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Relations between impulsive personality traits, alcohol and cannabis co-use, and negative alcohol consequences: A test of cognitive and behavioral mediators

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Abstract

Objective: Alcohol and cannabis co-users experience more negative alcohol consequences, but distal and mediating mechanisms of this association remain largely unstudied. Considering research suggests that individuals high in impulsivity and sensation seeking are more likely to be co-users, it is possible that co-users have more positive expectancies and become heavier drinkers, which confer risk for future negative consequences. Therefore, the current study tested prospective mediation models in which impulsive personality traits indirectly predicted negative consequences through co-use, heavier drinking, and expectancies.

Methods: The current study used data from a study of familial AUD spanning 3 waves (1995–2010). Participants (N = 567) reported on impulsivity (via the Eysenck Personality Inventory and Sensation Seeking Scale) alcohol and cannabis use, alcohol expectancies, and negative consequences. Models tested the factor structure of impulsive personality traits and whether these traits predicted future negative consequences through past-year co-use and drinking/expectancies.

Results: Factor analysis suggested two factors, sensation seeking and lack of premeditation. Sensation seeking was associated with future negative consequences indirectly through co-use and both drinking quantity and positive expectancies. Lack of premeditation was not associated with co-use, but indirectly predicted negative consequences through positive expectancies, above and beyond co-use. Sensation seeking directly predicted negative expectancies, but negative expectancies did not predict negative consequences.

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Conclusions: Impulsive personality traits in co-users, particularly sensation seeking, explained variance in future negative alcohol consequences via heavier drinking (behavior) and positive expectancies (cognition). Personalized interventions targeting a lack of premeditation, and sensation seeking in co-users, may interrupt a developmental trajectory toward problem drinking.

Keywords

Alcohol; Cannabis; Co-use; Expectancies; Negative consequences

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1. Introduction

Heavy drinking and related negative consequences have increased since the early 2000′s (Grant et al., 2017) and represent the third leading cause of preventable death in the U.S. (Centers for Disease Control and Prevention (CDC, 2013). Negative alcohol consequences can mark the beginning stages of an Alcohol Use Disorder (AUD) (Nelson et al., 1996) and have significant impacts on society (e.g., economic burden; Sacks et al., 2015) and public health (e.g., alcohol-impaired driving; Perkins, 2002). Although heavy drinking is perhaps the most proximal risk factor for negative alcohol consequences, research suggests that using other substances also confers risk. Other than alcohol, cannabis is the most frequently used psychotropic drug in the U.S. (National Institute on Drug Abuse (NIDA, 2020), and rates of cannabis use have significantly increased across the past two decades (Hasin et al., 2016; Hasin, 2018). A substantial proportion of cannabis users report drinking (Suerken et al., 2014; Primack et al., 2012), and a sizable proportion of alcohol users report using cannabis (Patrick et al., 2018; Subbaraman and Kerr, 2015), a term referred to as alcohol and cannabis co-use (i.e., use of both substances during a given time period, but not necessarily on the same occasion; Gunn et al., 2018).

Several studies, although largely cross-sectional, suggest that being an alcohol and cannabis co-user confers risk for both heavier drinking (Haas et al., 2015; Patrick et al., 2017; Shillington and Clapp, 2006; Subbaraman and Kerr, 2015; Weiss and Dilkes, 2015) and experiencing more negative alcohol consequences, even when accounting for level of drinking (e.g., Green et al., 2019; Jackson et al., 2020; Linden-Carmichael et al., 2019; Patrick et al., 2017; Subbaraman and Kerr, 2015; Terry-McElrath et al., 2013; White et al., 2019). However, mechanisms through which between-person risk is conferred are largely unstudied.

One distal risk factor for co-use may be impulsive personality traits, namely impulsivity and sensation seeking. Impulsivity is broadly defined as rash action with little planning/ forethought (i.e., a lack of premeditation; Moeller et al., 2001; Whiteside and Lynam, 2001), whereas sensation seeking is defined as the tendency to seek novel, exciting experiences (Zuckerman, 2010). Both confer risk for heavier single substance use (Dick et al., 2010; Hamdan-Mansour et al., 2017; Charles et al., 2016), and some research suggests that dual- and poly-substance users (i.e., using more than one substance) have higher levels of impulsivity (Hammers and Suhr, 2010; Verdejo-García et al., 2010) and sensation seeking (Linden-Carmichael et al., 2019; Koller et al., 2015). However, these studies model impulsivity and sensation seeking in separate models, ignoring potential additive effects. To

our knowledge, only one study has tested the effects of both in the same model, finding unique effects of each on polysubstance use (Hamdan-Mansour et al., 2018).

Considering that individuals with elevated sensation seeking are motivated to seek novel and exciting experiences, these individuals may be more likely to seek out multiple forms of substance use. In support, research suggests that sensation seeking is related to greater substance use experimentation (Dawe and Loxton, 2004; Malmberg et al., 2012), and openness to new, exciting experiences (Aluja et al., 2003). In addition, individuals high in impulsivity are more likely to engage in rewarding behavior, despite the possibility of associated negative consequences (Moeller et al., 2001), which could lead to multiple forms of substance use. Research suggests a lack of premeditation/perseverance, which maps onto the definition of impulsivity, is the *strongest* predictor of heavier drinking and cannabis use (Coskunpinar et al., 2013; VanderVeen et al., 2016). Therefore, theory would suggest that both sensation seeking and impulsivity may be uniquely related to co-use.

Impulsivity and sensation seeking in alcohol and cannabis co-users may alter both *behavior and cognition* indirectly via co-use, which may explain relations between co-use and negative alcohol consequences. Because co-use is related to both heavier drinking and negative alcohol consequences (even when controlling for drinking), it is likely that there are both direct (controlling for drinking behavior) and indirect effects of co-use on negative alcohol consequences through drinking *behavior*. In addition, alcohol expectancies may serve as a *cognitive* mediator explaining effects of co-use on negative alcohol consequences. Alcohol expectancies are defined as learned associations about alcohol's effects on mood and behavior, and expectancies are strongly associated with heavier drinking, negative alcohol consequences, and a family history of AUD (Jones et al., 2001; Morean et al., 2012; Waddell et al., 2020).

The Acquired Preparedness Model (Smith and Anderson, 2001; Anderson et al., 2003) suggests that individuals with higher levels of impulsivity attend to positive alcohol cues and develop stronger positive alcohol expectancies, which then reinforce heavier, problem drinking. Studies find that positive expectancies mediate relations between impulsive personality traits and heavier drinking (Settles et al., 2010; Corbin et al., 2011, 2015), alcohol problems (Corbin et al., 2011, 2015) and cannabis use (e.g., Curry et al., 2018; Hayaki et al., 2011; Papinczak et al., 2018), with consistent findings for both impulsivity and sensation seeking. Considering that co-users have higher levels of both personality traits (e.g., Linden-Carmichael et al., 2019; O'Leary et al., 2019), co-users may thus form stronger positive alcohol expectancies, putting them at risk for problem drinking.

Only two studies to our knowledge have tested the effects of alcohol *and* cannabis use on alcohol expectancies. Willner (2001) found that participants who used any cannabis (yearly to daily) had significantly stronger positive alcohol expectancies, but Walther et al. (2019) found no relations between cannabis use frequency and positive alcohol ex pectancies. However, neither study tested whether participants co-used alcohol and cannabis, but rather tested whether cannabis use, regardless of whether the participant was a concurrent alcohol user, was associated with alcohol expectancies.

Therefore, the current study tested a longitudinal mediation model in which impulsive personality traits indirectly predict negative alcohol consequences through alcohol and cannabis co-use, and both behavior (drinking quantity) and cognition (alcohol expectancies). The current study specified a binary variable of whether an individual was a past- year co-user or alcohol-only user. The current study also included two measures of impulsivity, and tested their measurement properties, to differentiate whether co-users were higher in impulsivity, sensation seeking, or both. We hypothesized that impulsive personality traits (both impulsivity and sensation seeking) would confer risk for future negative alcohol consequences through co-use and both drinking and positive expectancies (see Fig. 1 for theoretical model). We included negative expectancies in the model, but we considered paths from negative expectancies exploratory given a lack of previous research.

2. Methods

2.1. Participants

Participants ($N = 567$) were from a longitudinal study examining the intergenerational transmission of AUD (Chassin et al., 1992). The target sample consisted of 454 adolescents (generation 2, "G2''") and their parents (generation 1, "G1s"). Fifty-four percent ($N = 246$) of G2s had at least one parent with an AUD, and remaining G2s were demographically-matched adolescents without familial AUD. Research assistants conducted a baseline interview (Wave 1) and participants were re-assessed annually for two years (Waves 2, 3), and then every five years (Wave 4, 1995–1999; Wave 5, 2000–2004; and Wave 6, 2005–2010) for follow-up assessments. At Wave 4, biological, age-eligible siblings and spouses of G2s were added, and children of G2s were added at Waves 5 and 6. The current sample consisted of Wave 4 target G2s and siblings who drank alcohol at least once in the past year. The current study used data from Waves 4, 5, and 6, which will be referred to as W4, W5, and W6. Of those surveyed at W4, 91 % were retained at W5, and 88.5 % at W6. Non-retained participants were significantly heavier drinkers at W4 ($t = 3.03$, $p = .003$) and were more likely to be male ($X^2 = 11.79$, $p = .001$).

2.2. Recruitment and procedures

Full recruitment information can be found in Chassin et al. (1992). Families with a history of parental alcohol use disorder were recruited through health maintenance organization (HMO) wellness questionnaires, court reports, hospital referrals, and community telephone screenings. Inclusion criteria for the G1 parents were a) currently living in Arizona, b) identifying as either Hispanic or non-Hispanic Caucasian, c) having children between the ages of 10.5 and 15.5, and d) being born between 1926–1960. Demographically-matched families without familial AUD were recruited using reverse directories. Adults gave consent and adolescents gave assent. All procedures were approved by the Arizona State University Institutional Review Board.

2.3. Measures

2.3.1. Demographics—G2 participants self-reported their age and sex at W4. Participants were 46.6 % female and had a mean age of 21.27 (SD = 2.28).

2.3.2.   Impulsivity and sensation seeking—W4 impulsivity and sensation seeking were assessed, respectively, via seven items from Revelle's version of the Eysenck Personality Inventory (EPI; Revelle et al., 1980) and six items from the Zuckerman Sensation Seeking Scale (SSS; Zuckerman et al., 1993). Both measures were included to isolate their unique effects as distal predictors of co-use and future negative alcohol consequences. Two EPI items that were also on the SSS were removed (i.e., "I often do things on the spur of the moment" and "I would do almost anything on a dare"), in line with previous research (Colder and Chassin, 1997). Participants rated each sensation-seeking item (e.g., "I like wild parties", "I like work that has lots of excitement") on a 5-point Likert scale from (1) Agree Strongly to (5) Disagree Strongly. Participants rated each impulsivity item (e.g., "I do not stop and think things over before doing them", "I generally do and say things quickly without stopping to think") on a scale of (1) Very true of me to (5) Not at all true of me. All items were reverse scored so that higher scores were indicative of higher impulsivity.

2.3.3.   Alcohol and Cannabis co-Use—W4 co-use was assessed by asking participants how often over the past-year they drank alcohol or used marijuana/hashish. Responses ranged from 0 (Never) to 7 (Everyday). Since alcohol abstainers were excluded, participants were classified as alcohol-only users (0) or co- users (1) if they endorsed using any marijuana over the past year. A total of 206 (36.3 %) participants were co-users.

2.3.4.   Drinking quantity—Typical drinking quantity was assessed at W4 and W5 by separate items asking participants how many "beers, glasses of wine, or wine coolers" and standard drinks of "hard liquor" they typically drank on drinking occasions. Responses ranged from 0 (No drinks) to 8 (Nine or more drinks). The two variables were averaged to create a typical drinking variable in line with past research (Lee et al., 2015). If a participant answered a "zero" on one but not the other, the other value was retained as the index of drinking. Mean levels of drinking non-significantly decreased from W4 to W5 (M_{W4} = 2.87 (SD = 1.60); M_{w5} = 2.76 (SD = 1.67); t (514) = 1.50, p = 0.14).

2.3.5.   Alcohol expectancies—Alcohol expectancies were assessed at W4 and W5 via items from three past expectancy questionnaires (Christiansen et al., 1982; Donovan et al., 2009; Fromme et al., 1993), and three items were added by project staff. Eighteen positive expectancies (e.g., "makes parties more fun", "helps me when I'm tense or nervous") and 12 negative expectancies (e.g., "I lose control and run into things", "makes me feel dizzy") were assessed on a 5-point Likert scale from 1 (strongly agree) to 5 (strongly disagree). Each item was reversed scored so higher scores were indicative of stronger expectancies. Positive expectancies significantly increased from W4 to W5 (M_{W4} = 2.49 (SD = 0.62); M_{w5} = 2.57 (SD = .64); t = 2.7, p = .007) and negative expectancies significantly decreased from W4 to W5 (M_{W4} = 3.06 (SD = .57); M_{W5} = 2.94 (SD = 0.58); t = −4.50, p < 0.001). Internal consistencies for positive expectancies (a = .93) and negative expectancies (a = .79) were adequate.

2.3.6.   Negative alcohol consequences—At W4 and W6, participants reported if they experienced 13 past-year negative alcohol consequences (e.g., "complaints from

friends", "suffering an accident or injury") derived from the Young Adult Alcohol Problems Screener (YAAPST; Hurlbut and Sher, 1992). A condensed count of consequences was created (0, 1, 2, 3+) that had at least 3% of the total cases (17 participants) per cell. This method allowed for the estimation of number of consequences experienced, while also having an adequate number of participants per cell to make meaningful comparisons. The number of alcohol consequences experienced significantly decreased from W4 to W6 (M_{W4} = .71 (SD = 1.09); M_{w6} = .28 (SD = .73); t = −8.26, p < 0.001).

2.4. Data analytic plan

The current study tested the factor structure of impulsivity and sensation seeking, and then estimated a longitudinal mediation model predicting negative alcohol consequences. All analyses were estimated in Mplus Version 8.5 (Muthén and Muthen, 1998–2020). Adequate model fit was determined via standard cutoffs (Hu and Bentler, 1999), suggesting RMSEA < 0.06, CFI > .95, and SRMR < .08.

First, we estimated a Confirmatory Factor Analyses (CFA) of the 7 items on Revelle's version of the EPI (factor 1) and the 6 items on the SSS (factor 2), allowing the two latent factors to correlate. Items that loaded lower than 0.32 (10 % overlapping variance) and items with large cross- loadings (indicated via modification indices in Mplus) were removed (Comrey and Lee, 1992; Tabachnick et al., 2007).

Next, we tested a longitudinal mediation model in which impulsive personality traits predicted co-use, and co-use predicted future negative alcohol consequences indirectly through alcohol expectancies and drinking quantity. Impulsive personality traits were distal predictors specified as both impulsivity and sensation seeking. All models specified autoregressive paths from W4 to W5 drinking quantity, positive expectancies, and negative expectancies, and from W4 to W6 negative alcohol consequences. In addition, paths from W4 drinking to W5 positive and negative expectancies were included. All exogenous variables were allowed to freely covary, as were mediators at the same time point (i.e., W5 drinking, positive expectancies, and negative expectancies). All direct paths were also included in the model. Sex, age, and family history of alcohol disorder were specified as covariates predicting all endogenous variables.

Due to the binary nature of the co-use variable (0=alcohol-only user, 1=co-user), the Weighted Least Squares estimator with mean and variance adjustments (WLSMV) and theta parametrization were used. WLSMV estimation computes ordinary least squares estimates for continuous outcomes and probit estimates for binary outcomes. Therefore, predictors of co-use will be interpreted as probabilities. The Type = COMPLEX feature was used to account for clustered data within families. All missing data were estimated as a function of valid predictor variables under WLSMV estimation (Schafer and Graham, 2002).

In the case of two mediators, indirect effects were tested using the joint significance test, a powerful and recommended test of indirect effects for several mediators. The joint significance test is recommended for 2+ mediators due to limitations of bootstrap confidence intervals (MacKinnon et al., 2002), and is considered the optimal balance of Type 1 error and statistical power (MacKinnon et al., 2002; Taylor et al., 2008). The joint significance

test states that there is a significant indirect effect if there are significant paths from the distal variable to the first mediator, from the first mediator to the second mediator, and from the second mediator to the outcome. In the case of one mediator, indirect effects were tested using bias-corrected bootstrap confidence intervals (5000 bootstrapped samples) in Mplus Version 8.5. All coefficients reported are standardized estimates.

3. Results

3.1. Confirmatory factor analysis

The model specifying the 7 Revelle EPI items and 6 items from the SSS as correlated factors provided inadequate fit (X^2(64) = 340.51, p <.001, RMSEA=.087, CFI=.777, SRMR=.089). Items with low loadings (<.32) were removed first, including "I am not slow and unhurried in the way I move" (Revelle item; b = .24) "I am usually carefree" (Revelle item; b = 0.20), and "I often long for excitement" (Revelle item; b = .31), which still lead to inadequate model fit (X^2(34) = 133.83, p < .001, RMSEA=.076, CFI=.889, SRMR=.072). Modification indices showed that "I like doing things in which I have to act quickly" (Revelle item) had a large cross-loading with sensation seeking, and removal of this item provided adequate model fit (X^2(26) = 82.149, p < .001, RMSEA=.062, CFI=.937, SRMR=.048). All items loaded above .32, and items represented sensation seeking (6 items; a = .79) and lack of pre meditation (3 items; a = 0.68; see Table 1).

3.2. Descriptive statistics and bivariate correlations

Co-users were more likely to be male, be younger, have higher levels of lack of premeditation and sensation seeking, have stronger positive and weaker negative expectancies, be heavier drinkers, and have more negative consequences (see Table 2). Bivariate correlations (see Table 3) indicated that W4 lack of premeditation and sensation seeking were positively correlated with W4 co-use, W5 positive expectancies, W5 negative expectancies, and W5 drinking; sensation seeking (significant) and lack of premeditation (marginal) were correlated with W6 negative alcohol consequences. W5 positive expectancies were positively correlated with W5 negative expectancies, W5 drinking, and W6 negative alcohol consequences, whereas W5 negative expectancies were positively correlated with W6 negative alcohol consequences but not W5 drinking. W5 drinking was positively correlated with W6 negative alcohol consequences.

3.3. Primary mediation model

The model testing unique effects of the two impulsive personality traits fit the data well (X^2(10) = 13.52, p = .20, RMSEA=.025, CFI=.997, SRMR=.01; see Fig. 2). Covariate effects were minimal; male sex was associated with heavier drinking and a higher likelihood of being a co-user, whereas being older at W4 was associated with lower positive expectancies and a lower likelihood of being a co-user (see Table 4 for model parameters).

W4 sensation seeking was uniquely associated with a higher likelihood of being a W4 co-user, whereas W4 lack of premeditation was not associated with being a W4 co-user. W4 co-use predicted both stronger W5 positive expectancies and heavier W5 drinking but not W5 negative expectancies. W4 lack of premeditation uniquely predicted stronger

W5 positive expectancies, and sensation seeking uniquely predicted weaker W5 negative expectancies. W5 positive expectancies and W5 drinking both predicted more W6 negative alcohol consequences, whereas W5 negative expectancies did not. However, there was still a direct effect of W4 co-use on W6 negative consequences.

According to joint significance testing, there was a significant indirect effect of W4 sensation seeking on W6 negative alcohol consequences through W4 co-use, and both W5 positive expectancies and W5 drinking. There was also a small magnitude indirect effect of W4 lack of premeditation on more W6 negative alcohol consequences through W5 positive expectancies ($b = .024$, $SE = .01$, $p = .026$, 95 % $CI = [.007, .05]$; proportion of effect mediated $= 36.3$ %).

3.4. Exploratory structural equation modeling analyses

The factor structure of impulsive personality traits was also tested using exploratory structural equation modeling (ESEM; Asparouhov and Muthén, 2009). ESEM estimates factor loadings for all items onto all factors, allowing for the inclusion of cross-loading items that were removed due to poor model fit. The ESEM model derived two factors that were nearly identical to the aforementioned CFA (i.e., sensation seeking and lack of premeditation). All paths using the ESEM factor scores were identical to above, except for the path from sensation seeking to negative expectancies, which became non-significant ($p = .065$; see supplemental material).

4. Discussion

The current study tested whether impulsive personality traits indirectly predicted future negative alcohol consequences through alcohol and cannabis co-use and both alcohol expectancies and typical drinking quantity. Several studies find that co-use is a predictor of negative alcohol consequences (Yurasek et al., 2017), yet distal and mediating mechanisms are largely unstudied. Findings suggested that sensation seeking was associated with co-use, which did in fact indirectly predict negative alcohol consequences through both positive expectancies and drinking quantity. A lack of premeditation was not associated with co-use, however a lack of premeditation predicted future negative alcohol consequences indirectly through positive expectancies. Finally, sensation seeking predicted weaker negative expectancies, but negative expectancies did not predict negative alcohol consequences. Findings are discussed in turn.

Study hypotheses were based on the acquired preparedness model (Smith and Anderson, 2001), which posits that impulsive personality traits indirectly predict problem drinking via stronger positive expectancies. However, the current study found that co-use mediated the association between sensation seeking and positive expectancies but *did not* mediate the association between impulsivity (i.e., lack of premeditation) and positive expectancies. One explanation may be that individuals high in sensation seeking are more likely to experiment with other drugs (Dawe and Loxton, 2004; Malmberg et al., 2012), which may provide a novel, thrilling experience. Thus, individuals high in sensation seeking may be more likely to experiment with cannabis (on top of alcohol use), which reinforces positive cognition and

future risk for negative consequences. In support, Linden-Carmichael et al. (2018) found that sensation seeking was associated with being a co-user but *not* with frequency of co-use.

Impulsivity items from the Revelle scale (i.e., lack of premeditation) were not associated with co-use but were associated with positive expectancies. Put in the context of acquired preparedness, individuals who lack planning/forethought may differentially attend to positive cues and develop stronger positive expectancies regardless of whether co-using. However, this was not the case for individuals high in sensation seeking, for whom effects were mediated through co-use. One possibility is that past acquired preparedness studies that use sensation seeking (e. g., Corbin et al., 2011) are in fact capturing the effects of unmeasured lack of premeditation rather than the unique effects of sensation seeking.

Although the unique variance in sensation seeking did not directly predict positive expectancies, it did predict lower negative expectancies. However, this effect became non-significant in sensitivity analyses, and thus we interpret this finding with caution. Considering links between negative expectancies and negative consequences are inconsistent across studies (e.g., Jones et al., 2001; McMahon et al., 1994), and considering this effect was not consistent across both CFA and ESEM analyses, future research is needed before interpreting these findings.

Findings have implications for personalized interventions. Regardless of co-use, interventions targeting a lack of planning/forethought may be effective in preventing future negative alcohol consequences via reductions in alcohol expectancies. However, the unique variance of thrill/novelty seeking is also worth targeting via interventions, considering that risk was conferred indirectly through co-use. Therefore, personality-centered interventions targeting both a lack of planning *and* experimentation/excitation seeking may be most helpful for those exhibiting sensation seeking. If an individual is already a co-user, targeting both positive expectancies and drinking quantity may be an effective way to prevent future negative alcohol consequences. However, a sole focus on drinking may not be the most effective, considering that past studies have found effects of co-use on negative consequences, even when controlling for drinking levels (e.g., Gunn et al., 2018; Wardell et al., 2020). Therefore, expectancy challenge interventions may be an effective route to decrease both positive expectancies and one's drinking quantity within co-users.

The current findings must be interpreted in light of limitations. First, the current study was unable to distinguish concurrent from simultaneous alcohol and cannabis use, despite research suggesting some group differences between the two (Jackson et al., 2020). Second, after factor analysis, the 7 Revelle items were reduced to three items measuring lack of premeditation. While these three items fit the data well, more comprehensive measures of lack of premeditation are needed. Third, the current study did not measure lack of perseverance or positive/negative urgency, and research suggests high levels of positive urgency and a lack of perseverance may be most risky within co-users (Waddell et al., 2021). Future research using the full UPPS-P model is needed to identify which facets uniquely predict which outcomes/mediators. Fourth, although the rigorous prospective design was a strength of the current study, time periods were five years apart. Future research is needed to test whether risk is conferred within shorter time periods. Finally, co-use was measured as

past-year co-use, however there may be stronger effects for individuals who regularly co-use (e.g., past-month).

Overall, the current study was the first to test distal and mediating mechanisms through which alcohol and cannabis co-use confers risk for future negative alcohol consequences. Findings suggest that sensation seeking was a distal risk factor for co-use, which indirectly predicted future negative alcohol consequences through positive expectancies and drinking quantity. In contrast, a lack of premeditation indirectly predicted future negative consequences through positive expectancies controlling for co-use. Future research using the full UPPS-P model and more detailed information related to co-use is needed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Role of funding source

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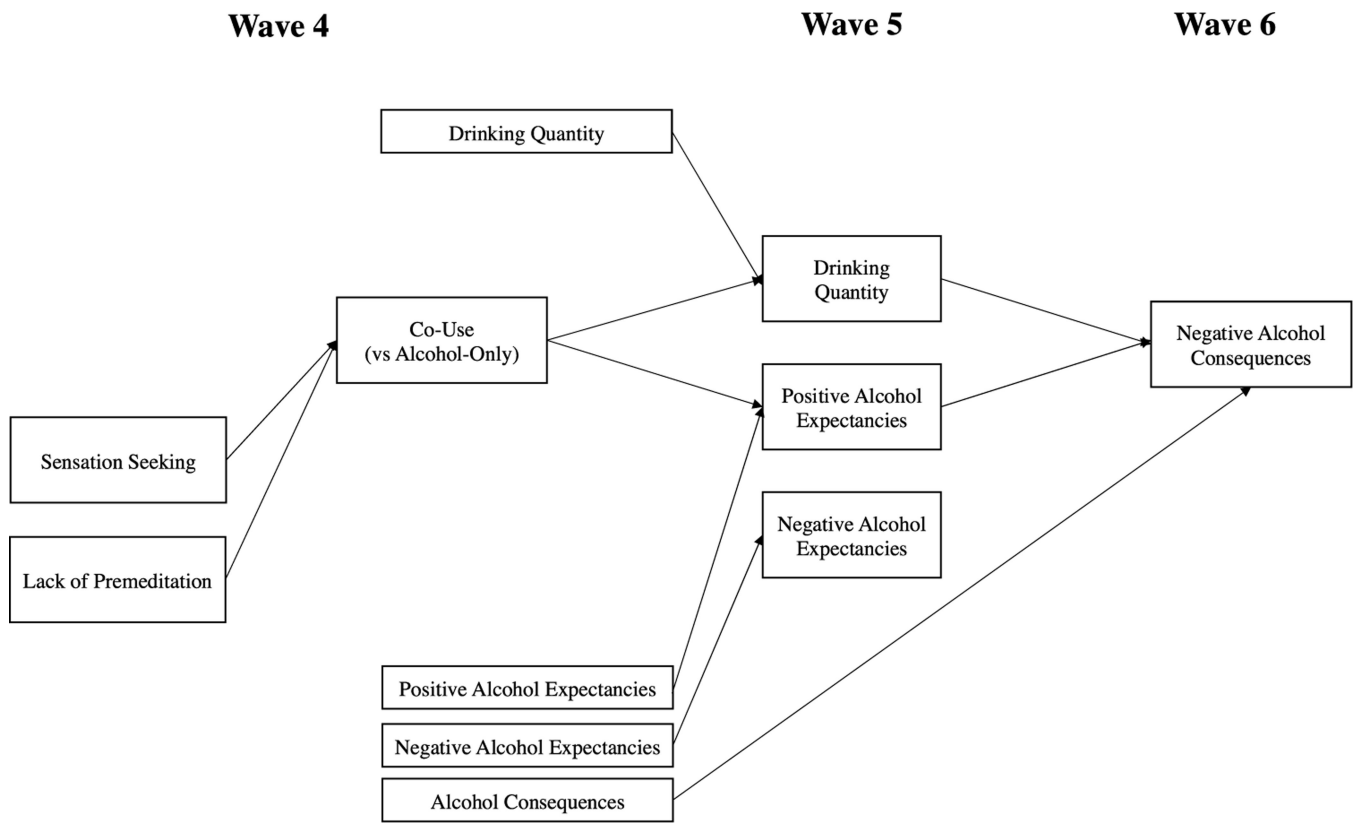
Wave 4 **Wave 5** **Wave 6**

Fig. 1.
Theoretical Model.
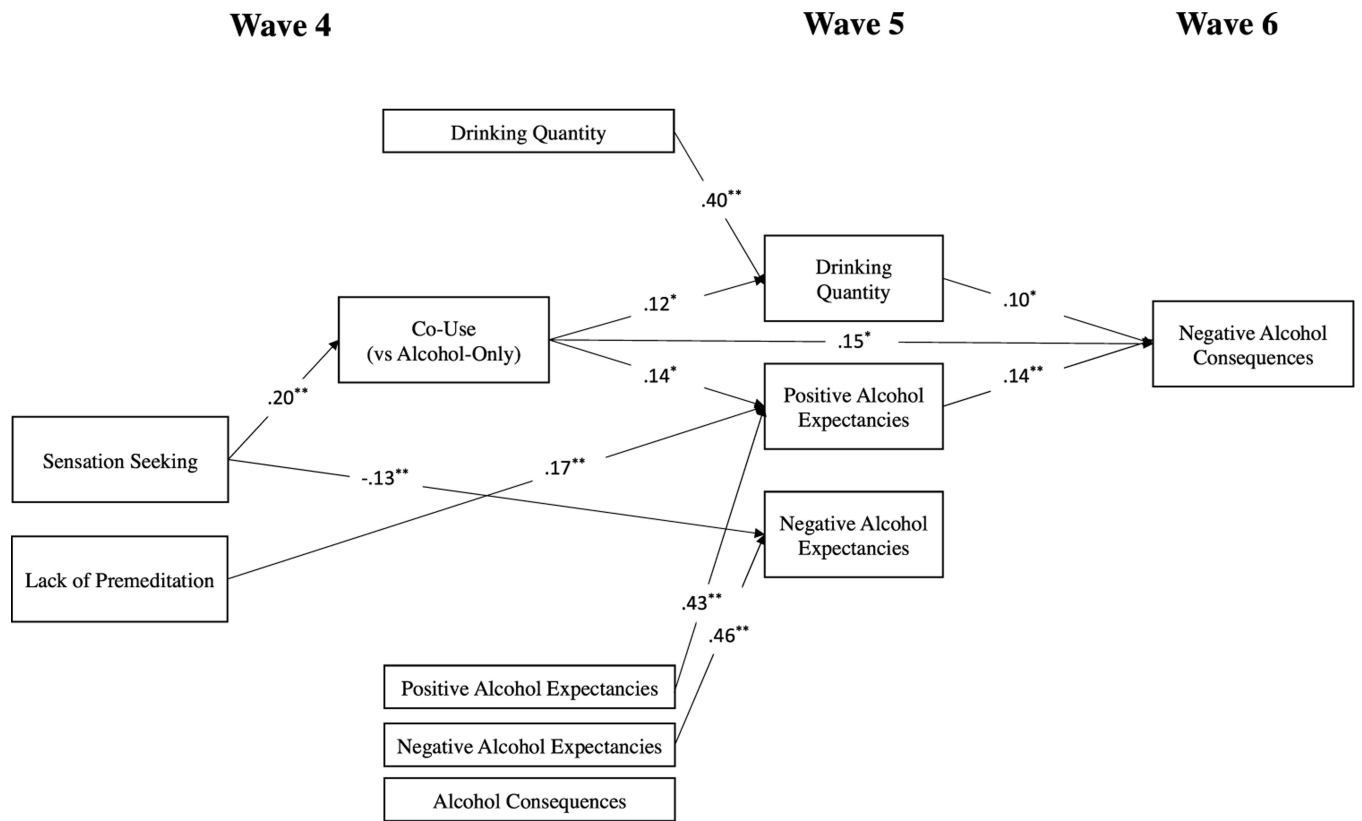
Fig. 2.
Primary Mediation Model.

Note: Total N = 567 (206 co-users, 361 alcohol-only users); only statistically significant paths are shown.

Table 1

Confirmatory Factor Analysis of Impulsive Personality Traits.

	Sensation Seeking	Lack of Premeditation
I like wild parties	.62	
I like do thing on spur of the moment	.67	
I like being where there is something going on all the time	.68	
I would do almost anything on a dare	.46	
I like work that has lots of excitement	.52	
I like to have new and exciting experiences, even if they are a little unconventional	.65	
I do not stop and think things over before doing anything.		.81
I generally do and say things quickly without stopping to think.		.80
When people shout at me, I shout back.		.39

Note: All items loaded significantly (p < .001) onto their respective factor; Total N = 567.

Table 2

Descriptive Statistics.

	Full Sample	Alcohol-Only	Co-Users	Difference Test
Sex	53 % Male	48 % Male	63 % Male	$X^2 = 12.15, p < .001$
Age	21.27 (2.28)	21.63 (2.32)	20.65 (2.06)	$t = -5.17, p < .001$
Family History of AUD	48 % FH+	45 % FH+	52 % FH+	$X^2 = 2.57, p = .065$
Lack of Premeditation	.00 (.66)	−.08 (.77)	.15 (.79)	$t = 3.40, p = .001$
Sensation Seeking	.00 (.78)	−.11 (..67)	.19 (.59)	$t = 5.64, p < .001$
W4 Positive Expectancies	2.50 (.62)	2.38 (.63)	2.70 (.54)	$t = 6.47, p < .001$
W5 Positive Expectancies	2.57 (.64)	2.45 (.62)	2.78 (.61)	$t = 5.83, p < .001$
W4 Negative Expectancies	3.05 (.57)	3.01 (.58)	3.14 (.54)	$t = 2.75, p = .006$
W5 Negative Expectancies	2.94 (.58)	2.90 (.57)	3.02 (.60)	$t = 2.20, p = .028$
W4 Drinking	2.93 (1.62)	2.60 (1.5)	3.51 (1.66)	$t = 6.55, p < .001$
W5 Drinking	2.76 (1.67)	2.45 (1.6)	3.30 (1.66)	$t = 5.56, p < .001$
W4 Consequences	.72 (1.09)	.43 (.85)	1.22 (1.25)	$t = 8.90, p < .001$
W6 Consequences	.28 (.83)	.15 (.56)	.50 (.93)	$t = 5.18, p < .001$

Note. FH+ = family history positive; Lack of Premeditation and Sensation Seeking are latent variables with a mean of zero; Total N = 567 (206 co-users, 361 alcohol-only users); Difference tests compared co-users to alcohol-only users.

Table 3

Bivariate Correlations.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Sex	—	−.11**	−.02	.15**	.03	.19**	.20**	.16**	−.07†	−.10*	.40**	.32**	.21**	.12**
2. Age		—	.02	−.21**	−.05	−.15**	−.06	−.15	−.10*	−.02	−.15**	−.15**	−.10*	−.08†
3. Family History of AUD			—	.07	.05	.06	.07	.10*	.06	.03	.14**	.15**	.07†	.12**
4. Co- (vs. Alcohol) User				—	.14*	.22**	.25**	.25**	.11**	.10*	.27**	.24**	.35**	.21**
5. Lack of Premeditation					—	.48**	.21**	.26**	.15**	.11**	.20**	.16**	.27**	.08†
6. Sensation Seeking						—	.22**	.19**	.08†	−.04	.21**	.18**	.24**	.11**
7. W4 Positive Expectancies							—	.51**	.23**	.08†	.36**	.28**	.36**	.14**
8. W5 Positive Expectancies								—	.13**	.15**	.24**	.37**	.25**	.28**
9. W4 Negative Expectancies									—	.49**	.03	−.02	.15**	.08†
10. W5 Negative Expectancies										—	.05	−.04	.12**	.11*
11. W4 Drinking Quantity											—	.50**	.43**	.16**
12. W5 Drinking Quantity												—	.31**	.25**
13. W4 Consequences													—	.25**
14. W6 Consequences														—

Note. Sex is coded as 1 = female, 2 = male; Co (vs. Alc) User is coded as 1 = alcohol-only user, 2 = co-user; Sensation seeking and lack of premeditation are saved latent factor scores; Total N = 567.

**
p < .01.

*
p < .05.

†
p < .10.

Table 4

Model Parameters for Mediation Model.

Path Estimate	Beta	SE	95 % CI	p-value
Sex → W6 Negative Consequences	.04	.05	(−.05, .13)	.36
Age → W6 Negative Consequences	−.01	.06	(−.13, .11)	.87
Family History → W6 Negative Consequences	.08	.04	(−.01, .17)	.071
W4 Negative Consequences → W6 Negative Consequences	.04	.05	(−.06, .14)	.42
W5 Positive Expectancies → W6 Negative Consequences	.14	.05	(.04, .24)	.006
W5 Negative Expectancies → W6 Negative Consequences	.07	.04	(−.02 .15)	.12
W5 Drinking → W6 Negative Consequences	.10	.05	(.01, .20)	.039
W4 Co-Use → W6 Negative Consequences	.15	.08	(.01, .29)	.044
W4 Lack of Premeditation → W6 Negative Consequences	−.03	.05	(−.12, .06)	.58
W4 Sensation Seeking → W6 Negative Consequences	− .01	.04	(−.09, .08)	.95
Sex → W5 Positive Expectancies	.06	.04	(−.02, .14)	.12
Age → W5 Positive Expectancies	− .09	.04	(−.16, −.01)	.026
Family History → W5 Positive Expectancies	.06	.04	(−.01, .14)	.10
W4 Positive Expectancies → W5 Positive Expectancies	.43	.03	(.36, .49)	< .001
W4 Drinking → W5 Positive Expectancies	− .04	.05	(−.14, .05)	.39
W4 Co-Use → W5 Positive Expectancies	.14	.06	(.03, .25)	.015
W4 Lack of Premeditation → W5 Positive Expectancies	.17	.05	(.08, .26)	< .001
W4 Sensation Seeking → W5 Positive Expectancies	−.05	.05	(−.14, .05)	.35
Sex → W5 Negative Expectancies	−.08	.04	(−.16, .01)	.07
Age → W5 Negative Expectancies	.03	.04	(−.04, .11)	.38
Family History → W5 Negative Expectancies	−.01	.04	(−.09, .07)	.81
W4 Negative Expectancies → W5 Negative Expectancies	.46	.03	(.40, .53)	< .001
W4 Drinking → W5 Negative Expectancies	.05	.04	(−.02, .13)	.19
W4 Co-Use → W5 Negative Expectancies	.09	.06	(−.02, .20)	.11
W4 Lack of Premeditation → W5 Negative Expectancies	.07	.05	(−.02, .16)	.13
W4 Sensation Seeking → W5 Negative Expectancies	−.13	.05	(−.22, −.03)	.011
Sex → W5 Drinking	.14	.04	(.06, .21)	.001
Age → W5 Drinking	−.04	.04	(−.11, .04)	.37
Family History → W5 Drinking	.08	.04	(−.01, 15)	.06
W4 Drinking → W5 Drinking	.41	.04	(.34, .48)	< .001
W4 Co-Use → W5 Drinking	.12	.05	(.03, .22)	.014
W4 Lack of Premeditation → W5 Drinking	.04	.04	(−.05, .13)	.36
W4 Sensation Seeking → W5 Drinking	.01	.05	(−.09, .09)	.97
Sex → W4 Co-Use	.12	.05	(.03, .22)	.014
Age → W4 Co-Use	−.23	.05	(−.33, −.12)	< .001
Family History → W4 Co-Use	.08	.06	(−.03, .19)	.17
W4 Lack of Premeditation → W4 Co-Use	.07	.06	(−.04, .18)	.23
W4 Sensation Seeking → W4 Co-Use	.20	.06	(.07, .32)	.002