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# Adverse childhood experiences (ACEs) and emotion dysregulation phenotypes: An intersectional analysis of race/ethnicity and gender in a nationally representative U.S. sample

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## ABSTRACT

**Background:** Adverse childhood experiences (ACEs) are strong, preventable risk factors for emotion dysregulation in adolescence, but whether ACEs-emotion dysregulation associations differ by race/ethnicity or gender remains unclear.

**Objective:** We examined (a) how race/ethnicity and gender jointly impact latent ACEs classes and emotion dysregulation phenotypes, and (b) how these ACEs classes in childhood (by age 9) transition to latent emotion dysregulation phenotypes in adolescence (at age 15).

**Participants and setting:** Participants were 3,273 children from two waves of data from the Future of Families and Child Wellbeing Study, a large, nationally representative cohort. The sample consisted of 26.6% non-Hispanic (NH) Black boys, 25.4% NH Black girls, 12.9% Hispanic boys, 12.6% Hispanic girls, 11.8% NH White boys, and 10.7% NH White girls.

**Method:** We estimated latent class models to identify ACEs patterns across ten indicators and dysregulation phenotypes across affective, attentional, and behavioral domains. Latent transition analysis was used to examine how ACEs classes transitioned into dysregulation phenotypes from childhood into adolescence.

**Results:** The findings revealed significant variation in the number and nature of latent classes of both ACEs and emotion dysregulation across the intersection of race/ethnicity and gender. NH Black and Hispanic children were more likely to be in the *Poverty and Parental Separation* class than NH White children. Hispanic boys had the highest prevalence of *Severe Dysregulation* (16%), whereas NH White boys had the highest prevalence of *Low Symptoms* (52%). Individuals in the *Poverty and Parental Separation* class had a higher probability of transitioning to the *Low Symptoms* class. In contrast, those in the *Abuse and Family Dysfunction* class were more likely to transition to the *Severe Dysregulation* class, with NH White girls showing the highest probability (.34), nearly twice that of NH Black girls (.19). These gender differences in these transition probabilities were observed for Whites but not Blacks.

**Conclusions:** These findings thus highlight the need for adopting an intersectional, person-centered approach when studying the effects of ACEs on adolescent development.

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## 1. Introduction

Adolescence is a critical developmental period characterized by rapid biological, cognitive, social, and emotional development (Lerner & Steinberg, 2009). Although many adolescents reach a peak in emotional instability during this time (Van den Akker et al., 2014), some have difficulty developing effective emotion regulation strategies and skills to recognize, evaluate, and modify emotions in socially acceptable ways in order to achieve their goals (Thompson, 1994; Zimmermann & Iwanski, 2014). This phenomenon, called *emotion dysregulation*, has gained increased scientific attention over the past two decades (Gratz & Roemer, 2004). This increased interest may be due to the recognition that deficits in emotion regulation, classified as a transdiagnostic construct, constitute one of the most common clinical challenges affecting youth (Aldao et al., 2016; Biederman et al., 2009; Gratz & Roemer, 2004; Weissman et al., 2019). Indeed, numerous studies have documented longitudinal associations between emotion regulation difficulties (or *emotion dysregulation*) and a myriad of clinically relevant outcomes, including depression, anxiety, post-traumatic stress disorder, and substance use disorder (Aldao, 2013; Aldao et al., 2010). Therefore, it is imperative to identify antecedents of emotion dysregulation in order to improve risk detection, health promotion, and targeted intervention programs.

Adverse childhood experiences (ACEs), such as child maltreatment and exposure to parental mental illness and substance use, are among the strongest preventable risk factors for emotional and behavioral problems across the lifespan (Green et al., 2010; Grummitt et al., 2022; McLaughlin et al., 2012). Although critical, however, research on ACEs and emotion dysregulation in adolescence is notably scant (Caro-Cañizares et al., 2015). Further, although research on ACEs that leverages person-centered approaches and mixture models, such as latent class analysis (LCA), is more informative for developing actionable prevention and intervention strategies than a traditional cumulative risk approach, a recent review highlighted the scarcity of such designs. Specifically, only 19 studies over the past ten years have used mixture models to examine the co-occurrence of ACEs (see Wang et al., 2023). Moreover, none of these studies have examined the effects of latent ACEs classes on adolescents' emotion dysregulation.

Prior research has examined differences in exposure to ACEs (Mersky & Janczewski, 2018; Sacks & Murphey, 2018; Zhang & Monnat, 2022) and emotional and behavioral problems (Chen et al., 2019; McLaughlin et al., 2007; Vilsaint et al., 2019), separately by race and gender. To our knowledge, however, no studies have simultaneously examined how the intersection of these identities together predicts patterns of ACEs and emotion dysregulation, nor have they investigated the associations between ACEs and emotion dysregulation by the intersectional impact of dual racial and gender marginalization (i.e., intersectional invisibility). In the present study, therefore, we investigated how race/ethnicity and gender jointly impact both ACEs classes and emotion dysregulation phenotypes and how these ACEs classes in childhood transition to dysregulation phenotypes in adolescence.

### 1.1. Race/Ethnicity and gender disparities in ACEs

As alluded to above, numerous studies have documented racial/ethnic and gender differences in exposure to ACEs. For example, racialized minority adolescents have been found to experience more ACEs compared to their White counterparts (Cronholm et al., 2015; Merrick et al., 2017; Zhang & Monnat, 2022). However, inconsistent findings have emerged when comparing specific types of ACEs. For example, rates of household members with mental health or substance use issues were higher among White individuals than Non-Hispanic (NH) Black and Hispanic individuals (Breslau et al., 2006; Hasin & Grant, 2015; Riolo et al., 2005). In contrast, the rates of violence exposure, such as child maltreatment and witnessing domestic violence, were higher among NH Black and Hispanic individuals than NH Whites (Crouch et al., 2000; Zhang & Monnat, 2022).

Furthermore, recent research has shown that ACEs tend to co-occur in specific exposure configurations, whereby certain types of ACEs are more likely to occur together (see below; for a review, see Wang et al., 2023). However, only a few studies to date have examined racial/ethnic differences among ACEs patterns (Liu et al., 2018; Zhang & Monnat, 2022). Among these studies, racial/ethnic variations in ACEs patterns are evident, albeit complex. For example, Zhang and Monnat (2022) found variations in the number of ACEs classes and the proportions of each class among NH White, NH Black, and Hispanic adolescents. These investigators also found differences in the configurations of ACEs patterns. In particular, NH White adolescents were twice as likely to be in the *Low Adversity* class than their NH Black or Hispanic peers. In contrast, the proportion of youth in the *High Socioeconomic Adversity* and *Paternal Incarceration* class, marked by high probabilities of family economic hardship, maternal low education, parental divorce, and paternal incarceration, was highest for NH Black youth (63%), followed by NH Hispanic (39%), and NH White (36%) youth.

Similarly, research on gender differences in ACEs has also yielded inconsistent findings. Some studies examining gender differences among specific types of ACEs have shown that compared to males, females report higher rates of childhood sexual abuse, emotional abuse, and exposure to a household member with mental health or substance use issues (Merrick et al., 2017). However, research examining the co-occurrence of ACEs has been mixed. Whereas some studies have reported significant gender differences in the patterning of ACEs (Wang et al., 2023), others have not (Zhang et al., 2023).

In sum, the literature on racial/ethnic and gender differences in ACEs has developed along two largely separate lines of inquiry: one focused on race/ethnicity and a second focused on gender. As a result, the intersectionality literature on ACEs is scant. This is unfortunate given that a more detailed description of exposure to ACEs among youth with intersecting identities is essential for developing both more accurate risk prediction models and more targeted prevention and intervention strategies for reducing the negative impact of ACEs on health and wellbeing.

### 1.2. Race/Ethnicity and gender differences in emotion dysregulation

Although no studies have directly assessed racial/ethnic and gender differences in emotion dysregulation, findings on differences in internalizing and externalizing symptoms among adolescents may offer insights into how emotion dysregulation varies across these groups. This is particularly relevant given that research has indicated that emotion dysregulation is a multi-dimensional construct, encompassing affective, behavioral, and cognitive domains, and it overlaps with both internalizing and externalizing symptomatology (Althoff, 2010; Althoff & Ametti, 2021). Although there is no consensus on the conceptualization and operationalization of emotion regulation, a growing body of work has demonstrated that the Child Behavior Checklist (CBCL) can be used to assess heterogeneity in emotion regulation ability (Biederman et al., 2022). Specifically, researchers have used the anxious/depressed, attention problems, and aggressive behaviors symptom scales (AAA scales) from the CBCL to assess the affective, cognitive, and behavioral domains of regulation (Ayer et al., 2009; Bianchi et al., 2022; Rescorla et al., 2021).

Early studies examining race/ethnic and gender differences have yielded inconclusive findings in the prevalence of depression, anxiety, and aggression symptoms in adolescents. Some studies have reported significant racial/ethnic differences (Austin & Chorpita, 2004; Roberts & Chen, 1995), whereas others have shown no differences (Cole et al., 1998). Similarly, gender differences have been found across these symptoms; however, the findings are mixed and vary by symptom. For example, females tend to report higher rates of depression (Hankin et al., 1998; Twenge & Nolen-Hoeksema, 2002), whereas males are more likely to experience physical aggression (Card et al., 2008). On the other hand, females tend to report higher rates of relational aggression (Cairns et al., 1989; Crick, 1997). Further, a more recent study using a large community adolescent sample revealed differences in psychopathology by both gender and race/ethnicity. Specifically, Hispanic females reported higher rates of depression, anxiety, and reputational aggression compared to other groups, whereas Black males reported higher levels of overt aggression relative to others in the sample (McLaughlin et al., 2007).

### 1.3. The need to examine the intersecting effects of race/ethnicity and gender on ACEs and dysregulation

Despite existing research indicating significant racial and gender disparities in both ACEs (Mersky & Janczewski, 2018; Sacks & Murphey, 2018; Zhang & Monnat, 2022) and emotional and behavioral problems (Chen et al., 2019; McLaughlin et al., 2007; Vilsaint et al., 2019), to our knowledge, no studies have simultaneously examined the intersection of race/ethnicity and gender in predicting patterns of ACEs exposure and emotion dysregulation, nor have they investigated relations between ACEs and emotion dysregulation. To address this issue, an intersectional approach is needed, which emphasizes structural inequality and posits that race/ethnicity and gender are key social identities that shape an individual's access to opportunities and resources, which play a pivotal role in health outcomes (Dill & Zambrana, 2009; Slavich et al., 2023). Adopting an intersectional approach when studying ACEs and emotion dysregulation in youth is critical for two reasons. First, the joint and simultaneous impact of race/ethnicity and gender on health is multiplicative rather than additive (Mullings & Schulz, 2006). Second, despite considerable prevention and intervention efforts aimed at addressing mental health disorders, adolescent mental health problems are on the rise (Mojtabai et al., 2016).

Just like primary research on ACEs, extant studies examining how ACEs patterns are related to adolescents' mental health have tended to treat race/ethnicity and gender as separate dimensions, typically ignoring how these two key factors intersect to shape adolescents' wellbeing. This is a critical scientific gap, as identifying the underlying patterns of ACEs by race/ethnicity and gender as antecedents of emotion dysregulation is needed to improve our understanding of who is at greatest risk of developing severe dysregulation later on in life while also helping to inform more precise prevention and treatment efforts in at-risk children (Kim et al., 2024; Moriarity & Slavich, 2023).

### 1.4. Present study

To address these issues, we used a specific type of mixture model, called latent transition mixture analysis, to examine how latent patterns of ACEs during childhood (by age 9) were related to subsequent emotion dysregulation phenotypes in adolescence (at age 15) in a large, prospective birth cohort of Americans. We had three specific aims. First, we examined the heterogeneity in ACEs to identify underlying latent *classes* or *patterns* of adverse experiences occurring before age 9 and investigated whether there were racial/ethnic and/or gender differences in the emergent latent classes. Second, based on prior research on the multidimensionality of emotion dysregulation and the hierarchical taxonomy of psychopathology (HiTOP; Kotov et al., 2017), we examined the heterogeneity of emotion dysregulation at age 15. Finally, we used latent transition mixture analysis to examine how distinct ACEs patterns (from Aim 1) were related to emotion dysregulation phenotypes (from Aim 2).

## 2. Method

### 2.1. Sample

Data were drawn from the Future of Families and Child Wellbeing Study (FFCWS), formerly the Fragile Families and Child Wellbeing Study, which is a population-based birth cohort study that oversampled low-income and single-parent families. The FFCWS followed 4,898 children born to parents in large United States (U.S.) cities between 1998 and 2000 (for a detailed description of the sample and design, see Reichman et al., 2001). The analytic sample for the present study included 3,273 adolescents whose mother or primary caregiver (hereafter mother) reported at least one wave of data for ACEs assessed at the child's average age of 3, 5, and 9 ( $n =$

3,417), and who had data on our outcome of interest at year 15 ( $n = 3,402$ ). Since our goal was to examine the intersection of race/ethnicity and gender, we further excluded 125 respondents whose race/ethnicity was not Non-Hispanic Black (hereafter Black), Hispanic, or Non-Hispanic White (hereafter White) due to small sample sizes, as well as 4 cases with missing demographic information. Our final analytic sample ( $n = 3,273$ ) included 870 Black boys, 832 Black girls, 422 Hispanic boys, 413 Hispanic girls, 386 White boys, and 350 White girls. Supplemental Table S1 presents the sample characteristics by race/ethnicity and gender.

## 2.2. Measures

### 2.2.1. Adverse childhood experiences indicators

Consistent with prior ACEs studies using data from the FFCWS (Zhang et al., 2023; Zhang & Monnat, 2022), ACEs were measured using ten indicators, including two not part of the original ACEs scale—family poverty and low education. Empirical and review studies suggest that these socioeconomic indicators are critical for understanding the impact of ACEs, particularly among disadvantaged populations (Affi, Salmon, et al., 2020; Finkelhor et al., 2015; Hughes et al., 2017). They were reported by mothers/fathers/primary caregivers when the focal child was, on average, ages 3, 5, and 9. We assigned a score of 1 indicating exposure to a specific ACE by age 9 if respondents reported experiencing that ACE in at least one of the three waves during which ACE data was collected. Similar to other studies (Zhang et al., 2023), we coded ACE indicators as missing when the child's mother reported living with the focal child for less than half of the time in the past year of the survey year to avoid potential bias.

**2.2.1.1. Psychological and physical abuse and neglect.** We included three types of maltreatment reported by primary caregivers, among which were respectively assessed using a five-item subscale of the Parent Child Conflict Tactics Scale (Straus et al., 1998), a well-validated measure for assessing child maltreatment. Sample questions were how many times you have “spanked your child on the bottom with your bare hand in the past year” and “had to leave your child home alone, even when you thought some adult should be with him/her,” ranging from *never* to *more than 20 times*. Consistent with prior studies (Hunt et al., 2017; Zhang & Monnat, 2022), we captured whether children had experienced each type of maltreatment by recoding each response using the midpoint approach (Straus & Donnelly, 2001), summing five items of each subscale and dummy coding those respondents in the top 10th percentile to indicate severe maltreatment (1 = *exposure*; 0 = *no exposure*). This percentile was selected to maintain consistency with prior research and minimize potential racial bias in reporting maltreatment (Berger, 2007; Berger et al., 2005).

**2.2.1.2. Domestic violence exposure.** Mothers reported whether (a) the child ever witnessed a physical fight between the mother and the father or their current partner and (b) if the father or their current partner physically hurt the mother in front of the child. From that information, we created a measure indicating domestic violence exposure (1 = *exposure*) when the mother answered a yes to either of the questions.

**2.2.1.3. Maternal substance use: alcohol and drug use.** Following Zhang and Monnat (2022), we constructed a binary variable for maternal alcohol use if mothers reported having four or more drinks in one day with one of the following options in the past 12 months: daily every day or almost every day, a few times a week, or a few times a month. A binary variable for maternal drug use was created based on mothers' reports of using any of five types of illicit drugs (e.g., cocaine and heroin) or misuse of prescription drugs (e.g., sedatives and tranquilizers) within the past 12 months. We then created a dichotomous item of any exposure to maternal substance use when the mother reported either alcohol use or drug use (1 = *exposure*).

**2.2.1.4. Maternal depression.** Mothers were administered 15 questions from the Composite International Diagnostic Interview – Short Form about their feelings of dysphoria or anhedonia in the past year that lasted for two weeks or more, and if these symptoms occurred every day and for how long (Kessler et al., 1999). Based on these responses, FFCWS constructed variables representing the likelihood of a major depressive episode (Bendheim-Thoman Center for Research on Child Wellbeing (CRCW), 2011). In this study, a conservative variable was used to indicate the child's exposure to maternal depression (1 = *exposure*).

**2.2.1.5. Paternal incarceration.** Both mothers and fathers reported whether the child's biological father had spent time in jail by age 9 (1 = *exposure*).

**2.2.1.6. Parental divorce or separation.** A dichotomous variable was created to indicate whether the youths' biological parents were separated or divorced, assessed when the youth were 3, 5, and 9 years old.

**2.2.1.7. Family poverty.** We categorized families at 200% or below the income-to-needs ratio as experiencing family poverty. This threshold is commonly used to define ‘low-income’ families, and is frequently used by researchers and policy advocates as an indicator of economic adversity in studies of poverty and development (Hair et al., 2022; Koball et al., 2021).

**2.2.1.8. Maternal low education.** The child was coded as exposed to maternal low education when the mother's self-reported education was high school or less by age 9 (1 = *exposure*).

### 2.2.2. Emotion dysregulation

We used the subscales for anxious/depressed (ANXD; 6 items), attention problems (ATT; 3 items), and aggressive behavior (AGG; 11 items) from the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) to model adolescents' emotion (dys)regulation patterns. These questions were reported by their primary caregivers on a 3-point Likert scale ranging from 1 (*not true*) to 3 (*very true or often true*). Consistent with other researchers (Althoff et al., 2006; Jordan et al., 2016), we dichotomized the responses of 2 (*somewhat or sometimes true*) and 3 (*often true*) as 1 and 1 (*not true*) as 0. Sample items included “child is nervous, high-strung, or tense,” “child cries a lot,” and “child destroys things belonging to the family or others.”

### 2.2.3. Covariates

The mother's age at the child's birth and the adolescent's age at age 15 were included as covariates.

## 2.3. Analytic plan

To investigate how patterns of childhood experiences occurring before age 9 subsequently portended different emotion dysregulation phenotypes in adolescence, we used a latent transition mixture model (Nylund-Gibson et al., 2014). Traditionally, a latent transition analysis (LTA) model is an extension of cross-sectional latent class analysis (LCA), which can be used to model changes over time where each time point involves an LCA (Collins & Lanza, 2009). In the present study, we used LCA to model heterogeneity in ACEs before age 9 by classifying adolescents into unobserved groupings (i.e., latent classes) with similar (more homogenous) patterns of experiences (Aim 1), another LCA to model heterogeneity in emotion dysregulation at age 15 (Aim 2). The manual three-step LTA method was used to model the transition probabilities between the two preidentified models (Aim 3). The transition probabilities indicate how children move from one ACEs class to a corresponding dysregulation phenotype. These probabilities can also be interpreted as the percentage of children within a specific ACEs class who will be found in a particular dysregulation class. Mplus 8.10 was used to conduct all inferential analyses, and all analyses were run separately for each race/ethnicity and gender subgroup.

### 2.3.1. Class enumeration for latent class analysis

The class enumeration process for ACEs and dysregulation models was conducted separately for each race/ethnicity by gender group to determine the number and nature of the classes (Nylund-Gibson et al., 2014). Missing data on ACEs and dysregulation indicators were handled using full information maximum likelihood estimation to reduce potential bias due to missing data (Little et al., 2014). We estimated models from a one-class to a  $k$ -class solution and compared whether adding one additional class significantly improved model fit. The best-fitting model was chosen based on substantive interpretability regarding the theory and literature, parsimony, class homogeneity, and multiple fit statistics. Fit statistics included Akaike information criterion (AIC), Bayesian information criterion (BIC), sample-size adjusted Bayesian information criterion (aBIC), the Vuong-Lo-Mendell-Rubin adjusted likelihood ratio test (VLMR-LRT), and the bootstrapped likelihood ratio test (BLRT) (Nylund et al., 2007; Vuong, 1989). Smaller absolute values of LL, AIC, BIC, and aBIC indicate better model fits (Nylund et al., 2007); significant  $p$  values of VLMR-LRT and BLRT suggest that the  $k$ -class model fits better than the  $k-1$  class model (Lo et al., 2001).

### 2.3.2. Three-step latent transition analysis

To address Aim 3, we used a latent transition model in which the ACEs latent class variable was used to predict transition probabilities on the latent class variable for dysregulation first without covariates, and then in a model adjusted for two covariates. We used the manual three-step approach to ensure the same classes identified in the prior stage remained unchanged (Lanza et al., 2013; Vermunt, 2010). A general conceptual model can be found in Supplemental Fig. F1, and a model across race/ethnicity and gender groups can be found in F2.

## 3. Results

### 3.1. Class enumeration and description of emergent latent classes of ACEs

We separately estimated one-class, two-class, up to seven-class solutions for each race/ethnicity by gender subgroup. Model fit statistics for these models are presented in Supplemental Table S2. Although the class enumeration process did not provide conclusive support for a single model applicable to all race/ethnicity and gender groups, we followed the practice of selecting a final model for each group individually. First, we identified the best-fitting model based on fit statistics. Then, we compared the item probability plots for all the models supported by each respective fit statistic while accounting for the sample size, substantive interpretability, and model parsimony (Nylund-Gibson et al., 2023). The  $k$ -class solution in each group was selected as the final model when (a) this model provided a distinctive pattern of item endorsement that was missed using the  $k-1$ -class model, and (b) the additional class in the  $k+1$ -class model did not provide additional distinctive pattern compared to the  $k$ -class model. Taken together, a 4-class solution was chosen as the final model for Black boys, Hispanic boys and girls, a 5-class for Black girls and White girls, and a 3-class for White boys.

Fig. 1 illustrates each group's final latent class model, including latent class prevalence and item-response probabilities. Although we observed variations across groups, five classes emerged consistently in at least two groups. One consistent pattern—*Poverty and Parental Separation*—emerged across five race/ethnicity and gender groups with the following prevalences: Black boys (42%), Black girls (46%), Hispanic boys (38%), White boys (23%), White girls (31%). The class prevalence for Black boys, Black girls, and Hispanic boys was higher than that of White adolescents and was the highest among all ACEs within each of these respective subgroups.

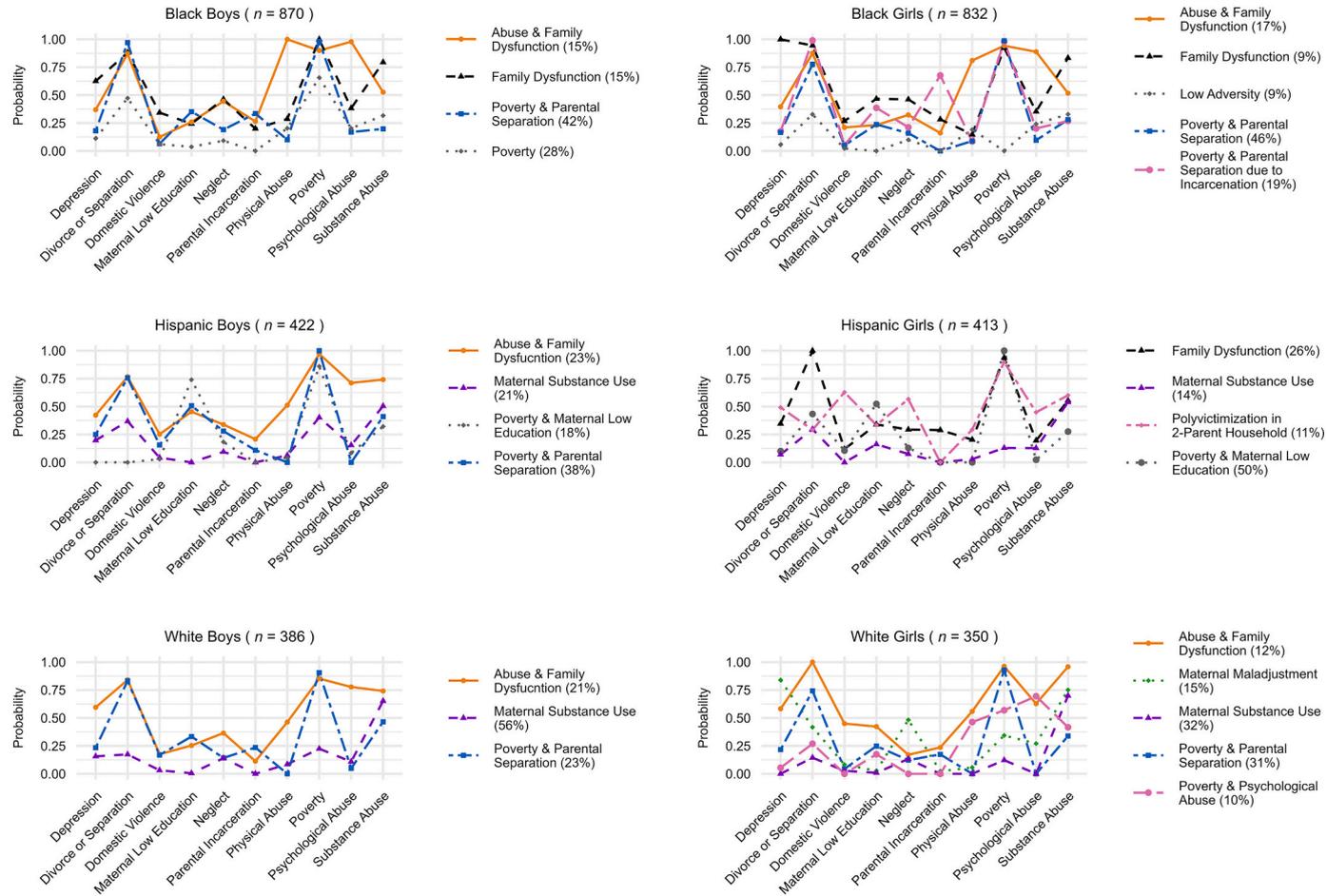


Fig. 1. Estimated item-response probabilities and class prevalence for the selected adverse childhood experience models by race/ethnicity and gender.

Similarly, *Abuse and Family Dysfunction* appeared in 5 out of 6 groups (Black boys: 15%; Black girls: 17%; Hispanic boys: 23%; White boys: 21%; White girls: 12%). Adolescents in this class were more likely to endorse abuse, poverty, parental separation, and maternal substance use.

Next, *Maternal Substance Use* was found among White boys (56%), White girls (32%), Hispanic boys (21%), and Hispanic girls (14%). *Family Dysfunction* was observed in three subgroups (Black boys: 15%; Black girls: 9%; Hispanic girls: 26%), characterized by high probabilities of experiencing poverty, parental separation, and maternal substance use and depression. Additionally, we found a *Poverty and Maternal Low Education* class among Hispanic boys (18%) and Hispanic girls (50%). Finally, we found several unique classes within each subgroup: *Low Adversity* in Black boys (28%), *Poverty, Parental Separation due to Father Incarceration* class for Black girls (19%), *Polyvictimization in 2-Parent Household* class in Hispanic Girls (11%), *Maternal Maladjustment* for White girls (15%) and *Poverty* and *Psychological Abuse* for White girls (10%).

### 3.2. Class enumeration and description of emergent latent phenotypes of dysregulation

A series of latent class models, starting from one class to five classes, were estimated within each race/ethnicity by gender group. Fit indices are presented in Supplemental Table S3. The collection of fit indices showed mixed endorsement for the best model. Therefore, the selection of the best-fitting model was based on the same criteria used for enumerating ACEs. The emergent classes are depicted in Fig. 2. Ultimately, we identified a 5-class solution for Black boys, 3-class solution for Black girls and White boys, and 4-class solution for Hispanic boys, Hispanic girls, and White girls.

Although there were some cross-group variations, two consistent classes emerged. First, we found a *Low Symptoms* class (Black boys: 42%; Black girls: 50%; Hispanic boys: 39%; Hispanic girls: 48%; White boys: 52%; White girls: 39%), comprising adolescents with a low likelihood of endorsing all symptoms. This represented the largest class size within each subgroup. The next commonly emerged class was labeled *Severe Dysregulation*, characterized by high item-response probabilities on most of the three AAA scale items. Class proportions for each group were similar, ranging from 11% to 16%. *Affective Dysregulation* was the next commonly observed class among Black boys (12%), Hispanic boys (10%), Hispanic girls (18%), and White girls (26%). *Behavioral Dysregulation* was also observed in four groups: Black boys (20%), Black girls (39%), Hispanic boys (35%), and Hispanic girls (23%). Further, *Cognitive and Behavioral Dysregulation* was found in Black boys (13%), White boys (36%), and White girls (22%).

### 3.3. Effects of ACEs classes on the subsequent transition to dysregulation phenotypes

Table 1 presents the transition probabilities describing patterns of movement from ACEs classes by age 9 to emotion dysregulation classes at age 15, based on the latent transition model and adjusting for mothers' age at the child's birth and adolescents' age at age 15. Results revealed that, across all ACEs classes, Black boys from the *Poverty* class had the highest probability ( $P = .59$ ) of transitioning into the *Low Symptoms* class, and the lowest probabilities of transitioning into the *Severe Dysregulation* ( $P = .05$ ) and *Affective Dysregulation* ( $P = .08$ ) classes. Interestingly, those from the *Poverty and Parental Separation* class had a high probability ( $P = .42$ ) of transitioning into the *Low Symptoms* class. In contrast, Black boys from the *Abuse and Family Dysfunction* class were most likely ( $P = .22$ ) to transition into the *Severe Dysregulation* class compared to the other ACEs classes—a likelihood similar to that of the *Family Dysfunction* class alone ( $P = .20$ ) and higher than that of the *Poverty and Parental Separation* class ( $P = .13$ ). Moreover, Black boys from both *Family Dysfunction*-related classes shared a similar probability ( $P = .17$  vs.  $P = .18$ ) of transitioning to the *Cognitive and Behavioral Dysregulation* class.

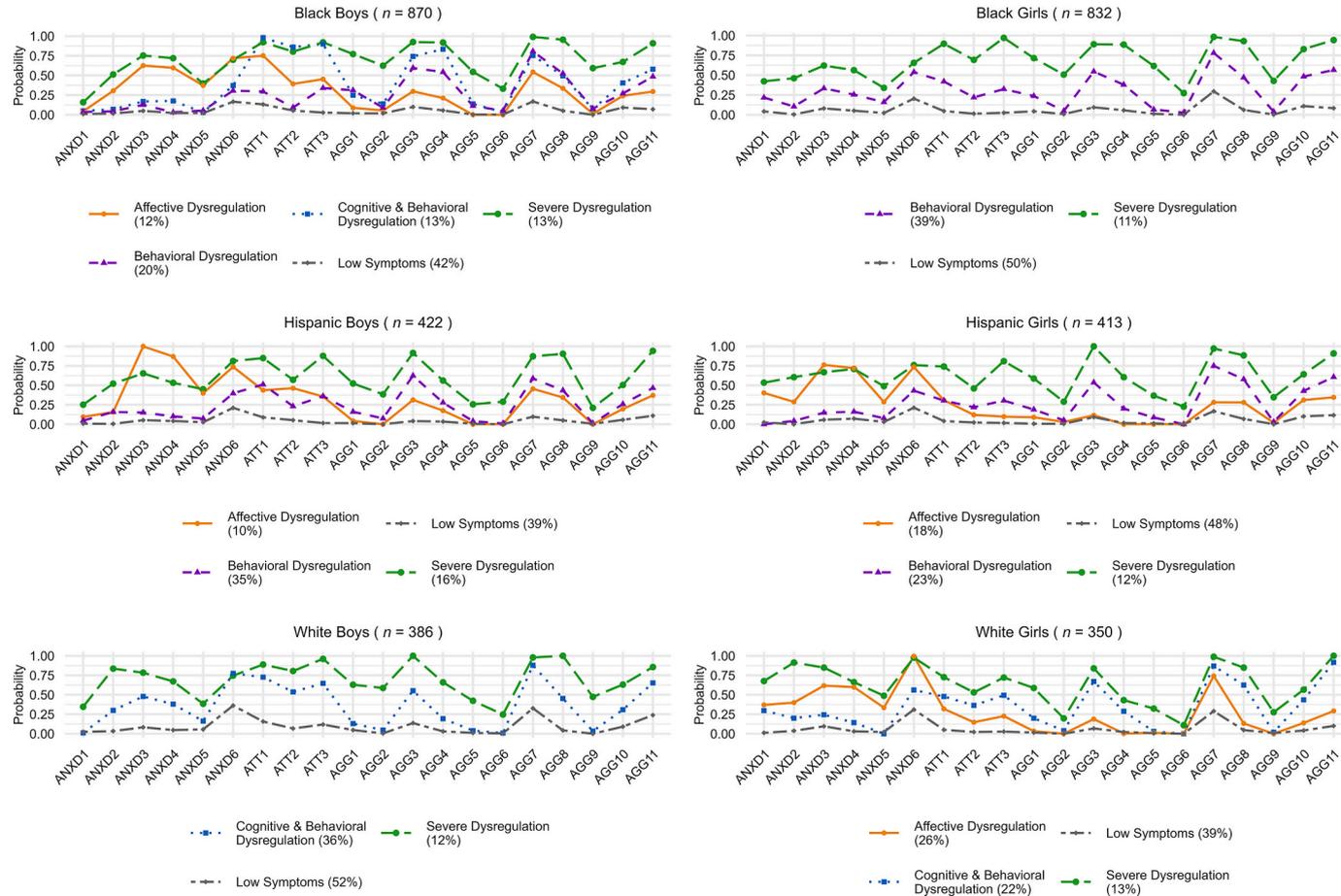
Black girls from the *Low Adversity* ( $P = .60$ ) and *Poverty and Parental Separation* ( $P = .63$ ) classes exhibited the highest probability of transitioning into the *Low Symptoms* class and the lowest probability of entering into the *Severe Dysregulation* class ( $P_s = .04$ ), compared to other ACEs classes. Conversely, Black girls from the *Family Dysfunction* class had the highest probability ( $P = .21$ ) of transitioning into the *Severe Dysregulation* class. Further, Black girls from the *Abuse and Family Dysfunction* class ( $P = .52$ ) and those in the *Poverty and Parental Separation due to Father Incarceration* class ( $P = .45$ ) were more likely to transition into the *Behavioral Dysregulation* class.

Hispanic boys, regardless of ACEs classes, exhibited relatively similar probabilities of transitioning into both the *Low Symptoms* class (ranging from .30 to .49) and the *Behavioral Dysregulation* class (ranging from .29 to .42). Boys from the *Abuse and Family Dysfunction* class had the highest probability ( $P = .29$ ) of transitioning into the *Severe Dysregulation* class, while those from the *Poverty and Maternal Low Education* class had the lowest probability ( $P = .01$ ). Interestingly, individuals from the *Poverty and Parental Separation* class had a transition probability of .17 into the *Severe Dysregulation* class.

Hispanic girls across all ACEs classes had the highest probabilities (ranging from .29 to .61) of transitioning into the *Low Symptoms* class within each respective ACEs class, except for those from the *Family Dysfunction* class. Hispanic girls from the *Family Dysfunction* class were most likely ( $P = .43$ ) to transition into the *Behavioral Dysregulation* class. Transition probabilities into the *Severe Dysregulation* class were comparatively low for both the *Maternal Substance Use* ( $P = .06$ ) and *Poverty and Maternal Low Education* ( $P = .05$ ) classes. However, individuals from the *Polyvictimization in 2-Parent Household* class had a .25 probability of developing *Severe Dysregulation*, which is comparable to those from the *Family Dysfunction* class ( $P = .21$ ).

White boys from the *Abuse and Family Dysfunction* class and *Poverty and Parental Separation* classes had relatively similar probabilities ( $P = .22$  vs.  $P = .23$ ) of transitioning into the *Severe Dysregulation* class. Of note, the latter was the highest compared to other race/ethnicity and gender subgroups from the same ACEs class. Interestingly, White boys from the *Maternal Substance Use* class had the lowest probability ( $P = .05$ ) of transitioning into the *Severe Dysregulation* class and the highest probability of transitioning into the *Low Symptoms* class ( $P = .58$ ).

Finally, White girls from the *Abuse and Family Dysfunction* class transitioned into the *Severe Dysregulation* class at a rate ( $P = .34$ )



**Fig. 2.** Estimated item-response probabilities and class prevalence for the selected dysregulation models by race/ethnicity and gender. ANXD1 = Child cries a lot, ANXD2 = Child feels worthless or inferior, ANXD3 = Child is nervous, high-strung, or tense, ANXD4 = Child is too fearful or anxious, ANXD5 = Child feels too guilty, ANXD6 = Child worries, ATT1 = Child can't concentrate, or can't pay attention for long, ATT2 = Child can't sit still; is restless or hyperactive, ATT3 = Child is impulsive or acts without thinking, AGG1 = Child is cruel, bullies, or shows meanness to others, AGG2 = Child destroys things belonging to the family or others, AGG3 = Child is disobedient at home, AGG4 = Child is disobedient at school, AGG5 = Child gets in many fights, AGG6 = Child physically attacks people, AGG7 = Child is stubborn, sullen, or irritable, AGG8 = Child has temper tantrums or a hot temper, AGG9 = Child threatens people, AGG10 = Child is unusually loud, AGG11 = Child argues a lot.

**Table 1**

Latent transition probabilities from ACEs classes (by age 9) to emotion dysregulation phenotypes (age 15) by race/ethnicity and gender.

ACEs Classes	Emotion Dysregulation Phenotypes				
<b>Black Adolescent Boys (n = 870)</b>	SD (13%)	CBD (13%)	AD (12%)	BD (20%)	LS (42%)
Family Dysfunction (15%)	.20	.18	.17	.22	.23
Abuse & Family Dysfunction (15%)	.22	.17	.09	.23	.28
Poverty & Parental Separation (42%)	.13	.11	.13	.22	.42
Poverty (28%)	.05	.13	.09	.15	.59
<b>Black Adolescent Girls (n = 832)</b>	SD (11%)	BD (39%)	LS (50%)		
Family Dysfunction (9%)	.21	.37	.42		
Abuse & Family Dysfunction (17%)	.19	.52	.30		
Poverty & Parental Separation due to Incarceration (19%)	.21	.45	.35		
Poverty & Parental Separation (46%)	.04	.33	.63		
Low Adversity (9%)	.04	.36	.60		
<b>Hispanic Adolescent Boys (n = 422)</b>	SD (16%)	AD (10%)	BD (35%)	LS (39%)	
Abuse & Family Dysfunction (23%)	.29	.06	.36	.30	
Poverty & Parental Separation (38%)	.17	.12	.34	.38	
Maternal Substance Use (21%)	.13	.01	.42	.43	
Poverty & Maternal Low Education (18%)	.01	.22	.29	.49	
<b>Hispanic Adolescent Girls (n = 413)</b>	SD (12%)	AD (18%)	BD (23%)	LS (48%)	
Family Dysfunction (26%)	.21	.11	.43	.25	
Poverty & Maternal Low Education (50%)	.05	.18	.15	.61	
Maternal Substance Use (14%)	.06	.23	.13	.58	
Polyvictimization in 2-Parent Household (11%)	.25	.26	.19	.29	
<b>White Adolescent Boys (n = 386)</b>	SD (12%)	CBD (36%)	LS (52%)		
Abuse & Family Dysfunction (21%)	.22	.44	.34		
Poverty & Parental Separation (23%)	.23	.23	.54		
Maternal Substance Use (56%)	.05	.37	.58		
<b>White Adolescent Girls (n = 350)</b>	SD (13%)	CBD (22%)	AD (26%)	LS (39%)	
Abuse & Family Dysfunction (12%)	.34	.30	.09	.27	
Poverty & Parental Separation (31%)	.16	.29	.21	.35	
Maternal Maladjustment (15%)	.17	.12	.32	.40	
Maternal Substance Use (32%)	.01	.15	.40	.44	
Poverty & Psychological Abuse (10%)	.13	.29	.09	.50	

Note. ACEs = adverse childhood experiences, SD = Severe Dysregulation, CBD = Cognitive and Behavioral Dysregulation, AD = Affective Dysregulation, BD = Behavioral Dysregulation, LS = Low Symptoms.

more than 33% higher than those from the *Maternal Substance Use* class ( $P = .01$ ). Notably, 50% of the White girls from the *Poverty and Psychological Abuse* class transitioned into the *Low Symptoms* class. Approximately 40% of adolescents from the *Maternal Substance Use* class transitioned into the *Low Symptoms* and *Affective Dysregulation* class, respectively.

#### 4. Discussion

To our knowledge, this study is the first to investigate how latent patterns of ACEs occurring before age 9 relate to multiple domains of emotion dysregulation at age 15 using an intersectional framework that incorporates race/ethnicity and gender. Leveraging an innovative latent transition mixture analysis and data from a large, nationally representative U.S. birth cohort, this research extends prior work by examining variations across six population groups defined by race/ethnicity and gender. In doing so, we uncovered significant heterogeneity in the patterning of both ACEs and emotion dysregulation and identified group-stratified associations between ACEs patterns and subsequent emotion dysregulation phenotypes.

##### 4.1. Adverse childhood experiences patterns across intersectionality groups

Using a person-centered approach, LCA, and an intersectional framework, we identified different numbers of ACEs classes across six groups. Specifically, we identified 3 distinct classes for White boys; 4 classes for Black boys, Hispanic boys, and Hispanic girls; and 5 classes for Black girls and White girls. These findings underscore the pressing need to employ intersectional and mixture modeling approaches to further unpack the complex, and apparently highly nuanced nature, of how early life experiences are patterned in children.

Similar to prior studies either using the same FFCWS data or other national survey data, we found that economic hardship and parental divorce or separation were the two most prevalent types of ACEs among American children (J. L. Crouch et al., 2000; Hunt et al., 2017; Zhang et al., 2023; Zhang & Monnat, 2022). This high prevalence was represented in three distinct classes, with *Poverty*

and *Parental Separation* being the most commonly observed class across five race/ethnicity and gender groups and the largest within each racialized group. *Abuse and Family Dysfunction* also frequently emerged in 5 out of 6 groups except for Hispanic girls. This class configuration suggests a high co-occurrence of ACEs, reinforcing a phenomenon observed in several past studies (for a review, see Wang et al., 2023). Notably, the proportions of individuals within each class varied widely across groups, with a larger proportion of Black and Hispanic children falling into the *Abuse and Family Dysfunction* class. Taken together, these two findings mirror prior evidence that racialized children are more likely to experience socioeconomic adversity and ACEs than their White counterparts (E. Crouch et al., 2017; Mersky et al., 2023; Zhang & Monnat, 2022).

Next, we found that *Family Dysfunction* emerged in three groups: Black boys, Black girls, and Hispanic girls. Additionally, *Maternal Substance Use* was notably prevalent among White children in our sample (boys: 56%; girls: 32%), which is consistent with prior research (e.g., Hunt et al., 2017). In contrast, although some studies on LCA of ACEs have commonly found a *Low Adversity* class (Liu et al., 2018; Zhang & Monnat, 2022), our study found only a small proportion of Black girls (9%) in this class. Perhaps these discrepant findings are partly due to the lack of consistency in the comparison groups across studies, as prior research has primarily examined racial/ethnic differences in class membership without attending to the simultaneous and intersecting effects of gender. Finally, we identified several distinct classes unique to specific subgroups. For example, we found a *Maternal Maladjustment* class among White girls, characterized by high endorsement of maternal substance use and depression.

#### 4.2. Emotion dysregulation patterns across intersectionality groups

In terms of emotion dysregulation, we found high levels of heterogeneity across multiple domains, as assessed by the three AAA scales of the CBCL. This heterogeneity was reflected in the consistent identification of two classes: a *Severe Dysregulation* class (11–16% across subgroups), characterized by elevated levels in all three domains, and another class that included adolescents with low symptoms. These classes were consistently observed across all six race/ethnicity and gender groups, suggesting that these patterns may be culturally universal (Bianchi et al., 2017, 2022; Jordan et al., 2016; Rescorla et al., 2021). For instance, the *Severe Dysregulation* class in our study corresponds to the *Dysregulation Profile/CBCL-DP*, first described by Althoff et al. (2010). This class has since been observed in a wide range of countries, with prevalence rates in community samples ranging from 1% to 26% (Jordan et al., 2016; Rescorla et al., 2021). Further, consistent with prior studies (Basten et al., 2013; Bianchi et al., 2017; De Caluwé et al., 2013), we identified other subtypes of dysregulation. Given that different forms of dysregulation are related to different health outcomes (Althoff et al., 2010; McQuillan et al., 2018) and often require distinct treatment or prevention efforts depending on their severity and nature, our findings provide valuable insights for tailoring prevention and intervention strategies aimed at addressing the diverse challenges faced by adolescents.

#### 4.3. Effects of ACEs on emotion dysregulation across intersectionality groups

Our third aim was to examine the impact of ACEs classes on emotion dysregulation phenotypes. This investigation responds to the call for research into the risk factors of emotion dysregulation (Caro-Cañizares et al., 2015). Our study advanced this line of inquiry by examining the differential effects of ACEs patterns by age 9 on subsequent emotion dysregulation at age 15 across six race/ethnicity and gender groups. Although we observed variations in transition probabilities from ACEs classes to adolescents' dysregulation phenotypes by the types of ACEs and race/ethnicity and gender, the findings were mixed. Five key findings emerged from our analysis that warrant further discussion.

First, not all adolescents experiencing ACEs are uniformly impacted. Our findings reveal that the likelihood of children transitioning into the *Low Symptoms* class within each ACEs class was not consistently the lowest across all emotion dysregulation phenotypes. This suggests the presence of a subgroup of adolescents who, despite encountering ACEs, report low levels of dysregulation symptoms. These results are consistent with resiliency theory, which describes why some children achieve favorable health outcomes despite facing adversity (Southwick et al., 2014). Resiliency theory, grounded in ecological frameworks, emphasizes a strengths-based approach and highlights two types of promotive factors—assets and resources—that help individuals mitigate some of the negative effects of adversity (Fergus & Zimmerman, 2005). This perspective suggests that some adolescents might possess psychophysiological toughness (Gilbert et al., 1998) and adopt a positive appraisal of adverse events (Dienstbier, 1989), thereby shielding themselves from the harmful impacts of adversity. Consistent with prior research, these youths may benefit from support systems, such as informal mentors, which have been shown to mitigate the effects of stress (Gowdy et al., 2020; Zhang, 2022). Our findings are consistent with established resilience research in child psychiatry, which has long demonstrated that not all children exposed to adversity develop stress-related disorders (Seery et al., 2010). Importantly, the present data extend this body of work by underscoring the necessity of adopting a person-centered approach, thereby challenging the dominance of variable-centered approaches in ACEs research, which often assumes that the average effect of a variable applies uniformly to all individuals, a critical limitation highlighted by Howard and Hoffman (2018).

The next two notable findings support several theories of adversity and health, including the dimensional model of adversity and psychopathology, as well as Social Safety Theory. Our second key result reveals that children in the *Poverty and Parental Separation* and the *Poverty and Maternal Low Education* class exhibited the highest probabilities of transitioning to the *Low Symptoms* class compared to other dysregulation classes within each ACEs class. This suggests that deprivation stemming from low income and low maternal education, which reflects low-resource environments with limited social supports, may be less detrimental to adolescent psychopathology than threat-based adversity, which will be discussed below (McLaughlin et al., 2014; Sheridan & McLaughlin, 2014).

In addition to the findings on deprivation-based adversity, our third notable result pertains to the relatively high probabilities

observed among adolescents in the *Abuse and Family Dysfunction* class for transitioning into the *Severe Dysregulation* class, with probabilities ranging from .19 (Black girls) to .34 (White girls). This class was characterized by threat-based adversities, including psychological and physical abuse, as well as other forms of family dysfunction. This finding aligns closely with the dimensional model of adversity and psychopathology (McLaughlin et al., 2014; Sheridan & McLaughlin, 2014) and Social Safety Theory (Slavich, 2020, 2022; Slavich et al., 2023; Tsomokos & Slavich, 2024), both of which posit that frequent exposure to *threatening* experiences significantly impacts the development of regulatory processes, thereby heightening vulnerability to psychopathology, as evidenced by *Severe Dysregulation* in our study. These high transition probabilities can be further explained by the mechanisms through which threat-based adversities shape neurobiological and psychosocial development. Prolonged exposure to abuse and family dysfunction can chronically engage stress response systems, such as the hypothalamic-pituitary-adrenal (HPA) axis and the autonomic nervous system, leading to alterations in emotion regulation and impulse control (Slavich et al., 2010; Teicher et al., 2016; Teicher & Samson, 2016). Additionally, these experiences may disrupt the development of a secure caregiver attachment that impairs adolescents' ability to seek and receive support (Cicchetti, 2016).

Fourth, we found that White girls had the highest probability ( $P = .34$ ) of transitioning from the *Abuse and Family Dysfunction* class to the *Severe Dysregulation* profile compared to all other groups. Substantively, this suggests that White girls may be more vulnerable to these adversities than racialized children, providing some support for the differential vulnerability hypothesis, which has generally received less attention in the stress and health research (Kessler, 1979). In contrast, the relatively lower possibilities of this transition among Black and Hispanic children might be explained by the stress-habituation hypothesis, which posits that chronic and prolonged stress exposure among racialized children may lead to desensitization or a reduced response to stress (Y. J. Kim et al., 2019).

In our study, this phenomenon is reflected in lower transition probabilities observed among these groups. Our findings are consistent with recent studies indicating that racialized youth report fewer post-traumatic stress symptoms than their White counterparts, even when exposed to higher rates of adversity (Herd et al., 2023). Additionally, our results indicate gender differences in the probability of transitioning from the *Abuse and Family Dysfunction* class to the *Severe Dysregulation* class among White but not Black participants. A prior study that identified gender differences in internalizing symptomatology might lend some support to this finding (Rosenfield et al., 2006); however, future research is warranted, particularly given the small sample size of Black boys in that study.

Lastly, Black children and Hispanic girls from the *Family Dysfunction* class—characterized by poverty, parental separation, and maternal substance use—also exhibited high probabilities of transitioning to the *Severe Dysregulation* class, with no differences observed across the intersecting race/ethnicity and gender groups. These findings challenge the graded dose-response relationship proposed by cumulative risk models of ACEs, which typically suggest that a higher number of ACEs correlates with worse health outcomes. Interestingly, despite the *Family Dysfunction* class having fewer ACEs than the *Abuse and Family Dysfunction* class, the likelihood of transitioning to *Severe Dysregulation* was comparable and observationally higher for Black girls. This higher probability may suggest the profound impact of maternal maladjustment, particularly maternal substance use, on emotion regulation for Black girls (Lander et al., 2013).

These findings differ from a prior study, which found that child maltreatment, but not family dysfunction, predicted children's socioemotional problems in a racially and ethnically diverse, small sample of mother-child dyads living in emergency homeless shelters (Narayan et al., 2017). This discrepancy may be attributed to the fact that the authors did not examine these relations by race, given the small sample size ( $N = 95$ ), which may have obscured the findings. Notably, the sole *Maternal Maladjustment* class identified among White girls also showed a comparable probability ( $P = .17$ ) of transitioning to the *Severe Dysregulation*. Taken together, these findings suggest that the specific nature of ACEs may be more influential than their quantity, highlighting the synergistic effects of certain ACEs (Briggs et al., 2021). This underscores the importance of adopting a person-centered and intersectional framework to uncover nuances that might otherwise remain undetected.

#### 4.4. Strengths and limitations

This study has several strengths, including its use of data from a large, prospective American birth cohort; use of latent transition mixture analysis to examine the relation between ACEs patterns during childhood and subsequent dysregulation phenotypes in adolescence; and incorporation of an intersectional framework to investigate how ACEs-dysregulation patterns might differ by race/ethnicity and gender. However, several limitations should also be noted. First, the use of secondary data prevented us from including other ACE indicators, such as sexual abuse, as well as other sources of reports for certain ACEs, such as maltreatment. Additionally, our use of a conservative threshold for maltreatment, chosen to minimize potential racial bias and maintain consistency with prior research, may have led us to underestimate the prevalence of maltreatment. Second, we did not include other adverse experiences that could lead to emotion dysregulation, such as peer bullying (Afifi et al., 2019; Afifi, Taillieu, et al., 2020; Slavich et al., 2019; Tsomokos & Slavich, 2024), because our interest was on the impact of children's familial ACEs on adolescents' dysregulation. Third, FFCWS only used a subset of CBCL items; we thus recommend that future research use the full scale to assess the replicability of our findings. Additionally, although these items were originally measured using a 3-point Likert scale, they were dichotomized to facilitate interpretation and compare findings with prior studies, resulting in some information loss.

Fourth, although our analysis leveraged data from a large, national urban birth cohort, the sizes of the analytic subgroups were reduced when adopting an intersectional approach. However, our approach enabled us to more accurately identify subpopulations at greater risk for severe dysregulation, which can provide evidence for targeted prevention and treatment strategies. Moreover, the exploratory nature of LCA, coupled with the nature of our sample, predominantly comprising children who grow up in low-income and single-parent households, may further limit the generalizability of our findings. Given these limitations, we encourage additional research to determine whether our findings are sample-specific or if they replicate (Bauer & Curran, 2004).

#### 4.5. Conclusion

Notwithstanding these limitations, the present study is, to our knowledge, the first to use longitudinal data to characterize how ACEs patterns before age 9 predict adolescents' dysregulation phenotypes at age 15, employing both innovative modeling approaches—latent class and latent transition analyses—and an intersectional theoretical framework. Our novel findings underscore the critical importance of adopting these approaches, as they revealed important differences in early life stress exposure, differential vulnerability, and habituation across race/ethnicity and gender that traditional models would otherwise obscure. Our results also underscore the necessity of adopting a strength-based and trauma-informed perspective to understand the influence of ACEs on dysregulation (Dooley et al., 2017). Although we acknowledge that ACEs are common and harmful, we advocate for further investigation into *what hurts whom* by employing mixture modeling and an intersectional theoretical framework. Findings from these approaches can broaden our understanding of the complex effects of ACEs on adolescents, thereby facilitating the development of more tailored interventions and prevention strategies.

Looking forward, additional research is needed to investigate specific cultural factors contributing to underlying cross-group differences, as this could enhance the effectiveness of tailored interventions. For instance, the relatively lower probabilities of transitioning from the *Abuse and Family Dysfunction* class to *Severe Dysregulation* among Black children compared to White girls might be attributed to family resilience, which has been shown to mediate the relation between abuse and functioning more strongly among Black children than White children (Goldstein et al., 2021). Given that past research suggests potential race/ethnicity and gender differences in stress reactivity (Alley et al., 2025; Malat et al., 2017; Mengelkoch et al., 2023, 2024; Slavich & Sacher, 2019; Toussaint et al., 2022), future research should also elucidate the biological processes linking ACEs, dysregulation, and health.

#### CRedit authorship contribution statement

**Xiaoyan Zhang:** Writing – review & editing, Writing – original draft, Visualization, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Gabriel J. Merrin:** Writing – review & editing, Visualization, Methodology. **George M. Slavich:** Writing – review & editing, Supervision, Conceptualization.

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#### Declaration of competing interest

The authors have no conflicts of interest to report.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chiabu.2024.107129>.

#### Data availability

The current manuscript uses publicly available data from the Future of Families and Child Wellbeing Study, which can be downloaded at: <https://ffcws.princeton.edu/>.

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