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# Contingency management and alcohol abuse

Amanda D. Walker

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# Contingency Management and Alcohol Abuse

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An Honors Program Project Presented to  
the Faculty of the Undergraduate  
College of Health and Behavioral Studies  
James Madison University

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by Amanda Walker

May 2015

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Accepted by the faculty of the Department of Psychology, James Madison University, in partial fulfillment of the requirements for the Honors Program.

FACULTY COMMITTEE:

HONORS PROGRAM APPROVAL:

---

Project Advisor: Daniel D. Holt, Ph.D.  
Assistant Professor, Psychology

---

Philip Frana, Ph.D.,  
Interim Director, Honors Program

---

Reader: Bryan Saville, Ph.D.  
Associate Professor, Psychology

---

Reader: Monica Reis-Bergan, Ph.D.  
Professor and Assistant Department Head,  
Psychology

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PUBLIC PRESENTATION

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## **Dedication**

This paper is dedicated to Jonny Novgrod, a wonderful mentor and friend. Thank you for your constant support and wonderful, welcoming attitude. You will be missed.

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Special thanks to Dan Holt, for all his help and patience as my thesis advisor. Thank you also to Monica Reis-Bergan and Bryan Saville for serving on my thesis committee. Lastly, thank you to the honors program for this opportunity.

## **Abstract**

This paper explores a substance abuse intervention strategy known as contingency management (CM), which has been shown to be effective in a variety of contexts (Prendergast, 2006).

Specifically, it identifies the minimum hypothetical amount of money participants might be willing to exchange for their abstinence from alcohol on a given day of the week. The

hypothetical amounts of money were identified using the Walker Alcohol Contingency Test

(WACT), and participants' risk level for alcohol consumption was identified using the Alcohol Use Disorders Identification Test (AUDIT), which grouped participants into one of three

categories. Additional information such as year in school and gender were included in order to

isolate factors that contribute to their differences in monetary amounts. Results showed that

participants identified by the AUDIT as high-risk for alcohol abuse problems required more

money overall than did lower-risk groups. This research can help to inform enactments of CM in

the future by providing a framework to determine how much money should be used, which

participants require more money, and on what days.

## **Introduction**

In 1984, the United States Congress passed the National Minimum Purchase Act, which encouraged each state to institute a minimum legal drinking age of 21. This act has helped reduce the number of alcohol-related deaths; the National Highway and Traffic Institute calculated that that age-21 policies prevented 846 deaths in 1997 and 17,359 total deaths since 1975 (Wagenaar & Toomey, 2002). Although the National Minimum Purchase Act has made a significant impact on traffic fatalities, drinking on college campuses continues to be problematic, specifically binge drinking among underage students (Wechsler, Dowdall, Davenport, & Rimm, 1995). Despite college administrators' multiple approaches to curb student alcohol abuse, this continues to be a glaring problem that results in negative consequences for the abusers, their peers, and the surrounding communities.

According to Wechsler et al. (1995), although underage college drinkers do not drink as often as their "of age" peers, when they do drink, they are more likely to binge drink (sometimes referred to as episodic drinking). In 1993, The Harvard School of Public Health College Alcohol Study (CAS) defined binge drinking as at least five consecutive drinks for men and four consecutive drinks for women on a single occasion within a two week time period. The difference in amount for women is based on their lower rate of gastric metabolism for alcohol, which leads to higher blood alcohol levels (BAC) compared with men for the same quantity of alcohol consumed (Wechsler et al., 1995). The 5/4 definition is consistent with findings that after consumption of this amount or more, individuals are at greater risk for exhibiting serious alcohol-related problems (e.g., vandalism, fights, injuries, drunk driving, trouble with police, etc.) and subsequent negative health, social, economic, or legal consequences (Wechsler, Lee, Kuo, & Lee, 2000). While people experience the effects of alcohol in all different stages of life, college is a time in a person's life when alcohol abuse is particularly prevalent.

Croom et al. (2009) found that adolescence is a critical period during which prolonged exposure to alcohol can have lasting effects on brain development and cognitive functioning. Further, people are more susceptible to substance abuse during developmental milestones such as college. Such substance abuse has the potential to impact the remodeling of neurons that typically occurs in young adults in their late teens and early twenties (Croom et al, 2009). Weissenbom and Duka (2003) performed a study where they administered alcohol to college age social drinkers. They found that high-risk drinkers had impairments in pattern and spatial recognition in comparison with non-binge drinkers, despite the fact that both groups were administered the same amount of alcohol. These results illustrate that prolonged exposure to alcohol can negatively affect a person long-term.

### **Prevalence**

In 1992, the Harvard School of Public Health began its CAS. Over the course of 14 years, they surveyed a national representative sample of college students at 4-year universities. More than 50,000 students at 120 colleges participated in the study. The four CAS study results were published in 1994, 1998, 2000, and 2002. Wechsler et al. (2002) compared the 2002 CAS results with the results from the three previous years to determine how they differed. They specifically selected the 2002 results because they felt that in the past few years, there had been an increased emphasis by schools and universities on preventing alcohol abuse. As a result, they wanted to know how this change affected the behavior of the student population. Wechsler et al. (2002) found that the overall rate of binge drinking had slightly increased. They also found that there was increased polarization regarding alcohol in college communities such that a higher amount of people reported that they binge drink and a higher amount of people also report that they abstain from alcohol.



Another notable difference in the 2002 results is that participants were more likely to report that their school provided some form of alcohol education. Moreover, Wechsler and Nelson (2008) reported that 48% of college students in their sample felt that getting drunk was an important reason for drinking and that 1 in 4 drank alcohol 10 or more times in a month. Results from Barnett et al. (2013) showed that 94% of students reported having a good time after drinking, but 57% of the same sample reported getting physically sick after drinking and 54% experienced memory loss.

### **Predictors**

Barnett et al. (2013) did a study that examined how various individual and contextual factors contributed to positive and negative drinking outcomes. They found that men typically experience negative outcomes of drinking in a more public way in the form of physical altercations or encounters with the police. Women, on the other hand, are just as likely to report negative consequences of drinking behavior. However, these consequences tend to be more internal. For example, a woman might feel regret or shame about her actions or interactions with others from a night of drinking long after that night has passed. Barnett et al. (2013) explained that, statistically, men are often reported as having more negative consequences of alcohol than women. They explain that this may be due to the fact that women tend to face more internal, less obvious consequences such as regret or shame. In addition, Lev-Ran, Strat, Imtiaz, Rehm, and Foll (2013) demonstrated that particularly with long-term exposure, males had a significantly higher prevalence of alcohol, sedatives, cannabis, tranquilizers, opioids, hallucinogens, and cocaine use disorders compared with females.

The time of year also relates to drinking outcomes. The beginning of each semester, when the workload is low, tends to be a heavier binge drinking time; in addition, freshman in their very first semester tend to drink the most relative to all other semesters (Barnett et al., 2013). In addition, 75% of students' drinking behaviors are likely to occur on Thursdays, Fridays, and Saturdays. This phenomenon is particularly notable for freshmen, who tend to drink very little during the week and then binge drink on the weekends (Borsari, Murphy, & Barnett, 2007).

Borsari et al. (2007) also reported that Greek membership and participation in drinking games increased the likelihood of alcohol abuse in students. While Greek membership can provide some students with a sense of belonging and camaraderie, it also provides students with more opportunities to drink and increased pressure to drink in order to fit in. In addition, the competitive nature of drinking games encourage students to drink large amounts of alcohol in a short period of time in order to look good in front of their peers. Such binge drinking behaviors have the potential to lead to a long list of negative consequences (Barnett et al., 2013). Often, Greek membership and drinking games go hand and hand, which exacerbates this problem.

### **Intervention strategies**

Underage binge drinking and the problems associated with it have continued to be a health and safety concern on college campuses and their surrounding communities for decades, despite national attention. Multiple prevention and treatment measures have been attempted to remedy this problem. These include alcohol education, alcohol control policies, social norms campaigns, community-based interventions, and contingency management.

**Alcohol education.** According to a study conducted by Nelson, Toomey, and Lenk (2010), the most popular prevention method is alcohol education, with 98% of colleges using

alcohol education programs as their primary alcohol abuse intervention strategy. These education programs inform students about the potential negative consequences that may be realized by engaging in drinking and driving, alcohol abuse, or dependence. With this program, university educators assume that students are ignorant about the potential results of binge drinking behavior, so they hold talks or make pamphlets to illustrate to students all of the potential negative consequences of alcohol abuse. The goal of alcohol education programs is to inform students of the many aspects of life that can be ruined by alcohol abuse, such as social life, academic standing, and mental health. Alcohol education's effectiveness as a deterrent is challenged by many underage college students' feelings of indestructibility and overshadowed by their desire to drink (Nelson et al., 2010). In fact, Paek and Hove (2012) found that schools that used alcohol education as their primary method of abuse prevention were associated with higher student drinking levels. Perkins (2002) also noted that because many alcohol education programs are voluntary, often the most problematic students in need of help are not reached because they are less likely to self-select themselves as needing an alcohol intervention.

Croom et al. (2009) assessed the effectiveness of an online intervention tool called AlcoholEdu. In this day of technology, Croom et al. assumed that students might be reached more effectively through the Internet. AlcoholEdu consisted of a survey about alcohol knowledge, drinking behavior, attitudes, and demographics. An interactive online alcohol education program followed the survey portion. Croom et al. found that the intervention group had superior knowledge about alcohol in comparison with the control group. However, predictors of alcohol abuse such as protective behavior, risk related behavior, and high risk of binge drinking did not differ between the control group and the intervention group. The only significant difference caused by the intervention was a reduction of participation in drinking

games. Additionally, Croom et al. found that there was a higher likelihood of unsafe sex practices in the intervention group. As a result, AlcoholEdu seems to be ineffective on its own; however, it may be a useful intervention tool in combination with something else in the future.

**Alcohol control policies.** Alcohol control policies are found on every campus in the form of law enforcement. As a result, alcohol education is frequently combined with control policies. According to Kuo, Wechsler, Greenberg, and Lee (2003), college campuses also use alcohol control policies such as campus enforcement strategies and proof-of-age identification requirements in an effort to enforce the drinking age and cut down on binge drinking. For example, underage students who are caught drinking may have to spend a night in jail or do community service. In extreme cases, students may be dismissed from the university. Though proof-of-age identification requirements can serve as a deterrent from buying alcohol for some, many underage students simply acquire fake identification or have older students buy alcohol for them. Kuo et al. (2003) hypothesized that stricter enforcement policies would be positively correlated with lower levels of binge drinking. Although Kuo et al. found a correlation, it was not significant.

Chaloupka and Wechsler (1996) recommended that students may be less likely to binge drink if the probability of getting arrested is raised, the standards for arrest and conviction are lowered, and the punishment for driving under the influence is made more severe. However, women were less responsive to increases in alcohol price or drunk driving state policy laws in comparison to men. As such, they did not believe these changes would lower binge drinking in women as significantly as in men. Similarly, Wechsler, Lee, Nelson, and Lee (2003) found that areas with stringent restrictions on underage drinking, high volume consumption, sales of alcoholic drinks, and drunk driving laws had less instances of drinking and driving.

**Social norms campaigns.** Researchers have considered a few alternative approaches to alcohol education, as well. For example, the goal of a social norms campaign is to inform students of how much alcohol their peers actually consume, based on the assumption that most students overestimate this number (Paek & Hove, 2012). This message is delivered similar to alcohol education, using talks, pamphlets, or flyers. Because negative drinking tends to get plenty of attention, this can lead to the erroneous overestimation of alcohol consumption on college campuses. Social norms campaigns maintain that the majority of college students do not use and abuse alcohol and other drugs and that this is a message that needs to be promoted.

Paek and Hove (2012) showed that descriptive norms, which simply seek to describe behavior, were not significantly related to changes in alcohol consumption; however, injunctive norms, which seek to reveal attitudes about behavior, had a small effect on students' drinking behavior. Specifically, the more students thought that college students disapproved of drinking, the less likely students were to report that they drank. An additional study by Perkins (2002) found that educating a group of students about misperceived drinking norms was more effective at decreasing binge drinking behaviors after a 6-month follow-up than educating a group of students about safe drinking behaviors. Talbott, Wilkinson, Moore, and Usdan (2014) also examined the relationship between alcohol consumption and injunctive norms and found that injunctive norms were a significant predictor of drinking and amount of drinks, such that most people attempted to conform to the norm as closely as possible.

**Community-based interventions.** A study by Hingson and Howland (2002) found that community-based interventions used on different populations with a variety of addictive behaviors, such as alcohol free events in the community and on campus, were effective in causing behavior change. This research stated that the success of community interventions was

likely due to the reinforcing effects of peer interaction and support. In addition, the emphasis on community ownership and involvement likely contributed to the success of this intervention. Hingson and Howland (2002) also suggested that adolescents or college-age adults might be ideal participants for a community intervention, because they are still forming their perspectives and lifestyles. On the other hand, middle-aged adults were not as receptive to community interventions. They speculated that older adults may be more set in their ways and thus less likely to change. These researchers also stressed that a community intervention in combination with another intervention would likely be most effective.

Another effective community intervention model was the Sonagachi Project (Jana, Basu, Rotheram-Borus, & Newman, 2004). This project was designed to lower HIV rates in sex workers in India. Jana et al. (2004) used a multidimensional approach to address the community, and identify four key factors of the intervention. These are having a high-status advocate, addressing environmental barriers and resources, considering group factors such as changing social relationships, and individual factors such as skills and capabilities related to HIV prevention and treatment. According to Jana et al. (2004), such factors were proven to be effective in lowering HIV rates. Though this intervention is targeted towards a problem other than alcohol abuse, a similar framework from this study could be applied to an alcohol abuse community intervention.

**Contingency management.** All of the aforementioned interventions have been previously attempted by colleges and universities across the nation. Contingency management (CM), however, is a possible intervention that has not been as widely attempted at universities. This type of intervention involves offering a reinforcer in exchange for performed a specified behavior. According to Petry (2000), there are three basic tenets of a contingency management

(CM) program. First, the environment must be arranged so that a target behavior (e.g. alcohol abstinence) can be observed and measured. Next, a tangible reinforcer must be provided to the participant when the target behavior is demonstrated. Last, the reinforcer is withheld when the target behavior is not demonstrated.

Petry, Martin, Cooney, and Kranzler (2000) found that CM was an effective method to reduce alcohol dependence in 42 male veterans. Petry et al. used CM in their study by entering participants into a raffle bowl every time they had abstained from alcohol, which they confirmed through urinalysis. Petry et al. (2000) determined that another positive of a CM program is its client retention. They found that only 22% of alcohol-dependent clients successfully completed an 8-week outpatient program consisting of relapse training and prevention, coping skills training, and recreational training. However, 84% of clients with the same treatment who were also given the opportunity for prizes were retained contingent on abstinence.

Corby (2000) assessed a CM intervention in the treatment of adolescent cigarette smokers. During the first week, Corby et al. took baseline measurements. Participants would come to the lab twice daily Monday through Friday to have their carbon monoxide (CO) levels measured, and were paid \$4 regardless of the test results. In the second week, participants again came into the lab twice daily Monday through Friday. This time, participants were paid only when their CO tests showed that they had been abstinent. They received \$1 for the first instance of abstinence, and \$.50 additional cents for consecutive instances of abstinence. In the third week, they returned to baseline. The results showed that the mean amount of CO tests indicating abstinence in the first baseline phase was .88, and the mean of consecutive abstinences was .38. The mean of CO tests indicating abstinence from the intervention phase was 9.63, and mean of consecutive abstinences was 9.50. These results indicate that contingency management

significantly decreased CO levels in comparison with the baseline condition. Interestingly, Corby et al. asked participants to come back to the lab for CO and urine tests two weeks after the end of the experiment. Based on these results, they determined that the use of cash as a reinforcer did not facilitate further smoking or other drug use at the two-week follow-up period.

Fournier, Ehrhart, Glindemann, and Geller (2004) conducted a CM study on reinforcement for minimal drinking behaviors. The researchers attended four parties at the same fraternity house. The study was designed so that first, two baseline measurements were taken at the fraternity party with no intervention. The baseline measurements were followed by two intervention phases at two additional parties. In these phases, the researcher stood outside with the fraternity member letting people into the party and handed out flyers. The fliers explained that if their BAC was less than .05 at the end of the night, they would be entered into a raffle to potentially win \$100. The number of legally intoxicated participants was reduced by 50% or more at the two parties. Fournier et al. (2004) argued that this type of contingency gives people an excuse with their peers not to drink excessively and also allows them the opportunity to enjoy the natural reinforcers of a lower intoxication level. Prendergast, Podus, Finney, and Greenwell (2006) performed a meta-analysis on CM studies, which revealed a positive, significant effect of this type of treatment on subjects with substance-use disorders.

### **Purpose**

CM has been shown to be a promising intervention strategy in college students. However, more research needs to be done in order to optimize the effectiveness and efficiency of this intervention for both the participant and the people administering the intervention. The majority of previous CM researchers have arbitrarily selected reinforcers that they speculate will incentivize abstinence (Fournier et al., 2004; Petry et al, 2000). Using a more methodical



approach to determine the value of the reinforcer may yield better results. Specifically, this study will seek to determine the minimum amount of money that participants are willing to accept in exchange for their abstinence. In addition, it will attempt to isolate factors that may contribute to the minimum cost such as gender, day of the week, and alcohol risk level. As such, we hope to find a monetary amount that not only effectively incentivizes abstinence, but is also inexpensive as well.

## **Method**

### **Participants**

Participants were selected from a random sample through the Department of Psychology Student Participation pool. Participants received course credit for their participation in the study. All participants were administered an informed consent form and a demographic questionnaire. Of 209 total participants, 81 were male and 128 were female. There were 14 participants over 21 and 195 under 21, and 147 freshman, 57 sophomores, and 5 juniors.

Because underage college students tend to be the most at-risk for problems associated with binge drinking (Wechsler et al., 1995), we selected participants from this population for our study. Because the study analyzed behavior and majority of participants were under the age of 21, some participants may be at risk because they admitted to illegal drinking behaviors. Admission of this nature could allow law enforcement officials to subpoena the data if the participant is involved in any alcohol-related legal proceedings. In order to ensure confidentiality and thus protect the participants, the researchers administered a random number to each participant, which was linked to several demographic questions (email, course to receive credit, course instructor, year in school, GPA, etc.), and their survey responses. All information was collected and confidentially organized via Qualtrics. Informed consent was obtained electronically without linking identifying information to the responses in the study. That is, we asked participants for identifying information in order to award course credit for participation – but this information was contained in the informed consent portion of the study and not linked to the data in the study. To accomplish this, if participants granted consent, they clicked an option on the screen indicating such, were asked to provide information allowing us to award course credit, and were then directed via a new link to the study which effectively served to de-identify

subsequent responses. If a participant chose not to consent, selecting this option took them directly a new page thanking them for considering our study.

### **Walker Alcohol Contingency Test**

First, participants were introduced to a series of questions on the Walker Alcohol Contingency Test (WACT). The WACT was designed to determine participants' willingness to abstain from alcohol in exchange for differing amounts of cash. For example, the first survey question asked, which would you prefer? Go out drinking on Monday, or earn \$5? The WACT instructions stressed that the drinking option could involve any amount of any type of alcohol. If the participant selected drinking on Monday, then the next question asked, which would you prefer? Go drinking on Monday night, or earn \$10? If earning \$10 was selected, then \$10 is the point at which the participant prefers the cash reinforcer is preferred over drinking on Monday. However, \$7.50 is our best estimate of the amount a participant would be willing to abstain for. This number was derived by averaging the \$10 and \$5 together. This would mean that \$5 is not enough of an incentive not to drink on Monday for that participant, but \$10 is adequate. If drinking on Monday was selected again over the \$10, then the amount would be increased to \$15. If the participant continued to select drinking instead of the money, the dollar amount would hypothetically continue to increase up to \$100. A limit of twenty \$5 iterations will be imposed on each participant for each reinforcer per day, such that \$100 is the maximum hypothetical amount received per day. Once the participant chooses the money option, the questions will repeat with Tuesday, the following day of the week. This will continue through all the days of the week and will end with Sunday. The data will establish the amount of money that could effectively incentivize a college student's abstinence from alcohol on a given day of the week.

## **Alcohol Use Disorders Identification Test**

Participants will then complete the Alcohol Use Disorders Identification Test (AUDIT) questionnaire to determine their drinking levels (see Appendix for the full questionnaire). According to Bohn, Babor and Kranzler (1995), this test is a commonly known alcohol-screening instrument developed by the World Health Organization in a collaborative project including primary care health facilities all over the world. People from a variety of professions including health care workers, treatment personnel, and researchers use this screener. The AUDIT consists of 10 questions and is used to identify respondents who would benefit from either decreasing their alcohol consumption or abstaining from its use altogether. Bohn et al. (1995) assessed the AUDIT and determined it was a valid test in terms of appropriately identifying alcohol abuse as a construct and identifying drinkers versus non-drinkers. Reinert and Allen (2007) expanded upon this study by examining the AUDIT's validity within a variety of subgroups, including adolescents, women, older adults, ethnic minorities, and psychiatric patients. Overall, the AUDIT performed favorably in this study, as well. Nevertheless, Reinert and Allen (2007) urged that more research should be done on the AUDIT, particularly in the context of binge drinking in adolescents and college-age adults.

Further, the AUDIT questionnaire included in our survey served to identify three categories of participants: non-problem drinkers, harmful or hazardous drinkers, and alcohol-dependent drinkers. Each drinker category was identified based on cutoff AUDIT scores. A score of 8 or above indicates that the person has engaged in binge drinking behaviors (see Appendix for additional detail on AUDIT scoring).

## Results

The data were analyzed as a 2 (sex) x 3 (AUDIT group) x 7 (day of the week) mixed factorial ANOVA. There was not a significant three way interaction,  $F(12, 1218) = .55, p = .89, \eta^2 = .005$ . There was also no interaction between gender and day of the week,  $F(6, 203) = .964, p = .45, \eta^2 = .005$ , and no interaction between AUDIT group and gender,  $F(2, 203) = .02, p = .98, \eta^2 = .00$ . There was not a significant effect of gender,  $F(1, 203) = .001, p = .97, \eta^2 = .00$ ; however, there was a significant main effect of day of the week,  $F(6, 203) = 122.99, p < .001, \eta^2 = .38$ , a significant main effect of AUDIT group,  $F(2, 203) = 29.05, p < .001, \eta^2 = .22$ , and a significant interaction between day and AUDIT group,  $F(12, 203) = 14.71, p < .001, \eta^2 = .13$ .

The average monetary amount (standard error) for men alone was 2.99 (2.03), and for women it was 2.81 (1.51). For Monday, the average monetary amount and (standard deviation) was 3.65 (7.64), Tuesday was 3.72 (8.18), Wednesday was 3.00 (2.27), Thursday was 5.55 (8.39), Friday was 13.41 (13.06), Saturday was 14.19 (14.98), and Sunday was 2.88 (1.73). Of the 103 non-problem drinkers, 71 harmful or hazardous drinkers, and 35 alcohol-dependent drinkers, the means of the groups and (standard error) was 4.10 (.57) for non-problem drinkers, 7.50 (.64) for harmful or hazardous drinkers, and 12.23 (.92) for alcohol-dependent drinkers.

Next, we performed post-hoc *t* tests on AUDIT group, which revealed that each group was significantly different from one another (all  $ps < .001$ ). Then we performed post-hoc *t* tests on the days of the week. Monday and Tuesday were not significantly different from each other ( $p = .98$ ), but were significantly different from all other days of the week (all  $ps < .02$ ). Wednesdays and Sundays were not significantly different from each other ( $p = .49$ ), but were significantly different from all other days of the week as well (all  $ps < .02$ ). Thursday was significantly different from all other days (all  $ps < .004$ ) Friday and Saturday were not

significantly different from each other ( $p = .31$ ), and were also significantly different from all other days of the week (all  $ps < .001$ ). As a result, Wednesday and Sunday had the lowest means, Monday and Tuesday had the second lowest means, Friday and Saturday had the highest means, and Thursday had the second highest means.

## **Discussion**

### **Interpretation of results**

These data suggest that most students are willing to abstain from alcohol in exchange for money in a CM program. Men and women were relatively similar in terms of how much money they would exchange for alcohol abstinence. Additionally, both groups required significantly more money on Thursday, Friday and Saturday compared with the rest of the week. However, the interaction revealed that particularly students in the alcohol-dependent AUDIT category require more money than other groups on Sunday, Monday, Tuesday, and Wednesday, in addition to Friday and Saturday.

Now that we have a better idea of the monetary amounts that could incentivize abstinence in this population, a future study could use our estimates of monetary values to implement a CM intervention model such as the one suggested by Petry (2000). This model includes having an observable target behavior (abstinence), offering a tangible reinforcer in exchange for that target behavior (money), and withholding the reinforcer in the absence of the target behavior. This method of intervention would also give students a tangible excuse with their peers not to drink, which makes students more likely to abstain according to Fournier et al. (2004). This finding was based on the CM intervention discussed earlier where researchers attended a fraternity party and entered students below a certain BAC into a raffle to win money at the end of the night.

### **Limitations**

There were several limitations to this study. Because the survey was administered online as opposed to a lab setting, this may have lessened the amount of control in the experiment. Additionally, this study approached CM in terms of hypothetical money, which may not entirely capture how people would behave when real money is at stake. However, studies with humans

using hypothetical outcomes have shown similar hyperbolic functions to studies with nonhumans using actual outcomes such as food and water (Mazur, 1987; Richards, Mitchell, Wit, & Seiden, 1997), and to studies with humans using real outcomes such as money or consumer goods (Kirby & Maraković, 1995).

### **Future Directions**

These results suggest that CM may be more efficient and effective if preliminary testing is performed before an intervention begins to determine the person's current substance abuse risk level. If preliminary testing is performed, the interventionist may be able to gauge how much reinforcement the participant needs. This way, more resources can be allocated for high-risk participants and fewer resources for low-risk participants. Studies such as Fournier et al.'s (2004) could be taken one step further by administering a short survey concerning alcohol risk level such as the AUDIT once participants have been identified. Then, the amount of money offered to a student in exchange for abstinence could fluctuate according to their survey response in order to distribute the money as productively as possible. The alcohol risk survey and distribution of the money could even be done online for increased privacy and convenience; this would also make it easier to reach students in multiple locations. However, students would likely still have to be breathalyzed on-site in order to ensure honesty. Though this particular study was targeted specifically at college students, our results may inform CM research on other populations as well. CM has been shown to be effective in previous literature not only in college students (Fournier et al., 2004), but also with veterans (Petry et al., 2000), and people with a large variety of substance abuse issues (Pendergast et al., 2006).

Future research based on this study could also implement this CM procedure on a few freshman or sophomore dorms on a college campus. Working within the dorm setting might be a



convenient site for this research because subjects would continually congregate in the same location. In addition, CM could potentially be coupled with another intervention detailed above. In fact, Hingson and Howland (2002) found that though community interventions were somewhat effective, they would likely be more effective in combination with another intervention. They state that community interventions are particularly plausible since college students are generally more open to changes and less set in their ways. For example, these two interventions could be combined by placing check-in stations both in the dorms and around the campus and community on Thursday, Friday, and Saturday nights. The stations could have different substance free activities such as movie nights or live music. This combination could provide students with substance-free alternatives to partying while simultaneously reinforcing abstinent behavior.

In addition, in the next few years there should be a substantial decrease in the number of colleges and universities that use alcohol education as their primary intervention strategy. We know from Nelson et al. (2010) that 98% of institutions do this, despite Paek and Hove's (2012) research which showed that there is actually an inverse relationship between the prevalence of alcohol education at a university and the likelihood of students to drink. Because we know that alcohol education (Nelson et al., 2010), alcohol control policies (Kuo et al., 2003), social norms campaigns (Paek & Hove, 2012) and community interventions (Hingson & Howland, 2002) are either only moderately effective or completely ineffective, institutions should be endeavoring to try innovative new ways to approach this serious problem. The interventions that colleges and universities employ in the future should correspond with findings of the most recent literature that there are many other strategies with higher levels of effectiveness than alcohol education.

These results could potentially impact university administrators' approaches to policy regarding student substance abuse. In addition, some universities are currently spending a great deal of money on interventions that are unsuccessful. Though it might seem unorthodox to pay students not to drink, the potential benefit of CM far outweighs the current cost of not only interventions, but also the cost of behaviors that result from binge drinking such as vandalism, legal fees, sexual assault, school suspension, and so on.

### **Conclusion**

In summary, CM seems to show great promise as an intervention for a population with a serious substance abuse problem. This study has shown that the monetary amount exchanged for abstinence differs by day of the week. A person's alcohol risk level based on AUDIT scores also affects how much money a person will require, with the highest risk students requiring the most money specifically on Friday and Saturday. These results have the potential to inform future CM studies on the use and magnitude of reinforcers as well as university policy.

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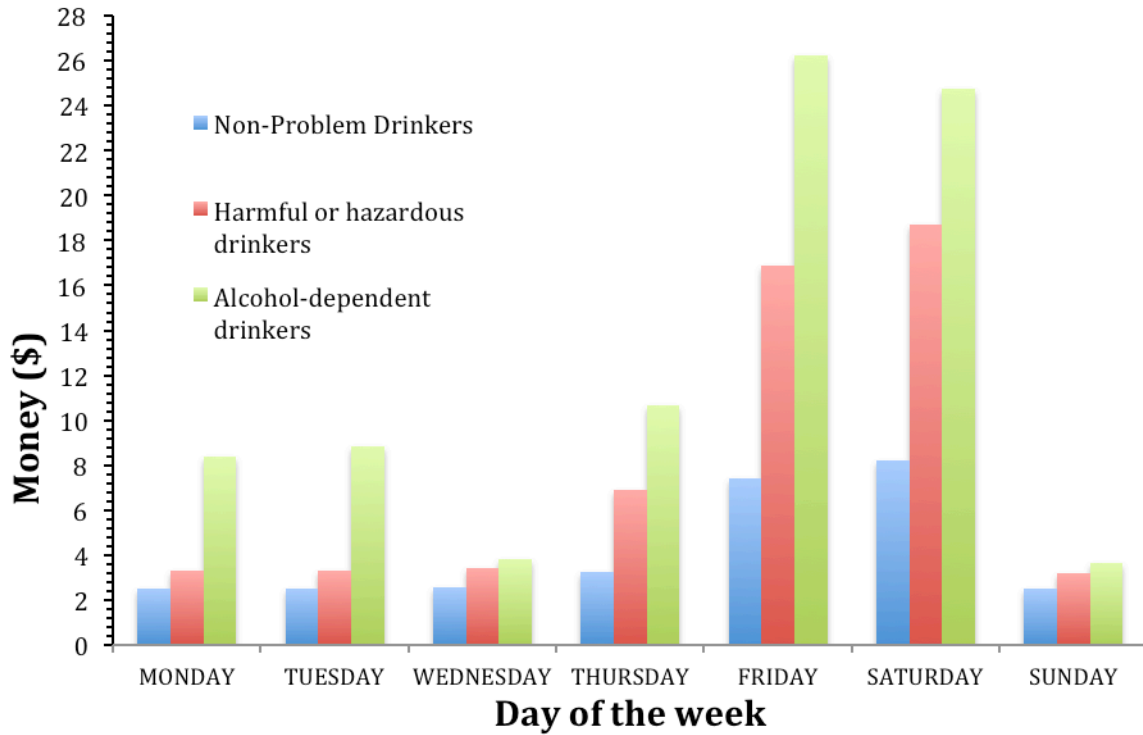


Figure 1. Amount of money required in exchange for abstinence for each AUDIT group.



## Appendix

### AUDIT questionnaire: screen for alcohol misuse

*Please select the answer that is correct for you.*

1. How often do you have a drink containing alcohol?

- Never
- Monthly or less
- 2–4 times a month
- 2–3 times a week
- 4 or more times a week

2. How many standard drinks containing alcohol do you have on a typical day when drinking?

- 1 or 2
- 3 or 4
- 5 or 6
- 7 to 9
- 10 or more

3. How often do you have six or more drinks on one occasion?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

4. During the past year, how often have you found that you were not able to stop drinking once you had started?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

5. During the past year, how often have you failed to do what was normally expected of you because of drinking?

- Never
- Less than monthly
- Monthly
- Weekly

- Daily or almost daily

6. During the past year, how often have you needed a drink in the morning to get yourself going after a heavy drinking session?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

7. During the past year, how often have you had a feeling of guilt or remorse after drinking?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

8. During the past year, have you been unable to remember what happened the night before because you had been drinking?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

9. Have you or someone else been injured as a result of your drinking?

- No
- Yes, but not in the past year
- Yes, during the past year

10. Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested you cut down?

- No
- Yes, but not in the past year
- Yes, during the past year

### *Scoring the audit*

Scores for each question range from 0 to 4, with the first response for each question (eg never) scoring 0, the second (eg less than monthly) scoring 1, the third (eg monthly) scoring 2, the

fourth (eg weekly) scoring 3, and the last response (eg. daily or almost daily) scoring 4. For questions 9 and 10, which only have three responses, the scoring is 0, 2 and 4 (from left to right).

A score of 8 or more is associated with harmful or hazardous drinking, a score of 13 or more in women, and 15 or more in men, is likely to indicate alcohol dependence.