Examining Blood Alcohol Concentrations Through a Simulated Drinking Game Procedure

by

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A thesis submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Master of Science

Auburn, Alabama
August 6, 2011

Keywords: College Students, Alcohol, Drinking Games, Blood Alcohol Concentrations

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Abstract

Alcohol consumption on college campuses is a prevalent activity, with over half of college students reporting alcohol consumption at least once in the past month, and it embodies "binge" drinking, consuming 4 (5 for males) drinks in a single sitting. One contributor to binge drinking on college campuses is the drinking game. These games include a set of rules that require players to consume alcohol if they fail at the game. The following study examined blood alcohol concentrations (BAC) associated with the popular college drinking game "beer pong," as well as differences in liquid consumed (water or beer), gender, consumption levels, BAC measurements, participants' desire to consume alcohol, and their subjective experiences during the lab sessions. Results indicated that game play differed by type of beverage served and gender. The results also suggest that estimates of BAC may not provide an accurate indication of actual BAC during drinking game session.

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List of Abbreviations

BAC	Blood Alcohol Concentration
BrAC	Breath Alcohol Concentration
eBAC	Estimated BAC from Matthews and Miller (1979)

Introduction

Alcohol is the most predominantly used substance on college campuses, with 79% of undergraduates reporting alcohol consumption at least once in the past year and 66% reporting consumption at least once in the past 30 days (Johnston, O'Malley, Bachman, & Schulenberg, 2010). It has also been reported that 40% to 55% of students engage in binge drinking (Core Institute, 2006; O'Malley & Johnston, 2002; Wechsler, Lee, Nelson, & Kuo, 2002; Wechsler, Lee, Kuo, Seibring, Nelson, & Lee, 2002). Binge drinking refers to consuming four drinks (five for males) in a single sitting at least once in the past two weeks (Wechsler & Nelson, 2001; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994). This measure accounts for quantity, time lapse in drinking, and gender differences, and is considered one of the primary measures for assessing heavy alcohol consumption among college students (Wechsler & Nelson, 2001). The measure is also predictive of alcohol related consequences (Borsari, Neal, Collins, & Carey, 2001).

For incoming college students, the transition from high-school to college is coupled with an increase in binge drinking behaviors. In these cases, binge drinking is adopted by incoming students and may be influenced by their expectations of alcohol and their social network's involvement with alcohol (Reifman & Watson, 2003). Individuals between the ages of 18 and 22 who are enrolled in college full time are more likely to binge drink than their peers not enrolled in college. One study reported that of those enrolled in college fulltime, 40.5% reported binge drinking compared to 38.1% who were not enrolled in college full time (Substance Abuse and Mental Health Services Administration, 2009). The heightened level of drinking is

accompanied by increased risk of alcohol dependence and abuse. For example, it has been estimated that two out of every five college students has at least one symptom of either alcohol abuse or dependence (Knight et al., 2002, p.266). Moreover, students who engage in frequent heavy episodic drinking (binge drinking at least three times in a two week span) are 13 times more likely to meet criteria for alcohol abuse, and 19 times more likely to meet criteria for alcohol dependence (Knight et al., 2002, p.266).

Negative Consequences

The use of alcohol on college campuses is associated with an increased risk for injury and other negative consequences for college students. Nearly 600,000 students per year report some kind of injury as a result of their alcohol use (Hingson, Zha, & Weitzman, 2009). Additional consequences may include hangovers, performing regrettable behaviors, and becoming nauseated or vomiting (Core Institute, 2006), and binge drinkers may be at a greater risk for these negative alcohol related consequences (Wechsler et al., 1994). Moreover, the effects of alcohol consumption extend beyond the user and may affect students who do not engage in alcohol consumption or binge drinking. These second hand effects of alcohol consumption affect more students than direct first-hand effects, with 696,000 students reporting being hit or assaulted by another drinking student, and 97,000 were victims of alcohol related sexual assault (Hingson et al., 2009). Despite an awareness of the consequences associated with their alcohol use, most college drinkers do not consider their drinking problematic (Wechsler et al., 1994).

Environments Related to Alcohol Consumption

Recent interests have shifted from focusing solely on the individual's drinking pattern to environmental factors that promote binge drinking (Mitka, 2009). Binge drinking among college students has been related to environmental and contextual influences, such as 21st birthdays,

collegiate tailgating, spring break, celebratory events or important sporting events for the college community (Neighbors, Oster-Aaland, Bergstrom & Lewis, 2006; Lee, Lewis, & Neighbors, 2009; Neal, Sugarman, Hustad, Caska, & Carey, 2005; Day-Cameron, Muse, Hauenstein, Simmons, & Correia, 2009). Off-campus parties, dorm parties, fraternity parties, and on campus dances are also related to heavy alcohol consumption (Wechsler, Kuo, Lee, & Dowdall, 2000). Field studies have also revealed differences in the environments where students drink at. For example, students attending themed, smaller, or private parties tend to have higher breath alcohol content (BrAC) (Clapp et al., 2008a; Clapp et al., 2008b). The occurrence of heavy drinking at these different environments may be related to specific environmental variables, such as intoxicated people, illegal drugs, and drinking games (Clapp et al., 2003). As such, it may be worthwhile for investigators to examine the impact of specific environmental variables on college student drinking.

Drinking Games

Drinking games are an environmental variable that has been associated with greater alcohol use, and both surveys and field studies suggest that playing drinking games is associated with higher BrAC levels (Borsari, Bergen-Cico, & Carey, 2003; Clapp et al., 2008). Drinking games are defined as "social activities in which standardized rules determine the amount of and the manner in which alcohol is consumed" (Polizzotto, Saw, Tjhung, Chua, & Stockwell, 2007, p. 469). Unlike most traditional games, drinking games involve a "reversal of competence" which involves consuming excessive amounts of alcohol as the game progresses, which in turn decreases the player's cognitive and motor ability to play the game (Green & Grider, 1990). One goal of drinking games involves getting other players drunk as well as getting oneself drunk. Therefore, the reward and punishment of the game are the same and no one technically wins the

game in the traditional game playing sense (Green & Grider, 1990). The consumption of alcohol may be rapid once students begin playing as they begin experiencing the reversal of competence and consume more alcohol than they had initially planned for that evening.

Prevalence and Consequences of Drinking Games

Previous research has found that over half of all college student drinkers engage in drinking games, with males more likely to play than females (Nagoshi, Wood, Cote, & Abbit 1994; Cameron, Heidelberg, Simmons, Lyle, Mitra-Varma, & Correia, 2010). Students who play drinking games are one and a half times more likely to binge drink than those who do not play drinking games (Pedersen & LaBrie, 2006). Comparatively, underage college students play drinking games more frequently than of-age students; however, both age groups consume similar quantities of alcohol during drinking games (Adams & Nagoshi, 1999). These games may provide underage drinkers a medium for obtaining the "forbidden fruit," and the games also account for a large increase in the amount of alcohol consumed by undergraduate freshman (Adams & Nagoshi, 1999).

Overall, individuals referred for alcohol violations who played drinking games indicate consuming more than those who do not play drinking games (Borsari, et al., 2007). Not only are drinking games related to greater alcohol use, but they are also associated with negative alcohol-related consequences and an increase in drinking related problems (Nagoshi et al., 1994; Engs & Hanson, 1993). For example, a greater percentage of game players experience problems related to alcohol as compared to nongame players (Engs & Hanson, 1993). These problems are also positively correlated with drinking game play across a given semester (Adams & Nagoshi, 1999). However, despite being aware of the risks associated with drinking games, students still participate in these games (Polizzotto, Saw, Tjhung, Chua, & Stockwell, 2007).

Motives for Playing Drinking Games

Students endorse a variety of motives for participating in drinking games. One of the most commonly endorsed motives for playing drinking games is drinking to get drunk (Borsari, Bergen-Cico, & Carey, 2003). Beyond playing to get drunk, students also play drinking games to facilitate socialization with their peers during parties. Students report that drinking games promote social interaction among peers and minimize social anxiety during such interactions (Johnson, Hamilton, & Sheets, 1990). The physiological effects from alcohol may account for the minimized anxiety, but students consider drinking game participation as a "standardized form of interaction" which serves to alleviate any awkwardness in the early gathering of friends (Polizzotto et al., 2007 p.471). Motives like competition & thrills, fun & celebration, social lubrication, sexual manipulation, and boredom are also strongly related to the number of drinks consumed during drinking games and frequency of game play (Johnson & Sheets, 2004; Johnson, Hamilton, & Sheets, 1990). However, motives related to conformity and boredom are not associated with intoxication level for drinking games (Zamboanga, Calvert, O'Riordan, & McCollum, 2007).

Although students report a variety of reasons for playing games, there are also a number of motives for not playing drinking games. Some of these motives include social responsibilities and obligations related to school or work. Students who endorse these motives for not playing are also likely to have negative attitudes toward drinking games and may have had negative experiences with drinking games (Johnson & Cohen, 2004). Evidence also suggests that students endorse a variety of reasons for ending play of drinking games. One of these reasons is the realization that one has over-consumed and is no longer capable of playing (Johnson, 2002).

This finding implies that while some students play drinking games to get drunk, their level of intoxication may eventually inhibit their ability to continue playing.

Types of Drinking Games

Borsari (2004) outlines six categories of drinking games: motor skills, verbal skills, gambling games, media games, team games, and consumption games. Motor skills games require participants to complete a type of coordinated movement or motor skill task in order to avoid alcohol consumption. Failure to perform the task results in consumption. One of the most frequently reported drinking games on college campuses is "beer pong" (Zamboanga, Calvert, O'Riordan, & McCollum, 2007), a game that is considered both a motor skills and team game. The game is played on a ping-pong table, with 6-10 sixteen ounce cups arranged in a triangle on each side of the table. Each cup contains about four to twelve ounces of beer; however, the amount may be dependent upon the players' preferences and the local "house rules." The game is typically played in teams of two. Each player takes turns attempting to toss a ping-pong ball into the opposing team's cups. If the ball lands in the cup, the opposing team must drink the beer in the cup and then remove the cup from the table. The first team to drink all of its cups is deemed the loser. Success in the game is based on the coordinated hand-eye movements required to toss the ping-pong ball into the cup. As the game progresses, the physiological effects of alcohol can exaggerate the "reversal of competence" (Green & Grider, 1990). Gaming sessions generally last 48-54 minutes, and beer is the most common type of alcohol used during gameplay (Zamboanga, et al., 2007).

Studying Alcohol Use in Laboratory Settings

The majority of research involving drinking games has utilized retrospective self-report data. While self report measures have become prominent in alcohol studies, the methodology

still has a number of limitations. Responses to self report measures can be influenced by the wording of the measure as well as participant bias (Kazdin, 2003). The latter is of concern with regards to college alcohol studies. Participant bias, such as failure to recall the number of drinks consumed and exaggerating or underreporting alcohol consumption for social desirability, may be deleterious to the outcomes of college alcohol studies. As such, laboratory studies may circumvent this problem in order to obtain veridical results about alcohol consumption during drinking games.

Collins, Parks, and Marlatt (1985) developed the Behavioral Alcohol Research Laboratory (BARLAB) to evaluate social influences on alcohol consumption in the laboratory setting. BARLAB was designed to simulate a tavern or cocktail lounge, with a bartender, appropriate lighting, tables, and background music. Participants in the study were instructed to pretend as much as possible that the setting was an actual bar. Overall, participants "tended to report that being in the experiments did not affect their pattern of consumption" in the study (p.199). This finding illustrates the efficacy of replicating the drinking environment as close as possible in order to minimize demand characteristics and promote external validity.

Previous research has replicated drinking game environments in the lab with considerable success. Correia & Cameron (2010) developed a simulated drinking game procedure, in which participants played an alcohol-free version of beer pong. Game play took place in the laboratory and followed respective rules and guidelines typically used in college parties. Participants played the game in pairs or individually. The researchers tracked the number of times each participant was instructed to drink while playing a game in a 20-minute period or during match play. Using the number of drinks consumed in match play and the 20-minute period, the researchers estimated possible peak blood alcohol concentration levels (BAC). Participants who

played singles consumed more drinks and had higher estimated BAC levels than those who played in doubles. Females also obtained higher estimated BAC levels than males despite similar levels of consumption.

Rationale and Goals of the Current Study

The current study was a systematic replication of the simulated drinking game paradigm used in the Correia & Cameron (2010) study. Instead of using only water and estimating possible BACs, the following study administered half of the participants water and the other half light-beer in each session. In addition to estimating BACs, the current study obtained BrACs using a calibrated breath alcohol analyzer machine. BACs assessed using physiological measures (e.g. breath, blood) are considered more accurate measures of intoxication levels compared to estimated BACs (i.e. computer software, math formulas, etc.) (Carey & Hustad, 2002). The current study examined differences in BAC levels obtained between estimates and the breathalyzer. Previous research indicates that estimated BACs and actual BrACs are related but their discrepancies are exaggerated at BAC levels beyond 0.08% (Carey & Hustad, 2002). It is unclear how various measures of BAC will perform when measuring alcohol consumption during drinking game. Additionally, the current study examined consumption during beer pong, the tendency to refuse drinks during game play, desire to consume alcohol over the course of the laboratory session, and the participants' subjective rating of their experiences during the laboratory sessions.

The utilization of a simulated drinking game in the laboratory is a novel and underdeveloped approach for studying the drinking behaviors among college students. The current study did not have any apriori hypotheses; however, the study intended to provide descriptive information regarding drinking behavior, possible alcohol absorption levels during

beer pong, as well as the utility of assessing alcohol consumption during beer pong in a laboratory setting. The study also examined how gender and the type of liquid consumed (beer vs. water) influenced various aspects of game play.

Method

Participants

Participants were recruited from a sample of undergraduate students enrolled in a large public Southeastern university. Data collection occurred during the fall and spring semesters. All participants first completed a screening survey, and had to meet the following criteria in order to qualify for the laboratory portion of the study: be at least 21 years old, not have any serious physical ailments or currently take any medications that may interact negatively with alcohol, report consuming at least two standard drinks in one sitting in the past month, and report playing Beer Pong at least once in the past year. Of the 407 students who completed the online survey, 138 (33.9%) met qualifications to participate in the lab portion of the study. Of the 138 who qualified, 40 (25 Female, *Mean* age=21.38, 90% Caucasian) participated in the laboratory portion of the study. All participants were compensated with extra credit for their psychology courses.

Alcohol consumption among the 40 laboratory participants varied, with typical weekly drinks ranging from zero to 38 drinks (M=14.77, SD=9.03). Additionally, participants' episodes of binge drinking ranged from zero to 14 episodes in the past 28 days (M=5.18, SD=3.91). The majority (85%) reported experiencing at least one alcohol related consequence in the past 28 days. With regards to drinking game experience, all participants reported playing beer pong at least once in the past year, and 77.5% reported playing beer pong at least once in the past month.

Measures

General information questionnaire. The measure assessed basic demographic information such as sex, age, years of school completed, Greek membership, ethnicity, and current residence. The questionnaire also asked participants if they had any serious physical ailments or currently take any medications that may interact negatively with alcohol. (See Appendix A)

Daily Drinking Questionnaire (DDQ). The DDQ (Collins, et al., 1985) is a self-report questionnaire that assesses participant's alcohol consumption during the past 28 days. In the current study the DDQ asked participants about their alcohol consumption for a typical drinking day, the number of drinks consumed during a heavy drinking week, the types of alcohol consumed, and episodes of binge drinking (See Appendix B). Previous research supports the use of self-reported substance use when participants' confidentiality is assured (Johnston & O'Malley, 1985). The DDQ was used to provide descriptive information about the sample.

Rutgers Alcohol Problem Inventory (RAPI). In order to assess problems related to alcohol use, a modified version of the RAPI (White & Labouvie, 1989) was administered to assess problems related to alcohol use in the past 28 days. The measure includes 23 items concerning consequences of alcohol use (See Appendix C). Participants rate each item on a scale of 0 (*never*) to 4 (*more than 10 times*). Scores may range from 0 to 92, with higher scores indicative of severe alcohol problems. Previous measures of internal consistency have been reliable (α's=0.77-0.82; White & Labouvie, 1989) and the modified version has shown adequate internal consistency among a college sample (α =0.84; Correia, Carey, & Borsari, 2002) and in the current study (α =0.79). Sample items include "got into fights, acted bad, or did mean

things", "felt physically or psychologically dependent on alcohol", and "felt you had a problem with alcohol." The RAPI was used to provide descriptive information about the sample.

Drinking Game Questionnaire. The 27-item Drinking Game Questionnaire was used to assess drinking game participation and drinking behaviors related to drinking games. The measure includes items used in a dissertation (Cameron, 2010), and were partially based on a measure used in Borsari et al (2003). The measure assessed drinking game involvement in the past 30 days, number of drinks consumed while playing, type of beverage consumed, types of games played, consequences from playing, and number of times the participant played beer pong in the past 30 days and past year (See Appendix D).

Alco-Sensor IV. A handheld portable breath alcohol instrument was used to assess participant's BrAC after completion of a game. The instrument measures breath alcohol between 0.000-0.400 BrAC. This instrument is approved by the National Highway Traffic Safety Administration and meets criteria for evidential use by law enforcement for in-field alcohol testing (Intoximeters Inc, 1995).

DUI Professional Blood-Alcohol Analysis. A commercially available software program was used to calculate BACs. The software examines the type of drink consumed, participant's weight, time of consumption, gender, and amount of food participant has eaten. With this information, the software calculates BAC levels using the Widmark formula and the rate of alcohol absorption and elimination. According to the manufacturers, the software may perform over 2,000 distinct calculations for a given BAC level (Meta Progress, Inc., 1998).

eBAC. In addition to examining estimated BACs obtained from a computer software program, the current study also examined estimated BACs using Matthews and Miller's (1979) formula for calculating BACs: $BAC= [(c/2) \times (GC/w)] - (\beta_{60} \times t)$, where *c* is the number of

standard drinks consumed, *GC* is gender constant (9.0 for females, and 7.5 for males), β_{60} is the average metabolism rate of alcohol per hour (0.017 g/dl), and *t* is amount of time passed (in hours) from the time of the first drink to the time of breathalyzer assessment(adapted from Hustad & Carey, 2005). This measurement of BAC was not considered apriori; rather this formula was utilized after initial examinations between the software estimated BACs and BrACs revealed weak relationships between the two. This formula was chosen given its' strong relationship with BrACs and previous use in field studies to estimate college students' BACs (e.g. Clapp et al., 2006).

Desire to Drink Questionnaire. A brief, four-item questionnaire was developed for the current study to examine participants' desire to drink alcohol throughout the laboratory phase. The items were based on commonly used items to study cravings for alcohol (Davidson, Tiffany, Johnston, Flury, & Li, 2003). The questionnaire included the following items: "I want to use alcohol right now," "I have an urge to drink now," "It would be great to use alcohol now," and "Nothing would be better than drinking right now." Participants were asked to rate the extent to which they agreed with each statement on a scale of 1 (Strongly Disagree) to 7 (Strongly Agree). All participants were administered the questionnaires at fixed intervals: before the game started, five minutes into the game, immediately after the game ended, 10 minutes after the game ended, and 20 minutes after the game ended (See Appendix E).

Evaluation Questionnaire. A questionnaire was administered to participants after their completion of the study to assess their experience during the simulated drinking game paradigm. The questionnaire was administered after all participants' BAC's returned to zero, to ensure that no responses were influenced by participants' intoxication. The questionnaire asked participants about the reality of the lab based drinking game, amount of consumption in the lab in relation to

how much they typically consume when they play beer pong, and how it compared to their previous experiences with beer pong at college parties (See Appendix F).

Procedure

Screening Phase. The current study occurred in two phases. The first phase was used as a screening stage whereby participants were evaluated for their previous alcohol consumption and previous participation in beer pong. Participants completed an online questionnaire packet that included the general information survey, DDQ, RAPI and drinking game questionnaire measures described in the previous section.

Individuals who qualified were contacted via e-mail within three weeks of submitting the screening packet and were invited to participate in a single laboratory study in exchange for additional extra credit hours. These participants were also told that the laboratory session may involve the optional consumption of alcohol, and were asked to refrain from consuming any recreational drugs or alcohol 24 hours before the study. Additionally, participants were asked to consume a light meal before coming to the laboratory study.

Laboratory Phase. Upon arrival to the lab, participants were given an overview of the consent form and instructed that the consumption of alcohol was optional and that they may withdraw from the study at any time. Participants were also reminded that they should have consumed a light meal prior to the study; however, snacks were available for them. Participants were instructed that they would need to remain in the lab for at least two hours after completion of the game, regardless if they did or did not consume alcohol. However, this length was changed halfway through the study because many participants' BrACs were zero within one hour after gameplay. As such, some participants were only required to stay for up to one hour after the game completed. Participants were also informed that they may need to remain in the lab

longer until the alcohol leaves their system. All participants were required to bring a form of identification to verify their current age (driver's license, passport, etc.). Participants were asked to not bring schoolwork with them to the lab sessions, as bringing work could influence their incentive to consume alcohol during the session.

After participants provided their consent, they were given a breathalyzer test to ensure that they did not consume any alcohol before the lab session. Participants were then weighed to ensure accurate estimations of the BAC. Food and non-alcoholic beverages were also made available to the participants before, during, and after game play. Participants were then provided with an overview of the rules for Beer Pong. Rules were also posted in the lab, and participants were given a 5-minute warm-up period to affiliate themselves to the table and the game. This five minute warm-up period required each participant to take practice shots and no alcohol was consumed during this time.

Game Play. Games were played on a regulation sized table and each side of the contained ten 16 oz cups arranged in a triangular design (Figure 1). Each cup contained two ounces of water on each side of the table during the warm up period. After the warm up period, a coin toss was performed to determine which side would receive beer. The winning team had their cups with water removed and replaced with ten 16 oz cups, each containing two ounces of light beer.

The rules specified that players alternate the consumption of cups within their team. However, participants were instructed that they did not need to consume the liquid in their designated cup, or that their partner could consume for them. At most, participants could consume 20 ounces of light beer (if they drink all 10 cups for their team), approximately equal to 1.5 standard drinks. Participants played a single game, regardless of a tie. During game play,

background music was played to boost the simulation of a drinking game in a drinking environment. Food and non-alcoholic beverages were available to participants during game play and they were allowed to take a break from playing to consume food and beverages.

After Game Play. After game play, participants who consumed light beer were instructed to wait ten minutes before providing a BrAC reading, to minimize the influences of residual alcohol in their mouth (a similar procedure was used in Clapp et al.'s [2008] field survey of BrAC levels for college students at different environmental contexts). All participants remained in the lab for at least one hour after completing the game. One participant had a BrAC above 0.002 after the one hour mark, and was asked to remain in the lab until their BrAC returned to zero or 0.002. During their time in the lab, participants were asked to provide a BrAC reading every 20 minutes. The lab was equipped with video games, DVD player, television, and computers with internet access to keep participants occupied after gameplay and simulate a drinking environment.

Data Coding. During game play, research assistants (RAs) recorded the number of times a participant removed and drank from their cup. Once a ball landed in a team's cup, the RAs observed which participant removed the cup, whether or not they drank from the cup immediately, and the time period of these behaviors. RAs also recorded if a participant refused to drink (i.e. removed the cup from play but did not drink from it), or if the participant consumed from a cup they previously removed. After removing the cup, each participant was asked to place their cup in a separate area from their team members. Once the game was finished, RAs recorded the remaining amount of liquid in each cup to determine the amount of liquid that was consumed by each player during the game.

Inter-observer agreeability (IOA) was calculated using sessions-totaled method. Observations for IOAs were conducted for six of the ten laboratory sessions. IOAs were calculated by dividing the number of agreements by the sum of the number of agreements and disagreements. [Agreements/(Agreements + Disagreements) * 100]. IOAs were calculated for each behavior (drank immediately after removing cup, did not drink after removing cup, drank a previously removed cup) within each session. The mean agreement for all six sessions and all three behaviors was 94.72% (*SD*=12.34%, *Range*=33.33%). This level of agreement suggests that the observers were highly similar in their observations of the drinking behaviors during gameplay. Please see Table 1 for a breakdown of the agreements and disagreements by session and by behavior.

Results

The time length of each game varied from five minutes to 26 minutes, and the average game length was 15.3 minutes. The average amount of liquid consumed for all participants was 5.88 oz (*SD*=4.51). Participants who were served beer consumed significantly more (*n*=20, *M*=7.85, *SD*=3.37) than those who were served water (*n*=20, *M*= 3.90, *SD*=4.70) [*t* (38)=3.05, *95% CI*:1.33, 6.57, $p<0.05$]. Differences in drink refusal were examined between these groups. Drink refusal was calculated as the proportion of liquid participants drank to amount of liquid participants were instructed to drink [(Amount instructed to drink-Amount actually drank)/Amount instructed to drink.] Participants who were served water refused more (*M*=0.58, *SD*=0.49) than those served beer (*M*=0.07, *SD*=0.23) [*t* (38)=4.14, 95% CI: -0.75,-0.26, $p<0.001$].

With regards to BACs, we examined the range of BrAC readings, the software estimated BACs, and the eBACs for those who were served beer. Peak BACs were chosen to identify the

highest level of intoxication obtained by participants during the laboratory session. The peak BrACs ranged from 0.000 to 0.027 (M= 0.007, SD=0.008), the software generated peak BACs ranged from 0.000 to 0.004 (M= 0.0004, SD=0.001), and the peak eBACs ranged from 0.000 to 0.025 (M= 0.01, SD=0.008).

We examined the relationships among the peak software BACs, BrACs, eBACs, and the amount of beer consumed. The analyses only included participants who were served and consumed beer (n = 19). As such, one participant who was served beer was not included in this analysis. The peak BrACs were positively related to the amount of beer consumed (r=0.55, p<0.05), and the eBACs (r=0.65, p<0.05). The software peak BACs were not related to either BrACs or amount of beer consumed; however, they were positively correlated with the eBACs (r=0.65, p<0.05). Lastly, the peak eBACs were positively related to the amount of beer consumed (r=0.50, p<0.05). Please see Table 2 for correlation matrix for all BAC variables and alcohol consumption.

Differences between measures of BAC

In order to examine if differences existed between the peak software calculated BACs and the peak BrACs, a 2x2 repeated measures ANOVA was conducted, with gender as a between subject factor. The analyses only examined participants who were served beer and consumed any amount of beer. The analyses indicated a main effect for the BACs [F (1, 17) =13.30, p<0.01], but there was no main effect for gender and no interaction between BACs and gender (p=ns), indicating that participants' peak software (M=0.0004, SD=0.001) and breathalyzer (M=0.007, SD=0.008) BACs were not similar (See Table 3 for ANOVA table & Figure 2 for plot).

A second 2x2 repeated measures ANOVA was conducted to compare the differences between Matthews & Miller's (1979) eBac and the peak BrACs. Similar to the previous repeated measures, gender was a between subject factor and the analyses only examined participants who were served beer and consumed any amount of beer. The analyses indicated a main effect for BACs [eBAC M=0.011, SD=0.008; breathalyzer BAC M=0.007, SD=0.008; F (1,17)= 5.970, p<0.05] and an interaction between BACs and gender [F (1,17)=5.590, p<0.05]. There was no main effect for gender (See Table 4). Given the interaction between BACs and gender, simple main effects were examined for gender within BACs. Within the eBAC, females were significantly higher (M=0.015, SD=0.008) than males (M=0.005, SD=0.005) [F (1,17) = 8.40, p<0.05]; however, males and females were not different from each other with respect to their peak BrACs. Simple main effects were also examined for BACs within gender. Among males, there were no significant differences between their eBACs and BrACs. Among females, their eBACs were significantly higher (M=0.148) than their BrACs (M=0.008), [F (1,10) = 11.45, p<0.01]. The simple main effects for gender and BAC indicate that the original main effect for BACs observed in the repeated measures model may not be applicable given the impact of gender (See Figure 3).

Desire to Consume Alcohol During Laboratory Sessions

To evaluate participants' desire to consume alcohol, responses to the Desire to Drink questionnaire were summed up for each respective time frame. As such, there were five separate summed scores. The possible range for the scores was 4 (Low Desire) to 28 (High Desire), and the actual ranges were the same. The time frames varied with respect to mean scores. The highest mean scores were seen for "Before the Game" (M=14.00, SD=6.15) & "5 minutes into the Game" (M=14.00, SD= 6.49), followed by "End of Game" (M=13.85, SD=6.31), "10 minutes

after the game ended" (*M*=12.35, *SD*=5.87), and "20 minutes after the game ended" (*M*=11.05, *SD*=5.65). Overall, each time interval for desire to drink was positively correlated with one another; however, none of the intervals were correlated with amount of liquid consumed. Additional correlations were run, separated by type of beverage served. The correlations were similar to the previous correlation; however, among those served beer, both the 5 minute desire to drink scores and the 20 minute after the game desire to drink scores were positively correlated with amount of liquid consumed ($p<0.05$, See table 5). A 2x2x5 repeated measures ANOVA was also conducted to determine within-participant differences across the five desire to drink scores and between-group differences based on liquid served and gender. Results indicated a main effect for time of administration [F (4, 112) = 5.55, $p<0.001$] and a main effect for gender [F (1,28) = 7.61, $p<0.05$], with males reporting higher scores than females (See Table 6 & Figure 4). There were no significant interactions between desire to drink scores, liquid served, or gender. For males, pairwise comparisons indicated that "End of Game" (*M*=17.77, *SE*=1.27) was significantly higher than "20 minutes after the game ended" (*M*=14.39, *SE*=1.00) ($p<0.05$). For females, "Before the Game" (*M*=12.26, *SE*=1.52) was significantly higher than "20 minutes after the game ended" (*M*=8.79, *SE*=1.45) ($p<0.05$). For females, both "5 minutes into the Game" (*M*=12.00,*SE*=1.37) and "End of Game" (*M*=11.31, *SE*=1.43) were higher than"10 minutes after the game ended" (*M*=10.00, *SE*=1.45) and "20 minutes after the game ended" (*M*=8.79, *SE*=1.45) ($p<0.05$).

Lastly, we examined participants' evaluation of the simulated drinking game paradigm. When asked if they played the game as they normally do, all participants who were served beer reported this statement as being at least slightly true, compared to 90% of those served water. All participants who were served water reported consuming less in the laboratory than they

normally do, compared to 90% of those served beer. With regards to the rules of gameplay being similar to when they normally play, all participants endorsed this is item as being at least slightly true. When asked if the game was as much fun as they normally play, 90% of those served beer found this item to be at least slightly true, compared to 70% of those served water.

Discussion

The current study provided an initial examination into the replication of beer pong in the laboratory, using light beer in addition to water. The study evaluated descriptive information regarding game play, consumption levels, differences in alcohol absorption levels using three separate measures of BAC, differences in desires to drink alcohol during the game, and participants' perceptions of playing beer pong in the laboratory.

First, the study identified that game length of beer pong varies considerably, with games in the current study lasting briefly (e.g. 5 minutes) and or over a long period of time (i.e., 30 minutes). These game lengths are different from previous assessments of beer pong sessions (e.g. 48-54 minutes; Zamboanga, et al., 2007). However, the latter game lengths may have included more than one game, unlike the current study. Beyond game length, the amount of liquid consumed by participants varied depending on the type of beverage served, with those who were served beer consuming more than those who were served water. Additionally, the portion of drinks refused indicates that those served water refused more of their drinks than those served beer. Despite differences in consumption rates and refusal rates, the majority of participants agreed that the amount of liquid consumed during the study was less than what they normally consume in the laboratory study. This may suggest that participants were served less during the study than they typically play within the party environment. Future research will need to balance

the need to accurately simulate the drinking game experience with the need to ensure the safety of participants.

With regards to the BACs, both eBAC and BrAC were positively related to each other and to the amount of beer consumed by participants; however, the software BAC was only positively related to the eBAC. The BrAC was significantly different from both the software BAC and the eBAC, as it was higher than the software BAC, but lower than the eBAC. However, the differences between BrAC and eBAC may be impacted by gender, in that the eBAC formula overestimates female BACs compared to the BrAC, but not for males. The differences in the BrAC and software BAC may reflect a difficulty in using the computer software to accurately estimate levels of intoxication achieved during a simulated drinking game procedure. Both the computer BAC and eBAC make assumptions about consumption patterns over a period of time and the rate of alcohol absorption. However, the type of consumption in a drinking game involves a relatively large amount over a quick period of time, and this variability in consumption may make both estimates less accurate.

Lastly, the study also indicates that the players' desire to drink alcohol varies throughout a session of beer pong. For males, their desire to drink alcohol was higher at the end of the game than 20 minutes after the game ended. For females, their desire to drink alcohol was higher before the game than it was 20 minutes after the game ended. Additionally, their desire to consume alcohol was higher at five minutes into the game than it was 10 minutes after the game ended and 20 minutes after the game ended. Similarly, their desire at the end of the game was higher than both 10 and 20 minutes after the game ended. This pattern suggests that playing beer pong may increase the players desire to consume alcohol during the lab; however, this desire

must be taken in light of the participants' previous experiences with the game and the associations formed between beer pong, alcohol, and the reinforcement value of these variables.

The incorporation of water in the lab game presented a number of gains and losses for the current study, and implications for the use of water in future simulated drinking game studies. For gains, the use of water is safer for assessing possible BACs achieved during beer pong, and minimizes the risk associated with serving alcohol to students. Using water allows the experimenter recruit from a wider participant pool, use greater quantities of liquid in the game, and minimizes the precautions that must be taken when alcohol is served in the laboratory. It is also financial cheaper compared to beer, thus keeping costs of the study down. Although water allows experimenters to use greater quantities, its' consumption may not reflect typical drinking game consumption, as seen by the higher refusal rates for water when compared to beer. Relatedly, the only way to assess levels of intoxications is through calculations, which may be inappropriate in some scenarios for drinking games. As such, the use of water may underestimate absorption levels associated with playing beer pong, possibly clouding the existing relationships between drinking games and alcohol related consequences. However, playing with small amounts of beer does not necessarily remedy all of the problems related to the use of water.

The introduction of alcohol in the simulated drinking game paradigm allows researchers to assess for levels of alcohol absorption (e.g. BrACs) achieved while playing a drinking game. This information may be incorporated in alcohol education programs for students, giving them an opportunity to better understand their drinking behaviors and associated consequences during drinking games. Currently, students show difficulties in estimating their current BAC levels despite existing college alcohol education programs that incorporate BAC education into their interventions (e.g. BASICS, Dimeff, Baer, Kivlahan, &Marlatt, 1999; and AlcoholEdu, Outside

the Classroom, 2010). Grant, LaBrie, Hummer, & Lac (2011) recently examined discrepancies between in vivo BrACs and students guesstimated BACs (a student's estimate of the precise BAC level achieved during a night of drinking). The study found that students with lower BrACs tended to overestimate their BACs, while students with higher BrACs underestimated their BACs. These findings suggest that students may not be accurately assessing their own levels of intoxication, especially on nights of heavier drinking. This is concerning given that students consume more alcohol in a given night when they play drinking games. Moreover, factors related to drinking games may also contribute to difficulties in assessing level of consumption and intoxication. For example, distractions while playing the game and reversal of competence may further inhibit student's ability to accurately recall the number of drinks consumed and their level of intoxication. This point is supported by the notion that students often stop playing drinking games because they are too intoxicated to continue playing (Johnson, 2002). Although the current study did not require students to guesstimate their BACs, it may be useful to incorporate this procedure into future laboratory studies.

Limitations

The findings of the current study must be considered in light of its' limitations. First, the study's sample size was small and primarily Caucasian, female, and 21 years of age, thus limiting its generalizability to college students as a whole. Second, the amount of beer chosen in the laboratory game was selected for safety reasons, not for ecological validity. The amount was chosen to control for the maximum amount of alcohol a participant could consume, ensuring that intoxication levels did not reach into harmful ranges. In previous lab studies, we have served participants up to two standard drinks with no serious consequences, and felt a similar amount should be used in the current study. Third, we did not directly assess for the amount of food

participants consumed prior to the lab study. Although we did indicate in the recruitment e-mail that participants should consume a light meal before coming to the laboratory session, we did not directly measure food consumption when participants entered the lab. When we calculated the software BACs, we assumed that participants consumed a light meal, and this may have lowered the software BACs, as food slows the absorption of alcohol. Fourth, the study was subject to reactivity from the participants. Game play and the decision to drink may have been impacted by participants awareness that they were being observed, and playing a drinking game with three strangers. Although we attempted to recreate the atmosphere as best as possible with music, food, television, couches, and decor, the presence of RAs, breathalyzers, and surveys may have minimized the authenticity. However, the presence of the researchers and assessments did not appear to inhibit students from consuming beer, nor did it deter participants from perceiving the rules as similar as to the rules they follow in the typical drinking environment.

Strengths

Despite these limitations, the study does present a number of strengths that help validate the findings. To our knowledge, this study is the first to assess BACs in a simulated drinking game environment. Although previous studies have assessed college students' BACs using a breathalyzer in the natural environment (e.g. outside of college bars, inside college parties, etc.) no study to date has examined BAC levels related solely to drinking games. Second, the inclusion of beer into the current study extends the breadth of the simulated drinking game paradigm and its realistic design. The use of beer in the simulated drinking game paradigm may allow for future examinations into the social dynamics associated with drinking games, and how alcohol impacts these dynamics, as well as how the dynamics impact consumption rates. Relatedly, the study indicates that the rules of the simulated drinking game paradigm are

accurate in respect to the rules students typically play with in the natural environment. Third, the comparison of the BACs highlights the limitations of using mathematical formulas as predictors of BACs in drinking games, as well as using only water to estimate BACs obtained during these games. Lastly, the high rates of agreement among the RAs suggests that RAs in the current study were accurately assessing drinking behaviors and that the coding system may be utilized in future drinking game studies.

Future Studies

Both the limitations and strengths of the current study must be considered for future research that examines drinking games in the laboratory. Future studies may consider using more realistic amounts of alcohol, as two ounces seems to be lower than the amount typically used in drinking games and results in low BACs when participants consume all of their assigned drinks. Perhaps the discrepancies in the calculated BACs and the BrAC may be minimized when the amount of alcohol served is higher. In keeping with the realistic nature, future research may consider creating more realistic environments or using existing drinking environments as medium for collecting data on consumption levels during drinking games. For creating a realistic environment, future studies may consider minimizing the obvert signals that students are participating in a research study. For example, the use of video recording would eliminate the presence of the researcher in the room and would allow for additional data collecting (e.g. social interactions) that could account for variance in alcohol consumption. Additionally, creating a bar similar to the BARLAB (Collins, Parks, & Marlatt, 1985) may minimize participant reactivity. For existing environments, some college bars host beer pong tournaments. These events present an opportunity for using observations methods to examine consumption rates, refusal rates, and associated BrACs.

Conclusion

There has been recent interest in evaluating the environmental factors associated with binge drinking in college (Brower, 2002). Drinking games are one risk factor for excessive drinking, such that most students play to get drunk, and most games end when students have over consumed (Johnson, 2002). Current harm reduction approaches for heavy drinking aim to minimize the negative consequences associated with this drinking pattern, and these approaches could educate students about factors that contribute to excessive consumption during drinking games. One way to better understand these factors is through the replication of drinking games in the laboratory. This approach allows researchers to explore the antecedents and risk factors that contribute to over consumption, as well as control for extraneous variables that may impact the validity of field studies. In turn, this information can be shared with students in order to enhance their knowledge about when to quit playing a drinking game in order to avoid a negative outcome.

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Table 1.

Inter-observer agreeability for laboratory drinking behaviors

	Initially Refused Drink			Immediately Drank			Delayed Drink			
	A	D	% Agreed	A	D	% Agreed	A	D	% Agreed	RA Observed
Session 1	10	0	100	NA	NA	NA	NA	NA	NA	A
Session 2	4	0	100	6	0	100	8	0	100	B
Session 3	1	0	100	9	0	100	7	3	70	C
Session 6	NA	NA	NA	10	0	100	5	0	100	D
Session 7	NA	NA	NA	2	1	66.7	1	0	100	B
Session 9	NA	NA	NA	10	0	100	NA	NA	NA	D

Initially Refused: Participant did not drink immediately after removing cup
Immediately Drank: Participant drank immediately after removing cup
Delayed Drink: Participant drank a previously removed cup
A: Number of agreements, *D*:Number of disagreements
NA: The behavior did not occur for the team being observed
Mean, Standard Deviation, Range of the Agreements for all three behaviors across all sessions (in percentages):
Mean: 94.72, *SD*=12.35, *Range*=33.33

Table 2.

Correlations between Blood Alcohol Concentration Levels and Alcohol Consumption in Lab

	Software	BrAC	eBAC
Software	-		
BrAC	0.23	-	
eBAC	0.65*	0.65*	-
Amount Consumed	0.26	0.55*	0.50*

Software: Peak Software BAC
BrAC: Breathalyzer Obtained Peak BAC
eBAC: BAC calculated using Matthews & Miller (1979) formula
Amount Consumed: Amount of beer consumed during laboratory session
*$p<0.05$

Table 3.

Repeated Measures ANOVA Examining Differences in Peak Software Estimated BAC and Breathalyzer BAC

Source	SS	df	MS	F	p
Between					
Gender	.0000289	1	.00002892	0.924	*p*=ns
Subj(Gender)	0.001	17	.00003132		
Within					
BACs	0.000381	1	.000381	13.30	*p*<0.01
BAC*Gender	.0000100	1	.00001	0.35	*p=ns*
BAC*Subj(Group)	.000487	17	.0000287		
Total	0.0019069	37	0.00047994		

Software Peak BAC *Mean* (*SD*): 0.0004 (0.001)
Peak BrAC *Mean* (*SD*): 0.007 (0.008)

Table 4.

Repeated Measures ANOVA Examining Differences in Matthews & Miller eBAC (1979) and Breathalyzer BAC

Source	SS	df	MS	F	P
Between					
Gender	0.000341	1	.000341	3.82	*p*=ns
Subj(Gender)	0.002	17	.00003132		
Within					
BACs	0.000105	1	0.000105	5.97	*p*<0.05
BAC*Gender	0.0000987	1	0.0000987	5.90	*p*<0.05
BAC*Subj(Group)	0.0003	17	0.0000177		
Total	0.0028	37	0.0005937		

Peak eBAC *Mean* (*SD*): 0.011 (0.008)
Peak BrAC *Mean* (*SD*): 0.007 (0.008)

Table 5

Correlations between Desire to Drink Scores and Liquid Consumption in Lab among All Participants

	All Participants					Served Beer					Served Water				
	Before	5 Min	End	10 min After	20 Min After	Before	5 Min	End	10 min After	20 Min After	Before	5 Min	End	10 min After	20 Min After
Before	-					-					-				
5 Min	0.93**	-				0.94**	-				0.93**	-			
End	0.69**	0.87**	-			0.77**	0.90**	-			0.59**	0.85**	-		
10 Min after	0.54**	0.72**	0.91**	-		0.62**	0.71**	0.89**	-		0.48*	0.72**	0.95**	-	
20 min after	0.60**	0.71**	0.85**	0.93**	-	0.70**	0.75**	0.86**	0.92**	-	0.51*	0.68**	0.86**	0.94**	-
Amount Consumed	-0.02	-0.12	-0.01	-0.08	-0.03	0.35	0.54*	0.37	0.42	0.45*	-0.28	-0.45	-0.27	-0.28	-0.24

Before : Survey administered before game started, *5 min* : Survey given five minutes into gameplay, *End:* Survey given at end of game play, *10 Min After* : Survey given 10 minutes after gameplay ended, *20 min after:* survey given 20 minutes after gameplay ended, *Amount Consumed* : Amount of liqud consumed during laboratory session

* $p<0.05$, ** $p<0.01$

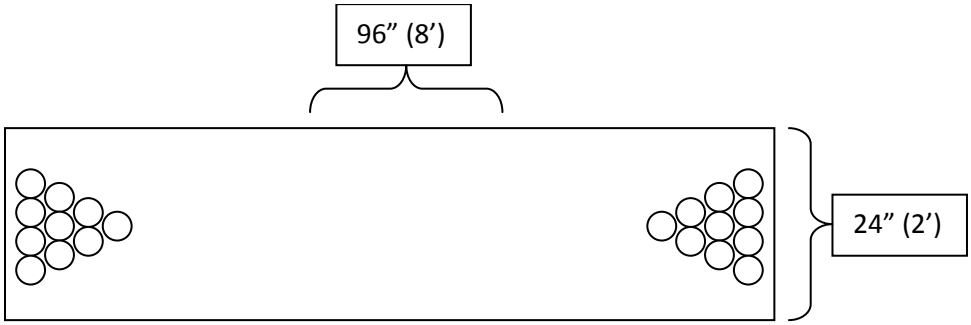
Table 6.

Repeated Measures ANOVA Examining Differences in Desires to Drink Scores

Source	SS	df	MS	F	P
Between					
Gender	1106.52	1	1106.52	7.61	$p<0.05$
Liquid Given	34.24	1	34.24	0.24	*p*=ns
Liquid Given* Gender	109.33	1	109.33	0.75	*p*=ns
Error	1250.09	3	1250.09		
Within					
Time	192.58	4	48.15	5.55	$p<0.001$
Time*Liquid Given	18.94	4	4.73	0.55	*p*=ns
Time*Gender	34.55	4	8.64	1.00	*p*=ns
Time*Liquid Given*Gender	54.36	4	13.59	1.57	*p*=ns
Error	971.05	112	8.67		
Total	1271.48	128	83.78		

Liquid Given: Beer or Water
Time: Before the Game Started (*M*=13.81, *SD*=6.55) 5 minutes into the game (*M*=14.00, *SD*=6.49), 10 minutes after game ended (*M*=12.38, *SD*=6.30), and 20 minutes after game ended (*M*=11.06, *SD*=5.99).

Figure 1. Dimensions of Beer Pong Table and Arrangement of Cups.



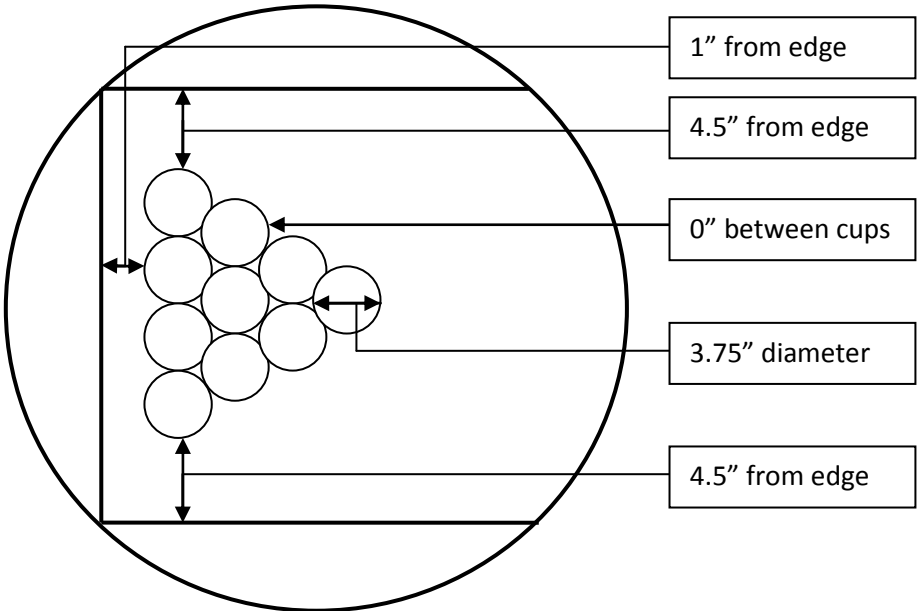


Figure 2. Peak BAC levels obtained using software estimate and breathalyzer for males and females who consumed beer.

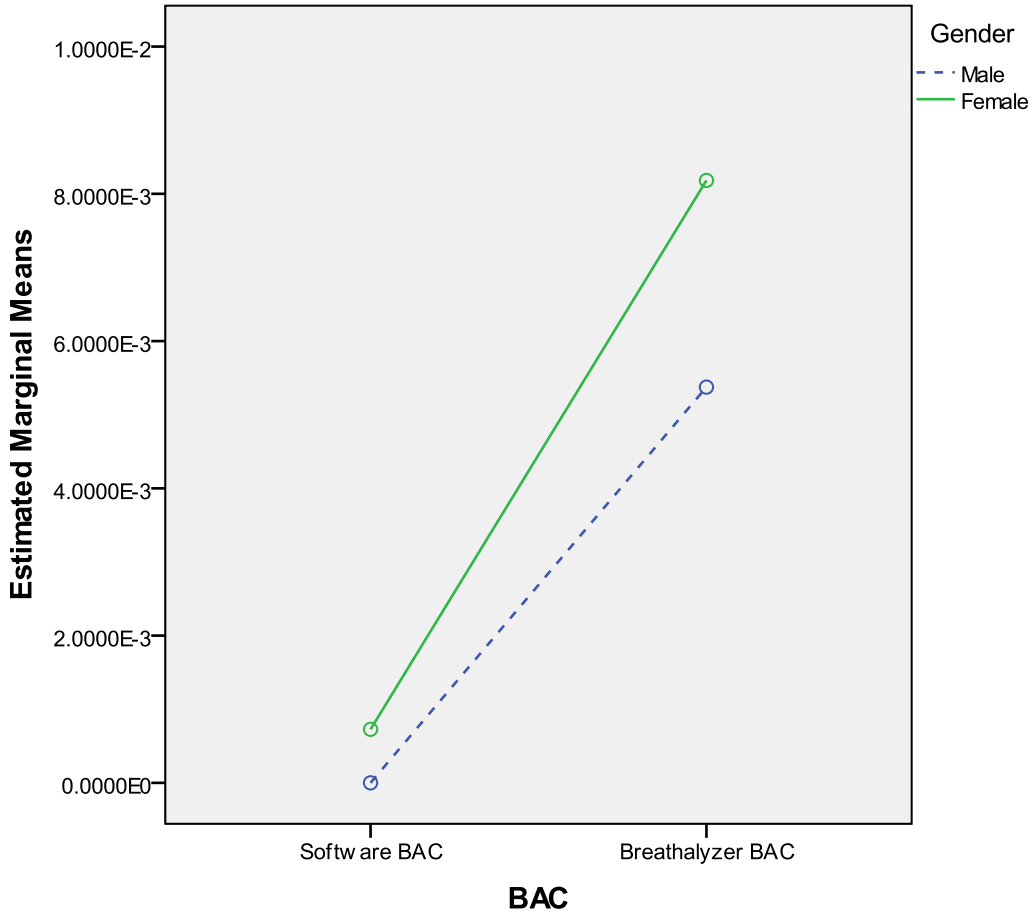


Figure 3. Peak BAC levels obtained using Matthews and Miller (1979) formula and breathalyzer for males and females who consumed beer.

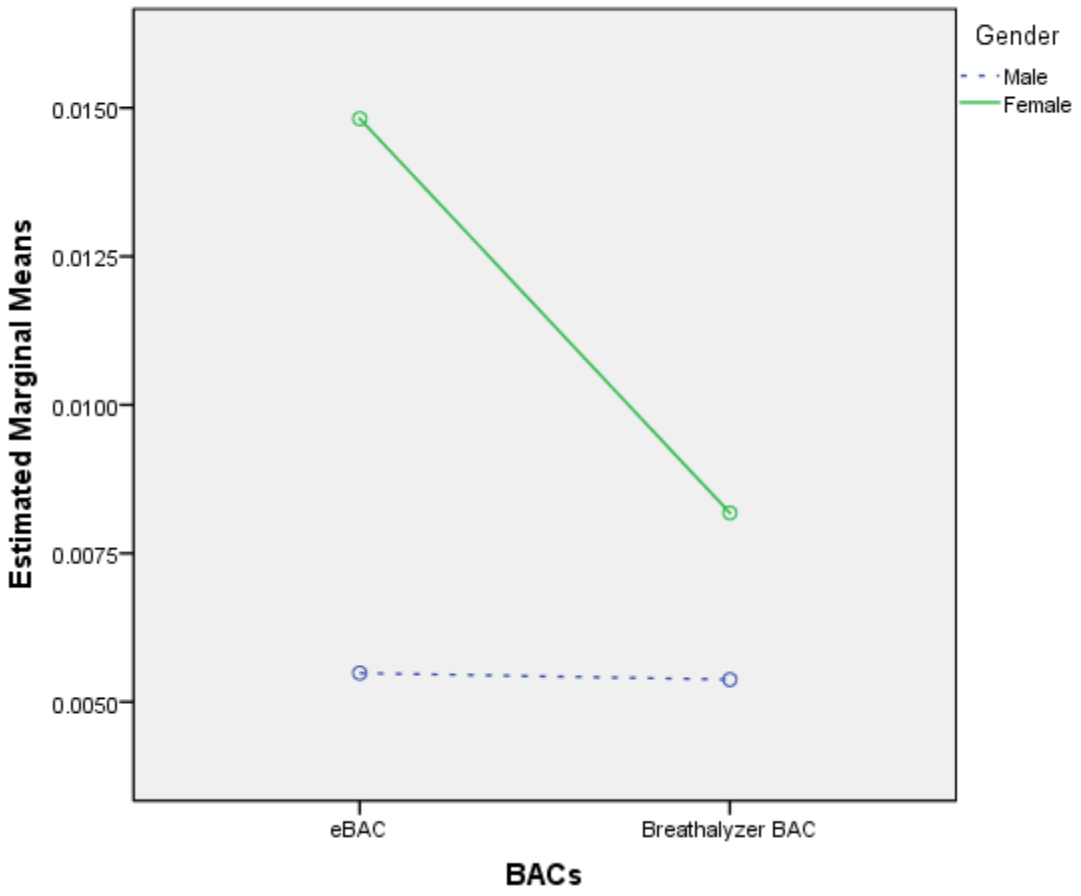
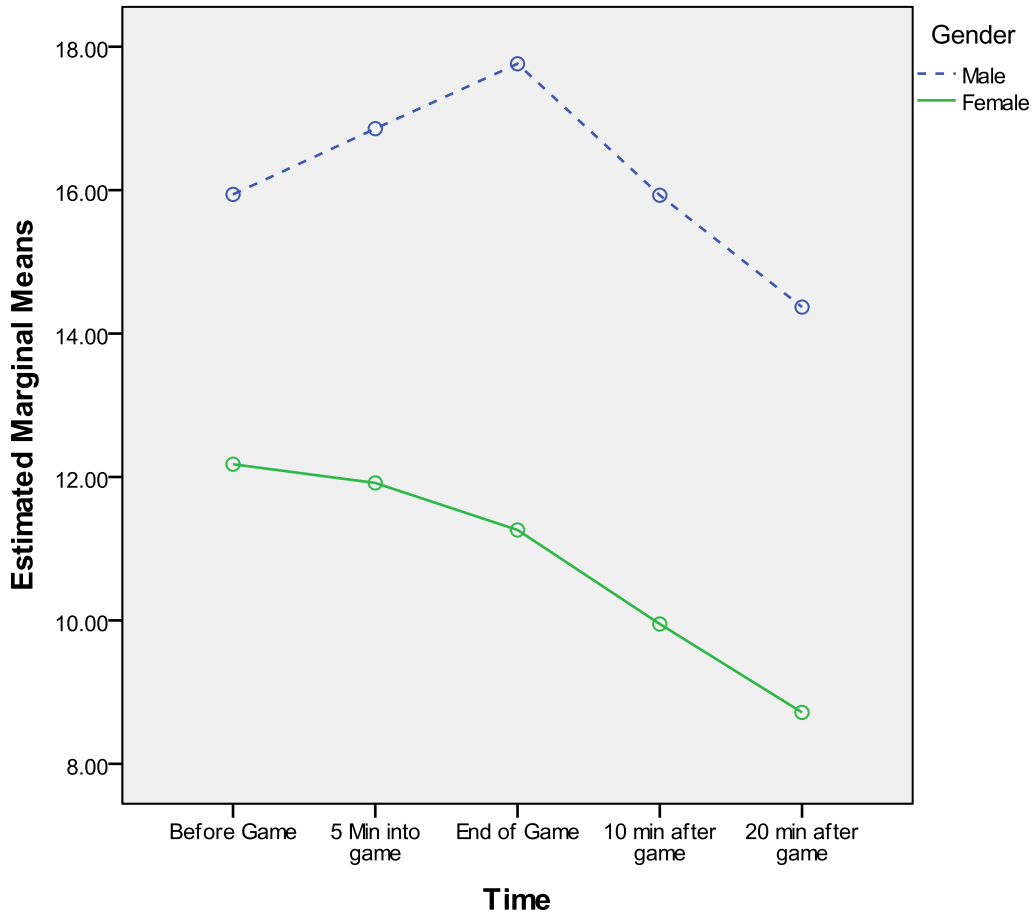


Figure 4. Desire to drink alcohol scores throughout the laboratory study for males and females.



Appendix A

Date: _____ Subject ID#:_____

General Information Questionnaire

1. Please indicate your gender: _____ Male (1) _____ Female (2)

2. How old are you? ____ ____ years.

3. How many years of school have you completed (e.g., graduated from high school = 12 years)?

____ ____ years.

4. Are you a member of a fraternity or sorority? _____ Yes (1) _____ No (2)

5. Please check one of the following Ethnic categories:

_____ Hispanic or Latino (1)

_____ Not Hispanic or Latino (2)

6. Please check as many of the following Racial categories that apply to you:

_____ American Indian or Alaska Native

_____ Asian

_____ Black or African American

_____ Native Hawaiian or Other Pacific Islander

_____ White

7. Where do you currently reside?

_____ Off campus house or apartment (1) _____ At home with parents/guardians (2)

_____ Fraternity House (3) _____ Campus dormitory (4)

_____ Sorority House (5) _____ Other :_____ (6)

8. Please list any current medical conditions.

_____

_____

_____

9. Are you currently taking medication for any of the medical conditions listed above?

_____ YES _____ NO

10. Please list any current psychological/psychiatric conditions.

_____

_____

_____

11. Are you currently taking medication for any of the psychological/psychiatric conditions listed above?

_____ YES _____ NO

Appendix B

Date: _____ Subject ID#:_____

Alcohol Survey

Please use the charts below to describe your recent drinking patterns. Please report your drinking in standard drinks, where 1 standard drink equals 12 ounces of beer, 4 ounces of wine, and or a 1 ounce shot of hard liquor.

For the **past month** fill in for each calendar day the number of standard drinks you **usually drink** on that day.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Now fill in for the **past month** the **maximum number** of standard drinks you had on each calendar day.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

1) During the last 28 days, on how many days did you drink alcohol? _____

_____

2) During the last 28 days, on how many days did you drink beer? _____

3) During the last 28 days, on how many days did you drink wine? _____

4) During the last 28 days, on how many days did you drink a shot of hard liquor? _____

_____

5). During the last 28 days, on how many days did you drink a mixed-drink? _____

_____

6) During the last 28 days, on how many days have you been drunk? _____

_____

7) MALE ONLY: During the last 28 days, on how many days did you have 5 or more standard drinks? _____

FEMALES ONLY: During the last 28 days, on how many days did you have 4 or more standard drinks? _____

8) During the last 28 days, what is the largest number of standard drinks you consumed in one night? _____

9) Approximately how many hours did it take you to finish the largest number of drinks mentioned in #7? _____

10) How much do you weigh? _____

Appendix C

Date: _____ Subject ID#:_____

RAPI

Instructions: Indicate if any of the following have happened during the last 28 days while you were using alcohol, or because of your alcohol use. When marking your answers, use the following code:

0 = never 1 = 1-2 times 2 = 3-5 times 3 = 6-10 times 4 = more than 10 times

1. Not able to do your homework or study for a test	0 1 2 3 4
2. Got into fights, acted bad or did mean things	0 1 2 3 4
3. Missed out on other things because you spent too much money on alcohol	0 1 2 3 4
4. Went to work or school drunk	0 1 2 3 4
5. Caused shame or embarrassment to someone	0 1 2 3 4
6. Neglected your responsibilities	0 1 2 3 4
7. Relative avoided you	0 1 2 3 4
8. Felt that you needed MORE alcohol than you used to use in order to get the same effect	0 1 2 3 4
9. Tried to control your drinking by trying to use only at certain times of the day or certain places	0 1 2 3 4
10. Had withdrawal symptoms, that is felt sick because you stopped or cut down drinking	0 1 2 3 4
11. Noticed a change in your personality	0 1 2 3 4
12. Felt you had a problem with alcohol	0 1 2 3 4
13. Missed a day (or part of a day) of school or work	0 1 2 3 4
14. Tried to cut down or quit drinking	0 1 2 3 4
15. Suddenly found yourself in a place you could not remember getting to	0 1 2 3 4
16. Passed out or fainted suddenly	0 1 2 3 4
17. Had a fight, argument, or bad feeling with a friend	0 1 2 3 4

18. Had a fight, argument, or bad feeling with a family member	0 1 2 3 4
19. Kept drinking when you promised yourself not to	0 1 2 3 4
20. Felt you were going crazy	0 1 2 3 4
21. Had a bad time	0 1 2 3 4
22. Felt physically or psychologically dependent on alcohol	0 1 2 3 4
23. Was told by a friend or neighbor to cut down on drinking	0 1 2 3 4

Appendix D

Drinking Games Measure

1. Have you ever played a drinking game?

____ yes ____ no

2. In the past 30 days, how often did you play a drinking game?

_____ Never _____ Once _____ 2-4 times/month _____ 2-3 times/week _____ 4+ times/week

3. In the past 30 days, please indicate how long you played on a typical night when you played drinking games. Please answer in minutes and provide a single number rather than a range (i.e. 25 instead of 20-30). Answer "0" if you did not play drinking games in the past 30 days.

_____

4. How many total drinks do you typically consume when you play drinking games? Please provide a single number rather than a range (i.e. 4 instead of 3-5). Answer "0" if you did not play drinking games during the last 30 days.

_____

5. In the past 30 days, what was the highest number of drinks you consumed while playing a drinking game. Please provide a single number rather than a range (i.e. 4 instead of 3-5). Answer "0" if you did not play a drinking game in the last 30 days.

_____

6. Do you typically drink beer when playing drinking games?

____ yes ____ no

7. Do you typically drink wine when playing drinking games?

____ yes ____ no

8. Do you typically drink shots when playing drinking games?

____ yes ____ no

9. Do you typically drink mixed drinks when playing drinking games?

____ yes ____ no

10. In the past 30 days, have you played Consumption Games (e.g., Chugging/Power Hour/Keg Stands)?

____ yes ____ no

11. In the past 30 days, have you played Team Games (e.g., Beer Pong/Beirut/Beer Races)?

____ yes ____ no

12. In the past 30 days, have you played Media Games (e.g., Drinking each time a phrase or word is heard in a TV show, movie, or song; "Have a Drink on Me")?

____ yes ____ no

13. In the past 30 days, have you played Dice Games (e.g., 7-11/Doubles/3 Man)?

____ yes ____ no

14. In the past 30 days, have you played Card Games (e.g., Kings/Asshole/Screw the Dealer)?

____ yes ____ no

15. In the past 30 days, have you played Verbal Games (e.g., Never Have I Ever/The Name Game/Animal)?

____ yes ____ no

16. In the past 30 days, have you played Motor Games (e.g., Jenga/Quarters/Thumper)?

____ yes ____ no

17. In the past 30 days, have you played Board Drinking Games (e.g., Monopoly/Pictionary/Scrabble/Shots and Ladders)?

____ yes ____ no

18. When you play drinking games, how often do you drink more alcohol than you intended?

_____ Never _____ Sometimes _____ Half of the Time _____ Most of the Time _____ Always

19. During the past 30 days, have you engaged in unplanned sexual activity that you later regretted as a result of playing drinking games?

____ yes ____ no

20. During the past 30 days, have you had a hangover (headache, sick stomach) the morning after playing drinking games?

____ yes ____ no

21. During the past 30 days, have you gotten physically sick (threw up) as a result of playing drinking games?

____ yes ____ no

22. During the past 30 days, have you found it difficult to limit how much you drank while playing drinking games?

____ yes ____ no

23. During the past 30 days, have you have become rude, obnoxious, or insulting after playing drinking games?

____ yes ____ no

24. During the past 30 days, have you have been unable to remember large stretches of time after playing drinking games?

____ yes ____ no

25. During the past 30 days, have you passed out from drinking alcohol as a result of playing drinking games?

____ yes ____ no

26. During the past 30 days, have you have driven a car when you knew you had too much to drink to drive safely after playing drinking games?

____ yes ____ no

27. How many times have you played Beer Pong in the last 30 days? (Please answer by typing a number, like "2")

28. How many times have you played Beer Pong in the past year? (Please answer by typing a number, like “2”).

Appendix E

Date:_____

Codename:_____

Time: _____

Desire to Drink

(1) I want to use alcohol right now

1 2 3 4 5 6 7
(strongly disagree) (strongly agree)

(2) I have an urge to drink now

1 2 3 4 5 6 7
(strongly disagree) (strongly agree)

(3) It would be great to use alcohol now

1 2 3 4 5 6 7
(strongly disagree) (strongly agree)

(4) Nothing would be better than drinking right now

1 2 3 4 5 6 7
(strongly disagree) (strongly agree)

Appendix F

Codename:_____ Date:_____

Post-Session Survey

The following questions concern your experience in the lab and how closely it resembled your previous experiences with drinking games.
Please respond to the questions as honestly as possible.

1) I played the game the same way I normally play beer pong.

0	1	2	3
Not at all True	Slightly True	Mainly True	Very True

2) Please indicate which of the following statements BEST describes the amount of alcohol you consumed while playing beer pong today:
(Select only one option)

I drank ***more*** in the lab than I normally do when I play beer pong _____

I drank ***less*** in the lab than I normally do when I play beer pong _____

I drank the ***same amount*** in the lab as I normally do when I play beer pong _____

3) The rules in the lab were similar to the rules I normally play by.

0	1	2	3
Not at all True	Slightly True	Mainly True	Very True

4) The game in the lab was as much fun as it is when I normally play.

0	1	2	3
Not at all True	Slightly True	Mainly True	Very True

5) What else should have been included to make the game experience more realistic?

6) Please include any other feedback that you would to provide on your experience today.