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Alcohol and Cannabis Co-Use in a National Sample of U.S. Adults Ages 30–80

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Abstract

Introduction.—Growing cannabis legalization has coincided with an increased focus on use of both alcohol and cannabis (AC co-use) among younger people; however, little is known about AC co-use among adults over age 30. This study examines the prevalence of different types of AC co-use among adults, as well as compares AC co-users and alcohol-only users on individual, social network, and neighborhood characteristics.

Methods.—Data come from three annual surveys of a nationally representative sample of 1,770 U.S. adults, initially between the ages of 30–80, conducted between 2019 and 2021. The baseline sample is 52.8 years old on average, 51.8% female, and 60.1% non-Hispanic White.

Results.—Past month co-use at baseline was reported by 8.4% of adults, and mostly consisted of simultaneous use, with less than 5% of the sample initiating co-use over the two-year follow-up period. Multivariable models indicate AC co-use was cross-sectionally associated with respondents being male, younger, Hispanic (vs. White), and having more alcohol use and related problems, and with their social network composition (e.g., having more drinking buddies and cannabis users in the network). However, co-use status was not associated with mental health, physical ailments, or neighborhood quality. Longitudinal analyses indicated that AC co-use at baseline predicted more alcohol use one year later and alcohol related problems two years later among men only.

Conclusions.—AC co-use among adults over age 30 deserves further attention given its prevalence and associations with heavier drinking and related problems. Network-focused interventions may be a promising approach for reducing AC co-use.

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Keywords

alcohol; cannabis; co-use; adults; longitudinal

1. INTRODUCTION

The spreading legalization of cannabis in the U.S. has coincided with increased rates of use in nearly every adult age group (Hasin et al., 2019). In 2020, prevalence of past year cannabis use ranged from 26% among adults in their early 30s to 10% among those ages 50 and older (Center for Behavioral Health Statistics and Quality, 2021). Given more widespread use of cannabis among adults, it is perhaps not surpring that its co-use with alcohol has increased in recent years (Kepner et al., 2022). There is growing evidence that alcohol and cannabis (AC) co-use can be more problematic than use of either substance alone (Gunn et al., 2022). However, most research has been conducted with young people and it is important to understand the patterns and correlates of AC co-use among adults.

1.2. Problems Associated with AC Co-Use

Types of AC co-use include using both substances, but only on separate occasions (concurrent co-use), and using both substances at the same time so their effects overlap (simultaneous co-use). While there is evidence that cannabis can potentially have a substituting or complementing effect on alcohol use (Gunn et al., 2022), generally individuals who engage in AC co-use tend to report heavier and more frequent use than those who use either substance alone (Yurasek et al., 2017). This heavier use, in turn, may contribute to the negative behavioral outcomes associated with AC co-use. Although research on older age groups is lacking, longitudinal studies of young people indicate that AC co-use predicts increased risk of sexual assault (Read et al., 2021), experiencing multiple substance-related problems (e.g., legal, academic, relational, health; Briere et al., 2011), and poorer academic performance (Meda et al., 2017). Cross-sectional studies have found that AC co-use is associated with various risk behaviors such as impaired driving (Duckworth & Lee, 2019; Terry-McElrath et al., 2014), truancy and use of other illicit drugs (Patrick et al., 2018; see also event-level studies by Egan et al., 2019; Gunn et al., 2018; Lee et al., 2020; Linden-Carmichael et al., 2020). While young people who engage in simultaneous AC co-use tend to have a higher risk profile than those who engage in concurrent use only (Cummings et al., 2019), both co-use types are associated with more negative consequences compared to single product use (Jackson et al., 2020; Subbaraman & Kerr, 2015).

1.3. Understanding AC Co-Use Beyond Young Adulthood

Given increasing AC co-use after young adulthood, and its potential for increasing their vulnerability to negative behavioral and health outcomes, it is important to better understand who is at risk for AC co-use during subsequent stages of life. One of the few studies in this area used national data to compare adults ages 50 and older who did versus did not engage in both past month cannabis use and binge drinking (Kepner et al., 2022). Respondents who engaged in co-use were more likely to be younger, male, Black, a tobacco user, and in past-year mental health treatment. While informative, this study is limited by its focus on

binge drinking, as well as the use of a comparison group that included both single substance users and abstainers. As a result, virtually nothing is known about AC co-use involving alcohol use in general among adults, or how adults who engage in AC co-use differ from those who use alcohol only. Further, this study was limited to examining individual-level correlates of AC co-use. While important, social-ecological models (e.g., Bronfenbrenner, 1979) emphasize that additional levels of influence, including interpersonal and contextual/environmental factors, should be considered to fully understand complex behaviors such as AC co-use.

1.4. Interpersonal and Contextual Factors

Numerous theories have explained the ways in which interpersonal influences on individual behavior may operate through social networks (e.g., Bandura, 1986; Durkheim, 1951; Hirschi, 1969). Studies applying formal social network analysis to understanding alcohol use have found, for example, that problematic alcohol use is more likely among adults with networks that are less resourceful (Shiovitz-Ezra & Litwin, 2012), less diverse (Kim et al., 2018), and denser (Tucker et al., 2021). One of the few studies examining interpersonal factors associated with AC co-use found that young adults were more likely to engage in AC co-use if they had spent more time during adolescence with peers who used one or both substances (D'Amico et al., 2020). Together, this suggests that both network structure (e.g., density) and composition (e.g., presence of substance users) may be relevant to understanding AC co-use among adults.

The study of contextual influences on substance use has often focused on neighborhoods, with social disorganization theories positing that poverty, instability, and lack of cohesion interfere with residents' ability to form and enforce common social norms and control mechanisms that deter problematic behavior (Sampson et al., 2002). Applied to substance use, studies indicate that younger people who live in disadvantaged neighborhoods are more likely to engage in heavier substance use (Abdelraham et al., 1999; Karvonen & Rimpela, 1997; Tucker et al., 2013) and specifically that adult cannabis use is linked to neighborhood problems and low social cohesion (Taggart et al., 2018). Our own work has shown that both neighborhood cohesion and disorder are associated with binge drinking among adults ages 30 and older (Tucker et al., 2021). Despite the relevance of neighborhood characteristics to substance use, we are not aware of studies examining whether cohesion and disorder within adults' neighborhoods are associated with their likelihood of AC co-use.

1.5. The Present Study

This study extends the limited literature on adult AC co-use in four important respects. First, it examines the prevalence of simultaneous and concurrent-only AC co-use in a nationally representative sample of U.S. adults ages 30 and older. Second, it extends the Kepner et al. (2022) study by not only examining individual correlates of AC co-use, but also social network and neighborhood characteristics that prior work has suggested are relevant to substance use. Third, given research showing that AC co-use is associated with poorer outcomes among younger people, this study longitudinally examines whether adults who engage in AC co-use are more likely to show escalations in their heaviness of drinking and mental health problems over a two-year period compared to adults who use alcohol only.

Little is known about long-term physical effects of AC co-use among adults; as such, we also explore group differences on physical ailments over time. Finally, it examines stability and change in substance use, with a specific focus on the extent to which adults initiate or quit AC co-use over time.

2. METHODS

2.1. Participants and Procedures

A random sample of 2,615 adults (ages 30–80) from the RAND American Life Panel (ALP; Pollard and Baird, 2017) were invited to participate in a larger ongoing study, with the intention of closing the survey once 1,700 surveys were completed. The ALP is a nationally representative Internet panel of over 5,000 U.S. adults who were age 18 or older at recruitment. ALP members are recruited via probability-based sampling methods, either sampled by random digit dial (landline and cell phone) or address-based sampling. Surveys were completed April-June 2019 (N=1770), May-July 2020 (N=1537), and June-July 2021 (N=1408). See Table 1 for sample characteristics. Participants provided informed consent, and study materials and procedures were approved by the study's institutional review board.

2.2. Measures

2.2.1. Alcohol and cannabis use.—Participants reported the number of days in the past month they used: "alcohol"; "marijuana"; "alcohol at the same time as an e-cigarette or personal vaporizer filled with a marijuana product"; and "alcohol at the same time as marijuana that is smoked or consumed as an edible". Participants were classified into one of five mutually exclusive groups: (1) no use; (2) alcohol use only; (3) cannabis use only; (4) concurrent-only AC co-use (i.e., used both substances in the past month, but not at the same time); and (5) any simultaneous AC co-use (i.e., used both substances at the same time). Past month average number of drinks consumed per day was derived by combining two additional variables: [(number of drinking days X number of drinks typically consumed on drinking days)/30]. The Short Inventory of Problems (SIP-2L; Miller et al., 1995) assessed adverse consequences of alcohol use in the past 3 months.

2.2.2. Individual.—These variables included sex, age, race/ethnicity, married or cohabitating (vs. not), college graduate (vs. not), household income (in $10,000), depression (Patient Health Questinnaire-8 (PHQ-8); Kroenke et al., 2009; α=0.92), anxiety (General Anxiety Disorder-7 (GAD-7); Spitzer et al., 2006; α=0.94), and number of physical ailments (Patient Health Questionnaire-15 (PHQ-15); Kroenke et al., 2002).

2.2.3. *Social network*.—Participants named up to 10 people ("alters") they interacted most often with in the past six months and then answered questions about each alter. They were also asked whether each unique pair of network members knew and interacted with each other ("ties"). From this information we derived six variables: core network size (i.e., number of alters identified as being in the participant's "core group of friends"); two indicators of network density (proportion of ties among network members relative to the total number of possible ties): density among alters who used alcohol and/or cannabis and density among alters who used neither alcohol nor cannabis; and the proportion of alters

who the participant reported used cannabis, drank alcohol, and drank alcohol with the participant ("drinking buddies") in the past 3 months.

2.2.4. Neighborhood.—Disorder was assessed using seven items from the National Survey on Drug Use and Health (NSDUH) (Winstanley et al., 2008; α=.87). Cohesion was assessed using four items from the Sampson Social Cohesion Scale (Sampson et al., 2002; α=.91). Lastly, we determined whether each participant resided in a state where cannabis was legal for medical and/or recreational purposes at the time of the survey (yes/no).

2.3. Analytic Plan

We first calculated descriptive statistics for the main study variables. Due to small numbers, subsequent analyses: (a) excluded adults who only used cannabis (n=31); and (b) combined the concurrent-only (n=31) and simultaneous AC (n=114) co-use groups. The main analyses used logistic regression analysis to examine correlates of AC co-use (compared to alcohol use only) at Wave 1. Separate models examined associations of each individual, social network, and neighborhood variable with AC co-use status; variables associated with co-use status were then included in a multivariable model. Next, we examined stability and change in AC use and co-use patterns across Waves 1–3. Finally, we examined baseline AC co-use status as a predictor of alcohol use and related problems, physical ailments, and mental health at Waves 2 and 3 (controlling for all demographic variables described above, as well as the outcome measure at Wave 1). Given sex differences in patterns of alcohol use and problems that have emerged from this dataset (Pollard et al., 2020; Tucker et al., 2022), we explored whether these longitudinal associations differed for men and women by adding an AC Co-Use x Sex interaction term to these final models. Analyses were conducted using SAS v9.4 and included survey weights to make the sample's demographic distributions as representative of the U.S. population as possible (Pollard and Baird, 2017).

3. RESULTS

3.1. Prevalence of AC use and co-use.

As shown in Table 1, 34.9% of the sample reported no use in the past 30 days, 54.5% used alcohol only, 2.2% used cannabis only, and 8.4% used both substances. The mean number of days of use, among those who reported any use of the substance in the past 30 days, was 8.6 for alcohol, 11.0 for cannabis that is used in a personal vaporizer, 10.6 for cannabis that is smoked or consumed as an edible, 3.6 for alcohol with vaped cannabis, and 4.4 for alcohol with cumbustible/edible cannabis. Most AC co-users engaged in simultaneous use (6.7% of sample) rather than concurrent-only use (1.7% of sample). Due to the small number who engaged in concurrent-only use, subsequent analyses compared alcohol-only users with AC co-users of either type.

3.2. Correlates of AC co-use.

As shown in Table 2, bivariate analyses indicated that compared to adults who only used alcohol, those who engaged in AC co-use were more likely to be male, younger, Hispanic, not married/cohabitating, and of lower income. For other individual characteristics, AC co-use was associated with drinking more heavily, experiencing more problems from drinking,

and having greater depression and anxiety symptoms (but not necessarily more physical ailments, p=.08) compared to alcohol-only use. Results for the social network variables indicated that AC co-users had a smaller core network, more drinking buddies, and more cannabis users in their network than adults who only used alcohol; however, there was not a significant difference on the density of alters who used alcohol and/or cannabis, density of alters who used neither substance, or proportion of alters who drank alcohol. Finally, for neighborhood characteristics, adults who engaged in AC co-use reported living in neighborhoods with greater disorganization (although not necessarily less cohesion) – but were *less* likely to reside in a state where cannabis use is legal for medical and/or recreational purposes – compared to adults who only used alcohol.

When variables associated with AC co-use status were included in a final multivariable model (including physical ailments, which was marginally significant), the following were associated with a higher likelihood of engaging in AC co-use compared to alcohol use only: being male, younger, and Hispanic; heavier drinking and experiencing more problems from drinking; and having a smaller core network, more drinking buddies in the network, and more cannabis users in their network.

3.3. Change in patterns of alcohol and cannabis use over time.

Of adults who participated in all three annual waves, 73% were stable in their AC use classification across waves. About 4% of participants initiated AC co-use after Wave 1. Most transitions involved alcohol use initiation or cessation (see Table 3).

3.4. Longitudinal associations of AC co-use with individual functioning.

Table 4 shows results from regression models examining AC co-use status at Wave 1 as a predictor of mean changes in alcohol use and problems, physical ailments, and mental health symptoms at Waves 2 and 3 (i.e., W1-W2; W1-W3). The only significant association indicated that adults who engaged in AC co-use at Wave 1 increased their average number of drinks per day at Wave 2 more than did those who only used alcohol. When exploring whether these associations differed for men and women, results indicated a significant AC Co-Use x Sex interaction in predicting this outcome at Wave 2 (β=0.19, SE=0.44, p<.001). This interaction indicated that the greater increase in alcohol use over time among adults who engaged in co-use was limited to men (mean difference as a function of co-use status for men: β=−1.52, SE=0.29, p<.001; and women: β=.005, SE=0.34, p=.99). Further, there was a significant AC Co-Use x Sex interaction in predicting alcohol problems at Wave 3 (β=0.13, SE=0.37, p<.01), indicating that adults who engaged in AC co-use reported more alcohol problems over time than did those who only used alcohol – but, again, this was only the case for men (mean difference as a function of co-use status for men: β=−0.57, SE=0.24, p=.012; and women: β=0.42, SE=0.29, p=.15). AC co-use status was not prospectively associated with physical or mental health outcomes.

4. DISCUSSION

Consistent with NSDUH data (Center for Behavioral Health Statistics and Quality, 2021), we found that slightly over 10% of adults reported past month cannabis use at baseline.

Further, a key finding from this study is that two-thirds of adults who used cannabis reported that they simultaneously co-used cannabis with alcohol, rather than using cannabis exclusively or using both substances only on separate occasions. While any type of AC co-use appears to be associated with elevated risk compared to single-product use, simultaneous co-use has emerged as particularly problematic (Cummings et al., 2019). Better understanding patterns of AC co-use and its effects on functional outcomes among adults deserves increasing attention, especially if cannabis use continues to increase among U.S. adults (Hasin et al., 2019). Indeed, most of the transitions to AC co-use in our sample involved drinkers who began using cannabis. Results from this study provide an initial look at who is at higher risk for AC co-use, as well as some potentially important targets for intervention to reduce AC co-use among adults age 30 and older.

To better understand AC co-use in this age group, we compared adults who engaged in AC co-use and those who used alcohol only in terms of individual, social network, and neighborhood characteristics. Similar to results from Kepner et al. (2022), adults in our sample had a higher likelihood of AC co-use if they were male and younger. However, unlike the Kepner et al. (2022) study, which found that Hispanic adults had a lower likelihood and Black adults had a higher likelihood of AC co-use, we found that Hispanic adults had a higher likelihood of AC co-use and race was not significantly associated with co-use status. Given that both sets of findings are based on nationally representative samples of U.S. adults (albeit our ALP cohort also includes a younger group of 30–49 year olds), the reasons for this discrepancy are unclear. However, both studies suggest that there are racial/ethnic differences in AC co-use among adults that are deserving of further research given, among other considerations, known racial/ethnic disparities in substance use treatment outcomes among adults (Suntai et al., 2020). Heavier alcohol use among AC co-users has been documented among young adults (Yurasek et al., 2017) and our results suggest that this pattern continues across the adult lifespan. However, the greater increases in alcohol use and related problems over time among adults who engaged in AC co-use, compared to those who only used alcohol, were found for men only. This sex difference in drinking-related outcomes associated with AC co-use, combined with the higher prevalence of co-use among men than women, suggest that screening and prevention efforts to reduce AC co-use and related problems among adults should include a particular focus on men.

AC co-use has been associated with poorer health in mostly cross-sectional studies (Yurasek et al., 2017). In terms of physical ailments, we did not find differences between the AC co-use and the alcohol-only groups, either cross-sectionally or over time. Although more research is needed, it may be that anti-inflammatory effects of cannabis reduce the impact of co-use on physical health problems generally. For mental health, AC co-use status was associated with greater depression and anxiety in cross-sectional analyses; however, these associations weakened to non-significance in the multivariable model. A similar pattern was found for neighborhood characteristics and AC co-use, with associations weakening to non-significance when other factors were taken into account. Rather, certain social network characteristics emerged as the more important correlates of AC co-use in multivariable models. Specifically, adults who engaged in AC co-use reported a smaller core group of friends, and higher proportions of network members who were “drinking buddies” and used cannabis. However, adults who engaged in AC co-use and alcohol-only use were

similar in terms of the proportion of drinkers in their network, as well as the density of AC users and non-users in their network. Together, this suggests that social factors contribute to AC co-use among adults in ways that may have important implications for intervention. Both differential association (network segmentation) and social influence are effectively integrated into health behavior change interventions (Hunter et al., 2019; Latkin & Knowlton, 2015; Valente, 2012). Mutual aid recovery societies (e.g., Alcoholics Anonymous), peer-delivered interventions, and peer-based harm reduction interventions all rely on mechanisms of differential association and influence for successful behavior change in individuals and small groups (Bassuk et al., 2016; Kelly & Yeterian, 2011; Marlatt and Witkiewitz, 2002; Mogro-Wilson et al, 2015). These interventions change network composition, encourage healthier behaviors, and adjust attitudes for individuals. They could potentially achieve the same outcomes for drinking buddies who attend together. In fact, those outcomes might even be reinforced due to social influence processes.

Several study limitations are worth noting. First, due to small sample sizes we were not able to differentiate between concurrent-only and simultaneous co-use in most analyses, nor conduct comparisons with adults who used cannabis only. Second, there was little information in the dataset (aside from alcohol problems) on which to compare those who engaged in AC co-use and alcohol-only use on key behavioral outcomes (e.g., employment stability, victimization and perpetration). Third, Wave 2 occurred during the COVID-19 pandemic, when days of alcohol use were found to increase in this cohort (Pollard et al., 2020); while most analyses focus only on Wave 1 (pre-pandemic) and thus are unaffected, it may be the case that rates of transitioning across non-use, use, and co-use statuses across waves (Table 3) may have been affected to some extent by the pandemic. Nonetheless, this is the first study to use a nationally representative sample of U.S. adults ages 30–80 to provide a detailed understanding of AC co-use after young adulthood, including how individuals who engage in AC co-use differ from alcohol-only users in terms of demographics, behavioral health factors, and social network and environmental influences. Results highlight the importance of better understanding the social context of AC co-use among adults in order to inform prevention and treatment efforts.

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HIGHLIGHTS

- Current alcohol and cannabis (AC) co-use reported by 8.4% of adults ages 30–80
- Less than 5% of adults initiated AC co-use over two-year period
- AC co-use (vs. alcohol only) associated with being male, younger, and Hispanic
- AC co-use more related to network composition than to mental or physical health
- AC co-use (vs. alcohol only) associated with more drinking over one-year period

Table 1

Descriptive Statistics on Main Study Variables at Wave 1 (N = 1,770)

Variable	Mean (SD)	Weighted % (unweighted N)
Demographic variables		
Sex at birth (%)		48.2% (751)
Male		48.2% (751)
Female		51.8% (1,019)
Age (mean)	52.8 (13.8)	
Race/ethnicity (%)		
White		60.7% (1,229)
Hispanic		23.2% (270)
Black		11.4% (182)
Multiracial/other		4.7% (89)
Married and/or cohabitating with partner (%)		64.6% (1,078)
College graduate (%)		35.3% (917)
Household income, in $10,000 (mean)	76.6 (54.7)	
Individual variables: substance use and health		
Alcohol and cannabis co-use status		
No alcohol or cannabis use		34.9% (621)
Alcohol use only		54.5% (969)
Cannabis use only		2.2% (31)
Concurrent-only alcohol and cannabis co-use		1.7% (31)
Simultaneous alcohol and cannabis co-use		6.7% (114)
Average number of drinks/day (among past month drinkers)	1.1 (3.0)	
Alcohol problems (among past month drinkers)	0.5 (1.4)	
Number of physical ailments	6.4 (4.7)	
Depression	4.1 (4.7)	
Anxiety	3.4 (4.4)	
Personal network variables		
Core network size	5.1 (2.8)	
Network density of single substance or AC co-users	0.4 (0.3)	
Network density of non-users of both alcohol and cannabis	0.3 (0.4)	
Proportion of alters who use alcohol	0.6 (0.4)	
Proportion of alters the participant drinks with	0.3 (0.3)	
Proportion of alters who use cannabis	0.1 (0.3)	
Environmental variables		
Neighborhood cohesion (mean)	8.6 (2.5)	
Neighborhood disorganization (mean)	4.6 (3.9)	
Living where cannabis use is legal (%)		61.4% (1,113)

Table 2

Logistic Regression Model Examining Associations of Co-Use Status at Wave 1 with Participant Demographic, Individual, Neighborhood, and Personal Network Factors at Wave 1 (N = 1,114)

	Wave 1 Co-Use Status (AC Co-use = 1; Alcohol Only = 0)	
	Bivariate models	**Multivariable model**
Wave 1 variables	**OR (95% CI)**	**OR (95% CI)**
Demographic variables		
Male (vs. female)	**2.04 (1.41, 2.95)**	**2.16 (1.38, 3.39)**
Age (in years)	**0.96 (0.95, 0.98)**	**0.98 (0.96, 0.995)**
Hispanic (vs. White)	**1.61 (1.09, 2.38)**	**1.85 (1.08, 3.18)**
Black (vs. White)	0.92 (0.48, 1.77)	0.44 (0.18, 1.05)
Multiethnic/other (vs. White)	1.08 (0.45, 2.56)	1.12 (0.42, 2.97)
Married and/or cohabitating (vs. not)	**0.62 (0.44, 0.88)**	0.74 (0.45, 1.22)
College graduate (vs. less education)	0.94 (0.66, 1.34)	--
Household income (in $10,000)	**0.996 (0.993, 0.999)**	0.997 (0.993, 1.001)
Individual functioning variables		
Average number of drinks/day, past month	**1.07 (1.02, 1.12)**	**1.08 (1.01, 1.16)**
Alcohol problems, past 3 months	**1.32 (1.20, 1.45)**	**1.28 (1.12, 1.46)**
Number of physical ailments	1.04 (0.996, 1.08)	1.03 (0.96, 1.10)
Depression	**1.05 (1.01, 1.09)**	1.02 (0.94, 1.10)
Anxiety	**1.05 (1.01, 1.09)**	0.98 (0.91, 1.06)
Personal network variables		
Core network size	**0.89 (0.84, 0.95)**	**0.87 (0.80, 0.94)**
Network density of alters who use alcohol and/or cannabis	0.84 (0.46, 1.53)	--
Network density of alters who do not use alcohol or cannabis	1.06 (0.67, 1.68)	--
Proportion of alters who use alcohol	1.19 (0.77, 1.85)	--
Proportion of alters who are drinking buddies	**2.10 (1.18, 3.73)**	**2.59 (1.25, 5.37)**
Proportion of alters who use cannabis	**13.10 (7.77, 22.08)**	**10.21 (5.22, 19.94)**
Environmental variables		
Neighborhood cohesion	1.00 (0.92, 1.09)	--
Neighborhood disorganization	**1.06 (1.01, 1.11)**	0.98 (0.92, 1.04)
Live where cannabis use is legal (vs. not)	**0.70 (0.49, 0.99)**	0.66 (0.43, 1.02)

Note. Significant odds ratios (p<.05) are in bold typeface.

Table 3

Mutually Exclusive Patterns of Any Past Month Alcohol and Cannabis Use Across Three Annual Waves (N = 1,337)

Pattern	N (%)
Consistent across 3 waves	**975 (72.6%)**
None (000)	340
Alcohol only (111)	572
Cannabis only (222)	4
AC co-use (333)	59
Quitting: use/co-use → none	**128 (9.5%)**
Quitting alcohol (010, 100, 110)	113
Quitting cannabis (020, 200, 220)	6
Quitting co-use (030, 300, 330)	3
Quitting – other (120, 130, 210, 230, 310, 320)	6
Transitions: use ←→ co-use	**94 (7.2%)**
Alcohol to co-use (013, 113, 133)	39
Cannabis to co-use (023, 223, 233)	8
Co-use to alcohol (031, 311, 331)	25
Co-use to cannabis (032, 322, 332)	5
Other (123, 131, 231, 313, 323)	17
Initiation: none → use/co-use	**82 (6.5%)**
None to alcohol (001, 011)	71
None to cannabis (002, 022)	10
None to co-use (003, 033)	1
Transitions: use/co-use → none → use/co-use	**52 (3.9%)**
Alcohol to none to alcohol (101)	44
Other (102, 103, 201, 202, 301, 303)	8
Other: (021, 112, 211,)	**6 (0.4%)**

Note. Three digits refer to substance use at Waves 1, 2, and 3 respectively. 0 = no alcohol or cannabis; 1 = alcohol only, 2 = cannabis only, 3 = alcohol and cannabis co-use.

Table 4

Predicting Individual Functioning at Waves 2 and 3 from AC Co-Use Status at Wave 1

	Wave 2 Outcomes					Wave 3 Outcomes				
	Alcohol Quantity β	**Alcohol Problems β**	**Physical Ailments β**	**Depression β**	**Anxiety β**	**Alcohol Quantity β**	**Alcohol Problems β**	**Physical Ailments β**	**Depression β**	**Anxiety β**
Main effect models:										
Co-use (vs. alc only)	**0.14**‡	0.01	−0.01	−0.004	−0.03	0.03	.03	0.02	0.02	−0.05
Interaction models:										
Co-use (vs. alc only)	−0.001	−0.02	−0.01	−0.04	−0.01	−0.002	−0.07	−0.01	0.05	−0.05
Male (vs. female)	−0.01	−0.05	−0.01	0.01	0.02	0.04	−0.02	−0.04	−0.02	−0.02
Co-use × Male	**0.19**‡	0.05	−0.003	0.04	−0.03	0.05	**0.13**†	0.04	−0.05	0.05

Notes.

‡ $p < .001$.

† $p < .01$.

* $p < .05$.

Analyses adjust for gender, age, race/ethnicity, marital status, college graduate status, household income, and the outcome variable at Wave 1. Analytic sample is restricted to participants who had data at all three waves. Standardized regression coefficients are reported.