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ACEs and Substance use: Understanding the Influence of Childhood Experiences on Substance Use in Adolescence across Race and Ethnicity

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ABSTRACT

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Adverse Childhood Experiences (ACEs) affect numerous outcomes in adulthood, but relatively few studies examine their implications for adolescents. Understanding the effects of ACEs is important since adolescent behaviors affect subsequent life course milestones and transitions. One area of the ACEs research that is deficient involves adolescent substance use. In addition, there is a paucity of studies addressing whether the association between ACEs and substance use differs by race/ethnicity. Using data from the Fragile Families and Child Wellbeing Study, this study aims to fill these gaps by (a) examining whether adolescents who experience more ACEs tend to be at higher risk of alcohol and marijuana use; and (b) whether the association between ACEs and these forms of substance use differs among White, Black, and other racial/ethnic youth**.** The results show that, among Black youth, ACEs tend to affect alcohol and marijuana use at high levels (four or more). Among White youth, this association is limited to marijuana use. Nonetheless, age and peer substance use appear to have more consequential effects on the odds of alcohol and marijuana. The findings suggest that additional research is warranted, but that ACEs should be a focus of research on adolescent substance use.

Keywords: adverse childhood experiences (ACEs), delinquency, substance use, race/ethnicity

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INTRODUCTION

Stress influences many health and behavioral outcomes throughout life (Bruns and Geist 1984; Chaplin, Niehaus, and Gonçalves 2018; Duncan 1977; Mersky, Topitzes, and Reynolds 2013; Nurius et al. 2016). The life course approach, also known as life course theory, examines events in life and how these events affect life decisions, outcomes or life course trajectories (Elder, Johnson, and Crosnoe 2003). Life course theory offers a way to understand the impact stress has on individuals throughout their lives. Responses to stress can either be normative or dysregulated, and these patterns of dealing with stress are established early in the life course. A normative response to stress allows an individual to control negative emotions and harness them in a way that is beneficial rather than detrimental. A dysregulated response, though, involves not controlling the negative emotions produced by stress, which leads to a detrimental coping mechanism, such as substance use (Chaplin and Aldao 2013; Koss and Gunnar 2018; Teicher and Samson 2016; Whittle et al. 2013).

One method researchers have used to measure stress and its effects on a variety of outcomes is by examining adverse childhood experiences (ACEs). ACEs are stressful experiences such as sexual, physical and emotional abuse, physical and emotional neglect, being exposed to violence in the home, living with someone with a mental illness, parental separation or divorce, parental incarceration, and household alcohol or illicit substance use problems that are experienced by individuals between the ages of 0-18 (Felitti et al. 1998). Studies have shown that exposure to certain ACEs during childhood is associated with several health, psychiatric, and behavioral problems in adolescence and adulthood (Dube et al. 2003; Felitti et al., 1998).

Among the outcomes affected by ACEs is substance use. Consistent with the general stress literature, individuals who experience stressful life events may cope by using substances

such as alcohol, marijuana, and other illicit drugs (Chaplin and Aldao 2013). Researchers have found that ACEs influence substance use problems during adulthood (Chatterjee et al. 2018; Dube et al. 2006). ACEs have also been implicated in the comorbidity between substance use disorders and other mental health disorders, as well as physical health problems and diminished quality of life (Merrick et al. 2017; Wu et al. 2010).

Numerous studies on stressors during adolescence and substance use exist, but few studies have examined the influence of ACEs during childhood on adolescent substance use. Yet it is important to study adolescent behaviors because this is a period of substantial growth during which neurological development, physical development, and human capital acquisition occur. It is also a period where life-long habits begin, such as alcohol and cigarette use (Chambers, Taylor, and Potenza 2003; Elo & Preston 1992; Schafer, Ferraro, and Mustillo 2011). The scarce research concerning ACEs and adolescent substance use show that traumatic and stressful childhood events increase the likelihood of adolescent risk behaviors (Anda et al. 1999; Dube et al. 2006; Duke 2018; Fagan and Novak 2018).

Research has also observed differences in substance use behaviors by race and ethnicity (Kann et al. 2016; Keyes et al. 2015; Lee and Chen 2017; Wallace et al. 2002). Given that racial/ethnic minorities in the United States face more discrimination than Whites (Reskin 2012), are at increased risk of poverty, and may experience more child abuse and neglect (Darity 2005; Su et al., 2015), racial/ethnic minorities may experience more ACEs and worse lifetime outcomes when compared to White adolescents. Other research suggests, however, that Whites report some forms of ACEs and substance use outcomes more often than racial/ethnic minorities (Baglivio and Epps 2016; DeLisi et al. 2017; Lee and Chen 2017; Perez, Jennings, and Baglivio 2016).

Because there are racial/ethnic differences in the prevalence of substance use and ACEs, research should examine whether ACEs affect adolescent substance use differently among non-Hispanic White, non-Hispanic Black and other youth. This study addresses these issues by using the Fragile Families and Child Wellbeing Study (FFCW) to examine the influence of ACEs on adolescent substance use and whether their influence varies by the race/ethnicity of the adolescent.

BACKGROUND

Stress and Adverse Childhood Experiences

Stressful life events influence several health and behavioral outcomes throughout the life course (Bruns and Geist 1984; Chaplin et al. 2018; Duncan 1977; Mersky et al. 2013; Nurius et al. 2016). The stressful experiences an individual is exposed to during childhood can influence how individuals cope with stress later in life. One way to look at these influences is through life course framework, or life course theory. Life course theory provides a way to understand different sociological phenomena, such as social change, structural contexts, and stressors, that influence individuals throughout their lives (Elder et al. 2003). The principle of continual change, an aspect of life course theory, suggests that events in individuals' childhoods, such as experiences, transitions, or socioeconomic strains have long-term effects on educational, health, and other trajectories for the rest of their lives (Dannefer 2011; Elder et al. 2003; Jones et al. 2018). A single stressful experience may not affect one's overall life trajectory, but experiencing regular stress or adversity during early childhood might result in detrimental outcomes throughout the life course (Ackerman, Brown, and Izard 2004).

Experiencing any form of stress triggers a stress response system that can be normative or dysregulated. An example of a normative response to stress is studying for a test that is stressful,

whereas a dysregulated response is to avoid studying or the test in response to the stress. A dysregulated stress response includes either high reactivity or low/blunted reactivity to a certain stressor. High reactivity is presented by high negative emotions such as increased levels of depression and anxiety. Low reactivity is presented by low negative emotions such as sadness and fear (Chaplin et al. 2018). Often these ways of dealing with stress begin in childhood. A dysregulated stress response in adulthood may have developed in early childhood because of repeated uncontrollable and chronic stressors. These stressors can include child abuse or neglect, negative parenting, or stressful environments such as living in a dangerous neighborhood or experiencing low socioeconomic status (Chaplin et al. 2018; Koss and Gunner 2018: Teicher and Samson 2016; Whittle et al. 2013). These stressful events in childhood can lead individuals to cope in a problematic way by affecting healthy brain development and increasing the vulnerability for self-medicating with illicit substance use in adulthood (Anda et al. 1999; Brown and Shillington 2017; Chaplin et al. 2018; Chatterjee et al. 2018).

In a seminal article, Vincent J. Felitti and his colleagues (1998) examined the impact of early stressors on adult outcomes. They studied certain childhood stressors that they termed adverse childhood experiences, or ACEs, such as abuse, neglect, household dysfunction, and exposure to violence and crime (Felitti et al. 1998). Their research encouraged numerous subsequent studies of ACEs. This research finds that, on average, two-thirds of adults report experiencing one ACE during childhood, while 25 percent report experiencing three or more (Dube et al. 2003; Felitti et al. 1998; Ports, Ford and Merrick 2016; Whitfield et al. 2003). In fact, due to the interrelatedness of ACEs, experiencing one ACE increases the likelihood of experiencing multiple ACEs (Dong et al. 2004; Felitti et al. 1998). There is also a significant dose-response form between ACEs and negative life outcomes: more exposure to early

childhood adversity is associated with an increased risk of chronic and early drug use, risky sexual behaviors, and mental illnesses such as psychological distress and post-traumatic stress and depression (Anda et al. 2006; Chapman et al. 2004; Dube et al. 2003; Felitti et al. 1998, Jones et al. 2018). ACEs can have long term detrimental effects, including negative psychological, emotional, and behavioral outcomes during adolescence and adulthood (Brown & Shillington 2017; Dube et al. 2006; Felitti et al. 1998). Additionally, greater exposure to ACEs increase the risk of detrimental physical health outcomes such as autoimmune, liver, pulmonary and coronary diseases (Anda et al. 2008; Felitti et al. 1998). They also increase the risk of mortality over the entire life course (Anda et al. 2008; Dong et al. 2003; Dong et al. 2004; Dube et al. 2009; Felitti et al. 1998). Moreover, an increase in ACEs exposure also influences adult mental health. Indeed, when compared to individuals with no ACEs, individuals who are exposed to two or more ACEs report poorer overall health, low life satisfaction, more frequent depressive symptoms, and a higher risk of anxiety (Anda et al. 2006; Chapman et al. 2004; Mersky et al. 2013).

The Importance of Examining the Effects of ACEs during Adolescence

ACEs research focuses primarily on outcomes that occur during adulthood, usually during mid-life. Based on principles established in the life course theory, human development and aging continue throughout the entirety of one's life. Because of this principle, it is also important to examine adolescence because it is a time of rapid growth for individuals that affects their long-term trajectories. Many fundamental changes occur during childhood and adolescence (Dannefer 2011; Elder et al. 2003; Jones et al. 2018). The timing and duration of exposure to ACEs during the first five years of life are important to consider as these stressors affect the future health and development of an individual (Fine and Kotelchuck 2010). For instance, studies

demonstrate that ACEs during childhood are associated with poor general health, more doctor visits, sleep problems, emotional problems, and delinquent behavior during adolescence (Balistreri and Alvira-Hammond 2016; Fagan and Novak 2018; Flaherty et al. 2013).

The Influence of ACEs on Adolescent Substance Use

Adolescence is a period in the life course during which individuals are at risk of developing substance use behaviors. Research shows that substance use normally begins and increases during adolescence. Individuals with early initiation of substance use, around the ages of 12 to 14, are at risk for numerous detrimental outcomes later in life. These include longevity of substance use, substance use disorders in adulthood, psychological problems, health problems, suicide, morbidity and mortality as well as impaired brain development (Chaplin et al. 2018; Chassin, Pitts, and Prost 2002; Chatterjee et al. 2018; Moss, Chen, and Yi 2014; Squeglia et al., 2011; Windle et al. 2008).

Few studies have addressed ACEs and adolescent substance use and most have relied on retrospective data. Yet, these studies show that traumatic and stressful childhood events increase the likelihood of adolescent risk behaviors (Anda et al. 1999; Dube et al. 2006; Duke et al. 2010; Fagan and Novak 2018). Greater exposure to ACEs contribute to an increased risk of tobacco, alcohol, and other forms of illicit substance use early and these increase the likelihood of substance use disorders in adulthood (Anda et al. 1999; Dube et al. 2003; Dube et al. 2006; Fagan and Novak 2018; Mersky et al. 2013). For example, children who are living in a stressful environment, such as with a parent or guardian who abuses substances, are at a greater risk of using abuse substances themselves in adolescence (Brown and Shillington 2017). As a young child is exposed to adverse childhood experiences, a dysregulated stress response pattern may become ingrained. As children then transition into adolescence they are confronted with more

stressful changes biologically and in their environment. These changes can trigger the dysregulated stress response that was formed during early childhood and, in order to cope with these new stressors, adolescents may start using substances (Anda et al., 1999; Chambers et al. 2003; Chaplin et al. 2018).

Alcohol and marijuana are two of the most commonly used substances by adolescents in the U.S. (Chatterjee et al. 2018). In addition, beginning substance use in early adolescence increases the risks for detrimental outcomes later in life (Chaplin et al. 2018; Chassin et al. 2002; Chatterjee et al. 2018; Duke 2018; Moss et al. 2014; Squeglia et al. 2011; Windle et al. 2008). Research regarding ACEs and adolescent alcohol intake estimate that ACEs may account for a 20 to 27 percent increase in likelihood of alcohol initiation by age 14 (Dube et al. 2006; Duke 2018). Although research shows a relationship with alcohol initiation, studies on the impact of ACEs on marijuana and other illicit substances are rare. A recent study, however, finds that ACEs such as household dysfunction and food/housing hardship are associated with early initiation of alcohol and marijuana use (Duke 2018). The present study contributes to this literature in the literature by examining the effects of ACEs on adolescent alcohol and marijuana use.

Racial Differences in ACEs and Adolescent Substance Use

This study also aims to expand ACEs research by addressing differences by race/ethnicity. Studies focusing on substance use by race/ethnicity find that White adolescents report more alcohol use than Black adolescents; however, Black adolescents report more marijuana use than White adolescents (Kann et al. 2016; Keyes et al. 2015; Lee and Chen 2017; Wallace et al. 2002). Even though research shows racial/ethnic minorities may consume less alcohol than White youth, they are at a greater risk of experiencing substance abuse or

dependence in adulthood (Lee and Chen 2017; Mulia et al. 2009; Witbrodt et al. 2014; Zapolski et al. 2014).

Research regarding differences in ACEs by race/ethnicity is sparse. A few studies find that racial/ethnic minority adolescents experience more ACEs than White adolescents (Cronholm et al. 2015; Duke et al. 2010; Lee and Chen 2017). However, studies with data from a high-risk sample of adolescents show that White adolescents actually have a highest mean level of ACEs (Baglivio and Epps 2016; DeLisi et al. 2017; Perez et al. 2016). Even so, other studies find that racial/ethnic differences between ACEs are based more on specific ACEs rather than cumulative ACEs (Hunt, Slack, and Berger 2017; Schilling, Aseltine and Gore 2007). For example, Black adolescents are more likely to experience child maltreatment and parental incarceration; White adolescents are more likely to experience parental substance abuse (Hunt et al. 2017). Due to racial segregation and discrimination, people of color are disproportionately exposed to poverty and stressful environments that may magnify the influence of ACEs (Lee and Chen 2017; Umberson et al. 2014). Poverty is highly correlated with child abuse and neglect (Su et al. 2015). As mentioned, socioeconomic status as well as child abuse and neglect are stressful life circumstances and are deemed ACEs (Felitti et al. 1998).

In addition, research examining racial differences in ACEs tends to focus on male adolescents, young adults who are currently incarcerated, or juvenile delinquents and address whether ACEs are associated with their criminal activities (DeLisi et al. 2017; Sampson, Morenoff, and Raudenbush 2005). Yet, research on ACEs and adolescent substance use is rare.

One of the few studies examining the effects of ACEs on substance use by race/ethnicity determine that the effects of ACEs are stronger among White than among Black adolescents. Moreover, White adolescents report the highest level of substance use (Schilling et al. 2007).

Schilling et al. (2007) also find that ACEs are associated with substance use among White adolescents only, and that White adolescents with four ACEs score one standard deviation higher on drug use when compared to White adolescents who report experiencing no ACEs. In order for Black and Hispanic adolescents to report the same increase in substance use, they would have had to experience more than 20 ACEs. Another study, however, finds that as Black adolescents experience more ACEs, the likelihood of alcohol and marijuana use increases (Fagan and Novak 2018).

THE CURRENT STUDY

Since few studies examine whether ACEs affect adolescent substance use, with fewer still examining racial/ethnic differences, it is clear that more research is needed. The current study, therefore, contributes to the research on ACEs and adolescent substance use and whether there are racial/ethnic differences in their association. The analysis is guided by the following research questions:

Question 1. Are adolescents who report more ACEs likely to report more substance use behaviors?

Question 2. Do the effects of ACEs on adolescent substance use vary by race/ethnicity?

DATA AND METHODS

Data

Data for this study are from the Fragile Families and Child Wellbeing Study (FFCW), a population-based longitudinal study comprised of six waves of data collection. It started with roughly 4,700 children in 20 large cities in the US who were born between 1998 and 2000. Baseline interviews were conducted in the hospital shortly after the focal child's birth and follow up interviews have occurred after 1 year, 3 years, 5 years, 9 years, and 15 years. The 15 year

follow up took place from 2014-2017. Follow up interviews were conducted over the phone as well as during in-home assessments. The purpose of this study design is to learn more about the nature of relationships with these 'fragile families' in the US. 'Fragile Families' are generally made up of unmarried, poor, as well as minority families as they tend to have the risk factors that lead to vulnerability in the relationships of these families. Because of this, the study design uses a three-to-one sample of non-marital to marital births, which results in 3,600 non-married couples and 1,100 married couples. Thus, parents in this sample are more likely to have reduced educational attainment, low-income, minority race or ethnicity, and to be unmarried compared to the general US population.

To help understand the effect of ACEs on adolescent substance use by race, I combined baseline data with mother and father surveys at years 1, 3, 5, primary caregiver surveys from years 3, 5 and the child survey from year 15. The final sample sizes by race are: 590 non-Hispanic White adolescents, 1,601 non-Hispanic Black adolescents, and 1,074 other/Hispanic adolescents. All cases that were not in year 15 were dropped from analysis.

Adverse Childhood Experiences (ACEs)

Modeled after previous work on ACEs (Felitti et al. 1998; Hunt et al. 2017), I examined 8 ACEs for this study: physical neglect, emotional neglect, physical abuse, emotional abuse, parental substance abuse, parental incarceration, parental anxiety and/or depression, and parental interpersonal violence. ACE exposure was assessed from the focal child's birth through age 5. The measures of childhood maltreatment were taken from subscales of the Parent-Child Conflict Tactics Scale (CTS-PC**;** Straus et al. 1998). The subscale measured acts or circumstances of child maltreatment that may have occurred in 12 months preceding the time of the interview. The subscales were coded in an ordinal scale (never happened, once, twice, 3-5 times, 6-10 times, 11-

20 times, more than 20 times). To understand the degree of physical neglect, physical abuse, and emotional abuse the midpoint of each category was considered and then summed. The summed scores were recoded into a dichotomous variable indicating if a family scored in the top 10th percentile for the total number of acts toward the child.

Physical neglect was measured by asking the mother and father whether she or he "was not able to make sure (child) got the food he/she needed," "left child home alone, but thought some adult should be with him/her," "not able to make sure (child) got to a doctor or hospital when needed," and "were so drunk/high that you had a problem taking care of your child."

Emotional neglect was measured with one variable for both parents asking if they were "so caught up with your own problem that you were not able to show love to your child."

Emotional abuse was measured by asking the mother and father whether he or she had "ever swore or cursed at child," "called him/her dumb or lazy or some other name like that," "shouted, yelled, or screamed at child," "said you would send child away or would kick child out of the house," and "threatened to spank or hit child but did not actually do it."

Physical abuse was measured by asking the mother and father whether he or she had "hit child on bottom with a hard object," "shook child," "spanked him/her on the bottom with your bare hand," "slapped child on hand, arm or leg," and "pinched child."

Parental substance abuse was assessed differently for mothers, biological fathers and mothers' current partner (when applicable), with more detail collected on the mother of the focal child. For maternal substance use, 10-items were asked in years 3 and 5. These items asked the mother if they had used a variety of drugs or heavy alcohol in the past 12 months. These drugs included sedatives, tranquilizers, amphetamines, analgesics, inhalants, marijuana, cocaine, LSD, and heroine. Heavy drinking was measured by asking the mother if she had 4 or more drinks in

one day almost “every day,” “a few times a week,” or “a few times a month.” The data for biological fathers and current partners had less detail about drug and alcohol use. To determine the child’s biological father and the mother’s current partner alcohol and drug use, the mother was asked whether the biological father or current partner had “problems with job/family/friends because of alcohol/drug use” that was asked at year 1, 3, and 5. An overall dichotomous variable for parental substance abuse was created to show whether the focal child’s biological mother, biological father, or the mother’s current partner has or ever had a substance abuse problem (0=no drug or heavy alcohol use, 1=some drug and/or alcohol use).

Parental anxiety was determined by a constructed scale that assessed if the mother or biological father met anxious criteria at year 1 and/or 3 as indicated by the Composite Interview Diagnostic Interview (CIDI) (Kessler et al. 1998). Data about the mother’s current partner anxious criteria was not available. The CIDI was also used to determine whether the biological mother or biological father met depression criteria at year 1, 3 and/or 5. Again, data concerning the mother’s current partner depression criteria was not available. The CIDI is a standardized assessment of different mental disorders that contain 20 items used to measure generalized anxiety disorder as well as 15 items used to assess major depression. This scale has been found to have a strong reliability as well as validity for anxiety and depression (Patten et al. 2000; Wittchen 1994). The results were used to create a binary variable concerning any anxiety or depression (0=no caregiver anxiety or depression, 1=caregiver had anxiety and/or depression in the last 5 years).

Parental incarceration is a dichotomous variable that indicates if the biological mother, biological father of the child, or the mother’s current partner had ever spent any time in prison or jail.

Parental interpersonal violence was created from a combination of physical, emotional, and sexual violence experienced by the biological mother. Physical violence was determined if the mother was kicked, slapped, or hit with a fist or object at year 3 or 5. Emotional violence was measured with "he tried to keep you from seeing or talking with your friends or family," "he tried to prevent you from going to work or school," and "he withholds money, makes you ask for it, or takes it" at either year 3 or 5. Sexual abuse was measure whether the child's biological father or current partner "tried to make you have sex or do sexual things." If the mother reported any physical, emotional, or sexual abuse measures the dichotomous variable was coded yes (0=no, 1=yes).

These individual ACEs were then coded into a cumulative ACEs variable. If an ACE was reported at any baseline, 1-year, 3-year, and 5-year interviews, the child was assigned a 1 for that ACE. They were then summed to indicate a range from no exposure (0) to exposure to all 8 ACEs (8). Due to small sample sizes, and to be consistent with CDC-Kaiser ACE literature, ACE scores of 4 through 8 were combined into one category (4 or more) (Felitti et al. 1998).

Adolescent Substance Use

Alcohol and marijuana are used to measure substance use in this study. Respondents were asked during year 15 how many times they drank alcohol in the past 12 months (1=never, 2=1-3 days a month, 3=1 or 2 days a week, 4=3-4 days a week, 5=every day or nearly everyday). This variable was then coded into a dichotomous variable (0=never drank in past 12 months, 1=did drink in past 12 months). Respondents were also asked how often they use marijuana in the past year (1=never, 2=once a month or less, 3=2 or 3 days a month, 4=1-2 days a week, 5=3 days a week or more). This variable was also coded into a dichotomous variable (0=never used marijuana, 1=used marijuana in past year).

Race

Adolescent race is taken from a variable in the child year 15 survey. The question was open-ended for the respondent to fill in. From those responses FFCW made a variable of 5 categories: White non-Hispanic, Black non-Hispanic, Hispanic/Latino, other non-hispanic, and multi-racial non-hispanic. This variable was recoded to 3 categories (1=White, non-hispanic, 2=Black, non-hispanic, 3=other/hispanic).

Demographics

The demographic control variables that might affect the association between ACEs and substance use included child age, gender, poverty, mother/father education, and maternal marital status. Child age and gender were measured from variables taken in year 15 based on questions asked of the adolescents regarding their age (ranged from 14-19) and gender (0=male, 1=female). Poverty is measured from a variable taken at baseline which sorted families into 5 poverty levels (1=0-49%, 2=50-99%, 3=100-199%, 4=200-299%, 5=300%+). Mother and father education is taken from the baseline survey (1=less than high school, 2=high school or equivalent, 3=some college/technical, or 4=college grad). Maternal marital status with the focal child's biological father is also measured from the baseline survey (0=not married, 1=married).

Personal/Interpersonal

Several personal and interpersonal variables were also included in the analysis.

ADHD was taken at year 15. Primary caregivers were asked if the adolescents had ever been told by a health professional they had a diagnosis of attention deficit disorder (ADD) or attention deficit hyperactivity disorder (ADHD) (0=no, 1=yes).

Peer substance use was measured from 5 variables asked to the adolescent in year 15. The variables were based on questions asked that asked: "friends drank alcohol more than two

times without parents," "friends tried marijuana," "friends tried other drugs to get high," "friends ask them to go drinking with them," and "if friends sold marijuana or other drugs". These questions were coded into a 1-3 scale (1=never, 2=sometimes, 3=often). They were then added together to create one peer substance use measure ranging from 0-10 (higher scores indicated more peer substance use influence).

Parental supervision was modeled after previous work (Turney and Goldberg 2018). Three items were selected to create a parental supervision measure. The questions were asked during the year 15 survey. The adolescent was asked "how often they spend time alone in their home without an adult present" (1=often, 2=sometimes, 3=never), "primary caregiver knows what you do during your free time" and "primary caregiver knows what you spend money on" (1=never, 2=sometimes, 3=often). These were selected due to prior work with an alpha of .51. The first question was reverse coded then the variables were combined keeping the 1-3 scale.

Self-Control was measured using The Dickman Dysfunctional Impulsivity Scale (1990). The adolescent were asked in year 15 the following questions: "I will often say whatever comes into my head without thinking first," "I often make up my mind without taking the time to consider the situation from all angles," "I often get into trouble because I don't think before I act," "many times, the plans I make don't work out because I haven't gone over them carefully enough in advance," and "I often say and do things without considering the consequences" (1=strongly agree, 2=somewhat agree, 3=somewhat disagree, 4=strongly disagree). They were then reverse coded and added together to form the self-control measure (alpha of .77). Higher scores indicate more self-control.

Parent-Child closeness was modeled after De Luca, Yan and Johnston (2020). In year 15 the adolescents were asked "how close do you feel with biological mother," "how close do you

feel with biological father" (1=extremely close, 2=quite close, 3=fairly close, 4=not very close), "how well do you and your mom share ideas/talk," and "how well do you and biological father share ideas/talk" (1=extremely close, 2= quite close, 3=fairly close, 4=not very close). All these variables were reverse coded and added together into one parent-child closeness measure (alpha=.62) where higher scores indicate more parental closeness.

Analytical Plan

Table 1 presents basic descriptive statistics for the FFCW sample. Table 2 shows the distribution of cases across ACEs and substance use by race and ethnicity. In Table 3, the relationship between ACEs, race/ethnicity and adolescent alcohol use were examined using logistic regression. Model 1 assesses the relationship of the number of ACEs on adolescent alcohol in the past year by White, Black and other adolescents. Model 2 assesses the relationship established in Model 1 when all other demographics were added. In Table 4, the relationships between ACEs, race/ethnicity and adolescent marijuana use were examined using logistic regression. Model 1 assesses the relationship of the number of ACEs on adolescent marijuana use in the past year by White, Black and other adolescents. Model 2 assesses the relationship established in Model 1 when all other demographics were added. Logistic regression is appropriate as the outcome variable is dichotomous. All analyses were conducted using Stata statistical software.

RESULTS

Table 1 shows summary statistics for all the variables used in the analysis. ACEs range from 0-4. The most common group experienced one ACE (27.3%). Most adolescents reported no alcohol (90.1%) or marijuana use (86.2%). Due to the sampling of the FFCW study the plurality of adolescents are non-Hispanic Black (46.5%), followed by other (31.2%), and non-Hispanic

White (17.1%). Respondents' ages range from 14-19, with the mean of 15.6 years. There are more male adolescents (51.3%) than female respondents (48.7%).

The largest groups of respondents are in the median poverty category (100-199%) (26.1%), followed by the highest income level (300%) (23.4%), and the 0-49% group (18.1%). The largest groups of mothers had completed less than high school or finished high school (31.8%). Twenty-five percent of mothers in the sample had completed some college, while 11.1% were college graduates. For fathers most had graduated high school or earned something equivalent (33.8%). 31.5% of fathers in the sample did not finish high school, 21.5% had completed some college, and only 9.9% had graduated college. 75.9% of mothers in the sample reported not being married to the focal child's biological dad.

The majority of adolescents in the sample had not been diagnosed with ADHD (83.7%). Peer substance use is an index from 0-10 with higher scores indicating more peer substance use. The mean of peer substance use is 1.3, with a standard deviation of 2. The mean of parental supervision (2.5) indicates most respondents reported high levels of parental supervision, while most respondents reported medium self-control (7.2). Closeness with the parent had a mean of 10.4 on a scale that ranges from 0-16, with higher scores indicating higher levels of closeness.

(Table 1 about here)

Table 2 shows the number of cases for ACEs and substance use for each race/ethnicity group. The majority of respondents experienced zero or one ACE and reported no participation in alcohol or marijuana use in the past year. However, the frequency of ACEs differed among the groups. About 35% of Whites and 25% of Blacks experienced zero ACEs. About 10% of Black youth experienced four or more ACEs; the comparable prevalence among white youth was 6.6%. Moreover, Whites were more likely than Blacks to report alcohol use (12% vs. 7%), yet Blacks

were more likely than Whites to report marijuana use (14% vs. 10%).

(Table 2 about here)

Table 3 shows the results of the logistic regression model with alcohol use as the outcome predicted by ACEs for Blacks, Whites, and Others. Model 1 includes only ACEs as predictors, whereas Model 2 adds the covariates. Model 1 indicates the odds of alcohol use among Black youth who experience 4 or more ACEs to be 2.52 times the odds of Black youth who experience 0 ACEs ($p < 0.01$). None of the results are statistically significant for non-Hispanic White youth in Model 1. Model 2 adds the control variables. The results show that the odds of alcohol use among White youth who experience 2 ACEs are expected to be 2.95 times the odds among White youth who experience 0 ACEs ($p < 0.05$). The odds of alcohol use for Black youth who experience 4 or more ACEs are expected to be 2.46 times the odds among Black youth who experience 0 ACEs ($p < 0.05$). The odds of alcohol use among other youth who experience 3 ACEs are expected to be .38 times the odds among youth who experience 0 ACEs ($p < 0.05$). In other words, paradoxically their odds of alcohol use are lower.

The effect of age on alcohol use is statistically significant for all three race/ethnic groups. For example, each one-year increase in age for White youth is associated with a 124% increase in the odds of alcohol use net the effects of the other covariates ($p < 0.001$). Each one-year increase in age for Black youth is associated with a 34% increase in the odds of alcohol use net the effects of the other covariates ($p < 0.001$). Peer substance use also has a consistent effect on alcohol use. For instance, a one-unit increase in peer substance use for White youth is associated with a 99% increase in the odds of alcohol use ($p < 0.001$). Each one-unit increase in peer substance use for Black youth is associated with a 60% increase in the odds of alcohol use ($p < 0.001$).

Finally, parental supervision has a modest association with alcohol use. Among White youth, for example, each one-unit increase in parental supervision is associated with a 43% decrease in the odds of alcohol use ($p < 0.05$). The effect of parental supervision is not significantly associated with alcohol use among Black youth, however.

(Table 3 about here)

Table 4 shows the results of the logistic regression model with marijuana use as the outcome. Model 1 shows that the odds of marijuana use among non-Hispanic White adolescents who experience 4 or more ACEs are expected to be 3.93 times the odds among White youth who experience 0 ACEs ($p < 0.01$). The odds of marijuana use for non-Hispanic Black adolescents who experience 3 ACEs are expected to be 2 times the odds among Black youth who experience 0 ACEs ($p < 0.01$). And the odds of marijuana use for non-Hispanic Black adolescents who experience 4 or more ACEs are expected to be 2.05 times the odds among Black youth who experience 0 ACEs ($p < 0.01$). The odds of marijuana use among other ethnic youth who experience 2 ACEs are expected to be 2.12 times the odds of other youth who experience 0 ACEs ($p < 0.01$).

Model 2 introduces the control variables and indicates that the odds of marijuana use among non-Hispanic White youth who experience 2 ACEs to be 3.06 times the odds of White youth who experience 0 ACEs ($p < 0.05$). And the odds for marijuana use among non-Hispanic White youth who experience 4 or more ACEs is 7.63 times the odds of White youth who experience 0ACEs ($p <0 .01$). The odds for marijuana use among non-Hispanic Black youth who experience 4 or more ACEs is expected to be 2.13 times the odds of Black youth who experience 0 ACEs ($p < 0.05$).

The coefficient for age is also statistically significant across all racial categories. Each

one-year increase of age for non-Hispanic White youth is associated with an 82% increase in the odds of marijuana use ($p < 0.01$). Each one-year increase in age for Black youth is associated with a 51% increase in the odds of marijuana use ($p < 0.001$). And for each one-year increase in age for other youth is associated with a 60% increase in the odds of marijuana use ($p < 0.001$).

Several other variables are associated with marijuana use, including gender, ADHD, self-control, peer substance use, and parental supervision, but the associations vary by race/ethnicity. For instance, among Black youth, the odds of marijuana use among females are expected to be 68% lower than the odds among males ($p < 0.05$). Other ethnic adolescents with ADHD are expected to have a 175% increase in the odds of marijuana use relative to those without ADHD ($p < 0.01$). Each one-unit increase in self-control is associated with a 7% increase in the odds of marijuana use among Black youth ($p < 0.01$).

A one-unit increase in peer substance use is associated with a 96% and 57% increase in the odds of marijuana use among White and Black youth ($p < 0.001$). Finally, each one-unit increase in parental supervision is associated with a 22% decrease in the odds of marijuana use among White youth ($p < 0.05$), but has no statistically significant impact among Black youth.

(Table 4 about here)

DISCUSSION AND CONCLUSION

The purpose of this study was to examine the influence ACEs on adolescent substance use. This study builds on previous literature by examining whether early childhood ACEs (ages 0-5) influence adolescent substance use while assessing the differences across race/ethnicity. ACEs have been found to have many negative influences on individuals throughout their life course, specifically looking at adulthood (Bruns and Geist 1984; Duncan 1977; Chaplin et al. 2018; Mersky et al. 2013; Nurius et al. 2016). With most research focusing on adulthood, I

suggest looking at adolescence is important because, according to the life course theory, behaviors may continue into adulthood (Chaplin et al. 2018; Chassin et al. 2002; Chatterjee et al. 2018; Elder et al. 2003; Halfon et al. 2014; Moss et al. 2014; Squeglia et al. 2011; Windle et al. 2008). I also suggest that there are differences across race/ethnicity based on previous research that has found mixed results about adolescent substance use (Darity 2005; DeLisi et al. 2017; Kann et al. 2016; Keyes et al. 2015; Lee and Chen 2017; Su et al. 2015; Wallace et al. 2002).

The results support the first research question, but this support depends on race/ethnicity and whether alcohol or marijuana was examined. For example, non-Hispanic Black adolescents reported continuously higher odds of alcohol use as more ACEs were recorded. Non-Hispanic White adolescents, however, showed the highest odds of alcohol use only when experiencing two ACEs. The results were different for marijuana use: the odds of marijuana use do not increase continuously with each ACE category for any race/ethnicity. Rather, non-Hispanic White adolescents at the highest level of ACEs had the highest risk of marijuana use. These results do not support previous research regarding ACEs and the influence they have on the likelihood of adolescent substance use (Anda et al. 1999; Dube et al. 2003; Dube et al. 2006; Duke et al. 2010; Fagan and Novak 2018; Mersky et al. 2013).

My second research question considered the effect of ACEs on adolescent substance use by race/ethnicity. There are some notable differences. For example, Black youth who experienced four or more ACEs were more likely to report alcohol use, but ACEs affected White youth's alcohol use only when two were reported. These findings contradict previous research that finds that ACEs affect alcohol use primarily among White adolescents (Schilling et al. 2007). Furthermore, the association between experiencing four or more ACEs and marijuana use was germane for both White and Black adolescents, but the association appeared stronger among

the former group. Thus, in contrast with Fagan and Novak's study (2018), ACEs have a substantial association with one form of substance use among White youth.

Although ACEs have some compelling yet inconsistent associations with alcohol and marijuana use, the impact of peer substance use is consistent and substantial. This supports numerous other studies that demonstrate that peer substance use is a powerful predictor of one's own use (Van Ryzin, Fosco, and Dishion 2012; Wood et al. 2004; Windle 2000). ACEs are an important predictor of adolescent substance use, but other characteristics are even more important (Chaplin et al. 2018; Chassin et al. 2002; Chatterjee et al. 2018; Moss et al. 2014; Squeglia et al. 2011; Windle et al. 2008).

The differences between my results and those in previous studies might be the result of different research methods. As mentioned, most research has used retrospective data (Anda et al. 1999; Baglivio and Epps 2016; DeLisi et al. 2017; Duke et al. 2010; Dube et al. 2003; Felitti et al. 1998). This study used longitudinal data collected throughout childhood and into adolescence. Additionally, most ACEs research has focused on any ACE prior to age 18. This study focused on early childhood by measuring ACEs experienced only until age 5. In general, the results show that ACEs affect substance use during adolescence, not just adulthood. This supports life course theory and the principle of continual change (Ackerman et al. 2004; Bruns and Geist 1984; Chaplin et al. 2018; Dannefer 2011; Elder et al. 2003; Jones et al. 2018). It also recommends that future research examine not only the effects of ACEs on adolescent outcomes, but also their effects by race/ethnicity.

Limitations

There are limitations to this study and further research is needed to fully understand the relationships examined. First, the sample size was relatively small for some subgroups. For

instance, only 39 White youth experienced four or more ACEs. Datasets with different configurations of youth from ethnic/racial subgroups may yield different results. Additionally, the ACEs in this study are limited. Specifically, there are two measures of ACEs in the CDC-Kaiser ACE study (Felitti et al. 1998) that are not included in the dataset: sexual abuse and parental divorce or separation. There were no behavioral items on sexual abuse included in the FFCW interviews, and parental divorce or separation may not have seemed irrelevant as FFCW oversampled for non-marital births.

Future research should look at all ACEs, and other stressors that could also be deemed ACEs. Future research should also include a multiracial category. The multiracial population in the United States is growing and understanding how ACEs influences those individuals is scant. Research should also examine other subgroups in addition to those defined by race/ethnicity (e.g., age or gender groups) to better understand how ACEs affect adolescent substance use.

In summary, this study adds to the scarce research regarding the impact of ACEs on adolescent substance use across different racial/ethnic groups. ACEs do appear to affect alcohol and marijuana use, though not consistently. Additional research is needed to fully understand just how significant ACEs are in the pathways that lead to adolescent alcohol use. Understanding these influences can help individuals in many facets, as well as assist policy makers, counselors, teachers, parents, or anyone working closely with adolescents how best to help prevent adolescent substance use.

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Table 1. Variable statistics of adolescent substance use, race/ethnicity, ACEs, and demographic variables, Fragile Families and Child Wellbeing study

Variable	Description	Range	Mean or %	Standard Deviation
Adolescent Alcohol Use	Dichotomous variable measuring if adolescent has used alcohol in the last 12 months	0-1	No = 90.1 Yes = 9.4	
Adolescent Marijuana Use	Dichotomous variable measuring if adolescent used marijuana in the last 12 months	0-1	No = 86.2 Yes = 13.1	
Race/Ethnicity	Adolescent self-reported race/ethnicity	0-2	White = 17.1 Black = 46.5 Other = 31.2	
Cumulative ACEs	An additive scale using all ACEs	0-4	1 ACE = 27.3 2 ACE = 18.7 3 ACE = 10.3 4 or more ACE = 8.8	
Demographics				
Child Age	Age in years	14-19	15.6	.76
Child Sex	Male = 0 Female = 1	0-1	Male = 51.3 Female = 48.7	
Poverty	Poverty level of the family	1-5	0-49% = 18.1 50-99%= 16.9 100-199%= 26.1 200-299%= 15.2 300+%= 23.4	
Mother Education	Education finished by biological mother	1-4	Less than HS = 31.8 HS or equivalent = 31.8 Some college = 25.2 College grad or more = 11.1	

Father Education	Education finished by biological father	1-4	Less than HS = 31.5 HS or equivalent = 33.8 Some college = 21.5 College grad or more = 9.9	
Marital Status	Biological mother married to biological father	0-1	Not Married = 75.9 Married = 24.1	
Personal/Interpersonal ADHD	Adolescent diagnosed with ADHD	0-1	No = 83.7 Yes = 16.2	
Peer Substance Use	Adolescent's peers participate in substance use	0-10	1.3	2.03
Parental Supervision	Adolescent reported supervision from parents	1-3	2.5	.33
Self-control	Adolescent reported self-control (0=low self-control: 15=high self-control)	0-15	7.2	3.65
Parent-child closeness	Adolescent reported closeness with biological parents (0=low closeness: 16=high closeness)	0-16	10.4	3.52

Table 2. Frequency of ACEs and substance use by race and ethnicity, Fragile Families and Child Wellbeing Study

	non-Hispanic White	non-Hispanic Black	Other
ACEs			
0	206 (35%)	396 (25%)	321 (30%)
1	166 (28%)	422 (26%)	284 (26%)
2	91 (15%)	341 (21%)	190 (18%)
3	55 (9%)	179 (11%)	101 (9%)
4 or more	39 (7%)	163 (10%)	85 (8%)
Substance Use			
No Alcohol Use	516 (87%)	1486 (93%)	941 (88%)
Alcohol Use	69 (12%)	111 (7%)	129 (12%)
No Marijuana Use	527 (89%)	1372 (86%)	918 (85%)
Marijuana Use	59 (10%)	221 (14%)	151 (14%)
Sample size	590	1601	1074

Table 3. Logistic regression analysis of the associations between ACEs and alcohol use by race/ethnicity and other covariates, Fragile Families and Child Wellbeing Study

	Model 1			Model 2		
	White	Black	Other	White	Black	Other
ACEs						
1	0.70	1.13	0.86	0.71	0.98	0.57
2	1.93	1.24	1.22	2.95*	0.96	0.64
3	1.28	1.84	0.52	1.33	1.77	0.38*
4 or more	1.33	2.52**	1.05	2.22	2.46*	0.66
Demographics						
Child Age				2.24***	1.34*	1.67**
Child Sex				0.56	1.19	0.62
Poverty				1.16	1.02	0.99
Mother Education				0.85	0.93	0.92
Father Education				1.06	1.15	1.32
Mother Marital Status				0.91	1.04	0.87
Personal/Interpersonal						
ADHD				0.80	0.99	1.31
Self-Control				1.01	1.04	1.05
Peer Substance Use				1.99***	1.60***	1.51***
Parental Supervision				0.43*	0.54	0.36**
Parent-child Closeness				1.05	0.94	0.93*
Constant	0.11***	0.05***	.14***	4.17***	0.00***	0.00***

*p<0.05 **p<0.01 ***p<0.001

Table 4. Logistic regression analysis of the associations between ACEs and marijuana use by race/ethnicity and other covariates, Fragile Families and Child Wellbeing study

	Model 1			Model 2		
	White	Black	Other	White	Black	Other
ACEs						
1	0.99	1.50	1.20	1.03	1.63	1.11
2	1.97	1.22	2.12**	3.06*	1.13	1.40
3	0.99	2.00**	1.15	0.67	1.79	0.88
4 or more	3.93**	2.05**	1.41	7.63**	2.13*	0.81
Demographics						
Child Age				1.82**	1.51***	1.60**
Child Sex				0.64	0.68*	0.80
Poverty				1.13	0.92	1.02
Mother Education				0.68	0.87	0.92
Father Education				1.24	1.00	1.03
Mother Marital Status				1.10	0.69	0.50*
Personal/Interpersonal						
ADHD				1.12	1.17	2.75**
Self-Control				0.99	1.07**	1.07
Peer Substance Use				1.96***	1.57***	1.60***
Parental Supervision				0.22**	0.77	0.54
Parent-child Closeness				0.96	0.98	0.96
Constant	.079***	0.11***	0.12***	0.00***	0.00***	0.00***

*p<0.05 **p<0.01 ***p<0.001