Published in final edited form as:

Addict Behav. 2018 February ; 77: 96–99. doi:10.1016/j.addbeh.2017.10.002.

Simultaneous Alcohol & Tobacco Use Expectancies in Young Adult Co-Users

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1. Introduction

Alcohol and tobacco use are among the leading causes of preventable morbidity and mortality worldwide; in the United States alone, excessive alcohol use accounts for 1 in 10 deaths (Stahre et al., 2014), and cigarette smoking is responsible for more than 1 in 5 deaths (U.S. Department of Health and Human Services, 2014). The total economic impact ranges from ~\$249 billion/year for alcohol use (Sacks et al., 2015) to more than \$300 billion/year for smoking (U.S. Department of Health and Human Services, 2014). Epidemiological data have shown that co-use of both substances is common (McKee et al., 2007), and tobacco use is associated with frequent binge drinking and increased length of drinking episodes, and it potentiates the experience of alcohol-related reinforcement (see McKee & Weinberger, 2013 for a review). The co-use of alcohol and tobacco may be a risk factor for more problematic use of both substances in young adults, who report heightened effects of tobacco when alcohol is used simultaneously and vice versa (Jackson et al., 2010; Johnson et al., 2000; Rose et al., 2004) and thus may be disproportionately vulnerable to progressive use.

Expectancies, or beliefs about drug effects, play a key role in reinforcement and are robust predictors of alcohol (Flory et al., 2004) and tobacco use (Myers et al., 2003) in young adults. While relatively little research has examined expectancies specific to the co-use of alcohol and tobacco, preliminary work suggests that expectancies may play a similarly important role for the concurrent use of both substances. For example, individuals may engage in simultaneous alcohol and tobacco use (SATU) in order to enhance the positive

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Contributors

Ryan Trim and Neal Doran contributed to all major aspects of study design, protocol development, and data collection. Ryan Trim conducted the literature review, statistical analyses, and wrote the first draft of the manuscript for this study. Neal Doran contributed to subsequent revisions and both authors approved the final manuscript.

Conflict of interest

Both authors declare that they have no conflicts of interest.

effects, or to alleviate the negative effects, of either or both substances (Kirchner & Sayette, 2007; Rose et al., 2004; Sayette et al., 2005). Laboratory (Piasecki et al., 2008; Sayette et al., 2005; Shiffman & Kirchner, 2009) and survey (Johnson et al., 2000) studies suggest that simultaneous users expect more benefit from concurrent use compared with use of alcohol or tobacco alone. While there are a number of well-validated measures of various cognitive appraisals (including expectancies, beliefs, motives, and reasons) related to alcohol or tobacco use alone (Brown et al., 1987; Cooper, 1994; Fromme et al., 1993; Myers et al., 2003; Wahl et al., 2005; Wetter et al., 1994), there are no measures designed to assess expectancies for use of both. The present report details the initial psychometric examination of such a measure using survey data from a large group of young adults with recent SATU. Exploratory factor analysis was used to identify the factor structure of the novel measure. The associations between the resulting SATU-specific expectancy factors and recent SATU were then examined first alone and then in conjunction with other conceptually similar cognitive appraisal measures of alcohol-only and tobacco-only. It was hypothesized that scores on the newly developed measure would be associated with frequency of SATU even after controlling for well-validated and robust measures of alcohol and tobacco motives/expectancies.

2. Materials and methods

2.1. Participants

Participants were 1,063 young adults ($M=22.2$, $SD=2.07$, range=18–25; 47% female). Eligibility criteria included using alcohol and cigarettes simultaneously in the past month. Exclusion criteria include past year psychiatric hospitalization and/or difficulty with the English language.

2.2. Procedure

Participants were recruited online from January 2013 to September 2014 from a variety of sources (Craigslist, Facebook, SurveyMonkey panel, referrals from other studies, campus ads, community ads, and friend referrals). Internet-based recruitment (including use of social networking sites) has been shown to be an efficient and cost-effective option for assessment of health behavior in young adults (Pedersen & Kurz, 2016; Ramo & Prochaska, 2012; Thornton et al., 2015). Informed consent was obtained online and participants received \$30 for completing the online survey. Procedures were approved by the Institutional Review Board of the University of California, San Diego.

2.3. Measures

2.3.1 SATU expectancies—SATU expectancies were assessed with the Simultaneous Alcohol & Tobacco Expectancy Questionnaire (SAT-EQ). This measure was developed in an earlier qualitative study with 62 young adults (aged 18–25) who had used alcohol and tobacco simultaneously at least once in the previous 30 days. We first conducted four focus groups to generate expectancies for SATU, in a group discussion format and via written responses to handouts; each session was recorded and transcribed. We then developed a classification system to ensure a representative range of items that were presented to the next four focus groups, which focused on item development. Based on existing literature (Dani &

Harris, 2005; Duhig et al., 2005; Harrison et al., 2008; Harrison et al., 2009; McKee et al., 2004) and content analysis of focus group transcripts, we identified six broad item categories: automaticity, craving, reinforcement enhancement, sensory, social, and reversal of negative consequences. Two independent raters sorted responses from the item development focus groups into these categories. This process produced a preliminary measure that was presented to the final two focus groups for feedback on item wording, content and clarity, and response options. The final SAT-EQ measures consists of 18 items; the measure instructions were: "Please rate the extent to which each statement is true for you" on a 6-point Likert scale ranging from "very untrue" to "very true".

2.3.2. Alcohol expectancies—Alcohol expectancies were measured using the Alcohol Expectancies Questionnaire-Adolescent, Brief scale (AEQ-AB; Stein et al., 2007). This 7-item measure (which contains positive and negative expectancy subscales) was based on the original, larger AEQ-A (Brown et al., 1987).

2.3.3 Drinking motives—Drinking motives were measured using the two highest-loading items from each of the four subscales (social, coping, enhancement, and conformity motives) of the Drinking Motives Questionnaire-Revised (DMQ-R; Cooper, 1994).

2.3.4. Smoking expectancies—Smoking expectancies were evaluated using the 16-item short form of the Smoking Consequences Questionnaire (S-SCQ; Myers et al., 2003). The subscales include positive reinforcement, negative reinforcement, and negative consequences.

2.3.5. Alcohol and cigarette use and co-use—Participants reported past 30-day frequency of alcohol and cigarette use, as well as frequency of SATU ("In the past 30 days, how many days have you consumed alcohol and smoked cigarettes simultaneously (around the same time)?"). There was a wide distribution of past-month frequency of days with alcohol use ($M=11.1$, $SD=7.80$), cigarette use ($M=18.1$, $SD=12.03$), and SATU ($M=10.1$, $SD=8.37$).

2.4 Data analyses

The pattern of correlations among the SAT-EQ items was first examined using a graphical approach known as heat mapping (not shown). Maximum likelihood (ML) factor analysis was used to examine the underlying factor structure of the items. The factor solution implemented an oblique (promax) rotation which allowed for correlation among the factors. Several strategies were used to identify the number of retained factors (Costello & Osborne, 2005; Fabrigar et al., 1999; Pett et al., 2003), including examination of the scree plot of eigenvalues and interpretability of factors and communalities. The final solution met the following criteria: (a) each item loaded at least .32 on one factor; (b) items with cross-loadings of .32 or higher on two or more factors were removed if there were several strong loaders ($>.50$) on each factor; (c) items with communalities of less than .40 were removed; and (d) each factor had three or more strong loadings. The resulting factor scores on the SAT-EQ were next used to predict past-month SATU within an OLS regression framework to evaluate criterion validity of the measure. A larger regression model then evaluated

whether the SAT-EQ scales uniquely accounted for variance in past-month SATU when controlling for demographics and thematically related and validated measures of alcohol and smoking motives/expectancies. All statistical analyses were conducted in SPSS version 21 and R Studio version 1.0.143.

3. Results

3.1. Exploratory factor analysis

Maximum likelihood factor analysis indicated that the correlation matrix was not an identity matrix (Bartlett's test of sphericity ($\chi^2=10,839$, $df=153$, $p<.001$), and there was evidence that the factor analysis would account for a substantial amount of variance (Kaiser-Meyer-Olkin statistic=.90; Kaiser, 1974). The final result of this analysis was a rotated 4-factor solution, which accounted for 68.6% of the total variance. With 18 items and 1,063 participants, the scale exceeded the recommended 10-participants-per-item ratio recommended for instrument analysis (DeVellis, 2003; Nunnally & Bernstein, 1994). The four SAT-EQ factors were labeled affect regulation (6 items; $M=3.63$, $SD=1.30$, $\alpha=.91$), social enhancement (6 items; $M=3.49$, $SD=1.20$, $\alpha=.86$), craving/automaticity (3 items; $M=4.11$, $SD=1.37$, $\alpha=.83$), and social avoidance (3 items; $M=3.19$, $SD=1.35$, $\alpha=.81$). Internal consistency (Cronbach's alpha) for the full SAT-EQ measure was .90. Rotated factor loadings for the 4-factor solution are shown in Table 1. The SAT-EQ factor correlations and correlations of the SAT-EQ factors with subscales from related measures of alcohol and tobacco cognitive appraisals are shown in Table 2.

3.2. Regressing SATU on SAT-EQ scales

A linear regression model was estimated to evaluate association between SATU expectancies and SATU. The four SAT-EQ subscales accounted for 8.4% of the variance in predicting past-month frequency of days with SATU. Affect regulation ($b=1.14$, $s.e.=.25$, $p<.001$), social enhancement ($b=-.82$, $s.e.=.24$, $p<.001$), and craving/automaticity ($b=1.10$, $s.e.=.21$, $p<.001$) were all significant; social avoidance was not associated with the outcome ($b=.08$, $s.e.=.22$, $p=.70$) when controlling for the other subscales.

3.3. Regressing SATU on SAT-EQ scales controlling for other predictors

Linear regression was again used to further elucidate the association between SATU expectancies and SATU after controlling for age, gender, smoking expectancies (S-SCQ), alcohol expectancies (AEQ-AB), and drinking motives (DMQ-R). This entire set of 15 variables accounted for 16.3% of the variance in past-month frequency of days with SATU. The associations between the outcome and both social enhancement ($b=-.88$, $s.e.=.27$, $p<.01$) and craving/automaticity ($b=1.23$, $s.e.=.24$, $p<.001$) remained significant, affect regulation ($b=.49$, $s.e.=.26$, $p=.06$) was now marginal, and social avoidance was still non-significant ($b=-.07$, $s.e.=.23$, $p=.74$) when controlling for the other set of predictors. Among the related measures, only one drinking motive (coping: $b=.68$, $s.e.=.26$, $p<.01$) and two smoking expectancy (negative consequences: $b=-1.15$, $s.e.=.36$, $p<.01$; positive reinforcement: $b=.94$, $s.e.=.30$, $p<.01$) subscales were significantly associated with SATU outcome.

Exploratory regression analyses were performed to determine whether SATU expectancies predicted frequency of separate alcohol and cigarette use. When controlling for age, gender, alcohol expectancies, and drinking motives, craving/automaticity ($b=0.43$, $s.e.=.21$, $p<.05$) was the only SAT-EQ scale associated with past-month frequency of drinking days (the predictors accounted for 10.0% of the outcome variance). Similarly, when controlling for age, gender, and smoking expectancies, the SAT-EQ scales of affect regulation ($b=-1.37$, $s.e.=.32$, $p<.001$), social enhancement ($b=-2.66$, $s.e.=.31$, $p<.001$), and craving/automaticity ($b=3.10$, $s.e.=.30$, $p<.001$) were associated with past-month frequency of smoking days (the predictors accounted for 34.3% of the outcome variance).

4. Discussion

There is a robust literature examining cognitive appraisals (including expectancies, beliefs, motives, and reasons) related to alcohol and tobacco use in young adults. An emerging body of literature has suggested that simultaneous alcohol and tobacco use can increase the risk for problematic use of both substances due to a variety of mechanisms including reciprocal heightening of subjective reinforcement (McKee & Weinberger, 2013). This was the first study to provide initial validation for a novel measure designed to identify expectancies unique to SATU. The 18-item SAT-EQ loaded onto four distinct factors reflecting affect regulation, social enhancement, craving/automaticity, and social avoidance expectancies for SATU. These subscales were correlated with well-validated measures of alcohol expectancies and motives and smoking expectancies, and were also uniquely associated with SATU frequency even when controlling for validated substance-specific expectancy/motive measures. Consistent with our hypothesis, these analyses provide evidence of criterion validity for the SAT-EQ scales of social enhancement and craving/automaticity (and to a lesser degree affect regulation which had a marginal association with SATU after controlling for the larger set of measures).

The current study builds upon the growing body of SATU-related literature. Most importantly, this was the first known effort to explore the utility of a novel expectancy scale specific to SATU. There were several limitations including the cross-sectional design and focus on substance use frequency. As such, future research can build upon these initial findings through use of longitudinal studies (to better evaluate the predictive validity of the SAT-EQ) and by examining the association between SAT-EQ and a wider range of substance use patterns (including problems and diagnostic criteria) over time. Furthermore, examination of the SAT-EQ over time in younger populations at-risk for SATU would allow researchers to explore the impact of SATU-specific expectancies on the onset and progression of SATU. There are complex temporal issues involved in the measurement of SATU, and future studies could advance this research by evaluating different approaches to capture SATU involvement.

Acknowledgments

The authors wish to thank the study participants, Caroline Barnet and Natalie Stewart who helped collect data for this study, Mark Myers, Carmen Pulido, and Andrea Spadoni who provided feedback on various aspects of the larger study, and Michael Thomas who provided guidance on conducting data analysis using the R software package.

This work was supported by the UCSD Academic Senate and the National Institute on Alcohol Abuse and Alcoholism grant R21 AA021822 (Co-PIs: Doran & Trim).

Role of funding sources

Funding for this study was provided by UCSD Academic Senate and the National Institute on Alcohol Abuse and Alcoholism grant R21 AA021822. Neither UCSD nor NIAAA had any role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

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Highlights

- Alcohol and tobacco use is highly comorbid in young adults.
- Expectancies of simultaneous alcohol & tobacco use (SATU) have not been studied.
- The novel SAT-EQ correlated with validated measures of substance use cognitions.
- Craving/automaticity and social enhancement were robust predictors of SATU.

Table 1

Rotated factor loadings of SAT-EQ items (n=1,063)

Item	Factor 1-Affect Regulation	Factor 2-Social Enhancement	Factor 3-Craving/Automaticity	Factor 4-Social Avoidance
Smoking and drinking together are better at relieving stress than either on its own	.98	-.08	-.04	-.05
Smoking and drinking together are better at relieving anxiety than either is on its own	.92	-.06	-.03	-.02
Smoking and drinking together are better at taking my mind off things than either is alone	.77	-.01	-.06	.13
Smoking and drinking together makes me feel better than either one on its own	.74	.06	.10	-.04
Smoking and drinking together is more fun than using either one separately	.68	.13	.04	-.04
I smoke to enhance the relaxing effect of alcohol	.55	.03	.13	.06
While I'm drinking,	-.06	.86	-.02	-.06

Item	Factor 1-Affect Regulation	Factor 2-Social Enhancement	Factor 3-Craving/Automaticity	Factor 4-Social Avoidance
I smoke because my friends are smoking				
While I'm drinking, I smoke so that I won't be left out of a group	.02	.79	-.11	.04
While I'm drinking, I smoke to feel part of a social occasion	.07	.78	-.08	-.03
While I'm drinking, I smoke to talk to other people who are smoking	.02	.68	.00	.03
While I'm drinking, I smoke because other people offer me cigarettes	-.03	.61	.10	.02
While I'm drinking, I smoke because cigarettes are accessible	-.01	.50	.25	.01
Drinking alcohol makes me crave a smoke	.01	.01	.87	-.08
I smoke while drinking because using them both together is a habit for me	.04	.03	.81	-.01
While I'm drinking, I smoke without	.04	-.07	.63	.14

Item	Factor 1-Affect Regulation	Factor 2-Social Enhancement	Factor 3-Craving/Automaticity	Factor 4-Social Avoidance
thinking about it				
While I'm drinking, I smoke to have a few minutes alone	.00	-.14	.04	.92
While I'm drinking, I smoke to get away from noise or crowds	-.05	.13	.01	.69
While I'm drinking, I smoke to avoid awkward social situations	.06	.20	-.06	.59

Table 2

Correlations of SAT-EQ subscales with related measures (n=1,063)

	SATU AR	SATU SE	SATU CA	SATU SA
SATU Affect Regulation	–			
SATU Social Enhancement	.40 ***	–		
SATU Craving/Automacity	.54 ***	.21 ***	–	
SATU Social Avoidance	.43 ***	.50 ***	.28 ***	–
DMQ Enhancement Motives	.30 ***	.27 ***	.17 ***	.10 **
DMQ Social Motives	.27 ***	.35 ***	.17 ***	.11 **
DMQ Conformity Motives	.32 ***	.48 ***	.05	.38 ***
DMQ Coping Motives	.44 ***	.27 ***	.19 ***	.31 ***
AEQ Positive Expectancies	.42 ***	.37 ***	.24 ***	.33 ***
AEQ Negative Expectancies	.26 ***	.24 ***	.35 ***	.14 ***
SCQ Negative Consequences	.21 ***	.17 ***	.33 ***	.10 **
SCQ Positive Reinforcement	.44 ***	.17 ***	.41 ***	.36 ***
SCQ Negative Reinforcement	.53 ***	.12 ***	.62 ***	.34 ***

*
p<.05.**
p<.01***
p<.001