 < 1, 2, 3, 4, 5; 4 < 1, 3, 5; 2, 3, 5 < 1;
Physically Unhealthy Days	6.42 (0.24)	4.55 (0.25)	5.36 (0.18)	4.12 (0.14)	5.06 (0.16)	3.21 (0.06)	6 < 1, 2, 3, 4, 5; 4 < 1, 3, 5; 2, 3, 5 < 1;

Table 8

Multiple Linear Regression on Emotional and Social Support

	Unstandardized Coefficients		Standardized Coefficients		
Model	b	Std. Error	Beta	t	*p*
(Constant)	2.126	.034		62.270	<.001
Class 1	.335	.031	.065	10.977	<.001
Class 2	206	.032	.037	6.376	<.001
Class 3	.299	.024	.074	12.670	<.001
Class 4	.125	.019	.039	6.642	<.001
Class 5	.295	.021	.083	14.159	<.001
Male	.131	.012	.062	10.873	<.001
College Graduate	-.026	.013	-.012	-2.017	.044
Black	.155	.024	.037	6.396	<.001
Asian	.416	.022	.109	18.892	<.001
Age	.002	.000	.028	4.748	<.001
Household Income	-.098	.003	-.187	-29.420	<.001

Note. Class 6 (Low Trauma class) was used as the reference group for the other classes. White was used as the reference group for Black and Asian.

Table 9

Multiple Linear Regression on Life Satisfaction

	Unstandardized Coefficients		Standardized Coefficients		
Model	b	Std. Error	Beta	t	*p*
(Constant)	2.158	.020		105.527	<.001
Class 1	.282	.018	.090	15.682	<.001
Class 2	.172	.019	.052	9.065	<.001
Class 3	.231	.014	.095	16.673	<.001
Class 4	.105	.011	.054	9.507	<.001
Class 5	.232	.012	.108	18.914	<.001
Male	.047	.007	.037	6.599	<.001
College Graduate	-.035	.008	-.028	-4.585	<.001
Black	.021	.014	.008	1.486	.137
Asian	.077	.013	.034	5.973	<.001
Age	-.003	.000	-.067	-11.491	<.001
Household Income	-.082	.002	-.261	-41.832	<.001

Note. Class 6 (Low Trauma class) was used as the reference group for the other classes. White was used as the reference group for Black and Asian.

Table 10

Multiple Linear Regression on Physically Unhealthy Days

	Unstandardized Coefficients		Standardized Coefficients		
Model	b	Std. Error	Beta	t	*p*
(Constant)	6.458	.273		23.634	<.001
Class 1: High Trauma	3.210	.245	.077	13.109	<.001
Class 2: Substance Use	1.341	.258	.030	5.192	<.001
Class 3: Abuse and Conflict	2.147	.188	.066	11.413	<.001
Class 4: MLoHD	.906	.151	.035	6.011	<.001
Class 5: Emotional Abuse	1.851	.167	.065	11.112	<.001
Male	-.076	.096	-.004	-.786	.432
College Graduate	-.576	.103	-.035	-5.603	<.001
Black	.035	.194	.001	.181	.856
Asian	-.513	.176	-.017	-2.916	.004
Age	.042	.003	.078	13.105	<.001
Household Income	-.879	.027	-.210	-33.042	<.001

Note. Class 6 (Low Trauma class) was used as the reference group for the other classes. White was used as the reference group for Black and Asian.

Table 11

Multiple Linear Regression on Mentally Unhealthy Days

	Unstandardized Coefficients		Standardized Coefficients		
Model	b	Std. Error	Beta	t	*p*
(Constant)	9.288	.233		39.994	<.001
Class 1: High Trauma	4.077	.208	.114	19.568	<.001
Class 2: Substance Use	1.783	.220	.047	8.097	<.001
Class 3: Abuse and Conflict	2.364	.161	.085	14.705	<.001
Class 4: MLoHD	1.124	.129	.051	8.748	<.001
Class 5: Emotional Abuse	2.449	.142	.100	17.247	<.001
Male	-.729	.082	-.051	-8.889	<.001
College Graduate	-.345	.088	-.024	-3.930	<.001
Black	-.107	.165	-.004	-.645	.519
Asian	-.704	.150	-.027	-4.686	<.001
Age	-.046	.003	-.101	-17.072	<.001
Household Income	-.647	.023	-.181	-28.626	<.001

Note. Class 6 (Low Trauma class) was used as the reference group for the other classes. White was used as the reference group for Black and Asian.

Figure 1

Bayesian Information Criterion Plot (BIC) by Number of Classes

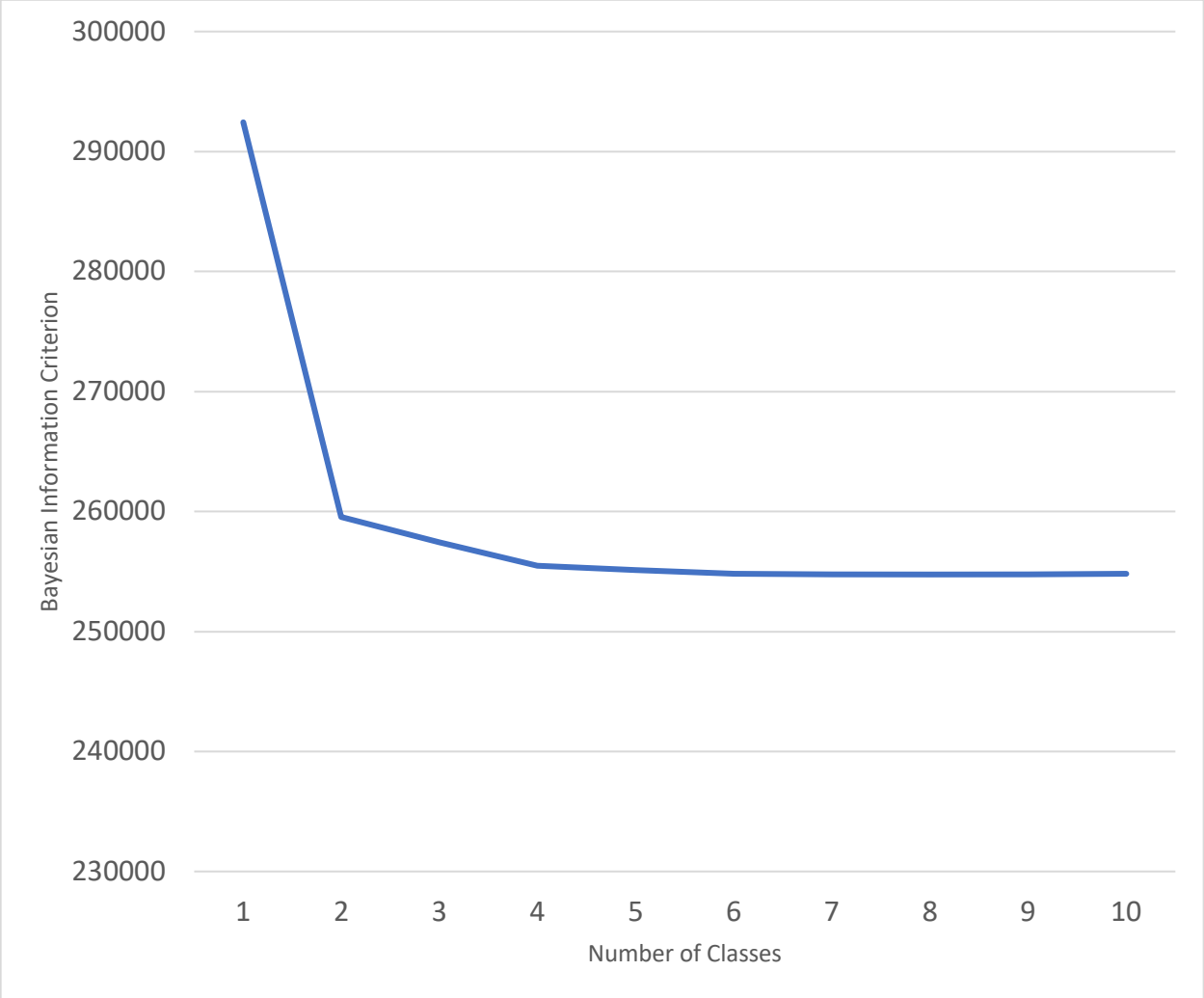


Figure 2

Adverse Childhood Experience Item Probability Plot

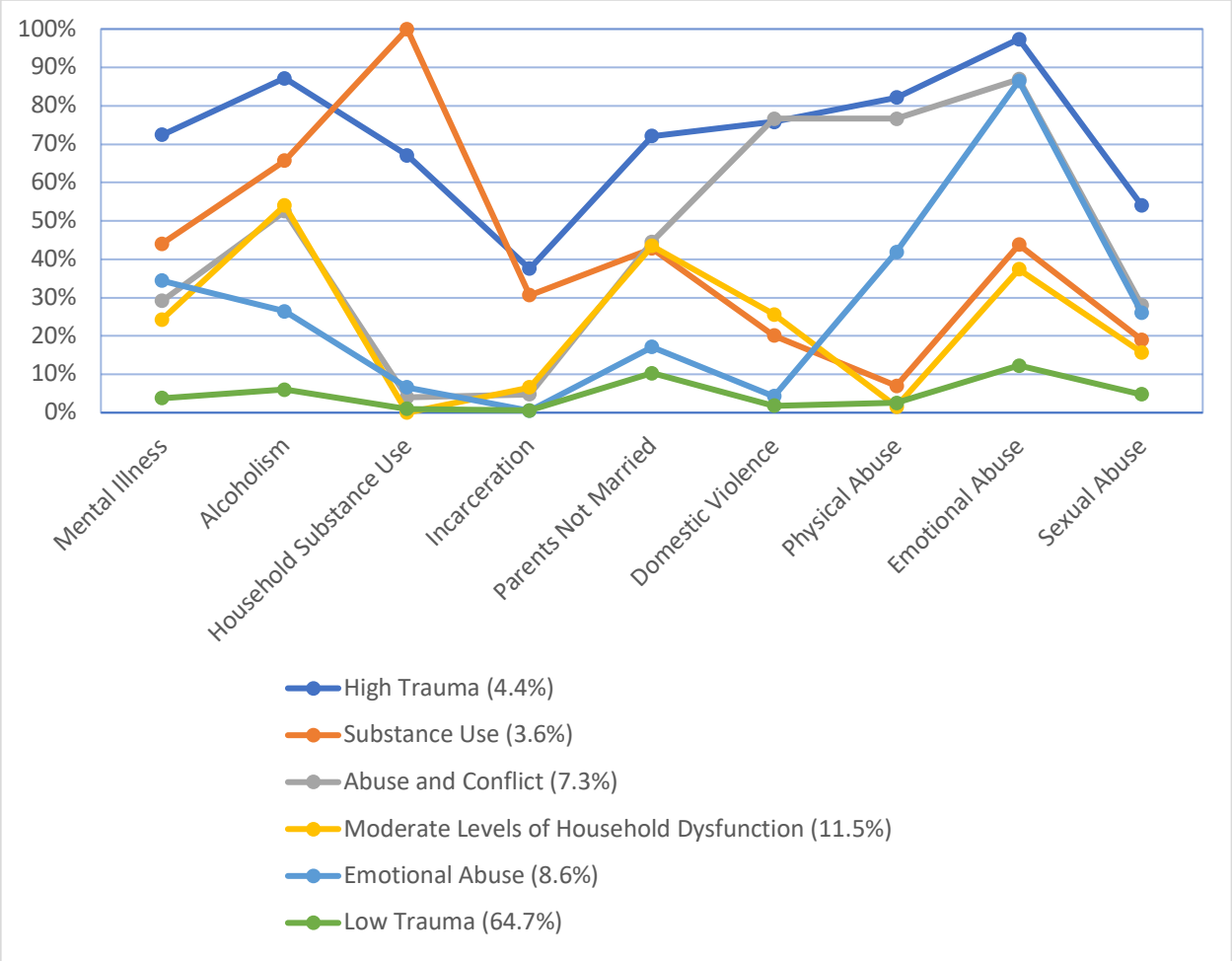


Figure 3

Class 1 (High Trauma) Item Probability Plot by State

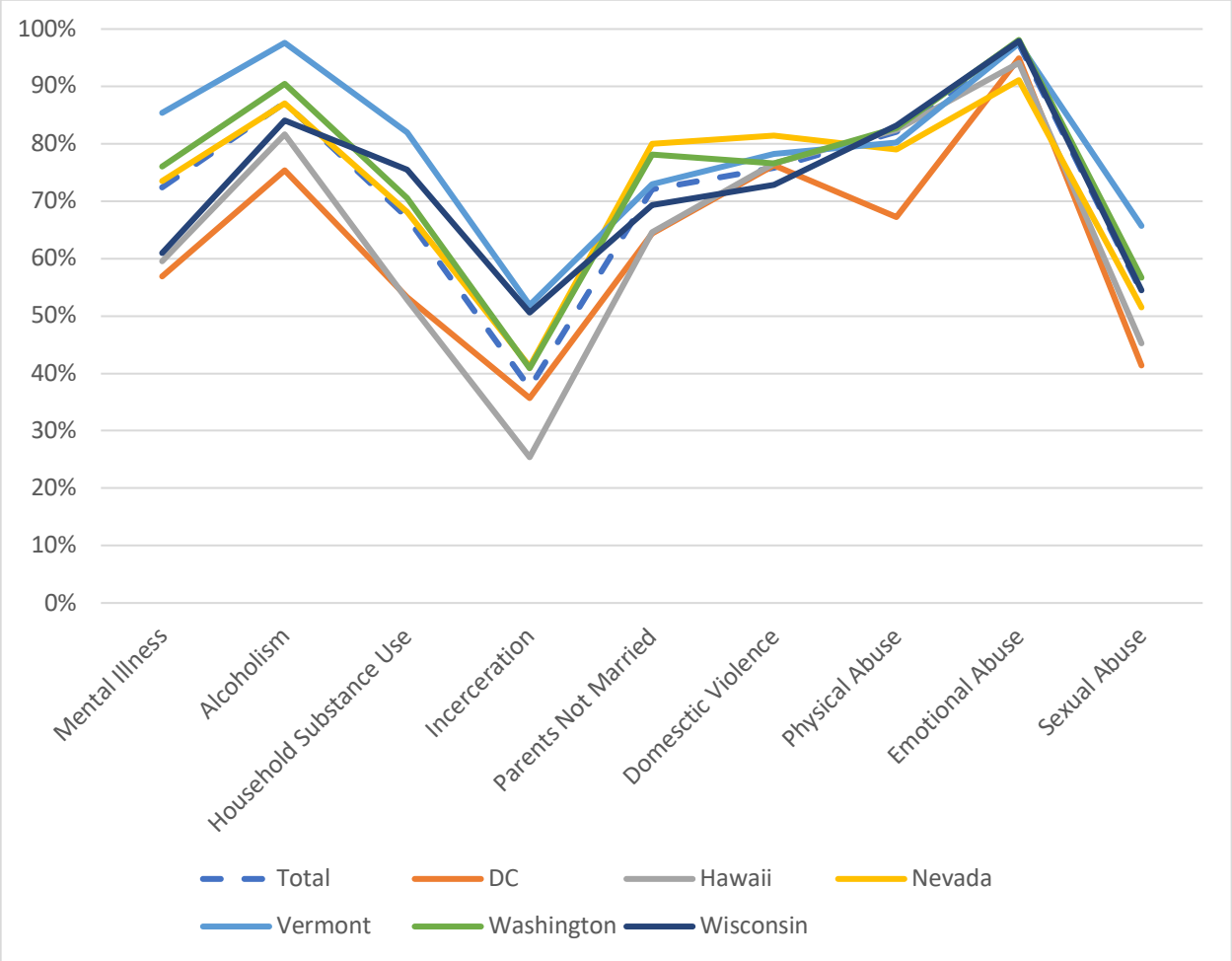


Figure 4

Class 2 (Substance Use) Item Probability Plot by State

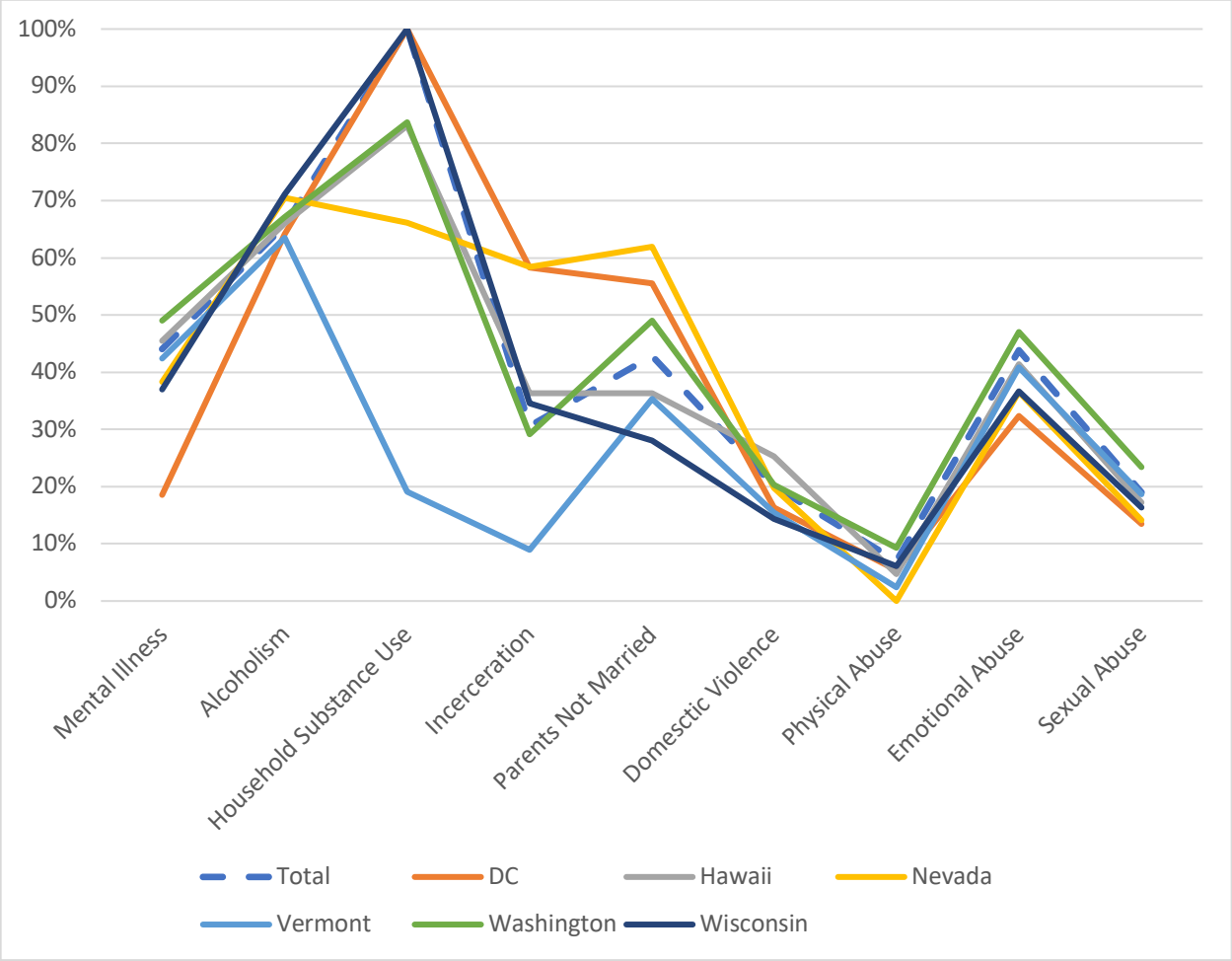


Figure 5

Class 3 (Abuse and Conflict) Item Probability Plot by State

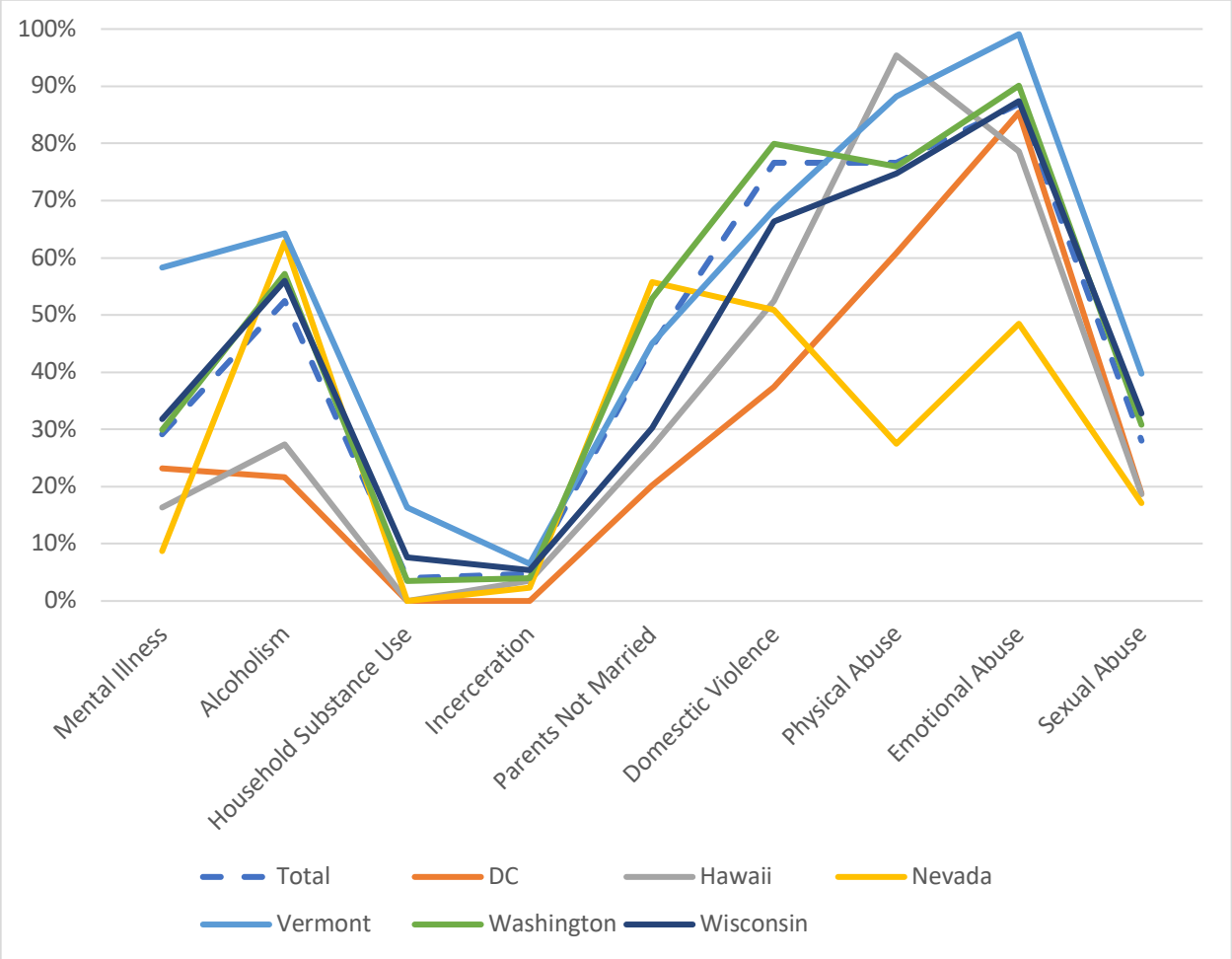


Figure 6

Class 4 (Moderate Levels of Household Dysfunction) Item Probability Plot by State

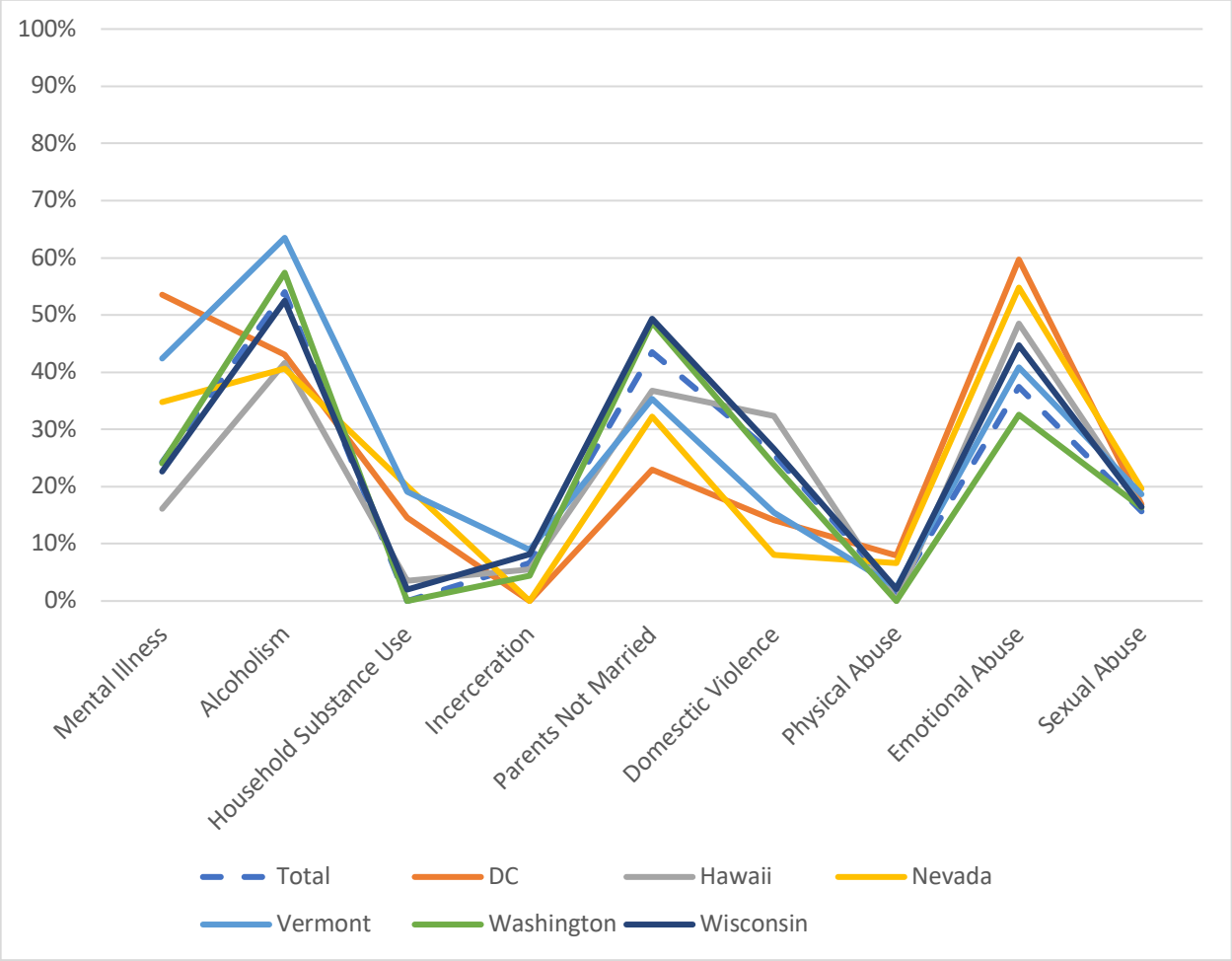


Figure 7

Class 5 (Emotional Abuse) Item Probability Plot by State

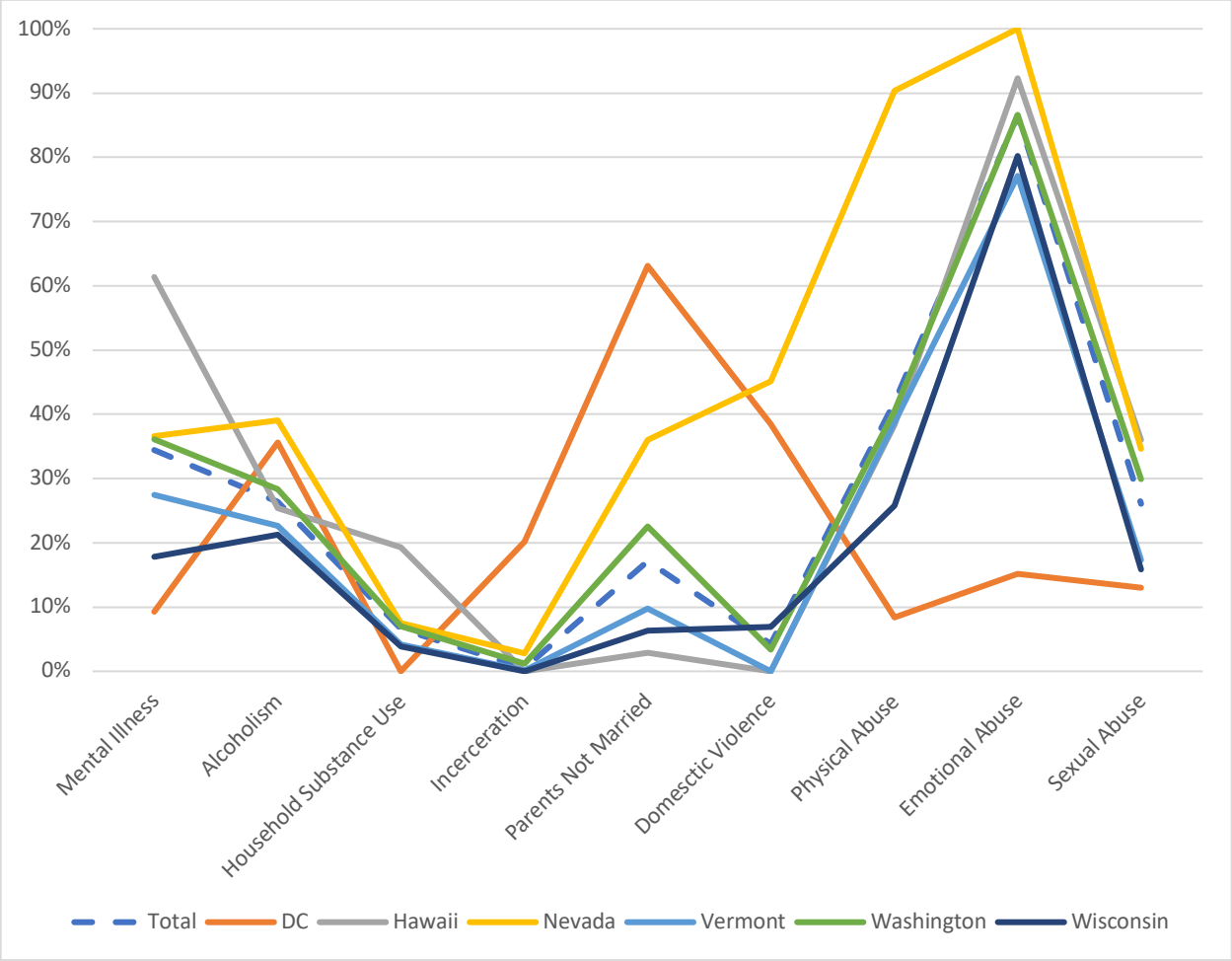
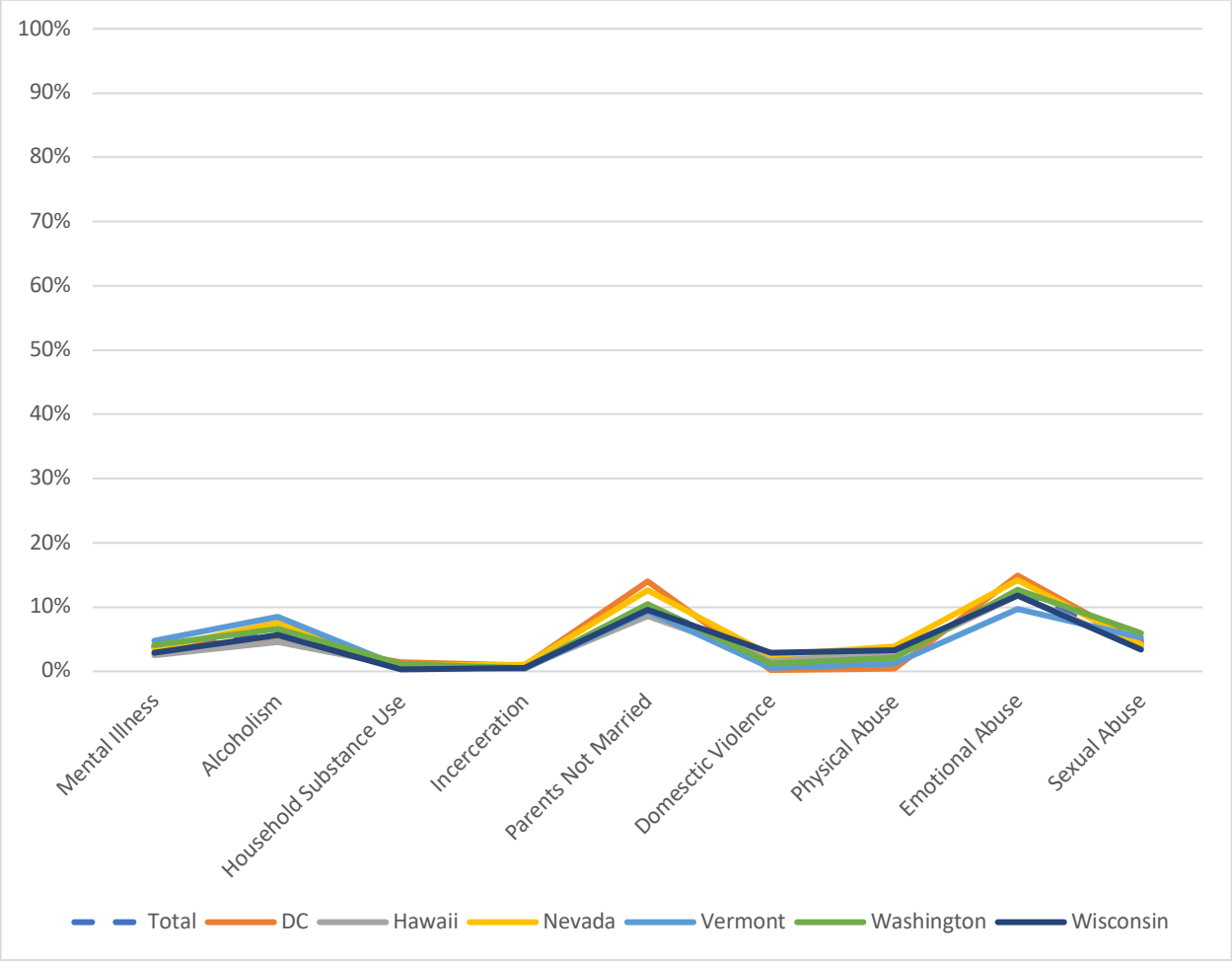


Figure 8

Class 6 (Low Trauma) Item Probability Plot by State



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