# An Incentive/Reward Intervention to Decrease College Alcohol Abuse at Fraternity Parties: Differential Reinforcement of Blood Alcohol Concentration

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*Thesis submitted to the Faculty of*

*Virginia Polytechnic Institute and State University*

*in partial fulfillment of the requirements for the degree of*

Master of Science

in

Clinical Psychology

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December 11, 2001

Blacksburg, Virginia

Abstract

This quasi-experimental field study examined the efficacy of an intervention to decrease alcohol abuse by college students. The harm reduction approach states that the ultimate goal when dealing with an unsafe behavior should be abstinence, but any change in behavior in the direction of less harm is supported. This approach was used as the basis of the current research, in combination with differential reinforcement in order to reduce alcohol consumption and its behavioral outcome, blood alcohol concentration (BAC). A total of 409 male and female college students participated while in the applied setting of four fraternity parties. The study took place at two separate fraternity houses, a control fraternity and an experimental fraternity. During the intervention phase, participants with a BAC below .05 were entered into a raffle to win a cash prize. Upon entry to the intervention party, participants were given flyers announcing the raffle and contingency, and gender-specific nomograms to aid in BAC self-monitoring. Dependent measures were blood alcohol concentration measured by hand-held breathalyzers, percentage of participants below criterion BAC levels (i.e., .05 and .08), accuracy of BAC self-estimation, number of negative outcomes due to excessive alcohol consumption, number of positive outcomes due to abstinence or moderate alcohol consumption, and amount of reported fun experienced at the party. Results showed the intervention did not significantly reduce the intoxication of participants or increase the percentage of participants below criterion BAC levels. These results are best explained by a floor effect, as the experimental fraternity had a relatively low baseline BAC. The use of nomograms at the intervention party increased the accuracy of students' BAC self-estimations. Implications for nomogram use and improvements for future implementation of the incentive/reward intervention are discussed.

Acknowledgements

There are many people who deserve credit for their contribution to this work, for without them it would not have been possible. First and foremost, I would like to thank my advisor and committee chair, Dr. E. Scott Geller. He spent a great deal of time teaching me about conducting and reporting research. He graciously welcomed me into his research world and afforded me the opportunity to turn an idea into an important research project and an educational experience. Scott, thank you for your guidance and patience and for creating the research machine that is the Center for Applied Behavior Systems (CABS).

I would also like to thank Dr. Kent Glindemann, another committee member who schooled me in alcohol research, from data collection to data analysis. He showed me the ropes and provided me with research skills that will carry me through my tenure as a graduate student, and beyond. I would like to thank the rest of my committee members, Dr. Jack Finney and Dr. Richard Winett, for guiding me in this endeavor and contributing to the design and intervention methodology through thoughtful suggestions. I appreciate your time and effort in the process of shaping graduate students into skilled researchers and look forward to collaborating with you in future research. I would also like to thank my undergraduate advisor, Dr. Thomas Berry, for "sparking" my interest in the field of psychology and in community research, and for showing me the way to a wonderful university, a top-notch psychology department, and an undeniably competent advisor. I appreciate your continued support.

Although I was very involved in data collection for this project, it could not have happened without the dedication of the center coordinators, Brian Lea and Ian Ehrhart, and many undergraduate research assistants, including the following: Rodney Alwang, Jill Anderson, Sarah Bensenhaver, Nic Buscemi, Andrea Cincotta, Eugenia Hu, Meredith Katz,

Eric Knox, Stephanie Krepinovich, Melissa Lipscomb, Jason Lynch, David Marshall, Zen Mottershead, Michelle Petersen, Sara Rayne, Bryan Roberts, Hillary Sewell, Melissa Stuart, Alison Taggi, Christine Weaver, and Holly Vande Linde. Thank you all for your late Friday nights of collecting data at fraternity parties and for your hours of careful data entry and verification. You truly were the nuts and bolts of this research.

I would also like to thank my fellow graduate students who contributed to this research: Chris Dula, Jeff Hickman, Phil Lehman, and Kelli England Will. On more than one occasion, each of you contributed to this study through discussion and suggestions, whether in formal meetings or in casual passing. I enjoy working with all of you and appreciate your support in this project.

I was fortunate enough to receive two awards, which funded the current research. I am in gratitude to the American Psychological Foundation for granting me a scholarship in support of this research and of the Virginia Tech Graduate Student Assembly for providing a research grant, which contributed financially to the project. Of course, this research wouldn't have been possible without the cooperation of the fraternities who participated. Although they shall remain anonymous, I would like to thank the fraternities of Virginia Tech for allowing us into their fraternity houses and cooperating with us while data collection took place.

And last but certainly not least, I wish to thank my husband, Justin. His love and support have endured many late nights of data collection and analysis and a few tears of frustration. Without his unconditional support, I would not have been able to conduct this research as swiftly or confidently. Thank you.

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# An Incentive/Reward Intervention to Decrease College Alcohol Abuse at Fraternity Parties: Differential Reinforcement of Blood Alcohol Concentration

One of the most important problems facing America today is alcohol abuse and its side effects, from physical disease to driving while intoxicated. In fact, in 1996, 32% of all traffic fatalities occurred in crashes with at least one legally intoxicated driver (NIAAA, 1996).

A population at special risk for problems with alcohol use and misuse is college students. Reports show that 42.7% of college students are binge drinkers and 20.7% are frequent binge drinkers (Wechsler, Lee, Kuo, & Lee, 2000). Binge drinking is an important health problem as it can contribute to a variety of negative consequences ranging from getting behind in schoolwork to death. The present study targeted this problem in an effort to reduce alcohol abuse among college students in a particularly at-risk population -- students attending fraternity parties.

The drinking culture on college campuses appears to be strong and impenetrable. Thus far, the applications of legislation, education, and behavioral intervention have been unsuccessful in ameliorating the problem. Researchers suggest an innovative and creative solution is necessary (Larimer, Irvine, Kilmer, & Marlatt, 1997). Excessive alcohol consumption and binge drinking among college students continues to represent one of the most serious public health problems confronting the college campus and surrounding community (Wechsler, Dowdall, Maener, Gledhill-Hoyt, & Lee, 1998; Wechsler et al., 2000). Survey research reveals that 80% to 90% of all college students consume alcoholic beverages (Wechsler, Davenport, Dowdall, Moekyens, & Castillo, 1994), and that almost half of all college students are binge drinkers (Wechsler et al., 2000).

Binge Drinking

The current definition of binge drinking is a gender-specific measure, taking into account differences in alcohol metabolism between the sexes. With this measure, binge drinking is defined as drinking five or more drinks in a sitting for men and four or more drinks in a sitting for women (Wechsler et al., 2000). The topic of college binge drinking has been a source of great inquiry in the last decade. In 1994, Wechsler et al., along with the Harvard School of Public Health, conducted the College Alcohol Study (CAS) and found that 44% of college students could be identified as binge drinkers.

After eight years and countless efforts to reduce binge drinking on college campuses, the most recent CAS found a binge drinking rate among college students of 44% once again (Wechsler et al., 2000). Despite continuous efforts to reduce alcohol abuse in university settings, the college drinking problem remains constant. Obviously, college campuses are still in need of an effective way to curb binge drinking and its negative consequences.

Alcohol-Related Problems

Excessive alcohol consumption and binge drinking can lead to a wide range of negative consequences. Such alcohol-related problems include sexual assault, unplanned and unsafe sexual activity, increased risk of contracting sexually transmitted diseases, physical violence, property damage, poor academic or work performance, and vehicle crashes (Lewis, Malow, & Ireland, 1997; Meilman, 1993; Presley, Meilman, & Lyerla, 1993; Wechsler et al., 1998). In 1996, 41% of all traffic fatalities were alcohol-related, translating into one alcohol-related traffic fatality every 31 minutes (NIAAA, 1996). And in 1997, alcohol-related traffic deaths cost Americans $29 billion (NCIPC, 1998). In 1999, frequent binge drinkers were found to be

eight times more likely than non-binge drinkers to experience poor academic performance, blackouts, and physical injury as a result of alcohol abuse (Wechsler et al., 2000).

The secondary effects of others' overconsumption of alcohol make up an important portion of the alcohol-related problems of college students. In 1999, 77% of college students surveyed indicated they had experienced at least one secondary negative outcome of drinking alcohol (Wechsler et al., 2000). Those college students who did *not* practice binge drinking reported the following as their most frequent alcohol-related problems: (a) having sleep or study interrupted, (b) having to care for another drunk student, and (c) being insulted or humiliated.

The Role of the Greek-life System in Alcohol Abuse

Members of Greek-life organizations are at heightened risk for both primary and secondary alcohol-related problems. Membership in a fraternity/sorority is positively correlated with excessive alcohol consumption, including binge drinking (Klein, 1992; Wechsler et al., 1994). When compared to non-Greek-life students in a survey study, Greek-life students averaged significantly more drinks per week, engaged in heavy drinking more often, and suffered more negative consequences (Cashin, Presley, & Meilman, 1998). This same study found that 98% of fraternity and sorority members surveyed drank some quantity of alcohol each week. In addition, leaders of both fraternities and sororities engaged in heavy drinking and had negative consequences as often or more often than other Greek-life members. This is critical because leaders of organizations set norms for their younger members as well as non-Greek-life students attending their parties.

Researchers investigating the relationship between perceived norms and high-risk behavior studied Greek-life houses with reputations for high, average, and low amounts of

alcohol consumption (Larimer et al., 1997). Results showed that high alcohol-consuming houses perceived their social reputations more positively and saw their heavy drinking to be more acceptable than other houses. Experts suggest that research on college drinking should focus on lowering the drinking level in fraternity/sorority houses, thereby changing house norms and making excessive alcohol consumption less acceptable (Goodwin, 1992).

Because Greek-life members drink more than non-Greek-life students, the Greek-life system has been accused of causing alcohol-related problems across college campuses. However, an alternative hypothesis was supported in a study by O'Connor, Cooper, and Theil, (1996) when studying prior alcohol use in high school. The study found that high school drinking predicted college drinking; the author concludes that perhaps heavy drinkers seek out fraternities, not that fraternities create heavy drinkers.

Moreover, recent research that measured partygoers' actual blood alcohol concentration (BAC) found that students at fraternity parties get significantly more intoxicated than students at private parties, *regardless* of Greek-life affiliation (Glindemann, Geller, & Buscemi, 2001). These findings suggest that the party environment may be a more important factor than Greek-life affiliation. Whether heavy drinkers are created by fraternities, drawn to fraternity membership, or attracted to attending their parities, fraternities are a popular drinking environment and a most appropriate setting to study the efficacy of an innovative intervention approach. If an intervention strategy can decrease intoxication in this setting, it's likely to be effective in any party setting, and perhaps also in some bars.

Intentions of College Student Drinkers

An effective intervention should take into consideration why the problem behavior occurs. Do students intentionally get dangerously intoxicated? Field research suggests an

unfortunate answer -- yes. Studies have found that the high levels of intoxication students intend to reach at fraternity parties are highly correlated with the intoxication levels they actually reach (Glindemann, Geller, & Ludwig, 1996).

Dose-Specific Effects of Alcohol

Feelings of well-being, relaxation, lower inhibitions, and stronger euphoria are characteristic of BACs ranging from .04 to .06. Experts suggest, however, that once BACs of .05 or more are attained, there may be impairment of psychomotor performance such as eye movements, glare resistance, visual perception, reaction time, and information processing (NIAAA, 1996). When BACs range from .07 to .09 there are additional negative effects, including impairment of balance, speech, and vision. Significant impairment of motor coordination and loss of judgment occur when BACs reach .10 and beyond (Bailey, 1993). Alcohol concentration beyond .20 becomes extremely dangerous, with loss of consciousness at .30 and death at .40.

Primary Prevention Strategies for Alcohol Abuse among College Students

Because a significant percentage of college students have alcohol-related problems, researchers and prevention practitioners have targeted this group with numerous intervention strategies in an attempt to prevent alcohol abuse and its associated negative consequences. As reviewed below, these approaches can be categorized as: (a) legislation and enforcement, (b) education, (c) providing alternative activities, (d) countering peer influence, and (e) environmental management.

Legislation and enforcement. This approach, while often effective, is frequently perceived as an infringement on personal liberties (e.g., Cranston, 1975). In addition to being unpopular, legal mandates are difficult to enforce, especially in university settings. Nelson

(1986), for example, contended that raising the minimum drinking age creates more problems than it can solve by causing college students to drink in more uncontrolled private settings rather than university-sponsored activities. And given the scarcity principle (Cialdini, Wosinka, Butner, & Gornik-Durose, 2001), restricting alcohol consumption can make intoxication seem more desirable. Moreover, the context of a legal mandate can decrease the impact of other prevention interventions.

A 1985 survey of college administrators indicated that they believe the change in the legal drinking age has had both positive and negative effects on patterns of alcohol and drug use (Gadaleto & Anderson, 1986). While 35% believed increasing the legal drinking age has decreased alcohol abuse, more believed it has had no effect (40%) and many believed it increased abusive drinking (25%).

While laws and enforcement have resulted in declines in DUI and related deaths and injuries, research is needed to develop intervention strategies that can foster informal social pressures not to drive after drinking, including changes in social host behavior, designated driver and safe-ride programs (Hingson, 1993). There's plenty of evidence that the more external control used to change behavior, the less internal buy-in or self-persuasion needed for long-term changes in individual behavior and social norms (e.g., Bem, 1972; Geller, 1998; Lepper & Green, 1978).

Educational approaches. The relationship of alcohol problems to internal or "cognitive" aspects of drinking (e.g., attitudes, beliefs, intentions, and knowledge) has often been explored with questionnaires. Many countermeasures designed to attack alcohol problems are based on the assumption that changes in knowledge or attitudes result in behavior change (Zaks-Walker & Larkin, 1976). However, a number of classic studies in social

psychology suggest a lack of correspondence between verbal statements of belief and actual behavior (Deutscher, 1966; Wicker, 1969). Several studies have found significant discrepancies between self-reported and actual behavioral impact of intervention efficacies (Corral-Verdugo, 1997; Geller, 1981; Hamilton, 1985).

The National Highway Traffic Safety Administration's evaluation of the Alcohol Safety Action Program (ASAP) indicated that it increased knowledge about alcohol impairment and elicited beneficial changes in relevant attitudes, but the educational approach did not result in a significant decrease in DUI arrests or crash involvement among the program participants (U.S. Department of Transportation, 1975). Likewise, evaluation of other education and information programs designed for the general public has shown that modifications in knowledge and attitudes are not related consistently to changes in DUI (Wilde, 1976). As a result, Geller and colleagues (Geller, Kalsher, & Clarke, 1991) suggested that public health professionals combine educational programs with efforts to change drinking behavior and the environmental context in which alcohol abuse and DUI occurs.

The number of colleges and universities with alcohol education programs increased significantly from 1979 to 1985, and there is evidence of significant increases in alcohol-related knowledge during this time period (Engs & Hanson, 1989). As evaluated by Anderson and Gadaleto (1986), the most common programs included information and articles in campus newspapers (76%), motivational speakers (63%), films (63%), poster campaigns (60%), and workshops focusing on drinking attitudes (50%). Despite numerous findings that indicate that increasing students' knowledge about alcohol has little or no impact on the prevalence of alcohol abuse (e.g., Hansen & Graham, 1991), this approach has been a key component of most alcohol abuse prevention programs (cf. Clarke & Geller, 1996; Ziemelis, 1993).

While most colleges and universities employ educational approaches to affect beneficial change, these approaches have not been effective in reducing rates of binge drinking. Most students have received some information about drinking, and those groups with the highest binge drinking rates (fraternity members and athletes) have received the most information. Although these educational programs are targeting the right audiences, high levels of binge drinking continue. It is probable that education and information alone are not sufficient to decrease problem-drinking behaviors (DeJong et al., 1998; Wechsler et al., 2000).

Alternative activities. This approach seeks to prevent alcohol abuse by providing opportunities, activities, and programs that can "provide greater satisfaction than can drugs" (Cohen, 1973, p. 1). The aim is to design programs that encourage students to engage in alternative non-alcohol activities that satisfy the same needs that motivate alcohol consumption. Thus, alternative activities are often designed to: (a) increase physical or emotional relaxation, (b) enhance the probability of safe-sex experiences, (c) provide psychological escape, (d) release or reduce emotions, tension, anxiety, or conflict, (e) alter mood states, (f) increase confidence or self-esteem, (g) provide opportunities for peer recognition, (h) reduce boredom, and (i) facilitate enjoyable peer interactions (cf. Cohen, 1973).

Goodstadt and Caleekal-John (1984) suggest that future research attempt a more systematic and detailed evaluation of the processes associated with alternative approaches, especially program characteristics related to both successes and failures. Systematic evaluation of the impact of this approach on alcohol abuse is scarce (Goodstadt & Caleekal-John, 1984). In one survey study, Engs and Mulhall (1981) found that neither physical conditioning nor passive recreation influence participants' patterns of alcohol consumption.

Social influence approaches. Research on adolescents indicates that peer group norms mediate program effectiveness (MacKinnon et al., 1991), and that changes in norms can account for changes in alcohol use (Bachman, Johnston, O'Malley, & Humphrey, 1988). A review by Hansen and Graham (1991) indicated that social influence approaches are one of the most effective strategies for postponing the onset of alcohol abuse among school-based prevention efforts. Although social influence activities have been used in prevention programming since the 1970s (i.e., Evans et al., 1978), relatively few sources have identified "norm setting" as an important component of programs to prevent alcohol abuse (Hansen et al., 1988; Hansen & Graham, 1991).

Alcohol abuse prevention efforts based on social influence usually seek to: (a) change perceptions of peer alcohol use and resulting negative outcomes, (b) develop refusal skills to resist social influence, (c) use peers as the agents of a behavior-change intervention, or (d) improve the social environment (e.g., through peer modeling and alcohol-free activities).

Normative feedback programs are based on evidence that students' perceptions of alcohol use and abuse on campus are often greater than the actual number of students using alcohol and other drugs (Perkins & Berkowitz, 1986). Feedback approaches attempt to make perception of alcohol use among peers more accurate by providing information on: (a) peer alcohol consumption, (b) the prevalence of at-risk alcohol use (e.g., chugging and funneling), and (c) alcohol-related negative outcomes.

A content analysis of 86 college substance abuse prevention programs funded by the U.S. Department of Education between 1990 and 1992 (Clarke & Geller, 1996), indicated that the number of substance abuse prevention programs using some form of normative feedback as

a prevention strategy has steadily increased from 16% in 1990 to 45% in 1993, despite little evidence of any effectiveness of this approach.

Several case studies (Haines, 1996; Perkins & Craig, 1997) have suggested that changing college students' perceptions of local drinking norms can lower the proportion of students engaging in binge drinking. However, while these results are encouraging, neither of these studies had a control group. In addition, a number of other alcohol-related prevention efforts occurred on these campuses at the same time as the project, including faculty and student workshops, infusion of alcohol-related materials in the classroom, and an increase in alcohol-related programming during new student orientation and in residence halls.

In a related study (Geller & Glindemann, 2000), myth reduction and skills training interventions were implemented to help change behaviors and beliefs about drinking. Subjects were all fraternity or sorority members attending two fraternity parties (pre- and post-intervention). Two training programs were developed based on the research literature: normative feedback and skills training.

Fraternity and sorority members attended these 2-hour training sessions on a Saturday afternoon and pre-and post-interview questionnaires were compared. For the skills training group, there was a significant increase in the number of individuals who: (a) consumed food before drinking, (b) alternated alcoholic and non-alcoholic beverages, and (c) used a "drinking plan" to help moderate their drinking. However, survey results also indicated that individuals who reported adopting these behaviors were already drinking at lower levels than other participants, $\underline{p} < .05$ (Geller & Glindemann, 2000).

Wechsler and colleagues have posited that some of the difficulty in changing norms may be that heavy drinking is highly visible and may be assumed to be the norm, even where

data suggest this is not the case (Wechsler, Molnar, Davenport, & Baer, 1999). In fact, rigorous research in large-scale communication of risks has shown individualistic case examples to have greater impact on perception and attitude than collective statistics (Sandman, 1987; Slovic, 1991).

Colleges where less heavy drinking takes place may benefit most from social marketing efforts designed to inform students about the actual rates of drinking in an attempt to change false assumptions that heavy drinking is the norm (Haines, 1996). It's also likely that culture change through normative-focused education takes time, and requires more long-term monitoring and evaluation than we have conducted to date. Actual behavior change may lag behind changes in knowledge and verbal report, given that interpersonal conversation defines culture (Geller, 2001; Krisco, 1997).

Environmental Management Approaches

Another approach for reducing at-risk drinking and associated problems on the college campus is to alter the environment or drinking context. Environmental management involves moving beyond general awareness and other educational programs to identify and change those factors in the physical, social, legal, and economic environment that promote or abate alcohol and other drug-related problems (DeJong et al., 1998; Kaphingst, 1997). This approach is based on the premise that the negative consequences of alcohol consumption can be reduced by altering the physical and/or social environment in which it occurs (Moore & Gerstein, 1981).

While more traditional approaches to prevention have tacitly accepted the world as it is and then tried to teach students how to resist its temptations, the environmental approach seeks to change the world, or at least the campus environment, in an attempt to produce beneficial

change (DeJong et al., 1998). This prevention strategy, based on the public health model, considers three elements: the host (user), the agent (alcohol), and the environment (Kuh, 1994).

Three lines of preliminary research have provided promising findings regarding the interaction of contextual factors and alcohol consumption: (a) a series of field experiments on environment-behavior relationships at university parties, (b) effectiveness of server intervention, and (c) field observations of bar patrons. First, consider a series of naturalistic studies by Geller and his associates (Geller & Kalsher, 1990; Geller, Kalsher, & Clarke, 1991; Glindemann, 1995; Kalsher & Geller, 1990; Russ & Geller, 1988a) that investigated situational determinants of excessive alcohol consumption at college fraternity parties. These studies showed dramatic effects of: (a) beer brand labeling on drink choice, (b) serving low-alcohol beer, and (c) using bartenders versus self-service stations to serve alcohol.

Changing brand labels. Two studies (Kalsher & Geller, 1990; Russ & Geller, 1988b) indicate that the simple environmental stimulus of a beer brand label can have a significant impact on drink choice and subsequent intoxication. Specifically, ongoing beer choices at a fraternity party matched taste preference (in a blind taste test) only when the beer brands were unlabeled. When kegs were labeled by beer type (regular, light, and low alcohol) subjects preferred the higher alcohol content beers (regular and light), while low alcohol beer was only consumed in quantity in an unlabeled condition. Thus, serving low alcohol beer only reduced intoxication when subjects were unaware of the beer brand.

Manipulating alcohol content. At two parties, either regular or low alcohol drinks were served. Results indicated that when low alcohol beer (3% alcohol) and mixed drinks (7/8 of an ounce) were introduced into a party setting *without the partygoers' knowledge*, college students did not increase their consumption to titrate and reach a “desired” level of intoxication.

Therefore they exited the party with significantly lower BACs than they did from a party where drinks contained standard alcohol contents. In addition, partygoers were apparently unaware that alcoholic beverages contained less alcohol (only one subject commented that the drinks were weak).

Bartenders versus self-service. Geller and Kalsher (1990) investigated the influence of bartenders versus self-service on the consumption of beer and mixed drinks at a fraternity party. Results indicated that beer drinkers randomly assigned to the self-serve condition drank beer at higher rates than beer drinkers served by bartenders. In contrast, individuals choosing to consume mixed drinks became significantly more intoxicated in the bartender condition than in the self-serve condition. Using a response-cost model, the authors concluded that partygoers drank more beer when serving themselves because the self-service of beer was faster and more convenient than getting service from a bartender. On the other hand, preparing a mixed drink requires some knowledge and inconvenience, thus bartenders decreased this response-cost.

Server intervention. Most server intervention programs teach servers of alcohol to identify specific warning signs indicating overindulgence and then to use a variety of impairment-reduction tactics to prevent or ameliorate intoxication. Intervention tactics include offering food, delaying service of alcoholic beverages, offering non-alcoholic beverages, and advising the person not to drive. Evaluations of these programs indicate that they can effectively reduce intoxication (Geller, Russ, & Delphos, 1987; Russ & Geller, 1987; McKnight, 1991; Saltz, 1987).

Although these server-intervention evaluations indicate this approach can lessen intoxication and associated negative consequences such as DUI, “effects will be transitory if the behaviors taught during training are not supported by the environmental context in which

they occur" (Geller, 1990, p. 268). For example, Geller suggests that instituting a mandatory gratuity may decrease waitpersons' concerns about reductions in tips associated with "cutting-off" a patron. Two special advantages of server intervention are that the intervention occurs within the drinking environment, and the particular method for intervening can be tailored to each drinker (Geller et al., 1987).

Harm-Reduction Model

All of the environmental management literature reviewed above changed the drinking context in an effort to reduce levels of intoxication and therefore reduce the harmful consequences contingent on overconsumption of alcohol. This approach reflects the harm-reduction model described by Marlatt, Larimer, Baer, and Quigley (1993). The harm-reduction perspective is based on the assumption that abstinence is the ideal outcome for a risky behavior, but any change that reduces harm of problems due to that behavior is worthwhile.

This paradigm has been applied to other public health campaigns, including needle-exchange programs, nicotine replacement methods, methadone maintenance, and condom distribution (Marlatt et al., 1993). Prevention efforts using this model have been aimed at reducing harm of alcohol abuse in adolescent binge drinkers and preventing the development of alcohol dependence among high-risk drinkers. According to Marlatt (1996), habits can be placed along a continuum of harmful consequences. The goal of harm reduction is to move the person with alcohol problems to the less harmful side of this continuum.

Because harmful consequences increase directly as alcohol consumption increases, reducing alcohol consumption reduces the risk of harm. The model portrays abstinence as the ultimate goal because there are some risks associated with moderate drinking (Marlatt, 1996). For instance, moderate-to-heavy drinking can increase the risk of motor vehicle crashes, birth

defects, and interactions with some medications. But any move in the direction of less harm should be pursued.

Marlatt (1996) has applied the harm-reduction model to college students in an effort to reduce their binge drinking. College freshmen identified as at-risk for harm due to alcohol consumption were interviewed regarding their typical drinking behavior, and then given confrontational feedback about their drinking behavior and the possible negative consequences. From a self-efficacy paradigm (Bandura, 1997), these individuals received information on outcome-expectancies. Two weeks prior to this interview, the students were given alcohol consumption monitoring cards to complete daily. During a one-hour interview, participants were given individualized feedback regarding their drinking rates, alcohol-related problems, and beliefs about alcohol. In addition, participants' self-reported drinking rates were compared with college averages (the norm), and perceived risks for current and future problems were identified. Upon completing the interview, students were given a personalized summary feedback sheet, comparing their responses with college norms.

In a two-year follow-up, researchers found that students in the intervention condition *reported* lower drinking rates and drinking-related problems than students in the control condition. While this study found a decrease in self-reported alcohol consumption, the one-on-one interviews were costly in terms of personnel, time, and effort. Furthermore, they did not take place in the actual drinking environment. However, the individuals targeted were those deemed likely to fall through the cracks following less expensive large-scale communication campaigns (cf. the multiple intervention level model proposed by Geller, Berry, Ludwig, & Evans, 1990).

Critique of Evaluation Approaches

Due to the large number of negative outcomes of alcohol abuse and binge drinking, intervention approaches to combat the problem have been frequent and varied. But most evaluations of program effectiveness have been disappointing, both in terms of methodology and results. Most interventions have been less successful than desired, and most were evaluated with self-report data rather than observations of actual behavior or intoxication levels.

Self-report data. Self-report studies base their findings on participants' self-reports of drinking behavior, alcohol-related problems, and estimated BAC. Such evaluations have several limitations. These self-reports are often in the form of interviews that occur up to six months after the actual drinking behavior. Furthermore, while comparisons of intoxication estimates and actual BAC have been significant (e.g., a Pearson *r* of .54 reported by Glindemann, Geller and colleagues, 1996), there is substantial room for error.

A final concern of the self-report is reactivity bias. Participants may have an unconscious desire to please the researchers (or intervention agents), and therefore report decreased alcohol use and related problems. For example, if students receiving moderation training know that the goal of the research is to influence less alcohol consumption, they might feel obligated to report improvement independent of their actual behavior. In other words, interventions may be more influential on verbal behavior than actual drinking behavior.

Behavioral data. A line of research funded by the National Institute for Alcoholism and Alcohol Abuse (NIAAA), has addressed these concerns by taking measures of actual intoxication in the settings where college students consume alcohol (Geller & Glindemann,

2000). In addition, appropriate control groups were used in an attempt to extensively and rigorously evaluate the impact of normative feedback and host-intervention approaches.

Unfortunately, to date the objective behavioral and BAC data have failed to support the usefulness of intervention approaches to reduce alcohol consumption at fraternity parties. Although significant decreases in verbal reports of high-risk alcohol consumption and negative outcomes were found, observations of actual drinking-related behaviors and BAC measures of intoxication did not change (Geller & Glindemann, 2000).

The primary aim of this study was to determine if an innovative incentive/reward intervention could change the drinking behavior of college students. Specifically, students were rewarded for maintaining a BAC considerably below the limit of legal impairment, as defined by medical experts. Actual BACs, percentage of participants below criterion BAC levels, self-reported positive and negative outcomes, and accuracy of BAC self-estimation were the dependent measures used to assess the efficacy of this approach.

Subgroups within the college drinking population have shown differential levels of alcohol abuse. For example, research suggests that male college students are more likely than their female counterparts to drink alcoholic beverages and engage in binge drinking (Clarke, 1993; Presely, Meilman, & Lyerla, 1993). With the incorporation of gender-specific measures, many researchers have concluded the gender gap is closing, although many more men than women still report experiencing alcohol-related problems (Haberman, 1994; Wechsler, Dowdall, Davenport, & Rimm, 1995). A second aim of the present study was to determine whether the intervention affects men and women differently.

The third aim of this research was to study the effect of the intervention on Greek-life students versus non-Greek-life students. Studies show that fraternity members drink alcohol

more frequently and become more intoxicated than other students (Presley et al., 1995). Therefore, an intervention to alter drinking behavior should target this subgroup specifically, and thus fraternity parties were the target setting of this research.

## Present Intervention Approach

Harm-reduction served as the underlying model for the intervention approach. Any change of behavior that significantly reduces the potential negative consequences of drinking, especially harm to self or others, supports the model. While the harm-reduction approach has been applied in individualized feedback interventions, the present study implemented this approach on a large sample of college students in the most at-risk drinking environment -- the fraternity party. The methodology used actual BACs of participants as the main dependent variable, and therefore was not subject to the limitations discussed above with self-report data.

### Incentive/Reward Intervention

The primary component of the intervention was an incentive/reward contingency offered to students at a fraternity party. An incentive is a verbal announcement (written or oral) of the availability of a positive consequence (reward) contingent on the occurrence of a certain behavior or an outcome of one or more behaviors (Geller, 1993). Partygoers were informed of the availability of a monetary reward upon meeting a particular BAC criterion. An immediate reward, in the form of a lottery ticket, was given to all participants meeting the criterion.

Applications of incentive/reward contingencies. Incentive/reward programs have been implemented in a variety of other aspects of community safety, proving successful at increasing safe behaviors (Geller, 1993). Specifically, safety-belt use has been increased in numerous industrial settings and on a college campuses. For example, during a campus-wide

incentive/ reward program, drivers observed using their shoulder belt had their vehicle license plate numbers recorded by campus police and entered into weekly prize raffles. Results showed dramatic increases in safety-belt use during the intervention period (Rudd & Geller, 1985). Thus, during this intervention the potential harm to hundreds of vehicle occupants was substantially reduced.

Differential reinforcement of low BAC. The incentive/reward used in the present study was used to differentially reinforce a behavioral outcome -- BAC. The behavior of drinking alcohol is reinforced by the natural consequences of its use. Moderate levels of alcohol can elicit relaxation and facilitate social interaction, but high levels of alcohol can impair judgment and slow reaction time. So it appears that drinking alcohol safely requires a certain degree of competency, which can be shaped through natural consequences. Differential reinforcement describes relationships in the environment and helps establish individual performance skill (Skinner, 1953).

Differential reinforcement has been used in an attempt to curb alcoholic drinking with a particular schedule of reinforcement -- differential reinforcement of *low* rates of behavior (DRL). With this schedule, a participant is reinforced for performing a behavior at a low rate, meaning a specified minimum interval of time is required between successive behaviors (Skinner, 1953). This is the experimental behavior analysis definition of DRL, and it has been applied with chronic alcoholics (Davidson, & Bremser, 1977).

Two diagnosed alcoholics were assessed individually for their baseline drinking rates and then exposed to a DRL of .5 minutes. That is, they were required to wait for a minimal interval of .5 minutes before performing a behavior (pulling a plunger) that provided a reward (a sip of an alcoholic beverage). Once the criterion of .5 minutes was met, participants were

exposed to successively longer intervals of time until the criterion of 16-minute intervals between sips was attained. As a result, the drinking rates of these alcoholics were lowered and each became less intoxicated. One of the two participants maintained moderate drinking rates after treatment, while the other returned to binge drinking. The authors conclude that exposing alcoholics to a DRL reinforcement schedule can be an effective way to establish controlled drinking.

The target population for the present research -- college students at fraternity parties -- were not alcoholics, but rather were potential alcohol abusers. Therefore, differential reinforcement was used in an innovative way with the same goal -- to lower BACs. Furthermore, it was a behavioral outcome, BAC, which was reinforced rather than the behavior of drinking. Specifically, participants were rewarded for having a BAC lower than .05.

Controlled Drinking

Because the population of interest was not alcoholics, the present study avoided the controversy regarding controlled drinking and alcoholism. Originally, the controlled drinking debate surrounded the treatment of alcohol dependence. It was based on whether alcoholics must practice complete abstinence from alcohol or whether they can learn to have alcohol in safe moderation, referred to as “controlled drinking” on (Sobell & Sobell, 1995a).

Sobell and Sobell’s stepped-care approach to alcohol problems (1995b) represents a compromise between the two sides of the controlled-drinking debate. In this approach, clients with alcohol-related problems receive the least intrusive or invasive treatment expected to be effective. If treatment outcome is beneficial, patients remain in that treatment. If treatment outcome is negative, patients receive a more intensive intervention. Based on outcome results, participants either continue certain treatment or move on to a more intensive intervention. As

such, patients able to successfully drink in moderation are not forced to completely abstain from alcohol consumption.

This approach has been criticized because many people view *any* consumption of alcohol as irresponsible, risk-taking behavior. The stepped-care approach to alcohol consumption and its problems is now proposed not only for clinical populations of alcohol abuse and dependence but may be applied to alcohol misuse in the general population, as a solution to this public health care problem (Sobell & Sobell, 1995b). The approach clearly fits within the harm reduction model referred to above.

Self-Monitoring Levels of Intoxication

In order for differential reinforcement to be effective in lowering BACs, students must be able to monitor their level of intoxication and to limit their alcohol consumption appropriately. Several field studies have investigated this topic and the findings are mixed. In a study mentioned earlier (Glindemann et al., 1996), students at a fraternity party were asked to estimate their current BAC. The correlation between participants' estimations of BAC and actual BAC was 0.54. These findings are not strong support for the contention that students can monitor their BACs. However, several partygoers in this research estimated their actual BAC within .01g alcohol/dL blood.

Nomograms. A nomogram can be used to aid the monitoring of one's BAC. This tool uses normative values to calculate a person's BAC from body weight, number of drinks, and drinking time. Nomograms have been printed on napkins and key chains in drunk–driving campaigns (Geller, 1990).

However, a study investigating variability of BACs in a controlled drinking study found prominent individual variation in BACs for given doses of alcohol (O'Neill, Williams,

& Dubowski, 1983). Authors concluded that alcohol nomograms could result in under- or overestimation of BACs and are not appropriate as primary interventions to decrease alcohol consumption. Thus, nomograms merely served as an adjunct to the present intervention approach, distributed during the incentive/reward program as an aid for students motivated to control their BAC. See Appendix A for a nomogram similar to the one we distributed to participants during the Intervention party.

## Pilot Study

A pilot study was performed to assess whether the incentive/reward intervention had the potential to change the drinking behavior and subsequent levels of intoxication of college students attending fraternity parties. BACs were assessed at four parties, all held by the same fraternity. The first two parties were considered Baseline parties, and no intervention was included. At the third and fourth parties the incentive/reward intervention was put into place. A total of 356 students (122 women, 234 men) participated in the study, including 96 students at Party 1, 83 students at Party 2, 86 students at Party 3, and 91 students at Party 4. It was hypothesized that students would be less intoxicated at the parties that included the incentive/reward intervention.

### Method

Each of the parties began at 10:00 pm and ended at approximately 2:00 am. Data collection began at 11:30 pm and ended at 12:30 am at all four parties. Upon the research teams' arrival at a party, data collectors spread out into various sections of the party and began recruiting people into the study. Participants read and signed an informed consent form and then answered a brief questionnaire. Participants' actual BAC levels were then assessed using hand-held breathalyzers.

The third and fourth parties included the incentive/reward intervention used in the present research. For these parties, two research assistants arrived at the party just before 10:00 pm and were stationed at the main entrance to the party. As guests arrived at the party these research assistants handed them a flyer that explained the incentive/reward condition that was in place for the night. The flyer explained that a research team would be giving free BAC assessments at the party, and that anyone participating and registering a BAC below .05 would be entered into a raffle for a $100 prize. Also included on the flyer were tips for keeping a person's level of intoxication down. The raffle drawings were held at 12:30 am, immediately after BAC assessments were completed. The winning students were present when the drawing was held, and were given the prize at that time.

Results

BAC data were analyzed using a 2 Condition X 2 Party X 2 Greek-life Status X 2 Gender ANOVA. Results indicated a significant main effect for Party, $F$ (3, 355) = 4.43, $p$ < .01. The mean BAC was .092 at Party 1, .102 at Party 2, .063 at Party 3, and .056 at Party 4. There was also a main effect for gender $F$ (1, 355) = 4.08, $p$ < .05. Specifically, men were more intoxicated than women at all fraternity parties.

<Insert Figure 1 About Here>

The percentage of students at each party with a BAC below .05 was also calculated. As shown in Figure 1, significantly more people registered a BAC under .05 at both the intervention parties as compared to the two baseline parties $F$ (3, 340) = 4.38, $p$ <.05. The number of participants registering a BAC at .08 or above was 44 (45.2 %) at Baseline party 1

and 31 (37.3%) at Baseline Party 2. This number increased to 60 (69.8%) at Intervention Party 1 and 71 (88%) at Intervention Party 2. In other words, the number of legally intoxicated participants was cut in half at both intervention parties.

These results strongly support the efficacy of the incentive/reward intervention. Students' mean intoxication levels were significantly lower at the Intervention parties than at either Baseline party. One possible confound in these comparisons is that there could have been some selection bias. Moderate and/or non-drinking students may have been more likely to make themselves available for a BAC assessment at the Intervention party, because low BACs were rewarded with a raffle entry. The extent of this potential bias is low, however, since the research teams attempted to approach everyone at each party and did not note a substantial number of refusals at any of the parties. Refusals were not recorded, however, and therefore one cannot verify a lack of differential refusal rates. In the present research, all refusals were recorded and a participation incentive was implemented at Baseline parties to ensure a representative sample.

## Hypotheses

The present study investigated the efficacy of an intervention designed to decrease at-risk drinking among college students at fraternity parties. The intervention incorporated nomograms and an incentive/reward program that differentially reinforced a behavioral outcome: BAC. Based on the information cited, it was hypothesized that mean BACs would be lower and the percentage of participants below criterion BAC levels would be higher in the Intervention condition than in Baseline. In addition, the number of self-reported negative outcomes of alcohol consumption would be lower in the Intervention condition than in Baseline, and the number of self-reported positive outcomes due to moderate drinking were

predicted to be higher in the Intervention condition than in Baseline. It was also predicted that there would be no difference in reported amount of fun experienced at the party, regardless of study condition. Due to the use of nomograms, which are aids in estimating alcohol concentration, students were predicted to be more accurate at estimating their BACs when given a nomogram and motivated to use it (i.e., at the Intervention party).

Levels of intoxication were categorized according to gender and Greek-life status. For gender, it was predicted that men would have higher BACs than women, in all conditions. For Greek-life status, it was hypothesized that Greek-life students would have higher BACs than non-Greek-life students, in all conditions.

## Method

### Participants and Settings

Participants included 409 male and female college students attending four parties at two fraternities of Virginia Polytechnic Institute and State University in Blacksburg, VA. Participants ranged in age from 18-24 years old. The settings were two fraternity houses, both located off-campus. Fraternity 1 had approximately 20 members and Fraternity 2 had approximately 30 members at the time of the study. All parties were open parties; both Greek-life and non-Greek-life students were allowed to attend. The fraternity parties took place between 10:00 pm and 2:00 am. Table 1 represents the gender and Greek-life versus non-Greek-life make-up of each party at each of the two fraternities.

<Insert Table 1 About Here>

Whenever possible, drinking practices of individual students and subsequent levels of intoxication were monitored and tracked across different phases of the study for within-subject comparisons. This was accomplished by having students generate a confidential subject number they could replicate each time they participated. This six-digit subject number was generated by asking participants (a) the first two letters of the city in which they were born, (b) the first two letters of their mothers' maiden name, and (c) the number of the month in which they were born.

Apparatus

Participants' BACs were assessed using hand-held Alco-Sensor IV breathalyzers (Intoximeters Inc., St. Louis, MO). To ensure an accurate reading, any residual alcohol was removed by having participants rinse their mouths with 2 oz of water before each BAC assessment. A standardized sampling procedure was used to ensure alveolar (i.e., deep lung) air was collected. All instruments were calibrated by the local police immediately prior to the study.

Dependent Measures

The dependent measures included: (a) mean BAC, (b) percentage of participants below criterion BAC levels, (c) accuracy of BAC estimation, (d) reports of negative outcomes from alcohol consumption, (e) reports of positive outcomes from abstaining or drinking in moderation, and (f) reported amount of fun experienced at the party. These variables were operationalized as follows:

Blood alcohol concentration. Students' BACs were measured at each fraternity party using hand-held breathalyzers. Mean BACs were calculated for each party, as well as standard deviations.

Percentage of participants below criterion BACs. For each party, the overall percentages of participants below criterion BAC levels was calculated. These criterion BACs were the raffle criterion (i.e., .05) and the legal limit of intoxication in Virginia (i.e., .08).

Accuracy of BAC estimation. At each party, student participants were first asked to estimate their current BAC. Participants were given a scale used to estimate intoxication and reported it to research assistants. See Appendix A for a picture of the scale students used to estimate their BAC.

Negative outcomes. The day after each party, research assistants attended a mandatory weekly meeting of the fraternity. Here, participants completed a brief post party questionnaire (PPQ), reporting any negative outcomes they encountered at, or after, the party due to alcohol consumption. All participants completing the PPQ used Form A, with the exception of those participants from Party 1 of Fraternity 2, who completed Form B of this survey (see Appendix D).

Positive outcomes. Similar to negative outcomes described above, the PPQ (Form A) included items assessing positive outcomes that one may experience as a result of drinking in moderation or not at all. These outcomes include positive experiences and accomplishments that occur the day after the fraternity party, such as completing homework and housework, running errands, and remembering everything that happened the night before.

Fun. As mentioned earlier, most students report to drink for alcohol's effect as a social lubricant, making them chatty and uninhibited. The premise of this research was to get students to experience a fun time while at a lower BAC. As a check of the amount of fun participants had at each party, they were asked to rate on a scale of 1 to 10, how much fun they had at the party. This question was asked of them during the exit BAC interview at the party

and on the PPQ at the follow-up meeting. This question was also useful in tracking how the presence of researchers and a raffle changed, if at all, the amount of fun partiers report having, tracking the integrity of the party.

Procedure

For each fraternity party of the study, except Baseline Party 1 of Fraternity 2, participants were informed that researchers would be giving free BAC assessments and that there would be a prize drawing of $100. A time sampling procedure was used to collect relevant data. Specifically, the research team arrived at a given party at 11:30 pm and collected BACs from voluntary participants for exactly one hour. This procedure was developed and used in the past (e.g., Glindemann, Geller, & Fortney, 1999), and typically allowed data collection of between 80 and 100 students per hour.

Upon arriving at the party, four teams of three research assistants each were dispersed throughout the setting to recruit participants and collect relevant data. One research assistant informed potential participants of the research procedure, answered any questions, and asked the participant to sign an informed consent form (see Appendix B). The second research assistant on a team then asked the participant a few questions from a survey form (see Appendix C). Finally, the third research assistant administered a BAC test (using a hand-held breathalyzer) to the student and afterwards informed them of their intoxication level, in confidence.

After receiving BAC feedback, participants were warned not to drive if their BAC was $\geq$ .05, encouraged not to consume any more alcohol if their BAC was $\geq$ .08, and told they may experience serious negative consequences if they continued to drink when their BAC was $\geq$ .15.

Experimental Design and Intervention

This quasi-experimental field study can be represented by a factorial of: 2 Fraternity X 2 Party X 2 Gender X 2 Greek-life status. Since some participants attended each of the parties of a given fraternity, it was possible to make both between-subject and within-subject comparisons. The dependent variables were mean BAC, percentage of participants below criterion BAC levels, accuracy of BAC estimations, number of reported negative outcomes due to alcohol consumption, number of reported positive outcomes due to abstaining or drinking in moderation, and reported amount of fun experienced at the party. Accuracy was defined as the absolute difference between the actual and estimated BAC, rounded to two decimal points (i.e., hundredths).

Fraternity 1 received two phases (or conditions) in the order indicated: $A^a$ -- B, while Fraternity 2 received the phases: A -- $A^a$. The phases were defined as: A = Baseline, $A^a$ = Baseline + Participation Incentive, and B = Intervention. The phases are defined as follows:

Baseline (A). During this phase, data were collected with no intervention. Participants were unaware that researchers would be at the party that night collecting data and there was no incentive to participate.

Baseline + Participation Incentive ($A^a$). During this phase of the study, data were collected with no intervention. However, all students entering the party were given a flyer (See Appendix A). The flyer was 8.5" x 5.5" with black type-written ink, informing students that researchers would be arriving at the party to give free BAC assessments and that everyone participating would be entered in a raffle to win $100 at the end of the night. Each participant, following the completion of a BAC assessment, wrote their name on a raffle ticket and placed

it in a sealed box. At 12:30 am, one name was drawn and that participant was given $100 on the spot.

Intervention (B). During this phase of the study, all students entering the party were given a flyer similar to the one in the Baseline + Participation Incentive phase, informing students they could earn a chance to win $100. However, the flyer specified that only those with a BAC below .05 near the end of the party would be entered in the raffle (See Appendix A for a copy of this flyer). Students entering the party were also given a nomogram. Those students meeting the BAC criterion (<.05) wrote their name on a raffle ticket and placed it in a sealed box. At 12:30 am, researchers drew one ticket from the box and the winner was given $100 on the spot.

## Results

### Sample Demographics

Exit BAC. A total of 409 men and women participated (271 men, 138 women), ranging in age from 18 to 24 years old. Table 1 depicts the percentage of men and women at each party as well as their fraternity or sorority membership. Combining the four parties (n=409), 40.8% of the participants were Greek-life students, 66.2% were men and 33.8% were women.

The percentage of partygoers sampled per party was calculated by dividing the number of students who were approached *and* agreed to have their BAC measured by the total number of guests at the party. A count was also taken of students who were approached but declined/ rejected an offer for BAC assessment. At the Baseline party of Fraternity 1, 89% (107 of 120) of the students were sampled; 45 guests declined to participate. At this fraternity's Intervention party, 62% (117 of 190) of the partygoers were sampled and 50 guests declined

the BAC assessment. Fraternity 2 had 40% (89 of 225) sampled at Baseline Party 1 and 60% (96 of 160) sampled at Baseline Party 2. Of these, 26 guests rejected BAC assessments at Baseline Party 2; the rejection count was not taken at Baseline Party 1.

Post-party questionnaire. For each party, a post-party questionnaire (PPQ) was completed by fraternity brothers at a mandatory meeting the Sunday after the party. Fraternity members who completed the PPQ but did not attend the party were excluded from the data. A total of 19 fraternity brothers from Fraternity 1 attended the party and completed the PPQ for the Baseline party and 16 did so for the Intervention party. The number of brothers who attended the party and completed the PPQ from Fraternity 2 was 28 for Baseline Party 1 and 46 for Baseline Party 2. These participants were all men, ranging in age from 18 to 22 years old.

<Insert Table 2 About Here>

## Dependent Measures

Exit BAC. Table 2 depicts the mean exit BACs at each party, classified by Fraternity, Gender, and Greek-life status. A 2 (Fraternity) X 2 (Party) X 2 (Greek-life status) X 2 (Gender) analysis of variance (ANOVA) was calculated on mean exit BACs. The results of the ANOVA revealed a significant main effect for Fraternity, $F$ (1, 393) = 18.78, $p$ <.001, and a significant main effect for Gender, $F$ (1, 393) = 6.99, $p$ < .05. As depicted in Figure 2, the exit BACs were higher at Fraternity 2 ( M = .099) than Fraternity 1 (M = .067), and men (M = .087) had significantly higher BACs than women (M = .071). No other effects were statistically significant (all $p$ >.10).

<Insert Figure 2 About Here>

The percentages of participants with BACs below the two target BAC levels were compared as an additional test of intervention efficacy. These target levels were the raffle criterion (i.e., .05), and the legal limit of intoxication in Virginia (i.e., .08). Table 3 depicts the percentage of participants below these target levels at each party. Across both parties of Fraternity 1, the Chi Square statistic showed no significant difference in the percentage of participants below .08, $X^2$ (1, 225) = .27, $\underline{p}$ >.10, nor below .05, $X^2$ (1, 225) = 2.49, $\underline{p}$>.10.

<Insert Table 3 About Here>

Comparing the second party of each fraternity (i.e., the Intervention party of Fraternity 1 versus Baseline Party 2 of Fraternity 2), the Chi Square statistic showed that Fraternity 1 had significantly more participants below .08, $X^2$ (1, 213) = $\underline{p}$ < .001, and below .05, $X^2$ (1, 213) = $\underline{p}$ < .001 than did Fraternity 2. Figure 3 depicts the percentage of participants below the target BACs at Party 2 of each fraternity and shows this significant difference. Because the BACs at the first party of Fraternity 2 were similar to those at this fraternity's second party (see Figure 3), this difference cannot be attributed to an intervention effect.

<Insert Figure 3 About Here>

Accuracy of BAC estimation. The accuracy of participants' estimations of their BACs was determined by finding the absolute difference between participants' estimated and actual

BACs. Figure 4 shows the mean absolute differences between actual and estimated BACs for each party, classified by Fraternity. A 2 (Fraternity) X 2 (Gender) X 2 (Party) X 2 (Greek-life Status) ANOVA was calculated on these absolute differences. The ANOVA showed a Fraternity X Party interaction approaching significance, $F$ (1, 408) = 3.72, $p$ = .055; no main effects or other interactions reached significance (all $p$'s > .10).

<Insert Figure 4 About Here>

The absolute differences for Fraternity 1 alone were analyzed, comparing Baseline and Intervention parties, with a one-way ANOVA. The participants at the Intervention party were significantly more accurate at estimating their BACs (mean absolute difference of .026) than were participants at the Baseline party (mean absolute difference of .036), $F$ (1, 223) = 6.54, $p$ < .05. There was no difference in mean absolute differences between the two baseline parties of Fraternity 2 (all $p$'s > .10).

Negative outcomes. Table 4 shows individual negative outcomes due to excessive alcohol consumption, as reported on the PPQ, and the percentage of participants reporting each, classified by Fraternity and Party. The number of negative outcomes were totaled and averaged for each party and frequencies were calculated for each individual negative outcome. A 2 (Fraternity) X 2 (Party) ANOVA, calculated on the mean number of negative outcomes reported at each party, indicated that Fraternity 2 reported significantly more negative outcomes than Fraternity 1, $F$ (1, 104) = 19.65, $p$ < .001. There was no significant main effect for Party and no interaction. Exit BAC and total number of negative outcomes reported were

significantly correlated. The higher the BAC, the more negative outcomes reported by participants, $r = .52$, ($p < .01$).

<Insert Table 4 About Here>

Positive outcomes. Positive outcomes due to reduced alcohol consumption were reported on the PPQ on a Likert scale from 1 to 5, where 1 represented "Strongly Disagree", and 5 represented "Strongly Agree." The mean total agreement with positive outcomes was calculated for each party, giving a positive outcome score.

Participants at Baseline Party 1 of Fraternity 2 were not queried about positive outcomes and therefore an overall 2 (Fraternity) X 2 (Party) ANOVA on all parties could not be calculated. Thus, these data were analyzed with two one-way ANOVAs, across both parties of Fraternity 1 and across both Fraternities for Party 2. The one-way ANOVA calculated across both parties of Fraternity 1 showed no significant difference in mean positive outcome scores, $F$ (I, 34) = 2.27, $p > .05$, between Baseline and Intervention Parties. The one-way ANOVA calculated across Party 2 of both fraternities showed a main effect for Fraternity, $F$ (1, 60) = 5.63, $p < .05$. Specifically, participants reported more total positive outcomes at Party 2 of Fraternity 1 than at Party 2 of Fraternity 2.

Fun. All participants receiving BAC assessments were asked to report the amount of fun they were experiencing at the party on a scale from one to ten, where one represents "no fun" and ten represents "maximum fun," creating a "fun score." The mean fun score of each party served as a dependent measure. Again, participants at Baseline Party 1 of Fraternity 2 were not queried about fun and an overall ANOVA on mean fun scores could not be

calculated. Therefore, these data were analyzed with two separate ANOVAs, across both parties of Fraternity 1 and across both fraternities for Party 2. The 2 (Party) X 2 (Greek-life status) X 2 (Gender) ANOVA for Fraternity 1 showed no significant main effects or interactions.

<Insert Figure 5 About Here>

Figure 5 depicts the mean fun score reported by participants at Party 2 of each fraternity, classified by Greek-life Status and Gender. The 2 (Fraternity) X 2 (Greek-life status) X 2 (Gender) ANOVA at Party 2 showed only a main effect for Greek-life status, $F$ (1, 212) = 4.16, $p < .05$. Specifically, Greek-life students reported having significantly more fun than non-Greek-life students. The ANOVA also showed a significant Fraternity X Gender interaction, F (1, 212) = 12.08, p = .001; men reported having significantly more fun than women at the Fraternity 2 party.

Subject Reactivity

Reactivity bias was assessed with interview questions at the party and on the PPQ. At each party, participants were asked: How would you say our presence at this party affected the amount of alcohol you consumed? Table 5 shows the percentage of participants reporting effects of researchers on drinking behavior at each party for Fraternity 1. The Chi Square statistic showed no significant difference between the Baseline and Intervention parties in the number of people who reported they drank more, they drank less or were not affected by the researchers' presence (all $p$'s > .10). Comparing Party 2 of each fraternity, the Chi Square

statistic also showed no significant differences in the effects of researchers on drinking behavior, reported by participants (all p's > .10).

<Insert Table 5 About Here>

Manipulation Check

At the mandatory house meeting the day after the Intervention party of Fraternity 1, participants were asked (a) if they received a flyer or other information about the raffle, (b) to explain how the drawing worked, (c) to explain what the raffle prize was, (d) whether they thought the incentive condition was a good idea, and (e) whether they would consider using a similar intervention at a subsequent party (see Appendix D for a copy of this survey).

A total of 16 male, Greek-life participants answered these social validity questions and Table 6 depicts the most common responses. Specifically, 31.2% of the participants reported receiving a flyer, 14.5% knew how to become eligible for the raffle, 60.5% knew exactly what the raffle prize was (i.e., $100), and 85.5% said the raffle should be used at future parties. Unfortunately, 28.9% of participants reported they never learned of the raffle, 39.5% were incorrect in their report of what the raffle prize was, and 40.8% reported that they did not know how to become eligible for the raffle.

<Insert Table 6 About Here>

Within-Subjects Effects

There were 13 participants from Fraternity 1 at both the Baseline and the Intervention party, allowing for a within-subject comparison of exit BACs. A paired-sample t-test showed

no significant difference between mean BACs for the Baseline and Intervention Parties, $t$ (13) = -.22, $p$ > .10. A total of 5 participants from Fraternity 2 attended both parties, constituting its within-subjects pool. The paired-sample t-test showed no significant difference between mean BACs for the two Baseline Parties, $t$ (5) = -1.92, $p$ >.10.

For Fraternity 1, 11 participants attended both the Baseline and Intervention Parties, constituting the within-subjects pool for PPQ items. Paired sample t-tests revealed no significant differences within-subjects in number of negative outcomes from the Baseline to Intervention Party, $t$ (11) = .25, $p$ > .05.

## Discussion

This quasi-experimental field study tested the efficacy of an incentive/reward intervention to reduce alcohol abuse among college students at fraternity parties. The results did not support the main hypothesis, that participants would have lower BACs at the Intervention party than at Baseline Parties, nor that the percentage of participants below criterion BAC levels (i.e., .05 and .08) would be higher at the Intervention party than during Baseline. In fact, the mean BAC at the experimental fraternity was virtually identical for the two conditions (Baseline = .065 and Intervention = .066).

There are several possible explanations for the lack of change in BAC. One possible explanation is a floor effect. That is, the exit BACs were relatively low at the Baseline party of the experimental fraternity (i.e., .065), compared to the Baseline parties of the control fraternity (i.e., .099). Thus, there was limited room for BAC improvement during Intervention. Floor effects have been used to explain a lack of intervention impact in other research studies testing the efficacy of treatment procedures (Krebs, Eickelberg, Krobath, & Baruch, 1989; Stoolmiller, Eddy, & Reid, 2000).

The pilot study for this research took place at a fraternity with high BACs during baseline, and a significant intervention effect was found. Therefore, the results of the present research are not indicative of a failed intervention, but are an informative, important step in defining the environment that can best benefit from it. It's still possible the incentive/reward intervention is an effective way to reduce alcohol abuse at parties where BACs are relatively high. In other words, the more at-risk drinking occurring at a fraternity party, the greater the potential impact of the incentive/reward intervention.

Another possible explanation is the knowledge of the raffle and contingency. As was found with the manipulation check after the Intervention Party, it seems a proportion of participants (a) did not know about the raffle (28.9%), (b) were incorrect in their report of what the raffle prize was (39.6%), and (c) did not know how to become eligible for the raffle (40.8%). Obviously, students must know there is a contingency in place and what the reward is, in order for the intervention to be effective. Therefore, a lack of knowledge in regards to the contingency is a viable explanation for a lack of intervention effect.

The small within-subjects sample (i.e., n = 5 and 11) is another possible explanation for the lack of intervention effect. Because there were so few students from each fraternity at both parties, there is a possible subject effect. That is, subsequent parties were comprised of different populations, and therefore mean BACs should not be compared from one party to another. There could be any number of differences in the party populations causing low or high mean BACs.

The hypothesis that participants would report more negative outcomes after Baseline than Intervention parties was also not supported. The same is true for the hypothesis that participants would report more positive outcomes following the Intervention party, compared

to the Baseline parties. Positive and negative outcomes reflect degree of intoxication, and given that mean BAC did not change from Baseline to Intervention, it is reasonable that the number of reported outcomes from alcohol consumption did not change. The control fraternity (i.e., Fraternity 2), which had significantly higher BACs than the experimental fraternity ($p < .001$), reported significantly more negative outcomes than the intervention fraternity ($p < .001$). This finding is consistent with literature suggesting students who consume excessive amounts of alcohol, compared to those who do not, are more likely to experience alcohol-related problems (Lewis et al., 1997; Meilman, 1993; Presley et al., 1993; Wechsler et al., 1998). The present study contributes to this literature, since it matched reported alcohol-related problems (i.e., negative outcomes) with actual biological measurements of intoxication (i.e., BAC). Exit BAC and total number of negative outcomes reported were significantly correlated ($r = .52$). The higher the BAC, the more negative outcomes reported by participants ($p < .01$).

Fraternity 2 (i.e., the control fraternity) also reported fewer positive outcomes, suggesting that students who drank to higher levels of intoxication felt worse and were less able to complete necessary tasks the day after the party, as compared to students who did not drink excessively. Although there is a plethora of literature from survey studies describing negative outcomes due to excessive drinking (Presley et al., 1993; Wechsler et al., 1998), there is no literature describing positive outcomes of drinking in moderation.

In addition, the existing literature relied primarily on self-report of intoxication, which involves students' estimations of the amount of alcohol they consumed or the level of intoxication they reportedly reached sometime after the drinking session. The current research went beyond these self-report investigations and assessed *actual* BACs of students *during the drinking episodes*.

Assessing positive outcomes after moderate party drinking is new to this line of research and the findings here warrant further investigation of this construct. Studies finding more positive outcomes when partygoers consume only moderate amounts of alcohol provide credibility for programs aimed at convincing students to consume alcohol in moderation rather than in excess.

The hypothesis that, overall, men would have significantly higher BACs than women was supported. Men were more intoxicated than women at all parties. This finding is consistent with several other field studies that found male college students to consume more alcohol in party settings than female college students (Geller, Altomari, Ross, & Harwood, 1984; Kaplan, 1979).

The effect of Greek-life membership on alcohol consumption is less clear. Findings to date have been mixed. Several survey studies suggest Greek-life students drink more often and to higher levels of intoxication than do non-Greek-life students (Cashin et al., 1998; Klein, 1992; Wechsler et al., 1994). On the other hand, recent research using actual BACs as the dependent variable suggests it is the fraternity party environment and not fraternity/sorority membership that links most directly with excessive alcohol consumption (Glindemann et al., 2001). The results of the present study support the latter. There were no differences between Greek-life and non-Greek-life students in either mean BAC or reported negative/positive outcomes. These subgroup findings suggest the fraternity party environment needs to be targeted for intervention to prevent alcohol abuse, and within that environment, men may need more persistent focus.

The hypothesis that students would be more accurate in self-BAC estimates at the Intervention party than Baseline parties was supported. This finding supports the efficacy of

alcohol nomograms as aids in BAC self-estimation and is novel to the field of alcohol research with college students. Nomograms have been ineffective as a primary intervention to reduce alcohol consumption and driving under the influence of alcohol (DUI) (Meier, Brigham, & Handel, 1984; Werch, 1988).

Due to variability in individual alcohol metabolism, nomograms have been questioned as an accurate estimate of BAC (O'Neil et al., 1983). Actually, research has shown that BAC feedback (whether the source is a nomogram or an actual breathalyzer assessment) has little if any positive effect on the behavior of those consuming alcohol (Russ, Geller, & Leland, 1988). In fact, BAC feedback can provoke some students to reach at-risk levels of intoxication (Russ et al., 1988). Thus, nomograms have been discouraged as primary intervention tools for reducing alcohol consumption.

In the present study, the nomograms were used as an adjunct component to an intervention package. More specifically, participants were given a nomogram to aid their monitoring of BAC in order to receive an entry in a cash raffle. This incentive/reward contingency motivated the participants to use the nomograms appropriately. As a result, the nomograms did not provoke more alcohol consumption, and participants were better at estimating their BACs when asked to do so by researchers, as compared to the BAC estimates at the Baseline parties where nomograms were not available ($p < .05$).

To date, research has not focused on the influence of nomograms on intention of one's BAC. The implications of these results are not only important for future implementations of the incentive/reward intervention, but also for other behavioral interventions aimed at reducing harmful consequences of excessive alcohol consumption. The key may be to provide partygoers with an extrinsic contingency to motivate appropriate use of a nomogram or other

tool to monitor BAC. Without the incentive/reward contingency, students in previous studies may have misused the nomograms to reach at-risk levels of intoxication, as has been found with other forms of BAC feedback (Russ et al., 1988). Moreover, asking partygoers to remain below a criterion BAC without the aid of nomograms could have been futile, since these individuals probably have had no training in BAC monitoring and estimation. A component analysis in future evaluation of this intervention approach could explain just that, dismantling the intervention into its separate components (i.e., the presence of researchers, flyers with nomograms, and the incentive/reward contingency).

Although survey research reports that college students drink because they want to be more social, achieve a feeling of euphoria, and gain a sense of well-being (Klein, 1992), researchers have not yet conducted a study that compares the amount of *fun* college students report having while drinking with actual measures of intoxication. In doing just that, the present study found a direct relationship between BAC and reports of having fun. Students' actual BACs at the party were matched to the fun score they reported at the party. Participants reported their fun score, a measure completely separate from reported positive outcomes, on a scale from one to ten, where one represents "no fun" and ten represents "maximum fun." The partygoers with higher BACs reported having more fun at the party than those with lower BACs ($\underline{p} < .05$). This relationship occurred at all parties, regardless of experimental condition.

The current study sheds light on another potential reason interventions used with college students are difficult to implement: students associate becoming intoxicated with having fun. The mean fun score at the experimental fraternity did not change from Baseline to Intervention, which, as with positive and negative outcomes, is consistent with the lack of change in the intoxication of partygoers. However, partygoers at the control fraternity, who

were significantly more intoxicated than partygoers at the experimental fraternity, did not report having more or less fun overall. Therefore, it cannot be concluded, at least from these results, that students associate being intoxicated with having fun.

The lack of change in fun scores also shows that the incentive/reward contingency did not harm the integrity of the party or "spoil the fun." Actually, in every condition students reported that the researchers had no effect on their drinking behavior. Thus, participants were not affected by the presence of researchers at the party, or at least did not want researchers to think otherwise. In addition, 85.5% of participants from the Intervention party who completed follow-up questions (n=16) reported that the raffle should be used at future parties. So it seems the raffle did not affect the integrity of the party and students did not react negatively to the presence of researchers. In fact, a majority of the participants (85.5%) would like to see future parties of the like. These collateral findings are positive and leave the door open for future implementation and evaluation of this intervention.

Future applications of the incentive/reward contingency should take into consideration several limitations of the present study. The first and most important weakness was the use of two methodologies. At the first Baseline party of Fraternity 2, participants were not queried about positive outcomes and perceived fun. Therefore, an overall ANOVA could not be conducted across all parties to analyze these variables. The only option was to perform a one-way ANOVA across the second party of Fraternities 1 and 2. In addition, causal inferences cannot be made from comparisons of variables across Party 2 of the two fraternities, because these fraternities were significantly different on several variables (e.g., mean BAC, percentage of participants below criterion BAC levels, and number of reported negative outcomes). Thus, comparing Party 2 across fraternities is not a useful comparison. That is, differences between

fraternities cannot be attributed to the intervention, leaving the one-way ANOVA across the two parties of Fraternity 1 as the only meaningful comparison.

A second weakness of the present research involved the collection of rejection rates (i.e., the number of partygoers who refused to participate by agreeing to a BAC measurement). Specifically, the rejection rates reported here are confounded by repeated refusals and postponements (i.e., participants were approached by researchers and said they wanted to participate later). Students who initially postponed a BAC assessment and later elected to participate were counted as both a rejection and an acceptance. Repeated refusals also confounded the rejection total. Because there were four teams of researchers throughout the party, repeat approaches were unavoidable. Students who were approached and rejected may have been asked more than once. It is possible that one person rejected several times to different researchers. Repeated refusals and postponements caused inflated rejection rates at all parties of the study. In the future, researchers must mark postponements and count them separately from refusals. All students approached must be asked if they have been approached by other researchers and their reply must be recorded accordingly. Accurate rejection rates are important in order to determine any selection bias that may occur at parties; a differential rejection rate between Baseline and Intervention parties could confound intervention effects.

A third limitation is the small sample size for the within-subjects pool and the PPQ survey (administered to fraternity members at mandatory meetings the day after each party). The within-subjects pool was very small for both Fraternity 1 and 2 ($n$=13 and 5, respectively), leaving virtually no power for statistical analysis. Likewise, since the PPQ was only administered to fraternity members, the sample size for this survey was also very small. The small sample ($n$=16) has the same power problem as the pool of subjects who attended both

parties per fraternity. In addition, the sample was skewed because all participants were male Greek-life students.

Future studies need to query a larger and more diverse sample of post-party participants. Students could voluntarily put their name and phone/e-mail information on a data collection sheet separate from all other data, giving researchers permission to contact them the next day and administer follow-up questions. Adding this to the data collection procedures would make it possible to assess positive and negative outcomes with all participants, not just the fraternity members. This is also true of the PPQ items that assessed the social validity of the incentive/reward intervention.

Intervention awareness is the fourth and final limitation of the present study. Besides the small, skewed sample that answered the social validity items (i.e., fraternity members, $\underline{n}$ = 16), it seems many participants did not know what the contingency was, what the prize was, or how to become eligible to win the prize. It is obvious that future implementations of the incentive/reward intervention must improve promotion. For the intervention to work, many more partygoers must know there is an incentive/reward contingency in place, and be able to define the BAC criterion. In fact, the lack of an impact of the intervention on mean BAC may be due in part to ineffective dissemination of the intervention contingency.

Disseminating the message, or spreading the word, about the contingency can be done by advertising it with promotions of the fraternity party. For example, the school newspaper ads and on-campus flyers, which announce upcoming fraternity parties, could include an explanation of the contingency that will be in place and the prize that will be awarded. In addition to the announcement of the party, the school newspaper could report the winner of the prize and the mean BAC at the party. In this way, students not only learn about the

contingency, but they see the results of the intervention, including the prizewinner. This is another avenue through which conversation of the contingency can occur and conversation is a crucial step in culture change (Geller & Williams, 2001). Announcing low BACs in the school newspaper, along with testimonials from students who drank in moderation and had fun has the potential to aid in changing perceived norms. As mentioned earlier, students often assume heavy drinking on campus to be the norm, even when data suggest this is not the case (Wechsler et al., 1999).

The incentive/reward intervention is a potentially worthwhile approach to reducing alcohol abuse among college students. The present study represents a first step toward demonstrating its utility, which brought attention to procedural concerns. This study points out nonfatal flaws in the implementation and data collection procedures, including inflated rejection rates, ineffective advertisement of the contingency, and a limited assessment of social validity. Addressing these concerns will strengthen future implementation and evaluation of the intervention.

An equally important conclusion is that the incentive/reward intervention should be used with at-risk fraternities who have relatively high baseline mean BACs. The present results, combined with those from the pilot study, suggest the approach has greatest potential for situations where at-risk alcohol consumption is relatively high (i.e., mean BACs $\geq$ .09).

Once the results of the pilot study have been verified, efforts can aim at institutionalizing the process, meaning that fraternities administer the incentive/reward contingency as a typical part of their parties, without the presence of researchers. In order to do so, fraternity members could be trained in the use of breathalyzers and hence implement incentive/reward parties on their own. The general public can purchase hand-held

breathalyzers, and although the cost is to a certain extent an investment, it is a fraction of the amount spent by universities annually on ineffective interventions. In addition, fraternity members can receive training in breathalyzer use by the local police or the company selling the equipment. In that way, the incentive/reward contingency can be used by university's nationwide, not just those that conduct alcohol research.

As for the cost of the raffle, there are a number of ways to handle this aspect of the intervention so it will be more acceptable by fraternities and universities. For example, by charging a dollar at the door to all guests entering the party, the raffle would be self-supporting; most fraternity parties have in excess of 100 guests, ensuring enough cash for a raffle prize, while relieving the fraternity itself from absorbing extra costs. The money at the door could be added to the cover charge, so all partygoers contribute, or the contribution could be voluntary. By contributing money voluntarily, partygoers are making a nonverbal commitment, which may enhance the likelihood of them becoming eligible for the raffle. Contributing a dollar to the raffle is analogous to college students who signed a pledge card to use their safety belt (Geller & Lehman, 1991). This commitment puts personal and social pressures on participants to behave in a way consistent with the commitment they have made (Geller & Williams, 2001). In addition, the raffle would have all the components that create an effective commitment: public, effortful, and perceived as voluntary (Cialdini et al., 2001).

Another way of supporting the incentive/reward contingency is to solicit prizes from the community, through local businesses or the university itself. For example, universities could donate textbooks from the bookstore or meal plans from the school dining halls. Local businesses could donate their products as raffle prizes. A key factor in the incentive/reward contingency is to find what is rewarding to college students. That is, what products, benefits,

or amount of cash will motivate students to change their drinking behavior? Moreover, how do the odds of winning affect students? For example, are several smaller prizes more motivating than one large prize, or vice versa? Answering these questions will help to maximize the beneficial impact and social validity of the incentive/reward intervention introduced with the current research.

The approach could be further improved by meeting with the students before a party, explaining the rationale of the incentive/reward contingency and instructing them on the use of nomograms to monitor intoxication. As mentioned before, education has been used in prior attempts to reduce harmful consequences of drinking (Clarke & Geller, 1996; Ziemelis, 1993). However, it is not usually paired with a behavior-change intervention, as suggested by researchers in the field (Geller, Clarke, & Kalsher, 1991).

With these improvements, the incentive/reward intervention has potential not only to change drinking behavior at an individual fraternity party, but also to change the culture of drinking on campus. The intervention gives partygoers an excuse not to drink excessively and it could change the drinking culture on campus, by getting students talking about it and its effects. Again, the overall goal of this approach is for students to have fun at no or low BACs and to experience reduced negative outcomes and increased positive outcomes the next day. These intrinsic rewards should become more reinforcing than a raffle and change the way they drink in all situations, thus reducing harmful consequences in various contexts.

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Table 1

Percentage of Participants in Demographic Subgroups at Each Fraternity Party

| | Fraternity 1 (n=225) | | Fraternity 2 (n=184) | |
|---|---|---|---|---|
| Subgroup | Baseline | Intervention | Baseline 1 | Baseline 2 |
| Men | 55 | 75 | 71 | 64 |
| Women | 45 | 25 | 29 | 36 |
| Greek-life | 23 | 32 | 62 | 52 |
| Non-Greek-life | 77 | 68 | 38 | 48 |

Table 2

Mean Exit BACs at Each Party, Classified by Fraternity, Party, Gender, and Greek-life Status

| | Fraternity 1 (n=225) | | Fraternity 2 (n=184) | |
|---|---|---|---|---|
| Subgroup | Baseline (g/dL) | Intervention (g/dL) | Baseline 1 (g/dL) | Baseline 2 (g/dL) |
| Overall Mean | .069 | .066 | .099 | .099 |
| Men | .071 | .070 | .107 | .107 |
| Women | .066 | .056 | .080 | .086 |
| Greek-life | .065 | .066 | .107 | .098 |
| Non-Greek-life | .070 | .066 | .087 | .101 |

Table 3

Percentage of Participants Below Target BAC Levels at Each Fraternity Party

| | Fraternity 1 | | Fraternity 2 | |
|---|---|---|---|---|
| BAC Category | Baseline (%) (n=107) | Intervention (%) (n=118) | Baseline 1 (%) (n=89) | Baseline 2 (%) (n=95) |
| < .080 | 36 | 40*** | 61 | 69*** |
| < .050 | 65 | 55*** | 81 | 81*** |

*** p < .001

Table 4

Percentage of Participants Reporting Negative Outcomes on the PPQ for Each Party

| | Fraternity 1 | | Fraternity 2 | |
|---|---|---|---|---|
| | Baseline (n=19) | Intervention (n=16) | Baseline 1 (n=27) | Baseline 2 (n=46) |
| Negative Outcome | % | % | % | % |
| Had a hangover: | 10.5 | 0 | 63.0 | 43.5 |
| Vomited: | 0 | 0 | 25.9 | 8.7 |
| Regrets something: | 5.3 | 0 | 29.6 | 13.0 |
| Experienced blackout: | 0 | 6.3 | 40.7 | 28.3 |
| Damaged property: | 0 | 6.3 | 33.3 | 21.7 |
| Got into an argument/fight: | 15.8 | 0 | 22.2 | 15.2 |
| Drove intoxicated: | 5.3 | 0 | 11.1 | 4.3 |
| Was physically injured: | 5.3 | 13.0 | 22.2 | 10.9 |
| Rode w/intoxicated driver: | 5.3 | 0 | 7.4 | 4.3 |

Table 5

The Effect of Researchers' Presence on the Drinking Behavior of Participants at Each Party, in Percent Reported

| | Fraternity 1 (n=225) | | Fraternity 2 (n=184) | |
|---|---|---|---|---|
| | Baseline | Intervention | Baseline 1 | Baseline 2 |
| Presence Effect | % | % | % | % |
| No Effect | 84.1 | 92.4 | 82.0 | 89.5 |
| Drank More | 9.3 | 5.1 | 12.4 | 10.5 |
| Drank Less | 6.5 | 3.0 | 5.6 | 0.0 |

Table 6

Answers to Items on PPQ Assessing Social Validity of Incentive/Reward Intervention

| Question | Percentage (n=16) | | | |
|---|---|---|---|---|
| Did you receive a flyer? | Yes: 31.2% | No: 68.8% | | |
| When did you learn about the raffle? | Before party: 25% | During party: 40.8% | After party: 3.9% | Never: 30.3% |
| How did you learn about the raffle? | Flyer: 19.7% | Friend: 30.3% | Researcher: 36.8% | Didn't: 28.9% |
| How did one become eligible? | Assessed: 43.3% | Below .08: 1.3% | Below .05: 14.5% | Don't know: 40.8% |
| What was the raffle prize? | Correct: 60.5% | Incorrect: 39.5% | -- | -- |
| Should raffle be used in the future? | Yes: 85.5% | No: 7.9% | -- | -- |

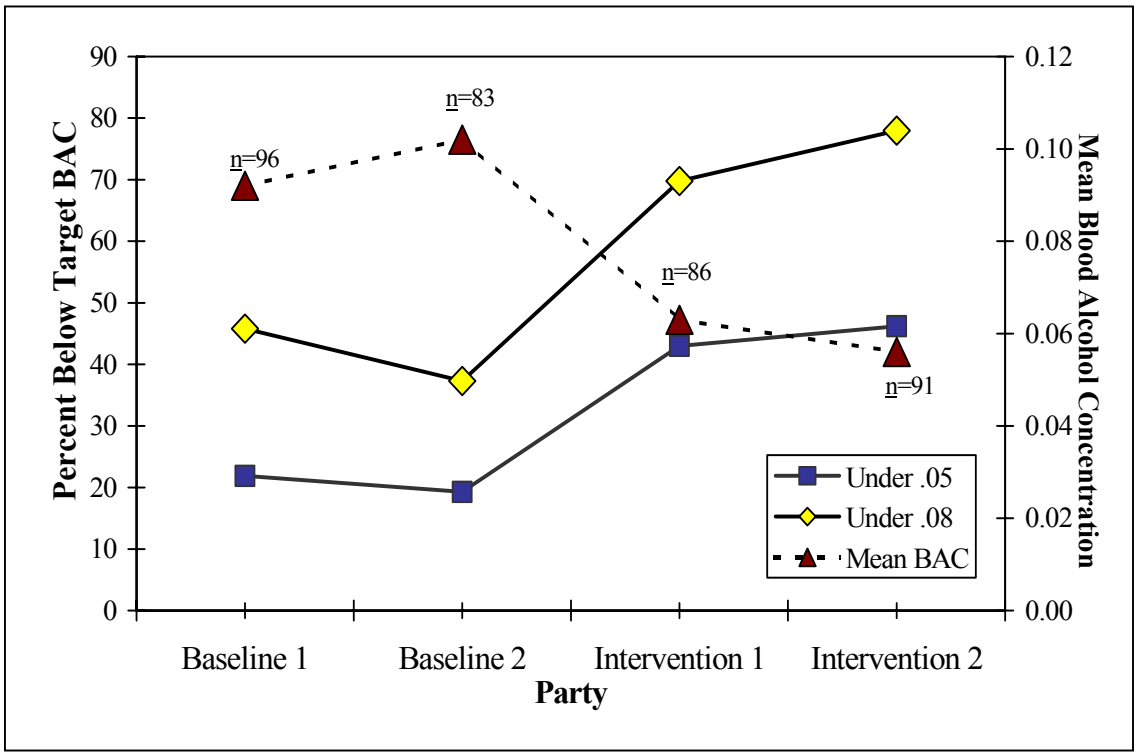


Figure 1. Mean BAC and percentage of students below criterion BACs at all four parties of the Pilot Study.

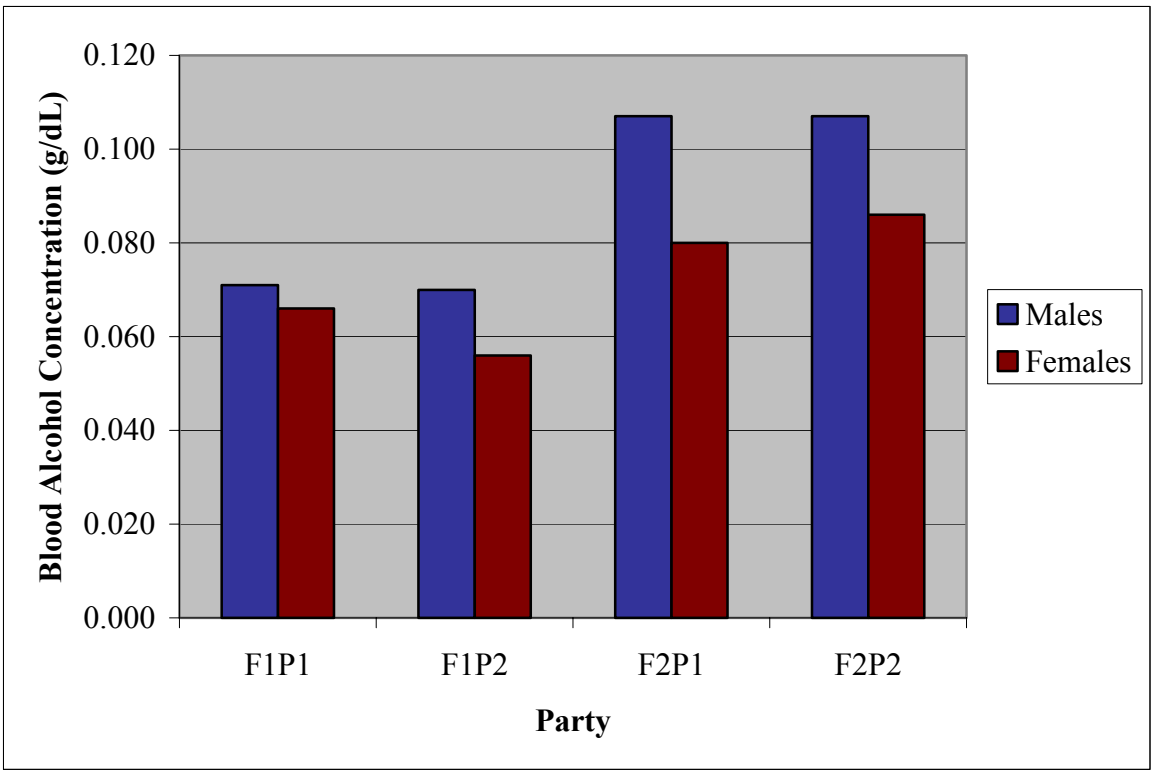


Figure 2. Mean exit BACs at each party of the study, classified by Gender. F1P1 = Fraternity 1, Party 1; F1P2 = Fraternity 1, Party 2; F2P1 = Fraternity 2, Party 1; F2P2 = Fraternity 2, Party 2.

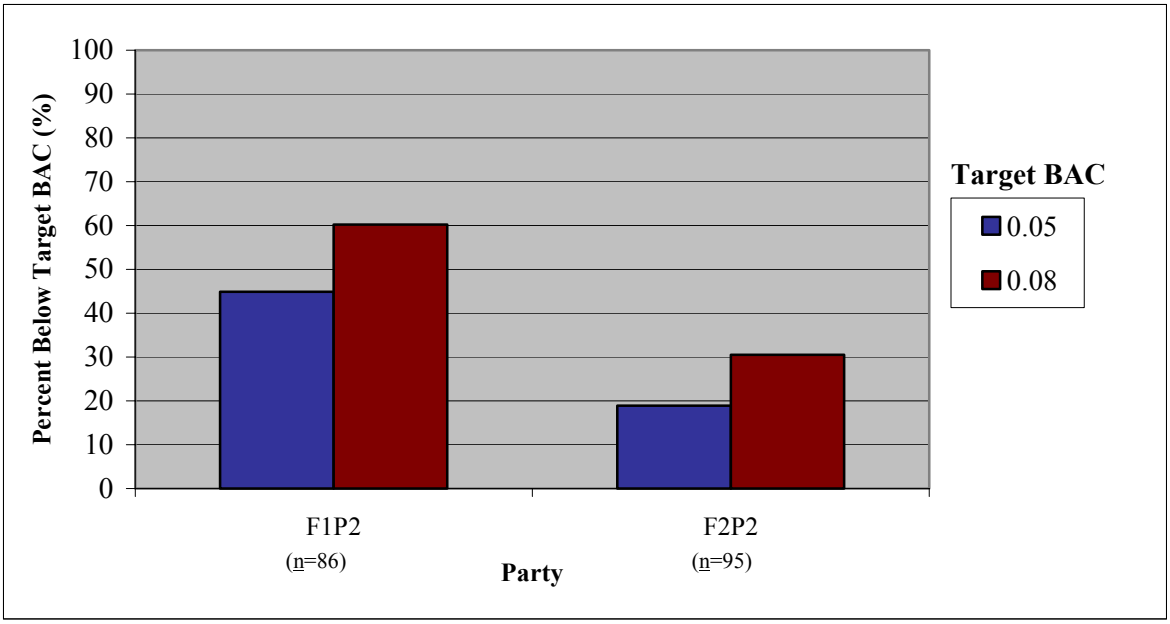


Figure 3. Percentage of participants below target BAC levels at Party 2 of each fraternity. F1P2 = Fraternity 1, Party 2; F2P2 = Fraternity 2, Party 2.

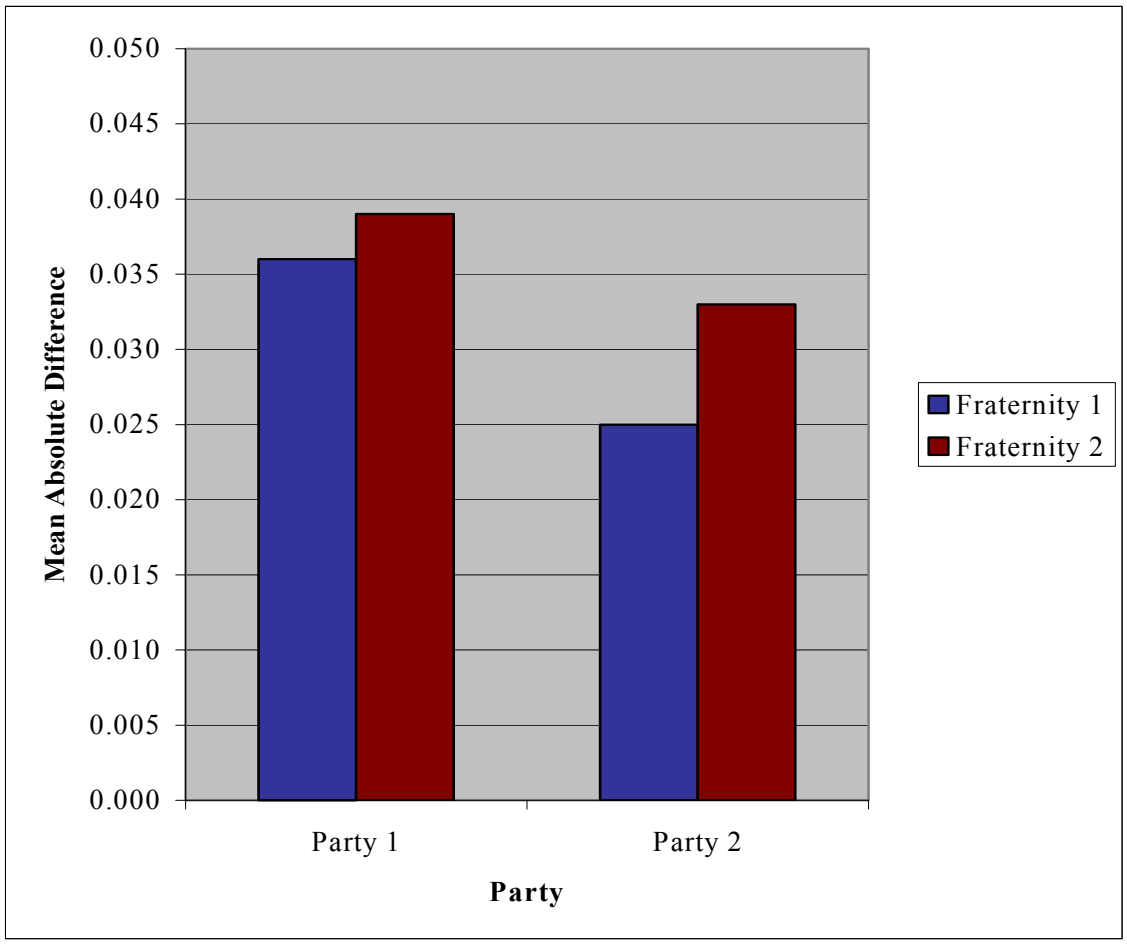


Figure 4. Mean absolute difference between actual and estimated BACs of participants at each party, classified by Fraternity.

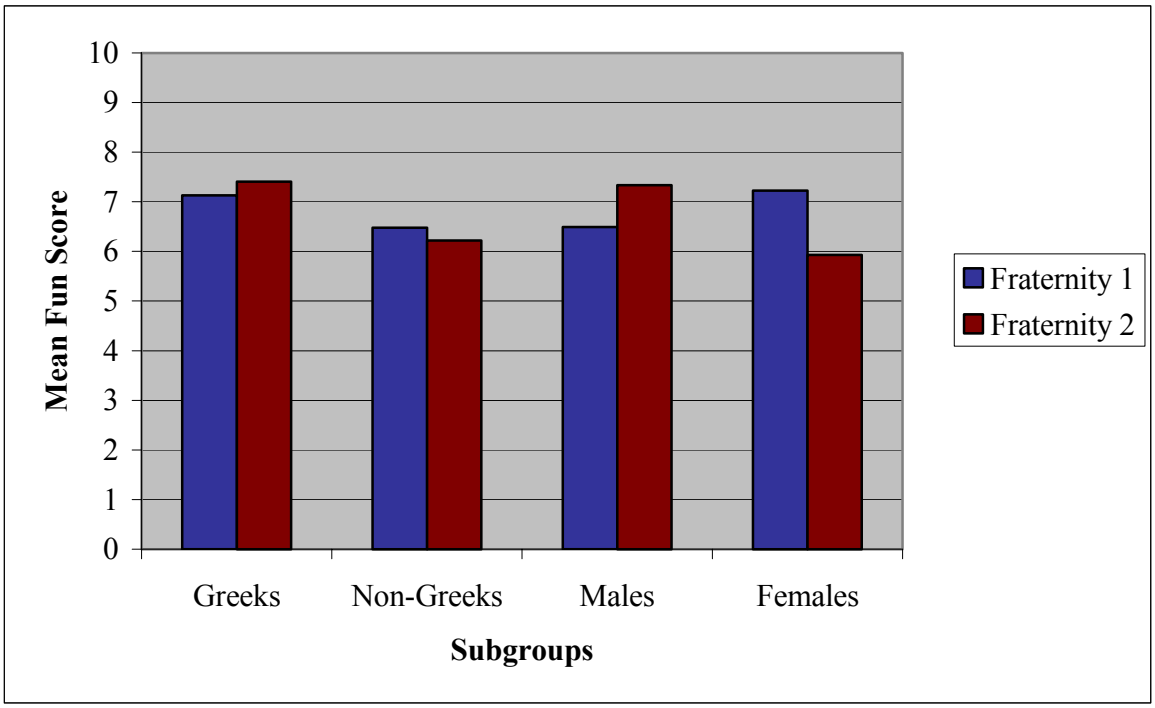


Figure 5. Mean fun score reported at Party 2 of each fraternity, classified by Greek-life status and Gender.

# Appendix A:
# Intervention Materials

**MALE** ALCOHOL IMPAIRMENT CHART

APPROXIMATE BLOOD ALCOHOL PERCENTAGE

SUBTRACT 1 DRINK FOR EVERY HOUR OF DRINKII

| | Body Weight in Pounds | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Drinks | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | |
| 0 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | ONLY SAFE DRIVING LIMIT |
| 1 | .04 | .03 | .03 | .02 | .02 | .02 | .02 | .02 | IMPAIRMENT BEGINS |
| 2 | .08 | .06 | .05 | .05 | .04 | .04 | .03 | .03 | |
| 3 | .11 | .09 | .08 | .07 | .06 | .06 | .05 | .05 | DRIVING SKILLS SIGNIFICANTLY IMPAIRED |
| 4 | .15 | .12 | .11 | .09 | .08 | .08 | .07 | .06 | |
| 5 | .19 | .16 | .13 | .12 | .11 | .09 | .09 | .08 | LEGALLY INTOXICATED |
| 6 | .23 | .19 | .16 | .14 | .13 | .11 | .10 | .09 | |
| 7 | .25 | .22 | .19 | .16 | .15 | .13 | .12 | .11 | CRIMINAL PENALTIES |
| 8 | .30 | .25 | .21 | .19 | .17 | .15 | .14 | .13 | |
| 9 | .34 | .28 | .24 | .21 | .19 | .17 | .15 | .14 | POSSIBLE DEATH @ LOW BODY WEIGHT |
| 10 | .38 | .31 | .27 | .23 | .21 | .19 | .17 | .16 | |

1 drink = 1.5 oz. 80 proof liquor, 12 oz. beer, 5 oz. table wine

Nomogram disseminated during the Intervention parties of the Pilot Study and the Intervention party of Fraternity 1.

# WIN $100 TONIGHT!

Virginia Tech Researchers will be giving free blood alcohol concentration (BAC) assessments tonight.

If you choose to participate, you will be registered in a drawing for **$100** to be given away tonight!

Flyer given to all students entering the Baseline party of Fraternity 1 and Baseline Party 2 of Fraternity 2.

# WIN $100 TONIGHT!

Virginia Tech researchers will be giving free BAC (blood alcohol concentration) assessments tonight.

If your BAC is **below .05**, you will be registered in a drawing for $100.

Here are some tips to help you keep a safe Buzz:

- Drink a glass of water between each alcohol-containing drink.
- Snack on food before and while drinking.
- Use the attached chart to estimate a safe number of drinks for your body weight.

Flyer given to all students entering the Intervention parties of the Pilot study and the Intervention party of Fraternity 1.

Appendix B:
Informed Consent Form

Appendix C:
Exit BAC Questionnaires

# EXIT DATA SHEET A

Fraternity:_____ Party: _____ Date:_____

1. What are the first two letters of the city in which you were born?
   What are the first two letters of your mother's maiden name?
   What is the number of the month in which you were born?

2. How many alcoholic drinks have you consumed at tonight's party?
   (1 drink = 12 oz. beer, 4 oz. glass of wine, 1.5 oz. of liquor, or 9 oz. wine cooler)

3. Referring to this scale, estimate your current level of intoxication.
   You can pick any number, not just those provided on the scale.

4. Estimate the average level of intoxication of other (same gender) attending tonight's party.
   You can pick any number, not just those provided on the scale.

5. Estimate the average level of intoxication of (opposite gender) attending tonight's party. You can pick any number, not just those provided on the scale.

6. Do you belong to a fraternity/sorority?

   Which Greek organization? (If they don't want to say then record "YES")

7. How would you say our presence at this party affected the amount of alcohol you consumed?
   1. Our presence had no effect on your drinking.
   2. You drank more than you normally would.
   3. You drank less than you normally would.

8. On a scale from 1 to 10, how much fun are you having at this party?
   (1 = no fun; 10 = maximum fun)

| Subj Num | Time | Gen | Self Drink | Self | Same Intox | Opp Intox | Greek Org | Pres Effect | Fun | BAC |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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EXIT DATA SHEET B

Fraternity:_____Party: _____Date:_____

1. What are the first two letters of the city in which you were born?
   What are the first two letters of your mother's maiden name?
   What is the number of the month in which you were born?

2. How many alcoholic drinks have you consumed at tonight's party?
   (1 drink = 12 oz. beer, 4 oz. glass of wine, 1.5 oz. of liquor, or 9 oz. wine cooler)
3. Referring to this scale, estimate your current level of intoxication.
   You can pick any number, not just those provided on the scale.

4. Estimate the average number of alcoholic drinks other (males/females) have consumed at tonight's party.
   (1 drink = 12 oz. beer, 4 oz. glass of wine, 1.5 oz. of liquor, or 9 oz. wine cooler)
5. Estimate the average level of intoxication of other (males/females) attending tonight's party. You can pick any number, not just those provided on the scale.

7. Do you belong to a fraternity/sorority?
8. Which Greek organization? (If they don't want to say then record "YES")

9. How would you say our presence at this party affected the amount of alcohol you consumed?
   1. Our presence had no effect on your drinking.
   2. You drank more than you normally would.
   3. You drank less than you normally would.

| Subj Num | Time | Gen | Self Drink | Self Intox | Other Drink | Other Intox | Greek Org | Pres Effect | BAC |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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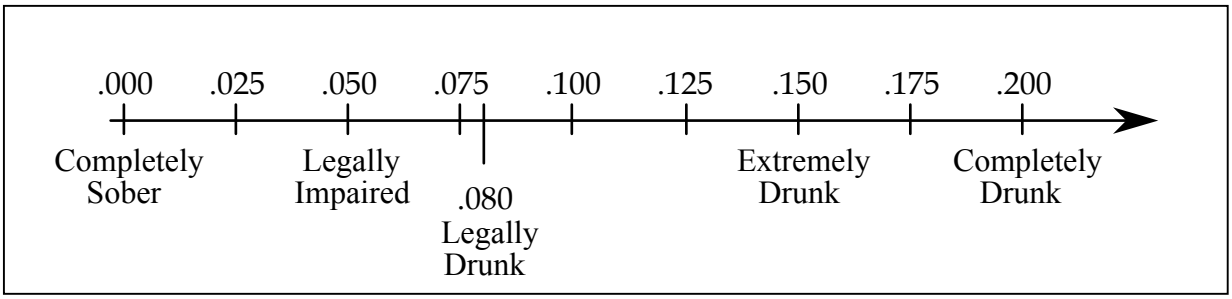


Scale students used at all parties to estimate their BAC while drinking.

Appendix D:
Post-Party Questionnaires

## Follow-up Questionnaire A

First two letters of the city in which you were born: _____

First two letters of your mother's maiden name: _____

Number of the month in which you were born: _____

Did you attend Friday's party? Yes No

1. Your AGE: _____

2. Indicate the number of drinks you consumed at Friday's party. _____
(1 drink = 12 oz. beer, 4 oz. glass of wine, 1.5 oz. liquor, or 9 oz. wine cooler)

3. On a scale from 1 to 10, how much fun did you have at Friday's party? _____
(1 = no fun; 10 = maximum fun)

### Drinking-related experiences:

The following are feelings or behaviors experienced by some people after consuming alcohol. Read each item, and indicate the degree to which you agree or disagree with each statement concerning the party.

| | Strongly Disagree | | Neutral | | Strongly Agree |
|---|---|---|---|---|---|
| 4. I reduced my level of tension and stress as a result of drinking | 1 | 2 | 3 | 4 | 5 |
| 5. I was more outgoing and social as a result of drinking. | 1 | 2 | 3 | 4 | 5 |
| 6. I increased my fun and enjoyment as a result of drinking. | 1 | 2 | 3 | 4 | 5 |
| 7. I felt sexier and more romantic as a result of drinking. | 1 | 2 | 3 | 4 | 5 |

The following items are experiences some people have as a result of consuming alcohol. Read each item, and then indicate which of the following you experienced as a result of consuming alcohol at the party.

| | | |
|---|---|---|
| 8. I had a hangover. | Yes | No |
| 9. I vomited. | Yes | No |
| 10. I did something I now regret. | Yes | No |
| 11. I had a memory loss (blackout) concerning part of the evening. | Yes | No |
| 12. I damaged property or got into other mischief. | Yes | No |
| 13. I got in an argument or fight. | Yes | No |
| 14. I drove a car under the influence of alcohol. | Yes | No |
| 15. I got hurt or injured. | Yes | No |
| 16. I got a ride from someone who was under the influence of alcohol. | Yes | No |

## The day after:

Read each of the following activities and indicate which ones you did the day after the party.

| | Strongly Disagree | | Neutral | | Strongly Agree | |
|---|---|---|---|---|---|---|
| 17. I completed all homework that needed to be done. | 1 | 2 | 3 | 4 | 5 | N/A |
| 18. I made all my scheduled appointments on time. | 1 | 2 | 3 | 4 | 5 | N/A |
| 19. I completed all of the housework I intended to do (i.e., cleaning, laundry). | 1 | 2 | 3 | 4 | 5 | N/A |
| 20. I woke up feeling good. | 1 | 2 | 3 | 4 | 5 | N/A |
| 21. I remembered everything I did at Friday's party. | 1 | 2 | 3 | 4 | 5 | N/A |

## Prize Drawing:

Please circle Yes or No for each of the below items regarding the prize drawing at Friday's party.

22. Did you receive a flyer about the raffle? Yes No

23. When did you first learn about the raffle? **(circle letter)**
    a. before the party
    b. during the party
    c. after the party
    d. never heard of the raffle

24. How did you learn about the raffle? **(check all that apply)**
    ___ flyer / at door
    ___ fraternity brother / friend
    ___ researcher
    ___ other: _____
    ___ didn't learn about the raffle

25. How did one become eligible for the raffle? **(circle letter)**
    a. Have BAC assessed
    b. BAC assessed-was below **.08**
    c. BAC assessed-was below **.05**
    d. BAC assessed-was below **.03**
    e. Don't know

26. What was the raffle prize? _____

27. Should this raffle be used at future parties? Yes No

F

## Follow-up Questionnaire B

First two letters of the city in which you were born: _____.

First two letters of your mother's maiden name: _____.

Number of the month in which you were born: _____.

Did you attend Friday's party? Yes No
(circle response)

1. Your AGE: _____

**** If you did not consume alcohol on Friday then skip to Question 16 on top of next page.**

2. Indicate the number of drinks you consumed at Fridays party.
(1 drink = 12 oz. beer, 4 oz. glass of wine, 1.5 oz. of liquor, or 9 oz. wine cooler). _____

### PART I: Drinking-Related Experiences:

The following are feelings or behaviors experienced by some people after consuming alcohol. Read each item, and indicate the degree to which you agree or disagree with each statement concerning Fridays party.

| | Strongly Disagree | | Neutral | | Strongly Agree |
|---|---|---|---|---|---|
| 3. I reduced my level of tension and stress as a result of drinking. | 1 | 2 | 3 | 4 | 5 |
| 4. I was more outgoing and social as a result of drinking. | 1 | 2 | 3 | 4 | 5 |
| 5. I increase my fun and enjoyment as a result of drinking. | 1 | 2 | 3 | 4 | 5 |
| 6. I felt sexier and more romantic as a result of drinking. | 1 | 2 | 3 | 4 | 5 |

The following items are experiences some people have as a result of consuming alcohol. Read each item, and then indicate which of the following you experienced as a result of consuming alcohol at Fridays party.

| | | |
|---|---|---|
| 7. I had a hangover. | Yes | No |
| 8. I vomited. | Yes | No |
| 9. I did something that I now regret. | Yes | No |
| 10. I had a memory loss (blackout) concerning part of the evening. | Yes | No |
| 11. I damaged property or got into other mischief. | Yes | No |
| 12. I got in an argument or fight. | Yes | No |
| 13. I drove a car under the influence of alcohol. | Yes | No |
| 14. I got hurt or injured. | Yes | No |
| 15. I got a ride from someone who was under the influence of alcohol. | Yes | No |

F

**** If you did not attend the party on Friday night STOP here.**

## PART II: Personal Party Behaviors:

The following items are behaviors that some people do at parties. Read each item, and then indicate which things you did at Fridays party.

| | | |
|---|---|---|
| 16. I played drinking games. | Yes | No |
| 17. I encouraged a friend or fraternity brother to get drunk. | Yes | No |
| 18. I looked out for a friend or fraternity brother who was drinking. | Yes | No |
| 19. I got a friend or fraternity brother a drink they indicated they did not want. | Yes | No |
| 20. I chugged or funneled drinks. | Yes | No |
| 21. I encouraged a friend or fraternity brother to play drinking games. | Yes | No |
| 22. I let a friend or fraternity brother drink and drive. | Yes | No |
| 23. I kept a friend's or fraternity brother's glass full. | Yes | No |
| 24. I drank quickly to feel the effects of alcohol. | Yes | No |
| 25. I encouraged a friend or fraternity brother to drink quickly. | Yes | No |
| 26. I made sure an intoxicated friend or fraternity brother got home safely. | Yes | No |
| 27. I got a friend or fraternity brother a drink without asking if they needed one. | Yes | No |
| 28. I drank with the goal of getting intoxicated. | Yes | No |
| 29. I encouraged a friend or fraternity brother to chug or funnel drinks. | Yes | No |
| 30. I told a friend or fraternity brother I thought they were drinking too much. | Yes | No |
| 31. I offered a friend or fraternity brother a shot. | Yes | No |
| 32. I cut off someone who had too much to drink. | Yes | No |

F

**PART IV: Fraternity Brother's Alcohol-Related Outcomes:**

The following items are experiences some people have as a result of consuming alcohol. Read each item, and then estimate the percentage of fraternity brothers who experienced each of the following as a result of their alcohol consumption at Fridays party.

33. Had a hangover. _____%

34. Vomited. _____%

35. Did something they now regret. _____%

36. Had a memory loss (blackout) for part of the evening. _____%

37. Damaged property or got into other mischief. _____%

38. Got in an argument or fight. _____%

39. Drove a car under the influence of alcohol. _____%

40. Got hurt or injured. _____%

41. Got a ride from someone who was under the influence of alcohol. _____%

F

## PART V: Fraternity Brother's Party Behaviors:

The following items are behaviors that some people do at parties or experience as a result of drinking. Read each item, and then estimate the percentage of fraternity brothers who did each of the following at Fridays party.

42. Played drinking games. _____%

43. Encouraged a friend or fraternity brother to get drunk. _____%

44. Looked out for a friend or fraternity brother who was drinking. _____%

45. Got a friend or fraternity brother a drink they indicated they did not want. _____%

46. Chugged or funneled drinks. _____%

47. Encouraged a friend or fraternity brother to play drinking games. _____%

48. Let a friend or fraternity brother drink and drive. _____%

49. Kept a friend's or fraternity brother's glass full. _____%

50. Drank quickly to feel the effects of alcohol. _____%

51. Encouraged a friend or fraternity brother to drink quickly. _____%

52. Made sure an intoxicated friend or fraternity brother got home safely. _____%

53. Got a friend or fraternity brother a drink without asking if they needed one. _____%

54. Drank with the goal of getting intoxicated. _____%

55. Encouraged a friend or fraternity brother to chug or funnel drinks. _____%

56. Told a friend or fraternity brother I thought they were drinking too much. _____%

57. Offered a friend or fraternity brother a shot. _____%

58. Cut off someone who had too much to drink. _____%

Appendix E:
Curriculum Vitae

Vita

# Angela Krom Fournier

665 Ellett Rd
Christiansburg, VA 24073
(540) 381-8917 / akrom@vt.edu

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**EDUCATION:**

| | |
|---|---|
| B.S. (May 2000) | Psychology<br>Christopher Newport University<br>Psych GPA: 3.88<br>Cumulative GPA: 3.60 |
| M.S. (expected May 2002) | Clinical Psychology<br>Virginia Polytechnic Ins. and State Univ.<br>Cumulative GPA: 3.66 |

**PROFESSIONAL EXPERIENCE:**

**Graduate Research Assistant** for Center for Applied Behavior Systems (CABS), Virginia Polytechnic Institute and State University, Blacksburg, VA. Duties include: Research planning, writing research protocols, organizing data collection, entry, and verification, data analysis, and leading undergraduate research assistants. August 2000 to present (Contact person: Dr. E. Scott Geller).

**Graduate Teaching Assistant** for Psychological Services Center, Virginia Polytechnic Institute and State University, Blacksburg, VA. Duties include: co-facilitating psychoeducational skills group for individuals with dually-diagnosed Axis I and Substance Use disorders, assessing potential group members through administration of psychological tests and clinical interviewing, writing comprehensive psychological reports, and reviewing client charts. August 2001 to present (Contact person: Dr. Lee D. Cooper).

**Graduate Teaching Assistant** for Department of Psychology, Virginia Polytechnic Institute and State University, Blacksburg, VA. Duties include: instructing Introductory Psychology students in a recitation section with tasks such as creating and grading assignments, lecturing, and facilitating discussion on material. August 2000 to May 2001 (Contact person: Dr. Jack W. Finney).

**Graduate Clinician** for Psychological Services Center, Virginia Polytechnic Institute and State University, Blacksburg, VA. Duties include evaluation, assessment, and treatment of adults and children in the community. Assessment includes administering and interpreting intellectual and personality measures and diagnostic measures as well as comprehensive report writing. August 2000 to present (Contact person: Dr. Lee D. Cooper).

**Research Project Leader** for Science of Psychology: Analysis, Research, and Cogitation Laboratory (SPARC), Christopher Newport University, Newport News, VA. Duties included: Research planning, writing research protocols, training research assistants, creating databases, supervising research assistants, and analyzing data for fast-food hand washing study and cafeteria study; data collection and analysis for two hand washing studies; and preparing papers for publication and conference submission. September 1999 August 2000 (Contact person: Dr. Thomas D. Berry).

**Research Assistant** for Science of Psychology: Analysis, Research, and Cogitation Laboratory (SPARC), Christopher Newport University, Newport News, VA. Duties include: supervising the library research, data collection, and data entry for hand washing study; collecting and entering data for safe sex study and traffic safety study; and attended weekly meetings. September 1998 to 1999 (Contact person: Dr. Thomas D. Berry).

**Research Assistant** for Psychological Research Laboratory, Old Dominion University, Norfolk, VA. Duties included: data collection and surveillance of traffic safety behaviors, specifically red light running. January 1999 to March 1999 (Contact person: Dr. Bryan E. Porter).

**Relief Staff** for Sarah Bonwell Hudgins of ARC Peninsula, Hampton, VA. Duties included: assistance with daily living skills, behavior modification implementation, documentation of behavior and mental and physical health. (August 1998 to November 1998).

**Direct Care Staff** for REM North Dakota, Grand Forks, ND. Duties included: assistance with daily living skills, administration of medication, behavioral intervention program implementation, attending psychological appointments and reporting and documenting behavior and mental and physical health of developmentally disabled individuals with mental illness. May 1996 to February 1998 (Contact person: Terri Deuschel, Residential Home Manager).

**PROFESSIONAL MEMBERSHIPS:**

American Psychological Association
Virginia Academy of Science
Eastern Psychological Association
Psi Chi
Applied Behavior Analysts
Virginia Psychological Association

**PUBLICATIONS:**

Krom, A. K., & Geller, E. S. (in press). Dummies change the driving behavior of a college town. Behavior Analysis Digest.

Berry, T. D, Krom, A. M., & Porter, B. E. (2000). Exploring restroom designs and appliances of fast-food restaurants as vehicles for pathogen risk and hand-touch hygiene. Manuscript submitted for publication.

Berry, T. D., Krom, A. M., Porter, B. E., & Rose, M. (2000). Analysis of interventions to increase hand washing and hand hygiene behaviors of university students. Manuscript submitted for publication.

**PUBLISHED ABSTRACTS**

Krom, A. M., Tanner, T. N., Cincotta, A. L., & Sewell, H. (2001). A behavioral analysis of red-light running and safety-belt use in a college town. A paper presented to the Eastern Psychological Association, Washington, DC.

Krom, A. M., Berry, T. D., Edwards, S. L., & Savage, L. (2000). An ecological analysis of "fast food restaurant" restroom designs as influencing hand washing behavior and the spread of disease. A poster presented to the Eastern Psychological Association, Baltimore, MD.

Tanner, T. N., Sewell, H., Cincotta, A. L., Krom, A. M., & Geller, E. S. (2001). Effect of gender on risky driving. A poster to be presented to Eastern Psychological Association, Washington, DC.

Rose, M., Newlon, M., Tarmy, G., Metts, L., Savage, L., Krom, A. M., & Berry, T. D. (2001). Survey of hand washing behaviors and hygiene habits of university students. A poster presented to the Eastern Psychological Association, Washington, DC.

**PROFESSIONAL PAPERS AND PRESENTATIONS:**

Fournier, A. K., Glindemann, K. E., Geller, E. S., & Lea, B. L. (2001). An incentive/reward intervention that decreased levels of intoxication at fraternity parties. A paper presented to the Virginia Psychological Association, Richmond, VA.

Fournier, A. K., Glindemann, K. E., & Geller, E. S. (2001). An incentive/reward intervention at fraternity parties: Implications for the theory of planned behavior. A paper presented to the Department of Education's Annual Meeting for the Prevention of Alcohol, Drug, and Violence in Higher Education, Washington, D.C.

Krom, A. M., Cincotta, A. L., Tanner, T. N., & Sewell, H. (2001). Red-light running behavior and safety-belt use: Daytime versus nighttime. A paper to be presented to Applied Behavior Analysts, New Orleans, LA.

Krom, A. M., Rose, M., Tarmy, G., Metts, L., & Savage, L. (2000) An intervention to increase the hand hygiene behavior of university students. A poster presented to the Virginia Academy of Science, Radford, VA.

Krom, A. M., Savage, L., Edwards, S., Tyree, S., Marshall, T., & Berry, T. D., (1999). An ecological analysis of restroom designs as influencing hand washing behavior and the spread of infectious disease. A poster presented to Virginia Academy of Science, Norfolk, VA.

Krom, A. M., Edwards, S. L., Savage, L., & Tyree, S. D., (1999). A preliminary analysis of restroom designs as influencing hand washing behavior and the spread of disease. A poster presented in the Annual Samuel Bauer Poster Contest, Christopher Newport University, VA.

Singleton, S., Krom, A. M., Edwards, S., Savage, L., Cartwright, K. B., & Berry, T. D., (1999). A context analysis of answering safe sex questions: Comparing mailed in surveys to surveys answered at bars and clubs. A poster presented to Virginia Academy of Science, Norfolk, VA.

Edwards, S., Krom, A. M., Savage, L., Tyree, S. D., Berry, T. D., & Cartwright, K. B., (1999). Birth order influences on sex attitudes and intentions to use condoms for university students. A poster presented to Virginia Academy of Science, Norfolk, VA.

Berry, T. D., Porter, B. E., Cawthorn, J., & Krom, A. M., (1999). Survey of driver safety abilities, attitudes, habits, and perceptions: Implications for community and safety psychology. A poster presented to Eastern Psychological Association, Boston, MA.

**COMPUTER SKILLS:**

Working knowledge of:

SPSS
QSTAT
SAS
Microsoft Excel
Microsoft Power Point
Microsoft Word
Claris Works

**PROFESSIONAL KNOWLEDGE, SKILLS & ABILITIES:**

Research Leadership: Writing Protocols, Research Planning, Training Staff

Research Implementation: Protocol Execution, Data Collection

Research Analysis: Data Entry, Data Verification, Data Analysis

Literature Review: Library Research, Internet Research

Surgical Stereotaxic Procedure

Psychological Test Evaluation and Assessment

Classroom Instruction: Lesson Planning, Lecturing, Grading Assignments, Leading Discussion

Intellectual Assessment: Administering, Scoring, Interpreting, and Reporting on Wechsler Intelligence Scale for Children, Third Edition (WISCC-III), Wechsler Adult Intelligence Scale, Third Edition (WAIS-III),Wechsler Memory Scale-Third Edition (WMS-III), and Woodcock-Johnson Achievement Test, Third Edition (WJ-III)

Personality Assessment: Administering, Interpreting, and Reporting on MCMI-III and MMPI-2, as well as etiological measures

Clinical Interviewing: Administering and Interpreting the SCID-I

Psychological Testing: Administering, scoring and interpreting the measures listed below:

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| Structured Clinical Interview for DSM-IV Axis I Disorders | SCID-I |
| Symptom Checklist 90-Revised | SCL-90-R |
| Mental Status Exam | MSE |

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| Michigan Alcohol Screening Test | MAST |
| Drug Abuse Screening Test | DAST |
| Inventory of Drug/Alcohol Taking Situations | IDS |
| Situational Confidence Questionnaire | SCQ |
| State Trait Anger Inventory-2 | STAXI-2 |
| Social Problem Solving Inventory-Revised | SPSI-R |
| Slossen Oral Reading Test-Revised | SORT-R |
| Conners' Adult ADHD Rating Scale-Self | CAARS-S |
| Conners' Adult ADHD Rating Scale-Other | CAARS-O |
| Conners' Continuous Performance Test II | CPT-II |
| Paced Auditory Serial Attention Test | PASAT |
| Symptom Checklist 90, Revised | SCL-90-R |
| Retrospective Structured Clinical Interview | RSCI |
| Wender Utah Rating Scale-Self | WURS-S |
| Wender Parents' Rating Scale | WPRS |