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Adverse childhood experiences (ACEs) and transitions in stages of alcohol involvement among US adults: progression and regression

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Abstract

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Background: Adverse childhood experiences (ACEs) are associated with a number of medical comorbidities. However, there is a paucity of data on the role ACEs play in transitions in stages of alcohol involvement.

Objective: To examine the association between ACEs and transitions in alcohol problems progression and regression between No Problems, Moderate Problems and Severe Problems stages.

Participants and Setting: Data from 14,363 male and 19,774 female participants in Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).

Methods: We used latent transition analysis (LTA) with propensity score adjustment to estimate the odds of transitioning across stages of alcohol involvement, between waves, based on the number of types of ACEs experienced. We hypothesized that ACEs would be associated with increased risk of progression and decreased risk of regression.

Results: ACEs were associated with progression to higher alcohol involvement stages, with greatest likelihood of progression from No Problems to Severe Problems for those reporting 3 ACEs (males: aOR=4.78 [CI (1.84 – 12.44)]; females: aOR=3.81 [CI (1.69 – 8.57)]). ACEs were also associated with decreased odds of regression to less problematic alcohol involvement stages, with some distinctive patterns of associations in males and in females.

Conclusions: This study suggests that ACEs impact transitions in alcohol involvement in both males and females, affecting both progression and regression. The association is magnified for those with multiple types of ACE exposures. These results highlight the need for prevention, early identification and intervention to mitigate the risks associated with childhood maltreatment.

1. Introduction

Adverse childhood experiences (ACEs), including physical, sexual and emotional abuse, neglect, and household dysfunction, are a significant public health problem. Results from population-based studies have shown that 51%−62% of adults in the United States (U.S.) report having experienced at least one ACE and approximately one-quarter report experiencing 3 ACEs (Afifi et al., 2011; Merrick, Ford, Ports & Guinn, 2018).

ACEs are associated with a variety of physical and mental health problems, including increased risk for problematic drinking and development of alcohol and other substance use disorders (Afifi et al,. 2011; Feliti et al., 1998; Fuller-Thomson, Roane & Brennenstuhl, 2016; Meyers et al., 2018). Several ACEs, particularly physical and/or sexual abuse, having a household member with mental illness or substance misuse or use disorder, and parental discord or divorce, were significantly associated with early onset drinking (age 14 years), a known risk factor for development of an alcohol use disorder (AUD) (Rothman, Edwards, Heeren, & Hingson, 2008). In a study of more than 39,000 respondents from 5 U.S. states, childhood verbal abuse was associated with increased binge drinking in both men and

women (Fang & McNeil, 2017). Examining five types of ACEs (physical abuse, sexual abuse, emotional abuse, physical neglect and emotional neglect), Afifi and colleagues (2012) found that all five types of childhood maltreatment were associated with increased risk of AUD for men (OR 1.1–1.6) and women (OR 1.2–1.6) after controlling for other factors including lifetime mood, anxiety or personality disorder (Afifi, Henriksen, Asmundson, & Sareen, 2012). Similarly, another study examining the impact of childhood physical abuse, sexual abuse and witnessed intimate partner violence, found that all three forms of early childhood trauma were associated with increased risk of AUD, with a greater association between physical abuse and AUD in men, and between witnessed partner violence and AUD in women (Meyers et al., 2018).

The impact of multiple ACEs appears to be cumulative with odds of developing medical and psychosocial consequences, including alcohol problems, increasing with the number of types of ACEs experienced. One study found that young adults in the High/Multiple ACEs class were more likely to report alcohol-related problems than those in the Low ACEs class (Shin, McDonald, & Conley, 2018). Pilowsky and colleagues (2009) found that experiencing two or more ACEs was significantly associated with AUD in adjusted analyses (Pilowsky, Keyes, & Hasin, 2009). A more recent latent class analysis of 2004 data from > 18,100 incarcerated persons found that compared to the class with the lowest exposure, those in the three classes representing greater ACEs exposure had greater odds of AUD in the year prior to incarceration. In particular, those in the class with high exposure to all adverse experiences were 1.9 times as likely to meet AUD criteria than those in the class with the lowest ACEs exposure (Henry, 2020).

In addition to development of problematic drinking and AUD, ACEs have also been shown to be associated with persistence of alcohol-related problems. Childhood physical, sexual and emotional abuse as well as physical neglect were associated with persistence of DSM-IV alcohol dependence across waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) (Elliott et al., 2014). Further, La Flair and colleagues (2013) found that women reporting any childhood physical abuse, sexual abuse, neglect or witnessed intimate partner violence were more likely to transition from a lower stage of drinking to a hazardous or severe stage between NESARC waves 1 and 2 (La Flair et al., 2013).

The mechanisms by which ACEs confer increased risk for morbidity are likely multifactorial, inclusive of epigenetic changes in the stress response (Cooper, Frone, Russell, & Mudar, 1995; Mehta et al., 2013; Ramo-Fernández et al., 2019; Tyrka, Price, Marsit, Walters, & Carpenter, 2012; Yang et al., 2013) and maladaptive coping mechanisms (Filipas & Ullman, 2006; Merrill & Thomas, 2013; Metzger et al., 2017). One potential explanation for the association between ACE exposure and negative alcohol outcomes is the self-medication hypothesis. This hypothesis theorizes that individuals use substances, such as alcohol, to cope with negative emotions (Khantzian, 1997), including those resulting from the trauma of ACEs. This theory has been applied to a variety of affective states and has been identified as one potential mechanism for development of alcohol problems after trauma exposure (Garland, Pettus-Davis, & Howard, 2013; Haller & Chassin, 2014). In fact, one study found that reports of drinking to self-medicate mood symptoms was associated

with both incidence and persistence of AUD (Crum et al., 2013). Thus, it is plausible that exposure to ACEs result in increased affective symptoms and thus increased risk for self-medication with alcohol.

Excessive alcohol consumption and alcohol use disorder are associated with substantial medical (Bagnardi et al., 2015; Rehm et al., 2010; Rehm et al., 2010; Rehm, Shield, Roerecke, & Gmel, 2016) and psychiatric comorbidity (Berenz et al., 2016: Blanco et al., 2013; Grant, Goldstein, Saha, & et al., 2015) and economic costs associated with health care expenditures, premature death and disability (Bouchery, Harwood, Sacks, Simon, & Brewer, 2011; Rehm et al., 2009). Alcohol involvement is often described as a stage-sequential process (Kalaydjian et al., 2009). One's alcohol involvement may advance through stages of increasingly problematic drinking before and after meeting diagnostic criteria for AUD, thus, increasing one's risk for comorbidity. However, alcohol involvement is often marked by periods of progression and regression, and not all persons transition through stages sequentially. While some may persist at the same stage for years, other may regress to a less problematic stage. Given the substantial morbidity and mortality associated with excessive alcohol consumption, identification of factors that promote or inhibit regression of alcohol involvement and associated problems is essential.

The longitudinal relationship between childhood maltreatment and progression through or regression from increasingly problematic stages of alcohol involvement is not well defined. Additionally, the impact of cumulative or multiple ACE exposure on progression and regression through stages of alcohol involvement in a general population sample is less well understood. Moreover, exploration of the relationship between ACEs and alcohol involvement in the different sexes warrants further investigation. Previous studies have demonstrated sex differences in risk for problematic drinking and AUD based on report of childhood sexual or physical abuse (Galaif, Stein, Newcomb, & Bernstein, 2001; MacMillan et al., 2001; Molnar, Berkman, & Buka, 2001; Thompson, Kingree, & Desai, 2004). A better understanding of the relationship between ACEs and alcohol transitions, in both men and women, can inform the design and implementation of sex-specific prevention and intervention initiatives. While a previous study examined the impact of childhood physical abuse, neglect and witnessed intimate partner violence on drinking progression among women drinkers (La Flair et al., 2013), it did not assess this association in men, nor did it assess the cumulative impact of exposure to multiple ACEs.

The goal of this study was to examine the impact of ACEs on progression to and regression from more severe stages of alcohol involvement for both men and women, specifically examining the impact of multiple ACEs exposure, using prospective population-based data from NESARC. While the majority of studies examining alcohol transitions examine transitions in to and out of problematic drinking or alcohol use disorder (AUD), fewer studies examine transitions through multiple stages of drinking representing increasing development of alcohol-related problems. This approach allowed us to include the entire NESARC sample, inclusive of drinkers and non-drinkers, thus providing a broader spectrum of alcohol involvement. We hypothesized that the presence of one or more types of ACEs would increase the probability of progressing from one stage of alcohol involvement to a

more severe or problematic stage. Further, we hypothesized that having at least one type of ACE exposure would reduce the probability of regressing to a less severe stage.

2. Methods

2.1 Study sample

This study is drawn from Waves 1 (2001–2002) and 2 (2004–2005) of the NESARC, one of the largest, prospective population-based studies of alcohol and drug use and associated psychiatric and medical comorbidities in the U.S. Details on study procedures and survey design are described elsewhere (Grant et al., 2003; Grant et al., 2004). Briefly, the NESARC sampled civilian, non-institutionalized adults, ages 18 and older, using computer assisted personal interviews. Wave 1 included 43,093 respondents of which 34,653 were re-interviewed for Wave 2, with response rates of 81% and 87%, respectively. Survey weights, based on U.S. Census data, were used to adjust for oversampling of those identifying as Blacks or Hispanic, and young adults (ages 18–24 years) and to provide nationally representative estimates. The present study included 14,363 males and 19,774 females assessed at both waves who also completed questions on adverse childhood experiences, which were assessed at Wave 2. Institutional Review Board approval was not required as this study used de-identified, publicly available data.

2.2 Measures

2.2.1 Alcohol involvement stages—At both waves, DSM-IV alcohol abuse and dependence criteria were assessed using the Alcohol Use Disorders and Associated Disabilities Interview Schedule (AUDADIS-IV), a structured diagnostic interview designed to assess alcohol, drug, and mental health disorders (Grant et al., 2003). As described in earlier publications (Crum et al., 2018; Green et al., 2019; La Flair et al., 2013; Pacek et al., 2019), alcohol involvement was characterized by dichotomous indicators (yes/no) of the four alcohol abuse and seven alcohol dependence DSM-IV criteria (American Psychiatric Association, 1994). Consistent with the DSM-5 approach for diagnosis of AUD (American Psychiatric Association, 2013), the abuse and dependence criteria were combined.

In latent class analyses, a 3-class model for alcohol use identified three distinct stages of alcohol involvement: No Problems, Moderate Problems and Severe Problems (Crum et al., 2018). The No Problems stage is characterized by low probabilities of having any of the 11 clinical AUD criteria. The Moderate Problems stage is characterized by criteria consistent with loss of control over one's drinking: drinking in hazardous situations, drinking in amounts larger than intended, having problems cutting down consumption, and experiencing tolerance and withdrawal symptoms. The Severe Problems stage is characterized by criteria reflecting loss of control over drinking but also the associated consequences of role failure, social problems, physical and psychological problems, greater time spent getting alcohol, and giving up of activities because of alcohol.

2.2.2 Adverse childhood experiences—Wave 2 of the NESARC assessed several types of childhood maltreatment based on exposures that were included in the Adverse Childhood Experiences study (Felitti et al., 1998). For this study, we assessed eight different

types of adverse childhood experiences, six types of maltreatment (emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect and endangerment) as well as two types of household dysfunction (domestic violence and parental dysfunction). The childhood maltreatment questions were adapted from previously validated measures (Bernstein et al., 1994; Straus, Hamby, Boney-McCoy, & Sugarman, 1996; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998; Wyatt, 1985). For childhood emotional abuse, physical abuse, sexual abuse, physical neglect, endangerment and witnessed domestic violence, participants responded using a 5-point scale ranging from "never" to "very often". Emotional neglect was assessed using a similar 5-point scale ranging from "never true" to "very often true". Household dysfunction, other than witnessed domestic violence, was assessed via "yes" or "no" responses.

Physical abuse was determined to have occurred if a respondent endorsed a response other than "never" to questions about how often a parent/caregiver 1) pushed, grabbed, shoved, slapped or hit them, or 2) hit them so hard that they had marks, bruises or were injured. Similarly, a response of other than "never" was considered positive to any of the four questions about sexual abuse, which inquired about fondling/touching in a sexual way, attempted or completed sexual intercourse. Emotional abuse was considered to have occurred if respondents endorsed "fairly often" or "very often" to any of three questions assessing 1) swearing, insulting or saying hurtful things; 2) threatening to hit or throw something at them; or 3) made to fear would be physically hurt or injured.

Physical neglect was defined by responses of "sometimes" or more frequently to any of four questions about 1) being left unsupervised before the age of 10; 2) going without needed clothing, shoes or school supplies; 3) going hungry; and 4) going without necessary medical treatment. Emotional neglect was determined by at least two of five questions in which the respondent answered "rarely true" or "never true" to questions regarding having a close knit family or having someone in the family that wanted them to succeed, was a source of strength and support, helped them to feel important, or believed in them. Respondents were considered to have been endangered if they endorsed being made to do chores that were too difficult or dangerous for their age "sometimes" or more frequently.

In assessing household dysfunction, witnessed partner violence was determined by a response of anything other than "never" to any of four questions about frequency of witnessing father/other adult male push, grab, slap or throw something at mother (inclusive of mother, stepmother, adoptive or foster mother, or father's girlfriend); hit her with fist or something hard; repeatedly hit her for at least a few minutes; or threaten her with or use of a knife/gun to hurt her. Parental dysfunction was assessed by a response of "yes" to any of six questions about parental substance use, imprisonment, mental illness, or attempted or completed suicide.

For our analyses, adverse childhood experience exposure was operationalized as an ordinal variable. Responses to the eight types of maltreatment were dichotomized as present or absent based on criteria described above, and then a count variable was created to represent the number of different types of ACEs experienced (range: 0–8). The total was then

categorized as: 1) no ACE exposure, 2) exposure to 1–2 types of ACEs, or 3) exposure to   3 types of ACEs.

2.2.3.   Covariates—Potential confounders were age, race and ethnicity (persons identifying as non-Hispanic White, non-Hispanic Black, Hispanic, and other), education (12 years, <12 years), lifetime illicit drug use disorder, nicotine dependence, lifetime mood disorders (major depressive disorder, dysthymia, mania and hypomania), lifetime anxiety disorders (generalized anxiety disorder, social phobia, specific phobia, and/or panic disorder), and family history of alcohol problems (any first-degree relative). Confounders were chosen based on findings from previous literature showing a relationship with problematic alcohol use. Multiple studies have shown that risk for problematic alcohol use is associated with age (Dawson, Goldstein, Chou, Ruan, & Grant, 2008; DeWit, Adlaf, Offord, & Ogborne, 2000; Grant & Dawson, 1997), race and ethnicity (Alvanzo et al., 2011; Chartier & Caetano, 2010), family history (Dawson, Harford, & Grant, 1992; Grant, 1998; Heath et al., 1997; Schuckit & Smith, 2000) and psychiatric disorders (Grant, Goldstein, Saha, & et al., 2015).

2.3.   Statistical analyses

Using latent transition analysis (LTA), we estimated the probability of transitioning between latent stages of alcohol involvement across the two waves of the NESARC. LTA extends latent class analysis to the longitudinal framework, expressing change over time in terms of transition probabilities and modeling the impact of covariates on transitions using a multinomial regression formulation. Transition probabilities reflect the probability of transitioning from one latent stage at Wave 1 to another latent stage at Wave 2 (Collins & Wugalter, 1992; Reboussin, Liang, & Reboussin, 1999; Reboussin, Reboussin, Liang, & Anthony, 1998).

To address potential confounding, which could bias estimates, between the three ACE exposure groups, we used the propensity score method of inverse probability of treatment weighting (IPTW) (Curtis, Hammill, Eisenstein, Kramer, & Anstrom, 2007; Rubin, 2010; Stuart, 2010). Using a multinomial logistic regression model, we calculated the propensity score by estimating the probability of having a history of ACE exposure (no exposure, 1 to 2 exposures, or 3 or more exposures) given sociodemographic and other clinical characteristics that were considered potential confounders. The effectiveness of propensity score weighting in balancing the composition of the exposure groups was assessed by comparing characteristics of the groups before and after applying the weights (Stuart, 2010). Application of IPTW in these analyses was deemed successful as the groups were similar with respect to the observed characteristics after using the weights.

LTA was carried out using *Mplus* version 7.0 (Muthén & Muthén, 1998–2010) taking into account survey sampling weights, clustering and stratification, which we are calling the unadjusted model. In order to account for confounding of sociodemographic and clinical characteristics, another set of LTA models took into account the combined weights (propensity score weights multiplied by the survey weights) (Dugoff, Schuler, & Stuart, 2014), which we are calling the adjusted model.

As presented originally in Crum et al. (2018), to confirm that a sex-stratified approach was appropriate, tests were conducted to determine whether the structure of the 3-status model varied for males and females. This testing found that pooling data for males and females would lead to a significantly worse model fit (likelihood difference test statistic =276.84, p < .001, and 182.25, p < .001 for waves 1 and 2, respectively). Thus, the structure of the latent statuses differed between males and females. We found that over a quarter of indicators of alcohol problems were significantly different by sex at p < .05 for both Wave 1 and Wave 2. As a result, all analyses for males and females were conducted separately, which precludes direct comparison of sexes.

3.   Results

The baseline characteristics of the sample, stratified by sex, are presented in Table 1. Forty-two percent of males reported no ACEs, 42% reported 1–2 types of ACEs, and 16% reported   3 types of ACEs. Results for females were as follows: 44% of females reported no ACEs, 37% reported 1–2 ACEs, and 19% reported   3 ACEs. For both sexes, those identifying as Black non-Hispanic and Hispanic were overrepresented for those reporting   3 ACEs (males: [$F_{(4.85, 315.56)}$ = 23.3, p< 0.0001]; females: [$F_{(4.22, 274.33)}$ = 47.7, p< 0.0001]). Additionally, those with at least three ACEs were less likely to have a high school education, had higher rates of all mood and anxiety disorders, were more likely to have a drug use disorder and were more likely to have a family history of alcohol problems (all p-values < 0.001).

3.1.   Cross-sectional association between ACEs exposure and alcohol involvement stage

Table 2 displays the cross-sectional association between ACEs exposure and alcohol involvement stages at baseline, with and without propensity score weighting adjustment. In unadjusted analyses, compared to males reporting no ACEs, males with 1–2 ACE types were more likely to be in the Moderate Problems stage and males with   3 ACE types were more likely to be in the Moderate and Severe Problems stages of alcohol involvement. Similarly, females with 1–2 ACEs and   3 ACEs were more likely to be in the Moderate or Severe Problems stage, compared to females reporting no ACEs. However, none of these associations, for males or females, remained after adjustment.

3.2.   Latent transition analyses

Adjusting for sampling weights, the estimated probabilities of transitioning across the three stages of alcohol involvement between waves are presented in Table 3. Briefly, the highest stability was found with the No Problems stage: 90% of males and 93% of females in this stage at baseline remained in this stage at follow-up. Approximately 11% of males and 11% of females transitioned from a less severe stage (Moderate or No Problems) to the Severe Problems stages. With respect to regression, 24% of males and 35% of females regressed from Moderate Problems to No Problems, while 56% of males and 65% of females in the Severe Problems stage regressed to a stage of alcohol involvement indicative of fewer alcohol-related problems (Moderate or No Problems).

3.2.1   ACEs Association with Alcohol Transitions—The longitudinal associations between ACEs history and transition between stages of alcohol involvement, stratified by sex, are presented in Table 4. The odds ratios represent the odds of transitioning between stages from wave 1 to wave 2 relative to remaining at the same stage. Individuals with no ACE exposure comprised the reference group.

3.2.2   Male Findings—After adjusting for potential confounders using propensity score methods, when compared to males reporting no ACEs, males with a history of 1–2 ACEs had elevated odds of movement from the No Problems stage at wave 1 to the Moderate Problems stage (adjusted odds ratio [aOR]=1.60, 95% confidence interval [CI] 1.26–2.04) or the Severe Problems stage of alcohol use (aOR=2.29, [CI 1.16–4.49]) at wave 2. Compared to males reporting no ACEs exposure, males experiencing ≥ 3 ACEs were more likely to transition from the No Problems to the Moderate Problems stage (aOR=2.12, [CI 1.51–2.99]) or Severe Problems stage (aOR=4.78, [CI 1.84–12.40]). Additionally, those reporting at least three ACEs had greater odds of transitioning from the Moderate Problems to the Severe Problems stage (aOR=2.96, [CI 1.06–8.26]).

With respect to regression to a less severe stage between waves 1 and 2, in propensity-score adjusted analyses, males with 1–2 ACEs exposure were less likely than those with no ACEs to transition from Moderate Problems to No Problems (aOR=0.49, [CI 0.30–0.80]) and from Severe Problems to No Problems (aOR=0.29, [CI 0.12–0.67]). Odds of transitioning from Severe Problems to Moderate Problems were not significantly different between those with 1–2 ACEs and those with no ACEs in adjusted analyses. For those with exposure to ≥ 3 ACEs, males were less likely to transition from Severe Problems to Moderate Problems (aOR=0.20, [CI 0.05–0.75]) and from Severe Problems to No problems (aOR=0.22, [CI 0.08–0.63]). Odds of transitioning from Moderate Problems to No Problems were not significantly different.

3.2.3   Female Findings—In propensity score adjusted analyses, females with a history of 1–2 ACEs were more likely than females reporting no ACEs to transition from the No Problems stage at baseline to the Moderate Problems stage (aOR=1.51, [CI 1.16–1.97]) or the Severe Problems stage (aOR=2.45, [CI 1.22–4.93]) at wave 2. The odds were even greater for the transition from No Problems to Moderate Problems (aOR=1.62, [CI 1.10–2.38]) or Severe Problems (aOR=3.81, [CI 1.69–8.57]) for those experiencing ≥ 3 ACEs, when compared to females without ACEs exposure. Odds of transitioning from the Moderate Problems to Severe Problems stage were not significantly different in adjusted analyses.

With respect to transition to a less severe problem stage between waves 1 and 2, in propensity-score adjusted analyses, females reporting 1–2 ACEs were less likely than those with no ACEs to transition from Moderate Problems to No Problems (aOR=0.46, [CI 1.33–2.54]). Similarly, for those with exposure to ≥ 3 ACEs, females were less likely to transition from Moderate Problems to No problems (aOR=0.29, [CI 0.09–0.94]). The odds of transitioning from the Severe Problems stage to a lesser stage were not significantly different in adjusted analyses.

4. Discussion

This study extends the existing literature on the association between adverse childhood experiences (ACEs) and alcohol problems. Using longitudinal data from a prospective population-based dataset, we were able to identify the potential impact of exposure to ACEs on transitions across stages of alcohol involvement, assessing both progression and regression. Further, we examined the impact of multiple types of ACEs exposure using sex-stratified analyses to understand alcohol transitions in both males and females.

Multiple studies have demonstrated a relationship between ACEs and problematic alcohol use as well as AUD (Afifi et al., 2012; Dube, Anda, Felitti, Edwards, & Croft, 2002; Elliott et al., 2014; La Flair et al., 2013; Pilowsky et al., 2009). However, very few studies have examined the relationship between ACEs and transitions through stages of alcohol involvement in males and females separately in a sample of drinkers and non-drinkers. We found that among both males and females, a history of exposure to even one ACE was associated with an increased likelihood for progression to more severe alcohol involvement.

We also found that ACE exposure has a negative impact on regression to less problematic stages of alcohol involvement, which has rarely been reported in the literature. Among adult females, the association between ACE exposure and regression was only seen when transitioning from the Moderate Problems to the No Problems stage, with those with any ACE exposure being less likely to regress. Yet, we noted a different pattern for males. For all potential transitions to a less severe stage, males with ACE exposure were less likely to regress to a less severe stage with significance varying by degree of ACE exposure. The finding of a negative association between ACEs and regression to less problematic drinking is most consistent with research that has shown that ACEs are associated with persistence of alcohol use disorder (Elliott et al., 2014). A subsequent study found that personality disorders, particularly borderline and antisocial personality, mediate the relationship between childhood maltreatment and alcohol persistence (Elliott et al., 2016). Taken together, these findings support additional research on potential mediators and moderators of the effects of ACEs on alcohol use behavior.

Consistent with other studies (Felitti, 2009; Pilowsky et al., 2009), our findings also highlight that the impact of ACE exposures is cumulative, with even greater harm for those reporting multiple types of exposures. We found the strongest relationship, for both males and females, for progression to a more severe alcohol problem stage among those who reported three or more types of ACEs. Additionally, when compared to those reporting no ACEs, females reporting 3 ACEs had notably lower odds of transitioning from the Moderate Problems to No Problems stage than those reporting 1–2 ACEs, and males with 3 ACEs were less likely to regress from the Severe Problems alcohol stage to a less severe stage.

Our findings should be interpreted in the context of several limitations. Data were collected via self-report, which introduces the possibility of social desirability bias as participants may be less likely to respond truthfully to questions about potentially stigmatizing events or behaviors, such as adverse childhood experiences or alcohol use and associated problems.

We were unable to control for all potential confounders. Specifically, we did not control for stressful life events, which may have also contributed to changes in drinking between NESARC waves 1 and 2. Alcohol misuse often occurs in a chronic recurring and remitting pattern and 3 years may not be a sufficient enough follow-up window to detect the majority of transitions. The coding scheme of the NESARC does not allow for exploration of potential differences in persons of mixed race or in persons who identify as White of Hispanic origin or Black of Hispanic origin, and this should be considered when interpreting results. The data for Waves 1 and 2 of the NESARC are older and may not be reflective of present patterns of drinking. Finally, the data were collected using questions that assessed for the DSM-IV diagnostic criteria for alcohol abuse and alcohol dependence as opposed to DSM-5 diagnostic criteria for alcohol use disorder. However, ten of the 11 diagnostic criteria from DSM-IV were carried forward to DSM-5, with removal of legal problems and the addition of cravings being the one difference in the 11 diagnostic criteria in the newer edition.

Despite these limitations, this study provides important information about the relationship between ACEs and alcohol use. It is among the first to assess ACEs' association with transitions in problematic alcohol use, examining the relationship for both men and women in a nationally representative sample that includes both drinkers and non-drinkers. Additionally, it provides insight on the impact of multiple ACE exposures on alcohol progression and regression. Given the high prevalence of ACEs and their associated consequences and the substantial morbidity and mortality associated with excessive alcohol use, our findings have clear clinical and research implications. First, they highlight the need for effective prevention initiatives, including identification of children at risk for ACE exposure, as well as the need to design, test and implement effective interventions to mitigate this risk. An unresolved question is whether early detection of childhood adversities and early interventions reduce the noxious effects of these experiences and prevent long-term adverse outcomes such as greater risk of transition to more serious alcohol involvement. Additionally, findings suggest that interventions should not be reserved for the most severe stages of problematic alcohol involvement but should be inclusive of all stages of alcohol involvement as those with no problems at baseline were more likely to progress to increasingly severe stages of alcohol problems on reassessments. Interventions should be designed to both reduce risk of progression to and promote regression from increasingly problematic alcohol involvement, recognizing that sex-specific interventions may be necessary. Future studies should investigate the longitudinal impact of ACEs on alcohol transitions over the lifespan. There is a paucity of data on potential protective or resiliency factors that may lessen the impact of ACEs on one's alcohol involvement and transition to more problematic use and these should be explored. Additionally, examination of the role of current life events and stressors on alcohol transitions in those with ACEs exposure are warranted. Finally, a better understanding of treatment utilization in those with ACEs exposure and alcohol problems, the effects of treatment for trauma, alcohol problems or both as well as the optimal duration of such treatment is needed.

Acknowledgements:

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Highlights

- Adverse Childhood Experiences (ACEs) confer increased risk of alcohol problems progression

- ACEs exposure seems to decrease risk of alcohol problems regression among adults

- Males and females have different patterns of association between ACEs and alcohol problems regression

- The associations of ACEs with alcohol transitions are magnified with more types of ACEs

Table 1.

Characteristics of participants by ACES[1], National Epidemiologic Survey on Alcohol and Related Conditions, wave 1.

		Males (n=14,363)					Females (n=19,774)				
		Total	No ACES	1–2 ACES	3 ACES		Total	No ACES	1–2 ACES	3 ACES	
		N (%)	N (%)	N (%)	N (%)	p-value	N (%)	N (%)	N (%)	N (%)	p-value
Age						<.0001					<.0001
	18–35	4481 (34.6)	1975 (37.4)	1813 (32.4)	703 (32.9)		6320 (32.4)	2717 (32.7)	2325 (31.8)	1278 (33.0)	
	36–49	4482 (30.1)	1705 (26.9)	1949 (32.0)	828 (33.7)		5652 (28.9)	2121 (24.6)	2223 (31.4)	1308 (34.2)	
	50+	5390 (35.3)	2283 (35.7)	2284 (35.6)	823 (33.4)		7802 (38.7)	3783 (42.7)	2752 (36.8)	1267 (32.7)	
Race and ethnicity						<.0001					<.0001
	White, non-Hispanic	8982 (73.2)	3777 (74.0)	3833 (73.8)	1372 (69.1)		11435 (72.6)	5019 (72.2)	4260 (73.6)	2156 (71.5)	
	Black, non-Hispanic	2242 (9.8)	888 (9.0)	946 (10.0)	408 (11.3)		4158 (11.8)	1730 (11.1)	1588 (12.0)	840 (12.8)	
	Hispanic	2674 (12.3)	1090 (11.7)	1085 (11.8)	499 (15.0)		3569 (10.9)	1542 (10.6)	1276 (10.7)	751 (11.9)	
	Other	465 (4.8)	208 (5.2)	182 (4.3)	75 (4.7)		612 (4.7)	330 (6.1)	176 (3.6)	106 (3.8)	
Education						<.0001					<.0001
	<12 years	2298 (14.3)	943 (14.1)	933 (14.1)	422 (17.8)		3281 (14.3)	1444 (14.4)	1122 (12.9)	715 (16.8)	
	12 years	12065 (85.3)	5020 (85.9)	5113 (85.9)	1932 (82.2)		7177	6178 (87.1)	3138 (83.2)	(85.6)	
Family history of alcohol use disorder		4313 (29.4)	1056 (16.9)	1928 (31.8)	1329 (58.0)	<.0001	6913 (34.2)	1715 (18.7)	2866 (39.3)	2332 (61.6)	<.0001
Illegal drug use disorder		1950 (13.7)	513 (8.7)	875 (14.7)	562 (24.8)	<.0001	1362 (7.0)	301 (3.5)	519 (7.4)	542 (14.8)	<.0001
Mood disorder											
	Major depressive disorder	1772 (11.8)	497 (7.9)	768 (12.2)	507 (22.0)	<.0001	4157 (21.0)	1167 (13.3)	1584 (22.0)	1406 (37.7)	<.0001
	Dysthymia	453 (3.0)	108 (1.9)	174 (2.7)	171 (6.9)	<.0001	1099 (5.3)	243 (2.7)	375 (4.9)	481 (12.4)	<.0001
	Mania	458 (3.1)	91 (1.4)	181 (3.1)	186 (8.1)	<.0001	699 (3.5)	146 (1.7)	234 (3.1)	319 (8.7)	<.0001
	Hypomania	372 (2.6)	125 (2.2)	158 (2.4)	89 (4.1)	<.0001	478 (2.2)	137 (1.6)	190 (2.4)	151 (3.3)	<.0001
Anxiety disorder											
	GAD	410 (2.8)	104 (1.8)	171 (2.8)	135 (5.5)	<.0001	1064 (5.4)	264 (3.0)	391 (5.5)	409 (11.3)	<.0001
	Panic disorder	489 (3.3)	138 (2.1)	187 (2.9)	164 (7.7)	<.0001	1281 (6.7)	355 (4.5)	460 (6.3)	466 (12.9)	<.0001

		Males (n=14,363)					Females (n=19,774)				
		Total	No ACES	1–2 ACES	3 ACES		Total	No ACES	1–2 ACES	3 ACES	
		N (%)	N (%)	N (%)	N (%)	p-value	N (%)	N (%)	N (%)	N (%)	p-value
	Social phobia	617 (4.3)	166 (2.6)	275 (4.9)	176 (7.2)	<.0001	1083 (5.8)	307 (3.8)	382 (5.6)	394 (11.2)	<.0001
	Specific phobia	935 (6.3)	310 (4.9)	404 (6.6)	221 (9.5)	<.0001	2433 (12.5)	830 (9.4)	931 (12.8)	672 (19.1)	<.0001

Notes: N's represent raw numbers; %s represent percentages weighted by Wave 2 weights

[1]Sum of the types of 'exposure': 1) emotional abuse, 2) physical abuse, 3) sexual abuse, 4) emotional neglect, 5) physical neglect, 6) endangerment, 7) witnessed domestic violence and 8) household dysfunction

Table 2.

Cross-sectional association of ACES[1] at baseline with alcohol involvement class at baseline, NESARC Wave 1.

Alcohol Involvement Class	1–2 ACES vs No ACES			3 ACES vs No ACES	
	Unadjusted OR (95% CI) p-value	Adjusted OR[a] (95% CI) p-value		Unadjusted OR (95% CI) p-value	Adjusted OR[a] (95% CI) p-value
Males					
No Problems	Reference			Reference	
Moderate	**1.30 (1.13, 1.51) <0.001**	1.16 (0.99, 1.35) 0.069		**1.61 (1.29, 2.02) <0.001**	1.13 (0.82, 1.54) 0.455
Severe	1.28 (0.98, 1.67) 0.075	0.98 (0.74, 1.29) 0.860		**2.26 (1.64, 3.10) <0.001**	0.85 (0.55, 1.31) 0.461
Females					
No Problems	Reference			Reference	
Moderate	**1.53 (1.28, 1.83) <0.001**	1.18 (0.96, 1.45) 0.111		**2.25 (1.85, 2.74) <0.001**	1.28 (0.95, 1.72) 0.110
Severe	**1.65 (1.21, 2.25) 0.002**	1.00 (0.75, 1.33) 1.000		**2.73 (1.99, 3.75) <0.001**	1.01 (0.67, 1.53) 0.967

[1]Sum of the types of 'exposure': 1) emotional abuse, 2) physical abuse, 3) sexual abuse, 4) emotional neglect, 5)physical neglect, 6) endangerment, 7) witnessed domestic violence and 8) household dysfunction

[a]Propensity score model adjusted for age, race and ethnicity, education, lifetime mood disorders, lifetime anxiety disorders, lifetime drug use disorder, and family history of alcohol problems.

Table 3.

Alcohol involvement class transition probabilities between NESARC waves 1 and 2.

		Men Wave 2		
		No Problems	**Moderate Problems**	**Severe Problems**
Wave 1	No Problems	0.896	0.094	0.010
	Moderate Problems	0.241	0.660	0.099
	Severe Problems	0.242	0.320	0.438
		Women Wave 2		
Wave 1	No Problems	0.927	0.064	0.008
	Moderate Problems	0.351	0.536	0.113
	Severe Problems	0.218	0.435	0.346

Note: Transition probabilities account for sample weights.

"While the transition probabilities are similar to previously published work, they vary slightly since the sample size for each analyses changes based on the independent variable and missing data for the covariates in the model."

Table 4.

The association of ACEs[1] with transitions in alcohol involvement between baseline, NESARC wave 1, and follow-up, wave 2.

Transition direction	MALES (N=14363) Odds Ratio, 95% CI, p-value Sampling Weights Only (Row 1) Propensity Score Weighted (Row 2)[a]			FEMALES (N=19774) Odds Ratio, 95% CI, p-value Sampling Weights Only (Row 1) Propensity Score Weighted (Row 2)[a]		
	1–2 ACES vs No ACES	3 ACES vs No ACES		1–2 ACES vs No ACES	3 ACES vs No ACES	
Progression						
No Problems to Moderate	1.58 (1.26, 1.98) <0.001 1.60 (1.26, 2.04) <0.001	1.90 (1.45, 2.49) <0.001 2.12 (1.51, 2.99) <0.001		1.85 (1.40, 2.44) <0.001 1.51 (1.16, 1.97) 0.002	2.62 (1.96, 3.51) <0.001 1.62 (1.10, 2.38) 0.014	
No Problems to Severe	2.29 (1.17, 4.47) 0.015 2.29 (1.16, 4.49) 0.016	3.37 (1.46, 7.76) 0.004 4.78 (1.84, 12.44) 0.001		1.96 (0.98, 3.92) 0.059 2.45 (1.22, 4.93) 0.012	3.14 (1.42, 6.96) 0.005 3.81 (1.69, 8.57) 0.001	
Moderate to Severe	1.70 (0.91, 3.16) 0.096 1.38 (0.72, 2.54) 0.331	3.25 (1.61, 6.54) 0.001 2.96 (1.06, 8.26) 0.039		0.83 (0.41, 1.69) 0.613 0.78 (0.36, 1.73) 0.547	2.18 (1.12, 4.25) 0.022 1.45 (0.59, 3.56) 0.414	
Recovery						
Moderate to No Problems	0.53 (0.35, 0.81) 0.003 0.49 (0.30, 0.80) 0.004	0.84 (0.47, 1.50), 0.551 1.24 (0.56, 2.73) 0.602		0.62 (0.39, 0.99) 0.044 0.46 (0.25, 0.84) 0.011	0.82 (0.49, 1.36) 0.440 0.29 (0.09, 0.94), 0.039	
Severe to No Problems	0.29 (0.12, 0.65) 0.003 0.29 (0.12, 0.67) 0.004	0.40 (0.17, 0.94) 0.035 0.22 (0.08, 0.63) 0.005		0.50 (0.21, 1.22) 0.128 0.56 (0.24, 1.30) 0.174	0.34 (0.14, 0.79) 0.012 0.42 (0.13, 1.36) 0.147	
Severe to Moderate	0.41 (0.19, 0.91) 0.028 0.55 (0.23, 1.32) 0.183	0.42 (0.16, 1.10) 0.078 0.20 (0.05, 0.75) 0.017		0.91 (0.33, 2.47) 0.859 0.41 (0.16, 1.08) 0.071	0.34 (0.13, 0.91) 0.032 0.47 (0.14, 1.64) 0.236	

[1] Sum of the types of 'exposure': 1) emotional abuse, 2) physical abuse, 3) sexual abuse, 4) emotional neglect, 5) physical neglect, 6) endangerment, 7) witnessed domestic violence and 8) household dysfunction

[a] Propensity score model adjusted for age, race and ethnicity, education, lifetime mood disorders, lifetime anxiety disorders, lifetime drug use disorder, and family history of alcohol problems