## Title

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# Future So Bright? Delay Discounting and Consideration of Future Consequences Predict Academic Performance among College Drinkers

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## Abstract

College student drinking is a major public health concern and can result in a range of negative consequences, from acute health risks to decreased academic performance and drop out. Harm reduction interventions have been developed to reduce problems associated with drinking but there is a need to identify specific risk/protective factors related to academic performance among college drinkers. Behavioral economics suggests that chronic alcohol misuse reflects a dysregulated behavioral process or *reinforcer pathology* – alcohol is overvalued and the value of prosocial rewards are sharply discounted due, in part, to their delay. This study examined delay discounting, consideration of future consequences (CFC), and protective behavioral strategies (PBS) as predictors of academic success (grade point average; GPA) and engagement (time devoted to academic activities) among 393 college drinkers (61% female). In multivariate models, PBS were associated with greater academic engagement, but were not with academic success. Lower discounting of delayed rewards and greater CFC were associated with both academic success and engagement among drinkers. Previous research suggests that future time orientation is malleable, and the current results provide support for efforts to enhance future time orientation as part of alcohol harm-reduction approaches.

### Keywords

academic performance; behavioral economics; college student drinkers; delay discounting; protective behavioral strategies

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Heavy drinking in the college population is a major public health concern. According to recent estimates, 60% of college students reported drinking in the past 30 days, and 38% reported a binge drinking episode (4/5 standard drinks for women/men, respectively, in the same occasion; Center for Behavioral Health Statistics and Quality, 2015). These rates have remained relatively stable over time (White & Hingson, 2013), and heavy drinking has consistently been associated with a range of negative consequences including hangover/sickness, unwanted sexual activity, driving while intoxicated, and a variety of other adverse health and social outcomes (Hingson, Zha, & Weitzman, 2009; White & Hingson, 2013).

## Heavy Alcohol Consumption Increases Risk for Academic Performance

There are many factors that influence academic performance among college students. Past performance (e.g., SAT scores or high school GPA) is one of the strongest predictors of academic success, and those effects appear to be due, in part, to both intelligence and academic self-efficacy (Mattern & Shaw, 2010; Zheng & Saunders, 2002). Other variables also impact academic performance, including demographic variables, parental education, depression and anxiety, and self-regulation (Deroma, Leach, & Leverett, 2009; Kitsantas, Winsler, & Huie, 2008; Owens, Stevenson, Hadwin, & Norgate, 2012; Parker, Summerfeldt, Hogan, & Majeski, 2004; Zheng & Saunders, 2002). Heavy drinking in college is also associated with academic performance (American College Health Association, 2014; Martinez, Sher, & Wood, 2008; Wechsler, Lee, Kuo, & Lee, 2000). One study found that heavy drinking was negatively correlated with academic aptitude and previous academic achievement in first-year college student drinkers, suggesting that students who drink may enter college less academically prepared than nondrinking peers (Wood, Sher, Erickson, & DeBord, 1997). Upon college entry, students who frequently binge drink are almost 17 times more likely to miss a class and eight times more likely to fall behind in schoolwork compared to their non-binge drinking peers (Wechsler et al., 2000). Regular heavy drinking might contribute to cognitive difficulties (see Zeigler et al., 2005) as well as missing classes and falling behind on homework due to hangovers and excessive time spent drinking instead of studying. Student drinkers may also experience fatigue related to late nights and poor sleep (Singleton & Wolfson, 2009) or engage with heavy drinking peers that encourage drinking behavior. Heavy drinking places students at risk for failure or drop out (Arria, Caldeira, Bugbee, Vincent, & O'Grady, 2013; Jennison, 2004; Latvala et al., 2014). In one study, 63% of those who met criteria for alcohol dependence failed a class during their first year (Aertgeerts & Buntinx, 2002). Even among students who graduate, heavy alcohol use during college predicts poorer career outcomes (i.e., working in less lucrative fields) and increases the risk for alcohol dependence ten years later (Jennison, 2004).

Despite the robust relation between alcohol misuse and academic deficits, many college drinkers manage to maintain high GPAs and ultimately graduate. We are aware of no published research that has specifically examined potentially malleable factors related to academic success among heavy drinkers. Studies have identified factors that protect against alcohol-related consequences among heavy drinkers more generally, including lower behavioral economic demand for alcohol (Teeters, Pickover, Dennhardt, Martens, & Murphy, 2014), greater religiosity (Templin & Martin, 1999), lower sensation seeking (Lindgren, Mullins, Neighbors, & Blayney, 2010; Stacy, Newcomb, & Bentler, 1993),

greater self-regulation (D'Lima, Pearson, & Kelley, 2012), and the use of protective behavioral strategies (Martens et al., 2004, 2005). Given the persistence of heavy drinking in college over the past 50 years (White & Hingson, 2013), identifying factors that might diminish the negative influence of alcohol use on academic success – specifically malleable variables that could be targeted in harm reduction interventions – could reduce the personal and societal impact of heavy drinking in college. Three potentially malleable factors are protective behavioral strategies, delay discounting, and the consideration of future consequences.

## Protective Behavioral Strategies (PBS)

Protective behavioral strategies are behaviors that an individual can engage in while drinking in order to limit the negative consequences of alcohol, such as limiting the number of drinks consumed, avoiding drinking games, and using a designated driver (Martens et al., 2004). Protective behavioral strategies are robust protective factors in that heavy drinkers who use these strategies tend to experience fewer consequences despite consuming large quantities of alcohol (Benton et al., 2004; Martens et al., 2004, 2005; Murphy et al., 2012). In fact, protective behavioral strategies explain at least some of the variance in alcohol-related problems not accounted for by alcohol consumption (Martens et al., 2005). To our knowledge, no study has examined protective behavioral strategies in the context of academic engagement or success. Despite high levels of alcohol consumption, those who use protective behavioral strategies may experience less academic performance deficits. For example, eating a substantive meal before drinking and avoiding drinking games slows the pace of consumption and maintain the desired effects of alcohol while minimizing the negative effects on next day academic activities. Further, those who utilize protective behavioral strategies during drinking may also be more likely to use strategies for successfully navigating academics compared to those who do not use protective behavioral strategies. Finally, protective behavioral strategies may minimize the impact heavy drinking can have on executive functioning by avoiding high blood alcohol levels.

## Delay discounting (DD)

Success in college requires that students regularly refrain from behavior associated with immediate rewards (i.e., drinking in a manner that impacts their ability to fulfill academic requirements) to accomplish long-term goals that may not occur for months or years (i.e., graduation and career development). This requires substantial self-control (Daugherty & Brase, 2010) and, specifically, an ability to value future outcomes enough to consistently work towards them, often in the face of many immediately rewarding temptations in the college environment. For example, a first-year undergraduate student will require at least four or more years of education and internship experiences before they graduate and achieve the financial and personal rewards associated with entering their desired profession. In contrast, drinking on a given night will reliably result in immediate physiological effects (euphoria, stress reduction) and social rewards.

Over the past few decades, the application of economic concepts to the study of human behavior, or behavioral economics, has provided fruitful information about human decision

making (Bickel, Green, & Vuchinich, 1995; Hursh, 1984; Vuchinich & Tucker, 1996). Behavioral economics (BE) describes alcohol misuse as dysregulated behavioral processes, or *reinforcer pathology*, that is a function of both endogenous and exogenous factors that create a strong preference for high potency immediate rewards, such as drugs and alcohol, relative to rewards that are less intense and distributed over time (Bickel, Johnson, Koffarnus, MacKillop, & Murphy, 2014).

Delay discounting is a behavioral economic concept defined as the degree to which a person devalues a consequence (reward or punishment) as a function of time and is typically measured by asking participants to choose between a series of larger, delayed or smaller, immediate monetary amounts (e.g., $10 today or $20 in 6-months). These choices are used to establish a discount function that plots the degree of reduction in current subjective value across a series of delays. Greater discounting of delayed rewards has a robust relation with addictive behavior (Bickel & Marsch, 2001; MacKillop et al., 2011; Reynolds, 2006), including alcohol misuse (Mackillop et al., 2010; MacKillop et al., 2011). Although the association between delay discounting and alcohol misuse is less robust in samples of college students (Dennhardt & Murphy, 2013), perhaps due to the overall lower severity of alcohol use in this population (Amlung, Vedelago, Acker, Balodis, & Mackillop, 2016), several studies suggest that greater delay discounting rates are predictive of alcohol-related problems (Kollins, 2003; Vuchinich & Simpson, 1998).

Delay discounting has also been shown to be associated with lower GPA (Kirby, Winston, & Santiesteban, 2005), and IQ (Shamosh & Gray, 2008) in general samples of college students. Although these preliminary findings suggest that delay discounting is linked to lower academic performance, no study to date has examined relations between delay discounting and academic success and engagement among college drinkers. Lower delay discounting may reduce the likelihood that students drink in a manner that jeopardizes both physical health and academic engagement or success and may result in behaviors that protect against academic harm (e.g., studying before drinking, drinking less the night before a test).

## Consideration of Future Consequences (CFC)

The consideration of future consequences construct characterizes the tendency to consider present versus future outcomes when making decisions (Strathman, Gleicher, Boninger, & Edwards, 1994) and, despite some conceptual overlap, is empirically distinct from delay discounting (Daugherty & Brase, 2010). Lower consideration of future consequences is associated with greater alcohol abuse (Keough, Zimbardo, & Boyd, 1999) and problem drinking in college (Vuchinich & Simpson, 1998) as well as greater levels of aggression while intoxicated among adults (Bushman, Giancola, Parrott, & Roth, 2012). Consideration of future consequences has also been shown to be a prospective predictor of drinking in a sample of college students participating in a brief alcohol intervention trial (Murphy et al., 2012). College students with higher consideration of future consequences report higher GPAs ($r = .29$; Peters, Joireman, & Ridgway, 2005) and successful attainment of previously set goals for scores on quizzes and tests (Joireman, 1999). However, no studies have examined if consideration of future consequences is specifically associated with academic engagement and outcomes among college drinkers.

## Current Study

The current study builds on previous work examining risk/protective factors against consequences from heavy drinking by specifically examining the relations between protective behavioral strategies, delay discounting, and consideration of future consequences and academic performance and engagement among college student drinkers. Despite the significant social and public health implications of college success, very little research has explicitly examined predictors of GPA and academic engagement among college student drinkers. We hypothesized that protective behavioral strategies, delay discounting, and consideration of future consequences would each be associated with both academic success and engagement after controlling for gender, race, alcohol consumption, and parental income. Support for these hypotheses would justify efforts to include behavioral economic intervention elements that enhance future orientation as a part of intervention strategies for college drinking (Bulley & Gullo, 2017; Dennhardt, Yurasek, & Murphy, 2015; Kaplan, Reed, & Jarmolowicz, 2016).

## Method

### Participants

Participants were 393 college student binge drinkers (men/women who had consumed 5/4 standard drinks, respectively, on two or more occasions in the past month) recruited from two large public universities in the Southern and Midwestern United States (age $M = 18.77$ years, range 18–25 years). Students were enrolled in a brief motivational intervention (BMI) randomized clinical trial for heavy alcohol use. The current report analyzed only baseline data from the study. Full demographic information for our sample can be found in Table 1.

### Procedures

Both universities' Institutional Review Boards approved all procedures. Participants were screened through introductory psychology courses (SONA), classroom screenings, and research participation solicitation emails. Students were invited to participate if they still reported two or more drinking days in the past month, were over the age of 18, and were either freshman or sophomores. After describing basic study information and confidentiality procedures, eligible participants were scheduled to come to a university research laboratory to complete baseline study measures as a part of a larger randomized clinical trial. Research assistants met with participants individually to review the informed consent materials, discuss confidentiality procedures, and respond to any participant questions. Participants then took an online survey in a private study room before taking part in the experimental portion of the study. Except for GPA, which was obtained from the university at the end of the semester, all study variables were collected during this baseline survey, which was administered five to 10 weeks into the semester. Participants received cash or extra credit for participating in the research.

### Measures

**Alcohol Use—**The Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) was used to measure participants' typical weekly alcohol consumption. Participants were

asked to estimate the total number of standard drinks they consumed on each day during a typical week in the past month. The DDQ has been shown to have good reliability and validity (Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990) and is a widely used measure of alcohol consumption.

### Academic Variables

**High School Rank:** Participants were asked to self-report high school rank using the following options (1) Top 10%, (2) Top 25%, (3) Top 50%, (4) Bottom 50%, and (5) I don't know. In previous studies, high school rank has been used to measure academic aptitude or ability upon college entry (Wood et al., 1997).

**GPA:** With consent from participants, final semester GPAs were obtained from each university's Registrar's Office at the close of the semester after interventions had been administered.

**Academic engagement:** Participants reported the estimated number of hours they had spent engaged in various activities during a typical week in the past month. These activities included time studying or doing homework, going to class, exercise, employment, extracurricular activities, socializing, and using alcohol or other drugs (Murphy et al., 2012). Time spent attending class and time spent studying and doing homework were combined to create a variable for overall time spent engaging in academic activities. We then created a ratio: time spent in academic-related activities divided by all time spent in any activities. To gauge typical time allocation during an academically active segment of the semester, ratios were calculated using data collected approximately 1 month into the semester and before any interventions were administered.

**Protective Behavioral Strategies—**Protective behavioral strategies were assessed using the 15-item Protective Behavioral Strategies Scale (PBSS; Martens et al., 2005). The measure asks students to rate the frequency in which they use different strategies to reduce or avoid negative consequences of alcohol on a scale of 1 (*Never*) to 6 (*Always*). These strategies include items like "use a designated driver", "stop drinking at a predetermined time", or "alternate alcoholic and non-alcoholic drinks". Responses to the 15 items were summed to create a total score of protective behavioral strategies, which has shown strong negative correlations with alcohol-related problems (Martens et al., 2005). Cronbach's alpha in the current sample was .80.

**Delay Discounting—**Delay discounting was measured using a 60-item delay discounting task (DDT) modeled after the Monetary Choice Questionnaire (Amlung & MacKillop, 2011; Kirby, Petry, & Bickel, 1999). Each item provides a hypothetical choice between a larger amount of money available at a later time and a smaller amount of immediately available money. Examples of items include: "If you were given the option, would you rather have $100 in one week or $60 today?" and "… would you rather have $90 today or $100 in one day?" Each choice contributes to the estimate of the participant's overall discounting rate parameter ($k$). Discounting rates are calculated using the GraphPad Prism macro (www.ibrinc.org), which fits participant choices to a hyperbolic equation. Higher $k$ values

indicate steeper discounting, or a greater proportion of choices for the smaller, sooner monetary amount. Hypothetical money choice tasks provide valid and reliable estimates of discounting rates that are associated with substance misuse and other health risk behaviors (Mackillop et al., 2010; Madden, Begotka, Raiff, & Kastern, 2003).

**Consideration of Future Consequences—**Participants completed a brief 9-item version of the Consideration of Future Consequences Scale (CFCS; Petrocelli, 2003; Strathman et al., 1994), which assesses the extent to which an individual makes decisions based on potential future outcomes. Participants are asked to rate each item on a scale from 1 (*Extremely Uncharacteristic*) to 5 (*Extremely Characteristic*). Examples of items include: "Often I engage in a particular behavior in order to achieve outcomes that may not result for many years" and "I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level." The CFCS has shown good reliability, and the scale demonstrates convergent validity and expected relations with relevant health behaviors among college students (Strathman et al., 1994). Cronbach's alpha in the current sample was .80.

## Data Analysis Plan

Outliers (values 3.29 standard deviations away from the mean) were corrected to one unit above the next most extreme score, as suggested by Tabachnick and Fidell (2013). The values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to assume normal univariate distribution (Field, 2013; Trochim & Donnelly, 2006). All variables met assumptions for skewness and kurtosis, with the exception of $k$ (delayed discounting) and alcohol consumption, which were corrected using square root transformations. Following transformations, alcohol consumption was within the acceptable limit; $k$ remained slightly kurtotic (2.58).

Bivariate correlations examined preliminary associations among key study variables. To examine our hypotheses, we conducted six hierarchical multiple regressions. Three regressions examined protective behavioral strategies, delay discounting, and consideration of future consequences separately as predictors of academic success and academic engagement. For all regressions, the following variables were used as covariates: gender, race, parental income, and alcohol consumption (Betts & Morell, 1999; Jencks & Phillips, 1998; Singleton & Wolfson, 2009). Because official GPA data was obtained from the registrar at the end of the semester after participants had been randomized to intervention condition, we controlled for intervention condition when using GPA as a dependent variable. Finally, we tested final models containing significant predictors of both academic success and engagement to examine the relationships between these variables above and beyond level of alcohol consumption to identify the unique protective effect of protective behavioral strategies, delay discounting, and consideration of future consequences. To determine unique effect, we reported the change in the coefficient of determination ($\Delta R^2$) which measures the variance in the dependent variable that is uniquely explained by the independent variables. Small, medium, and large effects are .01, .09, and .25, respectively (Cohen, 1992).

## Results

### Descriptive Data and Bivariate Correlations

The full sample ($N$ = 393) was 60.8% female and 78.9% white. Participants were, on average, 18.77 ($SD$ = 1.07) years of age, drank 17.03 ($SD$ = 13.78) standard drinks in a typical week in the past month, and reported 13.07 ($SD$ = 7.93) alcohol-related problems in the past month. See Table 1 for descriptive statistics on all study variables.

Table 2 displays correlations among gender, race, consumption, GPA, school-related time allocation, protective behavioral strategies, delay discounting, and consideration of future consequences. Consideration of future consequences, delay discounting, GPA, and academic engagement were all intercorrelated in the expected directions. Alcohol consumption was negatively correlated with academic engagement and GPA, but not with either delay discounting or consideration of future consequences. Protective behavioral strategies were negatively correlated with alcohol consumption, as expected, and positively correlated with GPA, engagement, and consideration of future consequences, but unrelated to any other study variables.

### Hierarchical Multiple Regression Analyses Predicting Academic Success

Table 3 (left panel) presents results for each of the three hierarchal regression models, as well as the final model with all significant predictors included in a single step. Figures 1 and 2 demonstrate the relation between both delay discounting and consideration of future consequences with academic success. Contrary to our hypothesis, protective behavioral strategies did not predict GPA, $\Delta R^2$ = .008, $p$ = .06[1]. Consistent with our hypotheses, delay discounting, $\Delta R^2$ = .05, $p$ < .001, and consideration of future consequences, $\Delta R^2$ = .02, $p$ = .006, significantly predicted GPA when included in separate models. When included in the same model, delay discounting and consideration of future consequences significantly predicted GPA, $\Delta R^2$ = .06, $p$ < .001[2], with delay discounting accounting for most of this variance.

### Hierarchical Multiple Regression Analyses Predicting Academic Engagement

Parallel models are presented in Table 3 (right panel). Protective behavioral strategies significantly predicted academic engagement, such that greater endorsement of protective behavioral strategies were associated with greater time spent engaged in academic-related activities, $\Delta R^2$ = .01, $p$ = .03. In separate models, delay discounting and consideration of future consequences significantly predicted time spent engaging in school-related activities, $\Delta R^2$ = .01, $p$ = .04, and $\Delta R^2$ = .03, $p$ < .001, respectively. In a final model, protective behavioral strategies, delay discounting, and consideration of future consequences significantly predicted time spent engaging in school related activities, $R^2$ = .04, $p$ < .001; consideration of future consequences, however, accounted for most of this variance. In the

[1]We also examined any differential associations for individual PBS subscales for all regression equations (Martens et al., 2005). Stopping/limiting drinking did not significantly predict academic engagement or success; both manner of drinking and serious negative consequences subscales produced the same results as the full scale.

[2]In GPA models, intervention condition did not influence the results and was therefore not reported. We also tested models including study site and high school GPA rank; neither of these variables influenced the results, and were therefore omitted from the analyses.

final model, alcohol consumption also accounted for significant variance in academic engagement.

## Discussion

To our knowledge, this is the first study to examine predictors of academic engagement and performance among college drinkers. We used a relatively large sample from two public universities and measured both official GPA reports and time devoted to academic activities. Our results suggest that the use of protective behavioral strategies is associated with greater academic engagement among college drinkers. Further, delay discounting and consideration of future consequences were uniquely predictive of academic success and engagement among drinkers.

Consistent with our hypotheses, delay discounting and consideration of future consequences both exhibited relations with GPA and academic engagement in multivariate models. These findings extend the literature by suggesting that students who value the future and organize their behavior around distal outcomes can experience academic success despite relatively heavy drinking. Conversely, college drinkers who devalue future outcomes are likely to spend less time attending class and studying and to earn lower grades. It is important to note that, although our results suggest that delay discounting and consideration of future consequences can be protective against academic deficits among heavy drinkers, this does not imply that future oriented heavy drinkers do not experience negative consequences as a result of alcohol in other aspects (i.e., social, family), or that their academic engagement and performance is not impacted by heavy drinking. Additionally, although all participants reported recent binge drinking episodes, it is important to note that there was significant variability in drinking level, with most participants drinking only 2–3 days per week.

When included in the same model, consideration of future consequences predicted academic engagement better than delay discounting, and delay discounting predicted GPA better than consideration of future consequences. These differential associations, combined with the small magnitude relation between consideration of future consequences and delay discounting replicates previous research (Daugherty & Brase, 2010) and suggests that the two aspects of future time orientation are heterogeneous. The relation between delay discounting – often considered a measure of monetary intertemporal choice – and GPA is consistent with previous research connecting the construct to intelligence (Shamosh & Gray, 2008) and executive functioning, which may contribute to the ability to plan and to rationally calculate reductions in expected future value based on delay (Bickel & Yi, 2008; Olson, Hooper, Collins, & Luciana, 2007; Weatherly & Ferraro, 2011). In contrast, consideration of future consequences scores reflect a direct report of one’s ability to organize behavior around future outcomes (e.g., “Often I engage in a particular behavior in order to achieve outcomes that may not result for many years”) and may be somewhat less dependent on executive functioning or intelligence. Interestingly, the greatest difference in delay discounting and consideration of future consequences seemed to occur around the 3.00 GPA threshold (Figure 1 and 2), an important point of demarcation between undergraduates who may be competitive for graduate school admissions and many selective jobs. This

points to the potentially practical significance of efforts to extend time horizons and reduce delay discounting.

Protective behavioral strategies were predictive of academic engagement (Benton et al., 2004). Students who utilize protective behavioral strategies may be less likely to experience alcohol-related consequences (e.g., hangovers, fatigue related to late night drinking) that might interfere with academic engagement. The finding that protective behavioral strategies was not predictive in models that included delay discounting and consideration of future consequences suggests that the impact of protective behavioral strategies on academic engagement may be primarily due to its covariance with consideration of future consequences. Indeed, consideration of future consequences and protective behavioral strategies were highly positively correlated in our study, and the ability to plan and implement protective behavioral strategies may require an ability to consider and value future outcomes. Thus, when considering the current results in conjunction with previous research (Martens et al., 2004, 2005; Murphy et al., 2012), it appears that protective behavioral strategies may be highly protective against acute alcohol-related outcomes (accidents, injuries, blackouts) whereas consideration of future consequences may be protective against more general academic performance deficits associated with patterns of behavior over time both within and outside of drinking contexts. Consistent with previous research (Wechsler et al., 2000), alcohol consumption was a robust predictor of academic engagement in multivariate models and negatively correlated with GPA in bivariate, but not multivariate models. The latter finding may be due in part to the restricted range in drinking in this sample (all participants were heavy drinking, that is two or more binge drinking episodes in the past month).

More generally, these results provide partial support for behavioral economic models of substance misuse which emphasize the role of delay discounting as a primary risk factor for substance misuse. Previous research suggests that excessive delay discounting is associated with risk factors for a range of unhealthy behaviors, including cigarette smoking (Bickel, Odum, & Madden, 1999), cocaine dependence (Coffey, Gudleski, Saladin, & Brady, 2003), heroin addiction and needle sharing (Kirby & Petry, 2004; Kirby, Petry, & Bickel, 1999; Odum, Madden, Badger, & Bickel, 2000), alcohol problems (Dennhardt & Murphy, 2011; Mackillop et al., 2010), alcohol use disorder (Gray & MacKillop, 2015; Mackillop, 2016), and diminished engagement with positive health behaviors (Daugherty & Brase, 2010). Consistent with this literature, the present results suggest that delay discounting is associated with a potentially important corollary of heavy drinking, namely academic performance. This is important given the prevalence of heavy drinking in college and the negative social and health outcomes associated with college failure and dropout (Woolf & Braveman, 2011). However, neither delay discounting nor consideration of future consequences were associated with drinking level, consistent with previous null relations with alcohol consumption among college students (Dennhardt & Murphy, 2011; MacKillop, Mattson, Anderson MacKillop, Castelda, & Donovick, 2007). Range restriction may be one reason for null findings in our sample (all participants were binge drinkers). Delay discounting also may not be related to quantity of weekly drinking among college students, which may be driven largely by social and environmental factors. Delay discounting and consideration of

future consequences, however, may still play an important role, given the relation to relevant academic outcomes.

## Limitations and Future Directions

First, the study utilized a cross-sectional design. Although GPA data were collected at the end of the semester, all other variables were collected in the middle of the semester. Because baseline data were collected in the middle of the semester, semester academic performance thus far may have had an influence on delay discounting and consideration of future consequences. Examination of longitudinal data may provide more nuanced information about the relations between these variables, GPA, and time allocated to academic activities over the course of the college career. Further, aside from official university GPA reports, the measures used were self-report which may not accurately reflect actual behavior. However, we used reliable and valid measures, and despite the self-report nature of hypothetical delay discounting tasks, these choices have been shown to correspond to actual choices (Madden et al., 2003). The study also used a sample of heavy drinking, nontreatment-seeking students in their first two years of college, and, therefore, the results may not generalize outside of this specific population. Future research examining the relation between delay discounting or consideration of future consequences and academic success should also include more stringent measures of academic aptitude as covariates, such as SAT or ACT scores, rather than just high school rank. It is important to emphasize the small effect sizes found for our independent variables, despite their significance, and that several demographic variables significantly predicted GPA as well. Given the considerable variance in engagement explained by alcohol consumption, students may also benefit academically from interventions that simply decrease consumption, such as brief motivational interventions. Other individual-level variables not included in the current study, such as IQ, parent education level, college major, career goals, and attitudes towards education, may play an even larger role in these relations and should be elucidated (Kitsantas et al., 2008; Mattern & Shaw, 2010; Parker et al., 2004). University-level variables or characteristics, such as academic rigor, size, and the presence of programming related to alcohol prevention or academic engagement, may also contribute substantially to the relations between protective behavioral strategies, delay discounting, consideration of future consequences, and academic success, although our results were consistent across the two somewhat disparate universities included in our study.

## Implications for Enhancing Academic Outcomes

The primary implication of this study is that protective behavioral strategies may enhance academic engagement, and that delay discounting and consideration of future consequences may enhance academic success and engagement among college drinkers. Standard brief alcohol interventions target protective behavioral strategies, but do not necessarily attempt to enhance delay discounting or consideration of future consequences (Tanner-Smith & Lipsey, 2015). Recent research suggests that these two constructs may be shifted with brief interventions that emphasize future or delayed outcomes (Murphy, Dennhardt, et al., 2012). For example, *episodic future thinking* is an experiential intervention that asks individuals to vividly imagine positive future events, which is theorized to enhance the salience of future oriented reward (Atance & O'Neill, 2001), and several preliminary studies suggest that it

can reduce delay discounting and reduce motivation to consume high calorie foods or to use tobacco and other drugs (Bulley & Gullo, 2017; Kaplan et al., 2016; Snider, LaConte, & Bickel, 2016). Another brief behavioral economic approach – the Substance-Free Activity Session (SFAS) – uses motivational interviewing and personalized feedback to encourage patterns of behavior associated with future goals and substance free activities. The SFAS has been shown to increase consideration of future consequences but not delay discounting (Murphy et al., 2012; Yurasek et al., 2014). Although both variables are future oriented, our results suggest they are heterogeneous, and these intervention studies suggest that they may even require distinct intervention approaches. Further research should continue to examine these intervention's influence on the two variables, in addition to their unique clinical correlates.

On a macro level, universities could design campaigns that disseminate materials encouraging students to repeatedly consider how they are spending their time, what they want most from the future, and the degree of consistency between their daily activity patterns and future college and life goals. Additionally, universities can restructure the academic atmosphere to be somewhat less dependent on infrequent and delayed rewards. This might be accomplished by providing more immediate feedback (e.g., computerized tests with feedback, more frequent tests and quizzes), encouraging classroom attendance via attendance policies, and creating structured opportunities to make progress on assignments. This would be consistent with previous research on procrastination, suggesting that students with firm deadlines on term papers perform better than those who are allowed to make their own deadlines (Ariely & Wertenbroch, 2002), a phenomenon that could be explained, at least in part, by deficits in future oriented thinking.

### Conclusion

Despite heavy drinking, some students are able to thrive academically. The current results suggest that protective behavioral strategies, delay discounting, and consideration of future consequences are protective factors that predict academic engagement and success even after accounting for important variables such as gender, parent income, and alcohol consumption. Alcohol harm reduction interventions should also attempt to increase academic performance by enhancing future orientation. This study provides further support for behavioral economic models of alcohol and drug misuse, which emphasize delay discounting as a central risk factor.

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## Public Significance Statement

This study suggests that protective behavioral strategies and greater future valuation may protect against diminished academic success and engagement among college drinkers. Universities should attempt to provide prevention approaches that enhance alcohol protective behavioral strategies and promote future orientation.

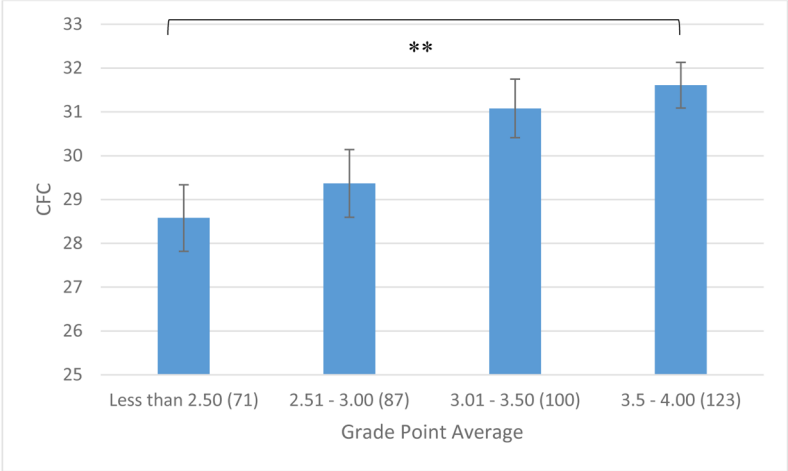


**Figure 1.**

Mean CFC value as a function of Grade Point Average. One-way ANOVA indicates that CFC scores for those in the highest GPA group (3.51 – 4.00) are significantly different from those in the lowest GPA group (less than 2.50; $p$<.01). *** $p$ < .01.

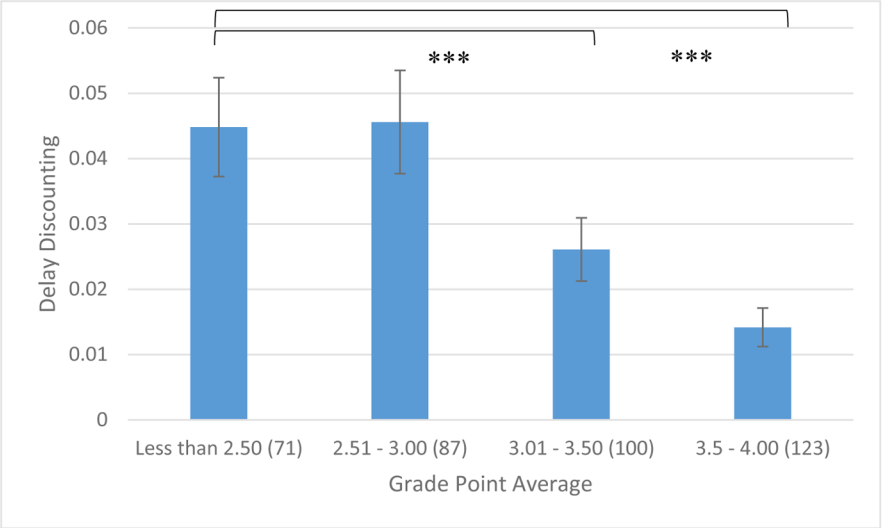


**Figure 2.**

Mean delay discounting values as a function of Grade Point Average. Those who achieved higher GPAs also reported lower discounting of delayed rewards. One-way ANOVA indicates that those in the highest GPA group (3.51 – 4.00) have significantly lower delay discounting than those in the two lowest GPA groups (less than 2.50; 2.51 – 3.00; both $p<.001$). *** $p < .001$.

## Table 1

Sample Characteristics

| | *N* | Mean | *SD* | Percent |
|---|---|---|---|---|
| Age | 381 | 18.77 | 1.07 | |
| Gender (female) | 393 | | | 60.8 |
| Ethnicity | 393 | | | |
| White | 310 | | | 78.9 |
| Hispanic | 11 | | | 2.8 |
| Asian | 5 | | | 1.3 |
| Black | 34 | | | 8.7 |
| Other | 5 | | | 1.3 |
| Multiracial | 28 | | | 7.1 |
| Alcohol Consumption | 393 | 17.03 | 13.79 | |
| Alcohol Problems | 393 | 13.07 | 7.93 | |
| GPA | 383 | 3.04 | .78 | |
| School (percent) | 393 | .35 | .12 | |
| High School Rank | 393 | | | |
| Top 10% | 112 | | | 28.5 |
| Top 25% | 124 | | | 31.6 |
| Top 50% | 73 | | | 18.6 |
| Bottom 50% | 10 | | | 2.5 |
| Uncertain | 74 | | | 18.8 |
| Parent Income | 392 | | | |
| <$25,000 | 30 | | | 7.6 |
| $25,000 – $50,000 | 51 | | | 13.0 |
| $50,000 – $75,000 | 72 | | | 18.3 |
| $75,000 – $100,000 | 71 | | | 18.1 |
| $100,000 – $150,000 | 89 | | | 22.6 |
| >$150,000 | 64 | | | 16.3 |
| No financial support | 15 | | | 3.8 |
| Delay Discounting | 389 | .0295 | .0546 | |
| CFC | 393 | 30.40 | 6.53 | |

*Note.* Total *N* = 393; Alcohol consumption = typical standard alcoholic drinks in the past month; Alcohol problems was calculated with the Young Adult Alcohol Consequences Questionnaire (YAACQ); School = Percentage of time spent in school related activities.

**Table 2**

Bivariate Pearson Correlations

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Gender | 1.00 | | | | | | | | |
| 2. Race | −.03 | 1.00 | | | | | | | |
| 3. Condition | .04 | −.09 | 1.00 | | | | | | |
| 4. Parent Income | −.03 | .23** | −.01 | 1.00 | | | | | |
| 5. Alcohol Use | −.28** | .00 | .02 | .00 | 1.00 | | | | |
| 6. GPA | .20** | .17** | −.05 | .20** | −.18** | 1.00 | | | |
| 7. Academic Engagement | .08 | .08 | .04 | .08 | −.25** | .29** | 1.00 | | |
| 8. *k* (DD) | −.06 | −.29** | .01 | −.16* | .04 | −.30** | −.14** | 1.00 | |
| 9. CFC | .05 | .05 | .00 | .05 | −.06 | .17** | .20** | −.19** | |
| 10. PBS | .07 | −.01 | −.01 | −.05 | −.36*** | .13* | .19*** | .08 | .18*** |

*Note.* DD = Delay Discounting, CFC = Consideration of Future Consequences, School = Involvement in School Related Activities, GPA = Grade Point Average.

* $p < .05$,

** $p < .01$

**Table 3**

Hierarchical Multiple Regression Analyses examining Delay Discounting and CFC as Predictors of GPA and Academic Involvement

| | GPA | | | | | Academic Engagement | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **B (SE)** | ***Beta*** | ***p*** | ***F*** | ***$R^2$*** | **B (SE)** | ***Beta*** | ***p*** | ***F*** | ***$R^2$*** |
| **Step 1** | | | | | .11 | | | | | .08 |
| Gender | .28 (.08) | .17 | .001 | | | .40 (.04) | .01 | .83 | | |
| Race | .26 (.10) | .14 | .007 | | | .02 (.02) | .07 | .19 | | |
| Parent Income | .08 (.02) | .17 | .001 | | | .01 (.003) | .07 | .18 | | |
| Alcohol Use | −.07 (.03) | −.13 | .01 | | | .004 (.01) | −.25 | <.001 | | |
| **Step 2** | | | | | | | | | | |
| PBS | .06 (.003) | .10 | .06 | 3.56 | .01 | .001 (.001) | .12 | .026 | 5.00 | 01 |
| *k* (DD) | −1.58 (.33) | −.24 | <.001 | 22.32 | .02 | −.11 (.06) | −.11 | .04 | 4.15 | .01 |
| CFC | .02 (.01) | .133 | .006 | 6.03 | .05 | .003 (.001) | .18 | < .001 | 13.34 | .03 |
| **Final Models** | | | | 13.24 | .06 | | | | 3.14 | .04 |
| PBS | − | - | - | | | .001 (.001) | .09 | .110 | | |
| *k* (DD) | -1.47 (.34) | -.22 | <.001 | | | −.09 (.06) | −.09 | .09 | | |
| CFC | .01 (.01) | .10 | .047 | | | .003 (.001) | .15 | .003 | | |

*Note.* DD = Delay Discounting, CFC = Consideration of Future Consequences, GPA = Grade Point Average. Only significant independent variables were used in the final models. Models were tested without controlling for consumption, and controlling for high school rank and condition (in models predicting GPA), although results did not change.