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Role of Executive Function and Alcohol-Sex Schema in the
Relationship between Alcohol Use and Sexual Assault

A Dissertation

Presented to

the Faculty of Arts and Humanities

University of Denver

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

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August 2018

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Title: Role of Executive Function and Alcohol-Sex Schema in the Relationship between Alcohol Use and Sexual Assault

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ABSTRACT

Heavy alcohol use and sexual assault are significant problems among women attending college. The current study examined the relationship between sexual assault and alcohol use across a four-month period and the role of executive function (EF) and alcohol-sex schema in this relationship. Participants were 176 women undergraduate students with a mean age of 19.50 years ($SD = 1.30$), with 85 participating in a second survey four months later. Participants completed self-report questionnaires regarding alcohol use and sexual assault, a battery of EF tasks, and a lexical decision task assessing alcohol-sex schema. Sexual assault significantly predicted alcohol use four months later. EF, specifically domains of working memory and processing speed, also significantly predicted alcohol use, even after controlling for previous alcohol use and age. Results provide information regarding EF having an additive effect on alcohol use following sexual assault, with implications for interventions on college campuses. Campus outreach programs may educate students on the risk of heavy alcohol use following sexual assault and the cognitive skills, such as information processing, which may mitigate such risks.

Keywords: alcohol use, sexual assault, executive function, college students

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CHAPTER ONE: INTRODUCTION

Heavy alcohol use and sexual assault are significant problems among women attending college. While research has established bidirectional links between heavy alcohol use and sexual assault (Abbey, 2002; Fisher et al., 2003), the mechanisms underlying this association in college women continues to require research attention. Two mechanisms that may link heavy alcohol use and sexual assault are executive function (EF) and alcohol-sex schema. Heavy alcohol use is associated with deficits in EF, the processes of cognitive control that influence behavior (Gianicola, 2000; Giancola & Moss, 1998), which in turn may increase risk of sexual assault. On the other hand, EF deficits may increase risk of alcohol use following sexual assault due to associated difficulties monitoring and regulating behavior. Additionally, heavy alcohol use may alter cognitive schema related to alcohol and sex such that women who drink heavily automatically and implicitly associate alcohol with sex. Strong alcohol-sex schema may place women at risk for sexual assault, for instance, due to expectations that alcohol leads to sex even when sexual contact is coerced. Further, EF deficits and strong alcohol-sex schema may decrease the likelihood of engaging in bystander behaviors (i.e., intervening in sexually coercive situations) due to reduced attention to social cues and implicit assumptions that alcohol leads to sex.

Drawing on theory and previous empirical evidence, the current study tested the roles of EF and alcohol-sex schema on the relationship between heavy alcohol use and later sexual assault among women in college. Bystander behaviors (i.e., prosocial helping behaviors such as intervening in a sexually coercive situation; Banyard, 2008; Darley & Latane, 1968) were assessed as an additional outcome measure of behaviors and attitudes related to sexual assault. Based on findings of the initial model, the current study then tested an alternative model of the additive role of EF in predicting alcohol use following sexual assault. The following sections provide the theoretical and empirical background for the predictions tested in these models.

Heavy Alcohol Use as Risk Factor for Sexual Assault

Heavy alcohol use is a significant problem among women in college. A higher percentage of women in college report alcohol use compared to other women in the same age group (57.3% vs. 48.7%), including heavy alcohol use, defined by 4 or more drinks on one occasion at least 5 times per month (10.0% vs. 6.9%; Substance Abuse and Mental Health Services Administration, 2015). Heavy alcohol use among college students is associated with multiple negative physical and psychosocial outcomes such as physical injury, health issues, legal issues, and impaired academic performance (National Institute on Alcohol Abuse and Alcoholism, 2002; Wechsler et al., 2002; Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002).

Sexual assault includes a range of forced sexual acts, such as forced sexual contact, attempted rape, and rape, which are perpetrated through force or threat of force, lack of consent, or inability to give consent due to age, intoxication, or mental status

(U.S. Department of Justice, 2014; Koss, 1992). Approximately 20% of women experience rape or attempted rape at some point in college (Fisher, Daigle, Cullen, & Turner, 2003; Krebs, Lindquist, Koetse, & Lattimore, 2007). While some men experience sexual assault in college, the majority of incidents involve women victims; thus, research has primarily focused on women victims and men perpetrators (Fisher et al., 2003; Krebs et al., 2007). Sexual assault during college is associated with negative outcomes, such as sexually transmitted disease, suicide, depression, post-traumatic stress disorder, and heavy alcohol use (Campbell, Sefl, & Ahrens, 2003; Koss, Koss, & Woodruff, 1991; Krebs et al., 2007).

Research has extensively documented the co-occurrence of alcohol use and sexual assault among women college students (Abbey, Ross, McDuffie, & McAuslan, 1996; Abbey, McAuslan, & Ross, 1998; Copenhaver & Grauerholz, 1991; Harrington & Leitenberg, 1994; Presley, Meilman, Cashin, & Leichliter, 1997). Approximately half of sexual assaults experienced by women in college involve alcohol (Abbey, 2002); however, researchers argue that this co-occurrence does not demonstrate that alcohol use *causes* assault (Abbey, 2002). Indeed, half of sexual assaults do not involve alcohol and the characteristics of alcohol-related and nonalcohol-related sexual assault are similar – approximately 90% are perpetrated by someone the woman knows, about half occur on a date, and the most common location of the sexual assault is the woman's or man's home (Abbey, 2002; Abbey et al., 1996; Koss, Dinero, Seibel, & Cox, 1988). Thus, researchers have argued that other variables, such as a pattern of heavy drinking, may better explain the relationship between alcohol use and sexual assault. Several studies have found that a

history of heavy alcohol use was the strongest predictor of crime victimization among college students, including sexual assault among women (Belknap & Erez, 1995; Fisher, Sloan, & Lu, 1998; Wechsler et al., 1994). Researchers assert that while heavy alcohol users may be more likely to experience sexual assault while drinking, the behavioral sequelae of heavy alcohol use may also contribute to sexual assault victimization. Thus, researchers emphasize the importance of identifying the mechanisms that link heavy alcohol use and sexual assault.

Executive Function

Executive function (EF) is one potential mechanism that may link heavy alcohol use and later sexual assault among women in college. EF includes processes of cognitive control that influence behavior and is involved in planning, initiating, monitoring, and modifying goal-oriented behavior. The cognitive abilities associated with EF include attentional control, inhibitory function, processing speed, and working memory. Research on alcohol use broadly has found EF deficits among heavy alcohol users (Brandt, Ryan, & Bayog, 1983; Courtney & Polich, 2009; Gianocola, 2000; Giancola & Moss, 1998; Knight & Longmore, 1994; Ratti, Giardini, & Soragna, 2002). Heavy alcohol use among adolescents and young adults is also associated with EF deficits and abnormalities in the prefrontal areas of the brain associated with EF (Brown, Tapert, Granholm, & Delis, 2000; Medina et al., 2008; Moss, Kirisci, Gordon, & Tarter, 1994; Tarter, Mezzich, Hsieh, & Parks, 1995). Specific to college samples, studies have found associations between heavy alcohol use and EF deficits in areas such as processing speed, as well as disruptions in the prefrontal cortex (Sher, Martin, Wood, & Rutledge, 1997; White &

Hingson, 2013). Prospective studies have found that heavy alcohol use among adolescents predicted poorer performance in EF tasks 3-10 years later in areas such as attention and working memory (Hanson, Medina, Padula, Tapert, & Brown, 2011; Squeglia, Spadoni, Infante, Myers, & Tapert, 2009; Tapert, Granholm, Leedy, & Brown, 2002). Specific to college students, heavy alcohol use predicted EF deficits in areas such as verbal memory and monitoring from the first to third year of college (Mota et al., 2013).

Alcohol use acutely disrupts EF and a history of heavy alcohol use has persistent negative impacts on EF, particularly among adolescents and young adults (Clark, Thatcher, & Tapert, 2008; Giancola, 2000). Alcohol use acutely disrupts cognitive processes such as planning, problem-solving, and processing of social cues (Abbey et al., 2004; Chermack & Giancola, 1997; Giancola, 2000). Heavy alcohol use has a persistent negative effect on EF due to the neurotoxic effects of alcohol on the prefrontal cortex (Giancola & Moss, 1998) and is associated with deficits in areas of working memory, pattern recognition, inhibition, and decision-making (Courtney & Polich, 2009). The frontal areas of the brain associated with EF (e.g., prefrontal cortex) continue to mature during the college years, making college students more susceptible to the negative effects of alcohol on EF (Steinberg, 2005).

Executive Function and Sexual Assault

Individuals who have been sexually assaulted have poorer EF compared to peers who have not experienced trauma (Berliner & Elliot, 2002; Navalta, Polcari, Webster, Boghossian, & Teicher, 2006; Stein, Hanna, Vaerum, & Koverola, 1999). Intimate

partner violence, including sexual assault, is associated with EF deficits such as poorer response inhibition, attention regulation, and processing speed (Lee & DePrince, 2017; Stein, Kennedy, & Twamley, 2002; Twamley et al., 2009). EF deficits may place women at risk of sexual assault through decreased attention, processing, and monitoring of relevant social cues (DePrince, Chu, Labus, Shirk, & Potter, 2015). However, the causal direction in the relationship between EF deficits and sexual assault victimization is difficult to infer. For instance, sexual assault may negatively impact EF through adverse effects of stress hormones on the prefrontal areas of the brain, as outlined in chronic stress models (e.g., McEwen, 2004).

Alcohol-Sex Schema

In addition to EF, alcohol-sex schema may underlie the relationship between heavy alcohol use and later sexual assault and engagement in bystander behaviors. Specifically, schematic representations that strongly associate alcohol and sex may increase risk of sexual assault among women in college. A schema is an automatically activated set of associations that impact thoughts and behavior (Bartlett, 1932; Piaget & Cook, 1952). Schema are developed and strengthened based on experience; thus, schema consisting of automatic alcohol-sex associations may arise when an individual has had multiple concurrent experiences with alcohol and sex. For an individual with strong alcohol-sex schema, when the concept of alcohol is activated (e.g., walking into a bar), the concept of sex is implicitly and automatically activated as well. Research demonstrates that expectations about sex and alcohol, such as beliefs that men should initiate and sometimes force sexual contact, increased risk of sexual assault among

college students (Abbey & Wegner, 2015). Women who have strong implicit associations between alcohol and sex, compared to women who have no or minimal associations between alcohol and sex, may be at risk for sexual assault due to acceptance that alcohol and sex are connected, even when the sexual experience is unwanted. Additionally, women who have strong implicit associations between alcohol and sex may be less likely to intervene in sexually coercive situations, particularly when alcohol is involved, due to their implicit expectations that alcohol leads to sex.

Expectations and beliefs about alcohol and sex that emerge from implicit alcohol-sex schema are automatic and occur outside of conscious awareness. However, most studies on the associations between alcohol and sex as risk factors for sexual assault utilize explicit self-report measures, which may not capture implicit expectations and beliefs about alcohol and sex. The current study therefore examined alcohol-sex schema by an implicit lexical decision-making task. Researchers have utilized implicit measures to examine associations relevant to alcohol, sex, and sexual aggression. For instance, Jajodia and Earleywine (2003) utilized an implicit measure to examine automatic expectations related to alcohol use among college students, particularly implicit positive expectations about alcohol use. Zurbriggen (2000) found that stronger automatic power-sex associations, as measured by a lexical decision-making task, predicted sexual aggression among men.

Bystander Behaviors

Most research examining alcohol use and sexual assault among college students measures sexual assault victimization and/or perpetration; however, emerging research

also addresses bystander behaviors as an important consideration in sexual assault research and prevention. Bystander behaviors are prosocial helping behaviors such as intervening in instances of crime or emergency (Banyard, 2008; Darley & Latane, 1968). The steps involved in being a bystander include “noticing what is happening and labeling it as a problem where help is needed, taking responsibility, deciding what actions to take, and feeling one has the skills to take action and can do so safely” (Darley & Latane, 1968). Research indicates that alcohol use and alcohol expectations (e.g., that drinking leads to sex) are associated with decreased willingness to engage in bystander behaviors in sexually coercive situations (Fleming & Wiersma-Mosley, 2015; Leone, Haikalis, Parrott, & DiLillo, 2017). While research has yet to address the role of EF on bystander behaviors, EF deficits may also decrease the likelihood of intervening in sexually coercive situations due to reduced attention to social cues and monitoring of behavior. Given the importance of the bystander approach in sexual assault prevention, the current study included bystander behaviors as an additional outcome variable.

Hypothesized Model

Drawing on past research and theory, the current study tested the roles of EF and alcohol-sex schema in the relationship between heavy alcohol use and sexual assault and engagement in bystander behaviors four months later among women in college (Figure 1). Specifically, the hypothesis was that greater alcohol use would be linked with poorer EF and stronger alcohol-sex schema, which in turn increases risk of sexual assault for women and decreases bystander behaviors over time.

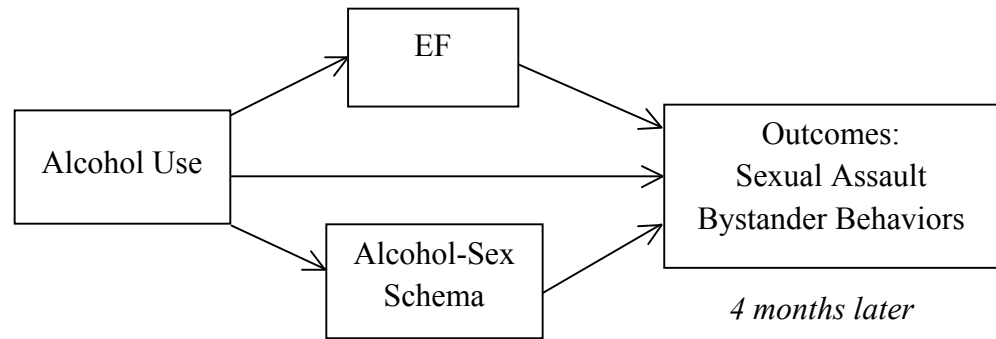


Figure 1. Hypothesized model assessing the indirect effect of EF and alcohol-sex schema on the relationship between heavy alcohol use and sexual assault and bystander behaviors 4 months later.

Alternative Model: Sexual Assault as a Risk Factor for Alcohol Use

The current study also assessed an alternative model of the additive role of EF on alcohol use following sexual assault. The alternative model was based on evidence supporting sexual assault and EF deficits as risk factors for alcohol use. Similar to the research on alcohol use predicting sexual assault, the role of neuropsychological factors such as EF in predicting alcohol use following sexual assault continues to require research attention. EF may have an additive effect to increase risk of alcohol use following sexual assault – for instance, through associated difficulties in affective, cognitive, and behavioral regulation.

Sexual Assault as a Risk Factor for Alcohol Use

Among the general adult population, retrospective studies demonstrate positive associations between previous sexual assault in adulthood and alcohol use (Campbell, Dworkin, & Cabral, 2009; Dworkin, Menon, Bystrynski, & Allen, 2017; Ullman, Filipas, Townsend, & Starzynski, 2005; Winfield, George, Swartz, & Blazer, 1990). Prospective

studies also indicate greater use of alcohol across time among women who experienced sexual assault compared to women who have not experienced sexual assault (Bryan et al., 2016; Frank, Turner, Stewart, Jacob, & West, 1981; Kilpatrick, Acierno, Resnick, Saunders, & Best, 1997; Rhew, Stappenbeck, Bedard-Gilligan, Hughes, & Kaysen, 2017). However, Testa, Livingston, and Hoffman (2007) utilized a prospective design and found that while sexual assault contributed to increased drinking over time among a community sample of women, the effect disappeared when controlling for prior alcohol use and demographic variables. Specific to women in college, experiencing sexual assault is associated with greater alcohol use (Abbey, 2002; Brener, McMahon, Warren, & Douglas, 1999; Goldstein, Flett, Kassel, Jackson, & Unrod, 2000; MacLean & Lecci, 2000; Miranda et al., 2002).

Women may drink more heavily following sexual assault as a means of coping with affective, cognitive, and behavioral dysregulation (Khantzian, 1985; Polusny & Follette, 1995; Root, 1989). Affective, cognitive, and behavioral dysregulation involve difficulty in modulating reactivity to environmental challenges (Dawes et al., 2000) and are associated with heavy alcohol use (Giancola & Tarter, 1999). Consistent with this hypothesis, Miranda and colleagues (2002) found that sexual assault was associated with increased psychological distress, which in turn was associated with alcohol use. Additionally, using a prospective design, Kaysen and colleagues (2014) found that women college students who experienced sexual assault had stronger urges to drink and were more likely to drink on days they experienced post-traumatic stress disorder (PTSD) symptoms. Affective, cognitive, and behavioral dysregulation, which have been

consistently linked with heavy alcohol use, are thought to be subsumed within EF (Luria, 1980; Milner, 1995). Adolescents at risk for heavy alcohol use (e.g., with family histories of alcohol use disorders) demonstrate affective, cognitive, and behavioral dysregulation, in addition to EF deficits and impairment in the prefrontal areas of the brain associated with EF (Clark et al., 2008).

Executive Function Predicting Alcohol Use

Prospective studies demonstrate EF deficits during childhood or adolescence as a risk factor for later heavy alcohol use. For instance, Nigg and colleagues (2006) found that poor response inhibition in childhood and early adolescence predicted frequency and quantity of alcohol use in late adolescence. Working memory assessed in early adolescence also predicted frequency of alcohol use throughout adolescence (Khurana et al., 2013). Additionally, Tarter (2002) found that the onset of alcohol use disorders between the ages of 16-19 was better predicted by measures of EF than previous alcohol use. Among college students, cross-sectional studies have found associations between EF deficits in areas of working memory and processing speed and alcohol use (Blume, Marlatt, & Schmalting, 2000; Parada et al., 2012). Researchers hypothesize that EF deficits are a risk factor for heavy alcohol use due to associated inability in recognizing and interrupting harmful behavior, inhibiting alcohol-related stimuli, monitoring behavior, flexibly thinking of new coping strategies, and executing alternative coping behaviors when encountering alcohol (Dawe & Loxton, 2004; Littlefield, Sher, & Steinley, 2010; Whitney, Jameson, & Hinson, 2004; Wong et al., 2006).

Alternative Model

The existing literature suggests that EF may play an additive role in predicting alcohol use following sexual assault; however, no studies that examined these variables longitudinally among women in college. Therefore, the current study tested an alternative model that assessed the additive role of EF on alcohol use following sexual assault. Specifically, the hypothesis was that greater number of sexual assault experiences and poorer EF would be associated with greater alcohol use four months later. Age and prior alcohol use were included in the alternative model as control variables.

Current Study

In summary, the current study tested an initial hypothesis assessing the roles of EF and alcohol-sex schema (Time 1) in the relationship between heavy alcohol use (Time 1) and experiences of sexual assault and engagement in bystander behaviors measured four months later (Time 2). An alternative hypothesis assessed the additive role of EF in predicting alcohol use following sexual assault. Sexual assault was measured at Time 1 as experiences of forced sexual contact, attempted rape, and rape since the age of 18, and alcohol use was measured at Time 2 as quantity and frequency of alcohol use within the previous four months. The current study assessed these variables utilizing a prospective design among a sample of women undergraduate students.

CHAPTER TWO: METHODOLOGY

Participants

Participants at Time 1 (T1) were 176 women undergraduate students receiving course credit in psychology classes for research participation. Mean age was 19.50 ($SD = 1.30$), ranging from 18 to 23 years. At the end of the T1 study, participants had the option of providing their email addresses to participate in a second survey in four months.

Participants were told that providing their contact information was optional and that their personal information would not be connected with their study responses. They were also informed that even if they provided their email addresses, participation in the T2 survey was optional. Among 136 participants who provided their email addresses at T1 and were contacted to participate, 85 participants completed the Time 2 (T2) survey four months later. Mean age of participants at T2 was 19.60 ($SD = 1.30$), ranging from 18 to 23 years. Demographic variables (Table 1) between participants who only completed T1 and participants who also completed T2 did not significant differ from each other.

Materials

Unless otherwise noted, measures were administered at both T1 and T2.

Alcohol Use. The Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, De la Fuente, & Grant, 1993) is a 10-item measure that assesses

frequency and quantity of alcohol use, as well as problem drinking behaviors (e.g., blacking out) and injury. A total score is calculated from 0 to 40, with a score of 0-7 indicating low risk, score of 8-15 indicating medium risk, and scores above 16 indicating high risk of alcohol problems. The AUDIT was administered at both T1 and T2. At T1, participants were asked about alcohol use in the past 12 months. At T2, participants were asked about alcohol use since the T1 interview. The AUDIT demonstrates high internal consistency with Cronbach's alphas ranging from .80 to .94 (de Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009). Cronbach's alphas in the current study were .84 at T1 and .83 at T2.

Executive Function. The EF measures were administered at T1. EF measures included the Symbol Search and Letter-Number Sequencing tasks from the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV; Wechsler, Coalson, & Raiford, 2008) and the Delis-Kaplan Color-Word Interference Test (D-KEFS; Delis, Kaplan, & Kramer, 2001). These tests are frequently used in neuropsychological batteries assessing EF (Daigneault, Braun, & Whitaker, 1992; Libon et al., 1994; Nelson, Yoash-Gantz, Pickett, & Campbell, 2009) and assess EFs that have been linked to violence in close relationships (processing speed, working memory, inhibitory function; Aupperle, Melrose, Stein, & Paulus, 2012; Majer, Nater, Lin, Capuron, & Reeves, 2010; Stein et al., 2002; Vasterling, Brailey, Constans, & Sutker, 1998). The Symbol Search task involves scanning rows of symbols to determine if the row contains one of two sample symbols. Performance on this task depends on processing speed and visual memory. Total score on the Symbol Search task was calculated by adding the number of correct responses within

a 120-second time limit. The Letter-Number Sequencing task involves listening to a string of numbers and letters and organizing them by numerical and alphabetical order. The strings get longer and the task becomes more difficult as the participant completes each sequence. Performance depends on attention toward stimuli and manipulating information in working memory. Total score on the Letter-Number Sequencing task was calculated by summing the number of sequences participants answered correctly.

The Delis-Kaplan Color-Word Interference Test (D-KEFS; Delis et al., 2001) assesses attention, inhibitory function, and cognitive set shifting. It is based on the original Stroop color-naming task (Stroop, 1935) with the addition of an Inhibition/Switching trial, resulting in four conditions:

1. Color Naming: Participants say aloud the color of each box in a list of colored boxes.
2. Word Reading: Participants read aloud a list of 50 color words (“red,” “blue”) written in the color ink of the word.
3. Inhibition: Participants read aloud 50 color words written in another color ink than the word.
4. Inhibition/Switching: Same as the Inhibition condition, except the rule “switches” throughout the task – they must read aloud the word (and not color of the ink) when the word is in a box and the color of the ink when the word is not in a box.

Participants were timed through all conditions. Completing Conditions 1 and 2 takes less time than Conditions 3 and 4 because the trials involve congruent stimuli (i.e.,

meaning of the word and the color of the ink match). Quickly naming the color ink in Condition 3 involves inhibition; that is, blocking out automatic semantic reading to name the incongruent color of the ink. It also involves selective attention – attending to one stimulus (i.e., color of ink) and not the other (i.e., meaning of the word). Performance in Condition 4 also involves inhibition and selective attention, as well as set shifting – the ability to switch between sets or rules (Berg, Swan, Banks, & Miller, 2015; Delis et al., 2001). In the case of the D-KEFS Inhibition/Switching trial, set shifting is required to switch back and forth from an automatic response and a more intentional response. The Inhibition score was calculated by subtracting the time to complete Condition 3 and the average time to complete two congruent conditions (Conditions 1 and 2). The Inhibition/Switching score was calculated by subtracting the time to complete Condition 4 and the average time to complete two congruent conditions (Conditions 1 and 2). Since higher scores indicated worse performance, these scores were reverse scored.

Alcohol-Sex Schema. Alcohol-sex schema was measured at T1 only. A lexical decision task (adapted from DePrince, Weinzierl, & Combs, 2009; Zurbriggen, 2000) was administered via E-Prime software (Psychology Software Tools, 2016). Participants were presented with two words at a time on a computer screen – for each pair, participants made key presses to indicate if both words are real or at least one word is a non-word. Alcohol-related words (e.g., “beer”, “drunk”), sex-related words (e.g., “lust”, “kiss”), and aggression-related words (e.g., “punch”, “hit”) were chosen based on stimuli from previous studies (DePrince & Freyd, 2004; Lee, Begun, DePrince, & Chu, 2016; McNally, Metzger, Lasko, Clancy, & Pitman, 1998), matched for length, and matched for

frequency in the English language based on the Corpus of Contemporary American English (COCA; Davies, 2008). Aggression-related words were included based on initial hypotheses regarding sex-aggression and alcohol-aggression links, but were ultimately not included in analyses. An alcohol-sex priming score was calculated to isolate the reaction time caused by seeing an alcohol-related word and sex-related word together, relative to other combinations of words and non-words (see DePrince et al., 2009; Zurbriggen, 2000 for equations). Higher alcohol-sex priming scores indicated a stronger association between alcohol and sex.

Before analysis of reaction time data, data were cleaned following procedures from previous studies (DePrince et al., 2009; Holland, Hendriks, & Aarts, 2005; Vitevitch, 2007). All incorrect trials (e.g., participant indicated both stimuli were real words when one was a non-word) and trials in which reaction time was greater than 2,000 *ms* or less than 200 *ms* were deleted. Data were examined for outliers at the individual and group level. Reaction times that exceeded 3 standard deviations above or below the mean for each participant and across all participants were windorized (i.e., $M \pm 3*SD$). The lexical decision task was administered at T1.

Sexual Assault. Participants reported experiences of sexual assault through the Sexual Experiences Survey (SES; Koss et al., 2007). The SES measures a range of unwanted sexual experiences, from sexual harassment to attempted rape and rape. For the purposes of this study, items relating to sexual contact, attempted rape, and rape were used to operationalize sexual assault. A sexual assault score was calculated by summing individual items endorsed by the participant. The SES was administered at both T1 and

T2. At T1, participants were asked about sexual assault since the age of 18. At T2, participants were asked about experiences of sexual assault since the T1 interview.

Bystander Behaviors. Bystander behaviors were assessed through three measures: the Bystander Efficacy Scale (BES), Willingness to Engage in Bystander Behaviors Scale (WTEBB), and the Bystander Behaviors Scale (BB; Banyard, 2008; Banyard & Moynihan, 2011). These measures assessed self-reported engagement in bystander behaviors in the past and attitudes related to bystander behaviors (i.e., likelihood to engage in behaviors). The Bystander Efficacy Scale (BES) asked participants to rate how confident they were to engage in bystander behaviors on a scale from 0 to 100%. Example items include: “*Ask a friend if they need to be walked home from a party,*” and “*Do something to help a very drunk person who is being brought upstairs to a bedroom by a group of people at a party.*” The total BES score was calculated by averaging across all 18 items. The Willingness to Engage in Bystander Behaviors Scale (WTEBB) asked participants to rate how likely they are to engage in bystander behaviors such as “*Enlist the help of others if an intoxicated acquaintance is being taken upstairs at a party,*” and “*Go with my friend to talk with someone (e.g. police, counselor, crisis center) about an unwanted sexual experience.*” Total WTEBB scores were calculated by averaging rating scores of 1 – *Very Unlikely* to 5 - *Very Likely* across 12 items. The Bystander Behaviors Scale (BB) asked participants whether or not they actually engaged in bystander behaviors in the last 6 months (T1) and 4 months (T2). Example items include: “*I checked in with my friend who looked very intoxicated when they were leaving with someone,*” and “*If a friend had too much to drink, I asked*

them if they need to be walked home.” Participants answered “Yes,” “No,” or “Not applicable.” Total BB scores were calculated by summing items to which participants answered “Yes” across 26 items. These measures demonstrate high reliability with Cronbach’s alphas ranging between .89 and .93 (Banyard, Moynihan, Cares, & Warner, 2014). Cronbach’s alphas in the current study for these three measures ranged from .93 to .94 at T1 and from .89 to .92 at T2.

Procedure

All procedures were approved by a university institutional review board prior to data collection. At T1, each participant was tested one at a time a trained graduate or undergraduate research assistant in a private university research office. Participants answered self-report questionnaires through an online survey and completed the lexical decision task on E-Prime software (Psychology Software Tools, 2016). The EF battery was administered in-person. T1 took approximately one hour to complete and participants received course credit for their participation in the study.

At the end of T1, participants were asked to provide contact information if they were interested in participating in a follow-up online survey in four months. They were assured that providing contact information and participation in the survey were voluntary. Participants were told that their personal information would not be connected to answers they provide in either the T1 or T2 survey.

Participants who provided their contact information at the end of T1 were emailed three months following the T1 study with an invitation to participate in the T2 survey. They received a reminder email two weeks following the initial email and a final

reminder email four weeks following the initial email to participate in the survey. The T2 survey was an online survey and took approximately 30 minutes to complete. Participants received a \$10 Amazon gift certificate for participating in the T2 survey. The T2 survey comprised a subgroup of surveys administered at T1 that assessed alcohol use, sexual assault, and bystander behaviors.

Informed consent procedures for both T1 and T2 detailed the time and task demands of the research, such as informing participants that the study includes questions about sexual assault. Informed consent procedures emphasized that participation is voluntary, responses were confidential, and that participants could skip any questions they did not wish to answer. Participants were assured that their name or identifying information is not connected to their responses and that responses are stored in a secure data files.

CHAPTER THREE: RESULTS

Descriptive Statistics

Descriptive statistics for participants who completed both time points ($n = 85$) is reported in Table 2. Baseline (i.e., T1) scores between participants who only completed T1 and participants completed both time points did not significant differ from each other (Table 3).

Bivariate Correlations

Table 4 presents bivariate correlations among all variables for participants who completed both time points ($n = 85$). Alcohol use and sexual assault experiences – measured by the AUDIT and SES, respectively – were significantly positively correlated at T1. Alcohol use was also significantly negatively correlated with willingness to engage in bystander behaviors, measured by the WTEBB, at T1. Alcohol use at T1 was significantly positively correlated with alcohol use at T2. Sexual assault experiences at T1 were significantly positively correlated with both alcohol use and sexual assault at T2.

All bystander behavior scores were significantly positively correlated with each other at T1. Bystander engagement at T2 was significantly positively correlated with all bystander scales at T1 and T2, with the exception of engagement in bystander behaviors

at T2. Similarly, the willingness to engage scale was significantly correlated with all bystander scales at T1 and T2 except for engagement in bystander behaviors at T2.

Among the individual EF measures, the significant correlations were between Symbol Search and the D-KEFS Inhibition/Switch condition and the D-KEFS Inhibition and Inhibition/Switch conditions. EF measures and the alcohol-sex priming score were not significantly correlated with each other, except for a negative correlation between the D-KEFS Inhibition/Switch condition and the priming score. Because of the relatively low correlations among EF measures, they were included separately in analyses rather than combining into a composite.

Direct and Indirect Effects

Tests of direct and indirect effects were conducted through the PROCESS macro for SPSS (Hayes, 2017) for participants who completed both time points ($n = 85$). Two models were analyzed to assess the direct and indirect effects of EF (Model 1) and alcohol-sex schema (Model 2) on the relationship between alcohol use at T1 and sexual assault at T2. For both models, there was no direct effect between variables (Table 5). Indirect effects of the individual EF measures and alcohol-sex schema were also not significant, as demonstrated by 95% confidence intervals of the indirect effects containing zero (Table 6). There were also no significant direct or indirect effects with bystander behavior measures as outcome variables. All models tested were additionally not significant when controlling for T1 sexual assault and age. Overall R^2 values for both models were not significant.

Alternative Model Results

Descriptive statistics included in the alternative model – specifically for the AUDIT and SES across both time points and EF measures ($n = 85$) are listed in Table 2. Table 7 describes bivariate correlations among variables in the alternative model. Alcohol use and sexual assault experiences were significantly positively correlated at T1 and T2. Alcohol use at T1 was significantly positively correlated with alcohol use at T2. Sexual assault experiences at T1 were significantly positively correlated with sexual assault at T2. Symbol Search was significantly positively correlated with sexual assault at T1.

Table 8 describes the results of the linear regression analysis predicting alcohol use at T2 ($n = 85$). The first model included T1 sexual assault and EF measures as predictors. The second model included the addition of age and T1 alcohol use as control variables to the first model. Both models were significant. Results indicate that T1 sexual assault and Letter-Number Sequencing significantly predict alcohol use at T2 (Model 1). After controlling for T1 alcohol use and age (Model 2), Symbol Search and Letter-Number Sequencing, but not T1 sexual assault, still significantly predicted T2 alcohol use. Alcohol use at T1 and age were also both significant predictors of T2 alcohol use.

CHAPTER FOUR: DISCUSSION

The current study initially tested the hypothesis that alcohol use would predict sexual assault four months later, and EF and alcohol-sex schema would indirectly link this relationship. Contrary to hypotheses, there was no significant direct effect of alcohol use on sexual assault and no significant indirect effects of EF and alcohol-sex schema. An alternative model testing the role of EF on alcohol use following sexual assault found that EF significantly predicted alcohol use four months later, even after controlling for previous alcohol use and age. This finding is consistent with other studies that demonstrate an increased risk of alcohol use among women who experienced sexual assault and reinforces the importance of examining cognitive factors such as EF in the relationship between alcohol use and sexual assault. Women may drink more heavily following sexual assault as a method to cope with negative emotions and regulate assault-related responses. As a mechanism of affective, cognitive, and behavioral regulation, EF – specifically the domains of working memory and processing speed – was shown to have additive effects in predicting alcohol use following sexual assault among college women.

Alcohol Use and Sexual Assault

The findings of the current study regarding alcohol use and later sexual assault are consistent with other studies that have found that alcohol use does not predict sexual assault. For instance, Gidycz, Hanson, and Layman (1995) found that sexual assault was predicted by previous sexual assault, but not alcohol use. Other studies found that individual and contextual factors better predicted sexual assault than alcohol use. For instance, low assertiveness and lack of social support have been shown to increase risk of sexual assault (Green & Navarro, 1998; Hurley, 1990). Additionally, alcohol use in bars and parties was found to predict sexual assault rather than the quantity of alcohol consumed and whether or not women were intoxicated (Fillmore, 1985; Parks & Zetes-Zanatta, 1999). In a review of studies examining the bidirectional relationship of alcohol use and sexual assault, Ullman (2003) argued that the literature may more strongly support sexual assault increasing risk of alcohol use rather than alcohol use increasing risk of sexual assault, at least for some women. She further argued that more research on mediating and moderating factors is required to better understand the relationship between alcohol use and later sexual assault. For instance, women with multiple experiences of childhood sexual abuse drink more heavily compared to women who have not experienced trauma, which increased their risk of sexual assault in adulthood (Hurley, 1991; Miller & Downs, 1995; Moncrieff & Farmer, 1998). The current study may have recruited a relatively low-risk sample of women in regards to trauma exposure. The study also did not ask about contextual factors and behaviors related to alcohol use, such as whether they frequently drink in bars or parties. Based on the literature, contextual

factors such as risky alcohol use, rather than quantity and frequency of alcohol use, may better predict sexual assault in this population.

Executive Function and Alcohol-Sex Schema

There were several unexpected findings regarding EF. First, the individual EF measures were not strongly correlated with each other. The current findings are consistent with other studies that have, for instance, found no significant correlations between measures of inhibition and set shifting (e.g., Miyake et al., 2000; St. Clair-Thompson & Gathercole, 2006). Miyake and colleagues (2000) argued specifically that working memory, inhibition, and set shifting are separable EFs and thus must be examined separately. In the current study, domains of working memory and processing speed, but not inhibition and set shifting, predicted later alcohol use. This finding is consistent with other studies that found that working memory and processing speed specifically were associated with alcohol use (Khurana et al., 2013; Nigg et al., 2006). Working memory deficits have been linked with impulsive decision-making and risk taking, both of which are related to heavy alcohol use (Bechara & Martin, 2004; Hinson, Jameson, & Whitney, 2003; Romer et al., 2009; Romer et al., 2011). Processing speed impairment may increase risk of alcohol use due to reduced ability to process alcohol-related information and react appropriately. In the current sample of college students, the skills related to working memory and processing speed may be more predictive of alcohol use rather than ability to inhibit information and think flexibly, which are skills related to inhibition and set shifting. For instance, ability to process risk in a situation and

react appropriately may better predict alcohol use and sexual assault among college students, who are frequently exposed to novel and risky situations.

Regarding alcohol-sex schema, the lexical decision task stimulus set was specifically developed for the current study and the first to include alcohol, sex, and aggression-related stimuli. Further research is required to validate the stimulus set used in the current study. Due to time constraints of the current study, the task had fewer trials and stimuli relative to other studies that have used this task (DePrince et al., 2009; Lee et al., 2016; Zurbriggen et al., 2000). Future studies may allot the majority of time to participants completing this task, including more trials and stimuli. Additional research is also required to assess the stimuli of the current study as valid measures of alcohol, sex, and aggression. Further research will be particularly important as language and frequency of words change over time. Finally, future studies may also include explicit measures of attitudes about sex, alcohol, and aggression. Implicit and explicit attitudes result from different cognitive processes (Greenwald & Banaji, 1995) – implicit attitudes are automatically activated, often without awareness, while explicit attitudes are more easily accessed and controlled (Gawronski & Bodenhausen, 2014). Explicit attitudes, such as beliefs that coerced sexual contact following alcohol use is acceptable, may better predict sexual assault than implicit attitudes among college students, whose explicit attitudes are strongly reinforced by peers. Utilizing a multi-method approach with both implicit and explicit measures is an important feature in research on interpersonal violence, as implicit and explicit beliefs may differentially affect violence-related outcomes (Lee et al., 2016).

Bystander Behaviors

In the current study, bystander behaviors were not associated with the other variables of interest. There were also unexpected results regarding correlations among bystander behavior scales. While bystander efficacy and willingness to engage were significantly correlated with each other at both time points, the number of bystander behaviors was not neither was related to efficacy or willingness to engage at T1 or T2. . One explanation may be that the bystander efficacy and willingness reflect attitudes, which differ from behaviors. The pattern of correlations suggests a possible disconnect between students' attitudes and behaviors. Additionally, bystander behaviors were not predicted by alcohol use, EF, or alcohol-sex schema. One explanation may be that four months was not a sufficient time period to predict changes in bystander behaviors. For instance, students may not have as many opportunities to engage in bystander behaviors within four months. Other studies that predict sexual assault-specific bystander behaviors have utilized follow-up time points up to 7 months (Austin, Dardis, Wilson, Gidycz, & Berkowitz, 2016). Future studies may employ a longer time gap when assessing bystander behaviors because over a longer time course, students may have more opportunities to engage in bystander behaviors that reflect their self-reported attitudes and willingness to engage in these behaviors.

Sexual Assault and Executive Function Predicting Alcohol Use

An alternative model examining sexual assault as a predictor of alcohol use and the additive role of EF found that experiences of sexual assault significantly predicted alcohol use four months later. Women may drink more heavily following sexual assault

as a method to cope with negative emotions and regulate assault-related responses (Khantzian, 1985; Polusny & Follette, 1995; Root, 1989). Women may also experience PTSD symptoms, which are also associated with more severe alcohol-related problems among women who experienced sexual assault (Kaysen et al., 2014; Ullman & Najdowski, 2010). Women who experienced sexual assault delay or do not seek help for sexual assault-related distress due to feelings of shame (Fisher et al., 2003). Women who drink heavily to cope with sexual assault-related distress are also not likely to seek help due to shame related to both sexual assault and alcohol use (Ullman & Najdowski, 2010). Given the negative effects of both alcohol use and sexual assault among college women, reducing stigma and making treatment for both issues more accessible will be important for research and intervention efforts in the future.

The current study also found that EF domains of working memory and processing speed had significant additive effects in predicting alcohol use following sexual assault. Working memory predicted alcohol use even after controlling for T1 alcohol use and age. Both working memory and processing speed predicted alcohol use better than T1 sexual assault after controlling for T1 alcohol use and age. The skills associated with working memory and processing speed are linked with impulsive decision making and risk taking, both of which are related to heavy alcohol use (Bechara & Martin, 2004; Hinson, Jameson, & Whitney, 2003; Romer et al., 2009; Romer et al., 2011). Skills such as the ability to hold information in memory and quickly processing environmental stimuli may be predictive of alcohol use among college students due to how these skills underlie processing of alcohol-related information. For instance, the

ability to process and respond quickly when offered a drink at a party may be negatively associated with harmful alcohol use among college students. Taken together, these findings add to the literature by identifying cognitive abilities underlying decision-making and information processing as predictors of alcohol use following sexual assault. The current study provides evidence that EF and associated abilities to respond to the environment are important to consider in conjunction to sexual assault experiences when considering alcohol use among college women.

The current study also found that the effect of T1 sexual assault on T2 alcohol use disappeared after controlling for T1 alcohol use and age. This finding is consistent with Testa and colleagues (2007) who found that that sexual assault predicted alcohol use over the course of one year, but not after controlling for previous alcohol use. Similarly, the current study found that younger age and higher previous alcohol use predicted later alcohol use. The finding that younger students drink more heavily is supported by other studies that have found that students under 21 years of age have higher rates of alcohol use and alcohol dependence compared to students above the age of 21 (Knight et al., 2002). Further, research has found that first and second year students are at higher risk of sexual assault compared to third and fourth year students (Mellins et al., 2017). Beginning college is typically associated with increased access to alcohol and proximity between men and women among first and second year students, increasing risk of both harmful alcohol use and sexual assault. Given the high prevalence of alcohol use and sexual assault within the first two years of college, these findings suggest that these first two years are particularly important to monitor among college students. These findings

related to age and previous alcohol use suggest that intervention efforts may focus on students under the age of 21 years and students with histories of harmful alcohol use, particularly among women who experienced sexual assault.

Limitations and Future Directions

Several limitations should be considered in interpreting the current findings. First, the sample included students from a private university in an urban setting with a majority White student population, recruited from psychology courses. To generalize findings to women in college more broadly, future research should examine these variables among students from other types of institutions, such as public universities, community colleges, and universities with more diverse populations. Additionally, while the current study assessed these variables among women, future research may also address sexual assault victimization, alcohol use, and EF among men.

Methodologically, while the current study utilized one follow-up time point, future studies may examine these variables utilizing multiple time points. Assessment across multiple years would also provide more information regarding how the relationships between these variables may change throughout students' time in college. When examining alcohol use, future research may assess the contextual factors related to alcohol use in addition to quantity and frequency of alcohol use. As discussed earlier in this chapter, contextual factors such as alcohol use in bars and parties may better predict sexual assault among a relatively low-risk sample of college women with limited childhood trauma exposure. Further research is also required on the stimulus set of alcohol, sex, and aggression-related words that were selected specifically for this study.

Study designs that include explicit measures in addition to implicit measures will also be important to better understand how implicit and explicit beliefs relate to sexual assault risk and harmful alcohol use. For instance, explicit attitudes may better predict attitudes about and engagement in bystander behaviors than implicit attitudes. Explicit attitudes are more accessible from memory and controllable than implicit attitudes, which are automatic and outside of conscious awareness. As such, strong explicit beliefs (e.g., that coerced sexual contact following alcohol use is unacceptable) may better predict explicit beliefs about bystander behaviors than weak implicit alcohol-sex associations.

While the current study did not find associations between bystander behaviors and the other variables of interest, examining attitudes about and engagement in bystander behaviors is an important area of future research, particularly for sexual assault on college campuses. In the current study, participants reported generally positive attitudes regarding bystander behaviors, but these attitudes were not correlated with engagement in bystander behaviors after four months. Participants in this study may not have had as many opportunities to engage in bystander behaviors within four months, and over a longer time course, students may have more opportunities to engage in behaviors that reflect their self-reported attitudes. Given the evidence supporting bystander intervention as an effective college sexual assault prevention program, further research is needed to understand the individual factors that predict likelihood to engage in and actual engagement in bystander behaviors.

Conclusion

Despite these limitations, the current study makes several novel contributions to existing research. Limited research has examined EF or alcohol-sex schema as potential mechanisms linking the relationship between alcohol use and sexual assault. While the current study did not find EF and alcohol-sex schema to have significant indirect effects, findings from the alternative model suggest that EF plays an additive role in alcohol use following sexual assault. Specifically, the EF domains of working memory and processing speed predicted alcohol use following sexual assault, even after controlling for baseline alcohol use and age. This finding suggests that skills related to monitoring and processing information are important in predicting alcohol use among college students, particularly women who experienced sexual assault.

Heavy alcohol use among women in college has multiple negative consequences across academic, psychological, and physical health domains. Women in college are also within a developmental period in which they may be physiologically and cognitively more susceptible to the effects of alcohol. Better predicting alcohol use among women in college has important implications for prevention and intervention efforts. For instance, campus outreach programs may educate students on the risk of heavy alcohol use following sexual assault, but that cognitive skills such as information processing may mitigate such risks. Outreach programs may also specifically target younger students in their first or second years and those with known histories of heavy alcohol use.

Findings from the current study and the overall literature demonstrate that the relationship between alcohol use and sexual assault is complex. While previous research

supports alcohol use as a risk factor for sexual assault, further research is needed to understand the individual and contextual factors that link this relationship. The current study provides additional evidence that sexual assault is a risk factor for alcohol use and that cognitive factors such as EF play an additive role in predicting alcohol use following sexual assault. Given the negative consequences of heavy alcohol use and sexual assault among women in college, better understanding the role of EF in this relationship may guide prevention and intervention efforts on campuses in the future.

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APPENDIX

Table 1

Participants' Demographic Information

		Time 1 <i>N = 167</i>	Time 2 <i>N = 85</i>
Year in College	1 st Years	47%	40%
	2 nd Years	24%	29%
	3 rd Years	14%	16%
	4 th Years	15%	14%
Race/Ethnicity	White/Caucasian	85%	86%
	Hispanic/Latina	9%	7%
	Asian/Asian-American/Pacific Islander	7%	6%
	Black/African-American	1%	1%
	More than one race	3%	2%
Sexual Orientation	Heterosexual/Straight	86%	85%
	Lesbian/Gay	3%	4%
	Bisexual	7%	8%
	Asexual	1%	1%
	Other/Not Sure	3%	2%
Relationship Status	Single	56%	54%
	Dating Exclusively	34%	36%
	Dating Not Exclusively	9%	7%

Table 2

Descriptive Statistics for Subsample (n = 85) Across Time Points

Variable	Measurement	T1	T2
		<i>n</i> = 176	<i>n</i> = 85
		<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Alcohol Use	AUDIT	6.56 (5.65)	6.13 (5.32)
Sexual Assault	SES	2.13 (3.00)	.42 (.98)
Bystander Behavior Measures	BES	84.94 (11.90)	84.44 (12.92)
	WTEBB	4.41 (.40)	4.35 (.61)
	BB	13.55 (4.83)	11.93 (5.44)
EF Measures	SS	40.75 (6.13)	
	LNS	19.96 (2.05)	
	D-KEFS: Inhibition	22.50 (8.48)	
	D-KEFS: Inhibition/Switch	28.53 (8.02)	
Alcohol-Sex Schema	Priming Score	43.09 (156.04)	

Note: EF measures were Symbol Search (SS) and Letter-Number Sequencing (LNS) from the WAIS-IV (Wechsler et al., 2008) and the Delis-Kaplan Color-Word Interference Test (D-KEFS; Delis et al., 2001). Higher scores on the EF measures indicate better performance. Alcohol-sex schema was measured through a lexical decision task (adapted from DePrince et al., 2009; Zurbriggen, 2000). Higher priming scores indicate stronger alcohol-sex schema.

Table 3

Descriptive Statistics for Full Sample at T1 (n = 176) vs. Subsample (n = 85)

Variable	Measurement	T1	T1
		<i>n</i> = 176	<i>n</i> = 85
		<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Alcohol Use	AUDIT	5.78 (5.85)	6.56 (5.65)
Sexual Assault	SES	2.02 (2.44)	2.13 (3.00)
Bystander Behavior Measures	BES	82.19 (12.31)	84.94 (11.90)
	WTEBB	4.32 (.43)	4.41 (.40)
	BB	13.07 (4.79)	13.55 (4.83)
EF Measures	SS	41.09 (6.54)	40.75 (6.13)
	LNS	20.03 (2.01)	19.96 (2.05)
	D-KEFS: Inhibition	23.45 (8.98)	22.50 (8.48)
	D-KEFS: Inhibition/Switch	30.21 (8.22)	28.53 (8.02)
Alcohol-Sex Schema	Priming Score	40.54 (143.33)	43.09 (156.04)

Note: EF measures were Symbol Search (SS) and Letter-Number Sequencing (LNS) from the WAIS-IV (Wechsler et al., 2008) and the Delis-Kaplan Color-Word Interference Test (D-KEFS; Delis et al., 2001). Higher scores on the EF measures indicate better performance. Alcohol-sex schema was measured through a lexical decision task (adapted from DePrince et al., 2009; Zurbriggen, 2000). Higher priming scores indicate stronger alcohol-sex schema.