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The Effects of Marijuana Use on Transitions through Stages of Alcohol Involvement for Men and Women in the NESARC I and II

Kerry M. Green¹, Beth A. Reboussin², Lauren R. Pacek³, Carla L. Storr^{4,5}, Ramin Mojtabai^{5,6}, Bernadette A. Cullen^{5,6}, Rosa M. Crum^{5,6,7}

¹Department of Behavioral and Community Health, University of Maryland School of Public Health, College Park, MD 20742 USA

²Department of Biostatistics and Data Science, Wake Forest School of Medicine, Winston-Salem, NC 27157 USA

³Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine, Durham, NC 27705 USA

⁴Department of Family and Community Health, University of Maryland School of Nursing, Baltimore, MD

⁵Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD 21205 USA

⁶Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD 21205 USA

⁷Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD 21205 USA

Abstract

Background: With the changing context of marijuana use, it is critical to identify effects of use. We extend previous work by examining whether marijuana use influences progression and remission through alcohol involvement stages for men and women.

Methods: Data come from Waves I and II of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC, n=34,432). We assess the potential influence of marijuana use at Wave 1 on transitions across three latent statuses of alcohol involvement between waves. We apply propensity score weighting to account for shared risk factors.

Results: Marijuana use was associated cross-sectionally and longitudinally with alcohol involvement statuses for both sexes. After propensity score adjustment, men with marijuana histories were 3.50 times as likely as men without such histories to transition from no to severe problems across waves relative to staying in the same status ($p<.001$). Women with marijuana histories were 1.74 times as likely as women without such histories to transition from no problems

at Wave 1 to moderate problems at Wave 2 ($p=.003$) and 0.13 times as likely as women without such histories to transition from severe problems to no problems ($p=.006$).

Conclusions: Results suggest that marijuana use impacts progression to more serious stages of alcohol involvement for both men and women, as well as hinders remission among women. Findings point to the importance of screening those with marijuana histories for alcohol problems, as well as the need to understand the mechanism of why marijuana use may increase the risk of alcohol problems.

Keywords

Alcohol progression; Alcohol remission; Cannabis effects; Latent transition analyses; Longitudinal data; Population-Based Data; Sex differences

1. Introduction

1.1 Alcohol and marijuana interrelationships

Marijuana and alcohol are two of the most commonly used psychoactive substances in the United States (U.S.), with evidence of increases in recent years (Compton et al., 2016; Grant et al., 2015; Hasin et al., 2015). While both substances are highly prevalent and often used together (Yurasek et al., 2017), less is known about whether they influence the use of one another over time. The typical sequencing in the progression of drug usage in Western societies is one in which alcohol or tobacco is initiated before illicit drugs, like marijuana (Kandel and Kandel, 2015; Kandel and Yamagucki, 1993). More recently, there is an increasing likelihood of individuals using marijuana prior to initiation of alcohol use (Fairman et al., 2018). A number of studies have offered evidence that marijuana use may increase the likelihood of problematic drinking, including an increased risk of AUDs in adulthood associated with marijuana use (Blanco et al., 2016; Guttmanova et al., 2017). Weinberger et al., (2016), for example, provide evidence that marijuana use is related to both incidence and persistence of AUD. This topic is particularly important to investigate now as attitudes, norms, and policies around marijuana have changed recently (Carliner et al., 2017), which may impact the marijuana-alcohol association. For example, Wen and colleagues (2015) offer evidence that medical marijuana laws have inadvertently affected the frequency of binge drinking in adulthood.

In addition, we need to understand whether marijuana use impacts not only the potential progression of problematic drinking, but also whether it effects the remission of alcohol problems. Subbaraman et al. (2018) offer evidence that marijuana use may impede recovery from alcohol problems among those in a treatment program. Pacula et al. (2008) found that comorbid use of marijuana and alcohol was associated with more costly and longer alcohol use disorder treatment.

1.2 Potential mechanisms

Regardless of which substance is initiated first, having a history of marijuana use may impact alcohol problems later in life. One proposed mechanism by which marijuana use may influence later alcohol problems is through altering the brain's reward processing. Volkow et

al., (2014a) provide evidence that marijuana use may lead to lower reward sensitivity and motivation, increased stress and irritability, and increased risk of addictive behaviors generally. Studies have also demonstrated the impact of marijuana exposure on brain functioning and structure and impair the reward processing system (Bava and Tapert, 2010), suggesting that marijuana use may prime an individual to develop a substance use disorder, particularly if marijuana use occurs during sensitive times of brain maturation (Chen et al., 2017).

1.3 Research questions

This study examines the association between marijuana use and transitions across stages of alcohol involvement over time for men and women using latent transition analysis. We estimate the potential influence of lifetime marijuana use at Wave 1 on the probabilities of transitioning between stages of alcohol involvement (i.e., progression, recovery based on alcohol use disorder criteria), for men and women separately, among a U.S. population-based sample followed up over a 3-year period. We hypothesize that those with a history of marijuana use are more likely to progress in alcohol problems and less likely to remit from alcohol problems over time. We expect similar associations for men and women in terms of direction but potential variability in the strength due to evidence of differential impact of marijuana use on drinking problems by sex (Buu et al., 2014), and evidence of differential effects by sex of marijuana on brain development (Medina et al., 2009). We apply propensity score methods in order to account for shared risk factors. This study builds on the work of others using the same population-based dataset (Blanco et al., 2016; Weinberger et al., 2016) by (1) considering associations may differ for men and women, (2) better addressing confounding through a propensity score weighting technique that retains the full sample, (3) considering both progression in and remission from alcohol problems, and (4) using a more nuanced look at alcohol problems in a way that better aligns with DSM-5 substance use criteria.

2. Methods

2.1 Study population

This study is a secondary data analysis of Waves 1 (2001-02) and Waves 2 (2004-05) of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a U.S. population-based survey conducted by the National Institute on Alcohol Abuse and Alcoholism. Data were collected via face-to-face computer-assisted personal interviewing.

For Wave 1, 43,093 civilian participants age 18 and older were interviewed with oversampling of Blacks, Hispanics, and young adults (ages 18-24). Of the 39,959 participants eligible for Wave 2 interviews, a total of 34,653 were re-interviewed. Response rates for wave 1 and eligible wave 2 surveys were 81% and 87%, respectively. Our sample included a total of 14,458 male and 19,974 female participants who participated in both the Wave 1 and Wave 2 assessment and had complete data on all measures. Data were weighted based on demographic information from the 2000 Census in order to be representative of the U.S. non-institutionalized, civilian population. Additional details on NESARC are available

in Grant et al. (2004; 2009). This study utilized de-identified, publicly available data that did not require Institutional Review Board approval.

2.2 Measures

2.2.1. Marijuana—Marijuana use was based on a single question that assessed lifetime non-medical use. The question specifically asks about “experiences with medicines and other kinds of drugs that you may have used on your own - that is, either without a doctor’s prescription; in greater amounts, more often, or longer than prescribed; or for a reason other than a doctor said you should use them. People use these medicines and drugs on their own to feel more alert, to relax or quiet their nerves, to feel better, to enjoy themselves, or to get high or just to see how they would work. Have you ever used ...marijuana, hash, THC, or grass?” The drug module also assessed age of onset and frequency of use.

2.2.2 Alcohol—Alcohol involvement was captured by items assessing clinical features of DSM-IV alcohol abuse and dependence assessed using the Alcohol Use Disorders and Associated Disabilities Interview Schedule (AUDADIS-IV) (Grant et al., 2003), a structured diagnostic interview designed to assess alcohol, drug, and mental health disorders according to DSM-IV diagnostic criteria (American Psychiatric Association, 1994). Past-year symptom questions were combined to form dichotomous indicators (yes/no) of the various alcohol use disorder (AUD) criteria that included four alcohol abuse criteria: 1) recurrent drinking resulting in a failure to fulfill major role obligations; 2) recurrent drinking in hazardous situations; 3) recurrent drinking-related legal problems; and 4) continued drinking despite recurrent interpersonal problems caused or exacerbated by drinking; and seven alcohol dependence criteria: 1) tolerance; 2) having two or more withdrawal symptoms; 3) drinking larger amounts/for a longer period than intended; 4) having a persistent desire/ unsuccessful attempts to cut down on drinking; 5) spending a great deal of time obtaining alcohol, drinking, or recovering from drinking’s effects; 6) giving up important social, occupational, or recreational activities in order to drink; and 7) continued drinking despite physical or psychological problems caused by drinking. Consistent with the approach adopted in DSM-5 and prior latent class analyses (Crum et al., 2018; Ehlke et al., 2012; La Flair et al., 2012, 2013; Muthén, 2006), abuse and dependence criteria were considered together. In accordance with previous work, we used a three-status model of alcohol problems for both males and females. Three statuses were chosen based on fit statistics and parsimony (see Crum et al., 2018).

2.2.3 Propensity score weighting variables—Potential confounders in the propensity score model included age as a continuous variable, race/ethnicity (non-Hispanic White, Non-Hispanic black, Hispanic and Other), education (≥ 12 years, <12 years), family history of alcoholism (any first-degree relative reported as “alcoholic or problem drinker”), lifetime use of other drugs (heroin, other narcotics, cocaine, stimulants, hallucinogens), nicotine dependence, mood disorders (major depressive disorder, dysthymia, mania, hypomania), and anxiety disorders (generalized anxiety disorder (GAD), panic disorder, social phobia, and/or specific phobia). Sex was controlled for through sex-stratification.

2.3 Statistical analysis

We examined the transitions in alcohol involvement over time using latent transition analysis, which relies on Markov modeling (LTA, Collins and Wugalter, 1992; Reboussin et al., 1999).¹ Within the LTA framework, we assessed via multinomial logistic regression, the potential influence of having a history of marijuana use at baseline on the probability of progressing from less advanced to more advanced stages of alcohol involvement, as well as the probability of having a marijuana history at baseline for hindering remission, that is a reduced probability of moving from a more advanced stage of alcohol problems to a less symptomatic alcohol involvement stage. In these models, the predictor is the latent status at wave 1, which is interacted with marijuana use. The interpretation of the odds ratio is the odds of transitioning from one status to another relative to remaining in the same status for marijuana users compared to non-users. These models take into account the uncertainty of class membership (i.e., we did not assign individuals to statuses).

To address confounding and isolate the association between marijuana use and alcohol stage transitions, we applied the propensity score method of inverse probability of treatment weighting (IPTW), which adjusts for the baseline differences between marijuana users and non-marijuana users (Curtis et al., 2007; Rubin, 2010; Stuart, 2010). We computed propensity scores (i.e., probability of marijuana use history) in R using a logistic regression model. Propensity scores reflected each participant's likelihood of being a marijuana user given her/his sociodemographic and clinical characteristics. An individual's data were then weighted by the inverse probability of being in their observed group (i.e. lifetime marijuana user or non-lifetime marijuana user). Due to the NESARC's complex sampling design, we carried out the LTA in Mplus version 7.0, which allowed us to take into account survey weights, clustering and stratification. We multiplied the propensity score weights by the survey weights and used the resulting combined weights in the analysis of the association of marijuana use with alcohol involvement transitions (Dugoff et al., 2014). To assess the effectiveness of IPTW in balancing the composition of marijuana users and nonusers on measured confounders, we compared characteristics of the group before and after applying the weights (Stuart, 2010). We deemed the application of IPTW as successful because marijuana users and nonusers were similar with respect to the observed characteristics after using the weights, with one exception. Marijuana users were more likely than non-users to use other illegal drugs. Thus, the LTA utilized a doubly robust procedure by also controlling for illegal drug use in addition to using propensity score weights that took into account illegal drug use.

All analyses stratified by sex. As presented originally in Crum et al. (2018), to confirm that sex-stratified was appropriate, we tested whether the structure of the 3-status model varied for males and females. Sex invariant testing suggested that pooling data for men and women would lead to a significantly worse model fit (likelihood difference test statistic =276.84, $p<0.001$, and 182.25, $p<0.001$ for waves 1 and 2, respectively). Thus the structure of latent statuses differed between males and females. We found that over a third of indicators of

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¹While the LCA and LTA portions are similar to previously published work, they vary slightly since the sample size for each analyses changes based on missing data for the covariates in the model.

alcohol problems were significantly different by sex at $p < 0.05$ for wave 1, and 27% were significantly different at wave 2. For example, males had significantly higher conditional probabilities for drinking in physically hazardous situations and developing tolerance than females.

3. Results

3.1 Description of marijuana users

We find that 25.4% of men and 16.9% of women have used marijuana in their lifetime at the time of baseline assessment, with a mean age of onset of 18.4 years ($sd=0.14$) for male and 18.3 years ($sd=0.12$) for female users (mode=16 years of age); 3.7% of those in the analytic sample used marijuana in the past year, which represents 19.1% of lifetime users. Over 90% of users report onset by age 23 (68% by age 18). As shown in Table 1, male and female marijuana users tend to be younger, White, and at least high school educated. Over 44% of male marijuana users and 53% of female marijuana users have a family history of an alcohol use disorder compared to only 24.5% of male non-users ($p < .001$) and 30.3% of female non-users ($p < .001$). The majority of male marijuana users and almost half of female marijuana users have used other illegal drugs in addition to marijuana. Both male and female marijuana users are significantly more likely than nonusers to meet criteria for nicotine dependence ($p's < .0001$), a mood disorder ($p's < .0001$), or an anxiety disorder ($p's < .0001$).

3.2 Latent statuses of alcohol involvement and transitions in alcohol involvement over time

The three-status model of alcohol involvement includes a No Problem status, a Moderate Problem status, and a Severe Problem status at each wave. Men and women in the Moderate Problem status on average endorse about two of 11 AUD criteria (four abuse and seven dependence criteria). This status is characterized by drinking in hazardous situations, drinking in larger amounts than intended, experiencing tolerance and withdrawal symptoms and having problems cutting down consumption. Men in the Severe Problem status on average endorse six of the 11 AUD criteria and women endorsed five. In addition to the problems of the Moderate Problem status, the Severe Problem status also experience role failure, social problems, physical and psychological problems, greater time spent getting alcohol, and giving up of activities because of alcohol.

As shown in Supplementary Table A available online, there was stability, progression, and remission over time in alcohol involvement. For example, an estimated 90% of men and 93% of women who are in the No Problem status at Wave 1 remain in that status at Wave 2, 66% of men and 54% of women in the Moderate Problem status at Wave 1 remain in that status at Wave 2, and 44% of men and 35% of women in the Severe Problem status at Wave 1 remain in that status. In terms of remission, an estimated 24% of men with Severe Problems moved to No Problems while 32% moved to Moderate Problems. For women, an estimated 22% of women with Severe Problems moved to No Problems and 43% moved to Moderate Problems.

3.3 Association of marijuana use with latent statuses of alcohol involvement

As shown in Table 2, in unadjusted models, both men and women with a history of marijuana use are significantly more likely to be in the Moderate or Severe Problem statuses at baseline compared to the No Problem status. After propensity score adjustment, a statistically significant association remains between marijuana use and membership in the Moderate Problem status for both men (aOR=1.40, $p=.029$) and women (aOR=2.03, $p<.001$).

3.4 Association of marijuana use with alcohol involvement transitions over time

Table 3 provides the association of marijuana use at Wave 1 with transitions in statuses of alcohol involvement across waves both with and without propensity score adjustment. In unadjusted models, men who have used marijuana were 1.96 times as likely as men who do not have a marijuana use history to transition from No Problems to Moderate Problems ($p<.001$); however, after propensity score weighting, this association is no longer statistically significant. For women, this transition from No Problems to Moderate Problems is statistically significant in both the unadjusted (OR=3.41, $p<.001$) and propensity score adjusted models (aOR=1.74, $p=.030$). For men only, marijuana use is associated in both unadjusted and adjusted models with the transition from No Problems to Severe Problems. After propensity score adjustment, men who have used marijuana are 3.50 times as likely as men without a history of marijuana use to transition from No Problems to Severe Problems during the 3 year interval ($p=.001$).

Results also show an association between marijuana use and a lower likelihood of remission. In unadjusted models, men who have used marijuana are less likely to move from Severe Problems to No Problems during the three years (OR=0.48, $p=.049$); however, this association is explained by confounding. For women though, in propensity score adjusted models, marijuana use is associated with a significantly lower likelihood of moving from Severe Problems to No Problems (aOR=0.13, $p=.006$).

4. Discussion

4.1 Conclusions and implications

With perceptions and policies about marijuana changing over time, as well increasing rates of marijuana use in recent years (Hasin et al., 2015), it is critical that we increase our understanding of the role that marijuana use may play in influencing progression in and remission from alcohol problems during adulthood, as this topic has rarely been studied in the past. Previous research instead has focused on how alcohol may lead to marijuana use or how marijuana influences the use of other illicit drugs. This understanding is particularly important because as individuals age, they move away from illegal drugs and are more likely to continue the legal, easily accessible, and more socially sanctioned substance of alcohol. This work extends previous studies that have focused on marijuana as a risk factor for other drugs such as cocaine, methamphetamines, and heroin (Agrawal et al., 2007; Degenhardt et al., 2001; Fergusson, et al., 2006) by focusing on marijuana's influence on the more commonly used substance of alcohol, specifically on problematic use. It considers multiple stages of alcohol problems instead of comparing those with and without alcohol use

disorders, as well as differential effects for men and women. It utilizes longitudinal population-based data enabling us to both establish time order between marijuana exposure and alcohol outcomes and overcomes the limitations of clinical or community-based samples. It addresses shared risk factors for alcohol and marijuana use (Vanyukov et al., 2003a, 2003b) using an advanced statistical technique, propensity score weighting.

A few previous studies have shown that marijuana use seems to increase the risk for developing alcohol abuse and dependence (Blanco et al., 2016; Grant et al., 2010; Guttmanova et al., 2017; Weinberger et al., 2016), which aligns with our findings. Our findings make a unique contribution to research because of our study's focuses on both the strength and direction of transition (both progression and remission) in stages of alcohol problems. We find that marijuana history is associated with being in a moderate alcohol problem status compared to no problems at baseline for both men and women. Across time, a marijuana history also seems to influence progression in alcohol problems. For women, after adjusting for confounders, women who have used marijuana are significantly more likely than women who have not used marijuana to progress from no alcohol problems to moderate alcohol problems across the three years. For men, after taking into account confounding variables, men with a history of marijuana use are over three times as likely as men without a marijuana history to progress from no alcohol problems to severe alcohol problems across the three year period. This rapid transition is concerning and requires further investigation.

We also found that women, but not men, with a marijuana history are significantly less likely than those without a marijuana history to remit from severe alcohol problems across the three years. This sex difference may be related to evidence that comorbidity is more common among women than men (Kessler et al., 1997), which may impact recovery, or biologic differences between men and women in the neurocircuits involved in addiction that impact recovery (Arain et al., 2013). Future research should assess the extent to which women may be substituting marijuana for alcohol to reduce drinking and aid in recovery (Subbaraman, 2014), even though research has not supported the effectiveness of this substitution (Subbaraman et al., 2018).

These are important findings as few studies have rigorously estimated potential consequences of marijuana use based on longitudinal, population-based data. In the NESARC, the vast majority of marijuana users began use during adolescence, but less than one-fifth of lifetime users were past year users when they were assessed at Wave 1 (mean age 46) years, confirming that marijuana primarily remains a problem in youth and young adults. We think that long-term effects, if proven to be causal, may be the result of how marijuana use, especially during active times of brain development, may prime the brain for later alcohol use disorders. More research is needed to ascertain whether the link is general to substance use involvement or specific to alcohol use involvement.

With the softening of policies around marijuana, it is critical for public health researchers and professionals to take an active role in identifying and minimizing potential harm from marijuana use, with progression and lack of remission from AUDs as significant potential consequences, as alcohol problems are costly to both the individual and society. By better

understanding the mechanisms by which a history of marijuana use leads to transitions (or lack thereof) in problematic drinking, there are potential opportunities to develop public awareness campaigns that highlight the risks and target prevention of use or delaying onset. Identifying potential subgroups that may benefit from targeted interventions will be important for future investigations.

4.2 Potential Mechanisms

Future research should test specific mechanism that may causally link marijuana exposure to later transitions in alcohol problems. One potential pathway is neurobiological, specifically the changes in brain chemistry resulting from marijuana use, including how THC can prime the brain for enhanced responses to other drugs (Ellgren et al., 2007; Panlilio et al., 2013; Volkow et al., 2014a). It would be helpful to tease out whether marijuana use leads specifically to alcohol problems or more generally to substance use disorders. Future research should also consider how marijuana and alcohol interact to affect developing brains as there may be synergistic effects of dual use during specific developmental periods, as it is likely that while those in the study sample were using marijuana, they were also partaking in alcohol co-use (Yurasek et al., 2017) though data limitations do not allow us to study that well in this dataset.

A second potential mechanism to explore in future research is psychological in nature. Marijuana use may interfere with the development of appropriate coping skills (Litt et al., 2005), particularly if marijuana is used as a primary coping mechanism. Thus, when adversity or stress arises, individuals without appropriate coping skills because of their marijuana use may turn to alcohol to deal with stressors due to its easy accessibility, which may lead to problem drinking.

4.3 Limitations

Findings should be considered in the context of several limitations. First, the prevalence of lifetime marijuana use in the NESARC is relatively low compared to other population-based surveys. For example, data from the National Survey on Drug Use and Health, reported the lifetime prevalence of marijuana use to be 40.4% in U.S. adults in 2002 compared to under 20% in the NESARC. Second, a lack of power precluded us from comparing more frequent marijuana users to those who used at a lower frequency to order to assess a dose response, as we would expect stronger associations with more regular use. This is something that should be explored in the future. Third, also due to a lack of power, we were unable to consider current use of marijuana at Wave 1, as previous work shows important pharmacokinetic effects of co-use of alcohol and marijuana (Lukas and Orozco, 2001). For example, marijuana may slow the absorption of alcohol and dampen the effect of alcohol (Yurasek et al., 2017), potentially increasing the desire for more alcohol and increasing the risk for alcohol-related problems. Fourth, NESARC data are now a number of years old; however, it is one of the few population-based prospective studies large enough and with a strong enough alcohol use disorder assessment to allow us to conduct an LTA on alcohol transitions. The generalizability of these findings should be assessed in more recent samples as with the changing context of marijuana use, the importance of this investigation of consequences may be more relevant today than when the original data was collected.

An alternative explanation for the associations we identified is a predisposition to both marijuana use and development of alcohol problems. While we attempted to rule out this alternative explanation through a statistical technique that takes into account an individual's propensity to use marijuana, we may not have adequately adjusted for confounders. We included a wide range of background variables (e.g., other substance use, nicotine dependence history, psychological comorbidity) in the propensity score model; however, there may be unmeasured confounders that were excluded.

4.5 Conclusion

This study adds to the growing research base of potential long-term adverse effects of marijuana use (see Volkow et al., 2014b) and has potential implications for future research, intervention, and policy. As AUDs have a high burden of morbidity and mortality (Shield et al., 2015; WHO, 2014), it is critical to increase our understanding of factors that may influence progression in and hinderance of remission from alcohol problems. This study offers evidence that marijuana use history may serve as a marker for individuals who are at greatest risk for an alcohol use progression or those who may struggle most to remit from alcohol problems (in the case of women), and this history should be considered in the screening process.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1:

Characteristics of Male (n=14,458) and Female (n=19,974) Participants by Lifetime Marijuana Use, National Epidemiologic Survey on Alcohol and Related Conditions, Wave 1

	Male Marijuana Users % (n=3,629)	Male Non-Users % (n=10,829)	p-value	Female Marijuana Users % (n=3,280)	Female Non-Users % (n=16,694)	p-value
Age						
18-35	42.4	31.9	<.001	43.9	29.9	<.001
36-49	39.9	26.6		42.2	25.9	
50+	17.8	41.5		13.9	44.2	
Race/ethnicity						
White	78.4	71.2	<.001	82.1	70.6	<.001
Black	9.9	9.8		8.6	12.4	
Hispanic	8.7	13.4		6.8	11.7	
Other	3.0	5.4		2.4	5.4	
Education						
<12 years	11.7	15.8	<.001	7.8	15.9	<.001
12 years	88.3	84.2		92.1	84.1	
Family history of alcohol use disorder	44.4	24.5	<.001	52.6	30.3	<.001
Illegal drug use (marijuana excluded)	54.8	2.9	<.001	46.5	2.9	<.001
Nicotine dependence	38.7	13.2	<.001	37.5	11.0	<.001
Mood disorder						
Major depressive disorder	20.4	9.0	<.001	36.8	17.8	<.001
Dysthymia	6.0	2.0	<.001	11.6	4.0	<.001
Mania	6.6	2.0	<.001	8.9	2.4	<.001
Hypomania	3.7	2.2	<.001	4.2	1.8	<.001
Anxiety disorder						
GAD	5.0	2.1	<.001	10.3	4.4	<.001
Panic disorder	6.1	2.4	<.001	12.4	5.5	<.001
Social phobia	7.5	3.2	<.001	10.2	5.0	<.001
Specific phobia	10.6	4.9	<.001	20.1	10.9	<.001

Note: Percentages are weighted by Wave 2 weights.

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Table 2.

Cross-Sectional Association of Lifetime Marijuana Use at Baseline with Alcohol Involvement Class at Baseline: NESARC Wave 1

Alcohol Involvement Class	Unadjusted Odds Ratio, 95% Confidence Interval, p-value	Propensity Score Weighted Odds Ratio, 95% Confidence Interval, p-value^a
Men		
No Problems	Reference	
Moderate	4.44 (3.83, 5.10) p<.001	1.40 (1.03, 1.91) p=.029
Severe	10.90 (8.40, 14.30) p <.001	1.79 (0.94, 3.44) p=.078
Women		
No Problems	Reference	
Moderate	7.24 (6.21, 8.43) p <.001	2.03 (1.49, 2.75) p<.001
Severe	13.70 (10.70, 17.70) p <.001	1.72 (0.89, 3.31) p=.106

^aPropensity score models include age, race-ethnicity, educational level, family history of alcoholism, use of other illegal drugs besides marijuana, lifetime nicotine dependence, and the history of a mood disorder or anxiety disorder. Estimates are doubly adjusted. Illegal drug use is included in propensity score model and the LTA model to adjust for remaining imbalance after propensity score matching.

Table 3:

Lifetime Marijuana Use Predicting Transitions in Stages of Alcohol Involvement from Wave 1 to Wave 2 among NESARC men (n=14,458) and Women (n=19,974)

Transition Direction	Males (25.1% lifetime marijuana use)		Women (16.4% lifetime marijuana use)	
	Unadjusted OR (95% CI) p-value	Adjusted OR* (95% CI) p-value	Unadjusted OR (95% CI) p-value	Adjusted OR* (95% CI) p-value
Alcohol Progression				
No Problems to Moderate	1.96 (1.58, 2.44) p<.001	1.18 (0.78, 1.77) p=.433	3.41 (2.65, 4.38) p<.001	1.74 (1.06, 2.88) p=.030
No Problems to Severe	2.25 (1.20, 4.22) p=.011	3.50 (1.62, 7.56) p=.001	1.01 (0.17, 5.92) p=.992	1.04 (0.32, 3.45) p=.944
Moderate to Severe	1.22 (0.75, 1.99) p=.426	1.81 (0.48, 6.75) p=.380	1.24 (0.75, 2.04) p=.399	2.60 (0.69, 9.73) p=.157
Alcohol Remission				
Moderate to No Problems	1.30 (0.90, 1.88) p=.159	0.85 (0.43, 1.66) p=.627	1.10 (0.73, 1.67) p=.640	1.25 (0.53, 2.95) p=.608
Severe to No Problems	0.48 (0.23, 1.00) p=.049	1.45 (0.38, 5.57) p=.589	0.81 (0.32, 2.05) p=.661	0.13 (0.03, 0.56) p=.006
Severe to Moderate	1.06 (0.47, 2.38) p=.883	7.15 (0.17, 302.6) p=.303	0.68 (0.34, 1.39) p=.294	0.62 (0.08, 4.49) p=.635

Note:

* Estimates are doubly adjusted. Illegal drug use is included in propensity score model and the LTA model to adjust for remaining imbalance after propensity score matching.