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Behavioral economic approaches to reduce college student drinking ☆

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Abstract

There is a need for novel, theory-based approaches to reduce heavy drinking on college campuses. Behavioral economics has guided basic laboratory research on drug administration for over 30 years and has recently been applied to human substance use in naturalistic and clinical settings. This paper provides an introduction to behavioral economics, reviews applications of behavioral economics to college student drinking, and describes prevention and intervention strategies that are consistent with behavioral economic theory. Behavioral economic theory predicts that college students' decisions about drinking are related to the relative availability and price of alcohol, the relative availability and price of substance-free alternative activities, and the extent to which reinforcement from delayed substance-free outcomes is devalued relative to the immediate reinforcement associated with drinking. Measures of problem severity are based on resource allocation towards alcohol and the relative value of alcohol compared to other reinforcers. Policy and individual level prevention approaches that are consistent with behavioral economic theory are discussed, including strategies for increasing the behavioral and monetary price of alcohol, increasing engagement in rewarding alternatives to substance use, and counteracting student drinkers' tendency to overvalue immediate relative to delayed rewards.
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1. Introduction

College student drinking remains a substantial public health problem and requires prevention approaches that are grounded in sound research and theory. Behavioral economics may provide a novel theoretical framework for generating prevention strategies and for connecting applied prevention efforts with basic theoretical and laboratory research on choice, decision making, and drug self-administration. The goals of this paper are to present an overview of behavioral economics, to review the emerging literature on the behavioral economics of college student drinking, and to discuss the implications of four key behavioral economic variables – price, substance-free reinforcement, relative reinforcement value, and delayed reward discounting – for reducing problem drinking among college students.

1.1. Overview of behavioral economic theory of substance abuse

Behavioral economics uses concepts from economics and operant psychology to describe and predict how organisms allocate valued resources (e.g., money, time, behavior) as a function of environmental constraints (Vuchinich & Heather, 2003). Early applications of behavioral economics demonstrated orderly relations between laboratory drug use and behavioral economic variables and set the stage for more recent "translational" research on human drug and alcohol use in the natural environment. The naturalistic or clinical results have largely replicated the basic research findings and suggest that human drug use is reliably related to price or response cost, levels of substance-free reinforcement, relative reinforcement value, and delayed reward discounting (Bickel & Marsch, 2001; Tucker, Vuchinich, Black, & Rippens, 2006).

Behavioral economic theory predicts that drug use is most likely when there are minimal constraints on drugs and substantial constraints on access to valued substance-free reinforcers (Vuchinich & Tucker, 1988). This postulate is supported by data indicating that: (1) rates of drug use are highly sensitive to alterations in response cost or price (2) drug use occurs at high rates in contexts devoid of substance-free sources of reinforcement, and (3) greater access to alternative reinforcers generally results in a decrease in drug use (Higgins, Heil, & Lussier, 2004).

Behavioral economics assumes that individuals make choices that maximize overall utility (i.e., happiness, satisfaction), but that the choice dynamic is critically dependent on the temporal context of the decisions (Vuchinich & Heather, 2003). Drug choices will often maximize utility if the time frame for maximization is short (Heyman & Dunn, 2002). For example, for a college student binge drinking on one particular day will likely maximize utility for that day compared to studying or engaging in some other constructive activity. However, if the temporal context were longer (e.g., a month or a year), greater behavioral allocation toward constructive activities (e.g., studying, exercise, or career related activities) would maximize utility. As discussed later, young adults, and in particular heavy drinkers (Vuchinich & Simpson, 1998), tend to devalue delayed outcomes, and this myopia may be an important target for prevention programs.

1.1.1. Relations to other theoretical approaches

Social cognitive theory has guided most research on college student drinking and has spawned a number of promising intervention strategies that target theoretically-relevant variables such as alcohol expectancies, coping and drinking moderation skills, descriptive and injunctive drinking norms, and intrinsic motivation (Larimer & Cronce, 2002). In comparison to social cognitive theories, behavioral

economics places less emphasis on the role of cognitive mediation of behavior, and more emphasis on the relative availability, price, and delay associated with alcohol and substance-free alternatives as determinants of drinking. Another distinguishing feature of behavioral economics is the focus on relative resource allocation (e.g., time, money) as a measure of strength of preference or problem severity. The behavioral economic focus on direct relations between environmental variables and drinking behavior is consistent with the social ecological approaches that have guided many environmental prevention approaches. Behavioral economics extends these approaches by incorporating quantitative models of decision making that are based on laboratory research (relative reinforcement value, delay discounting) and by more clearly operationalizing concepts such as price and alternative reinforcement. For a more comprehensive analysis of the similarities and differences between behavioral economics and other theoretical approaches to understand substance abuse see Vuchinich and Tucker (1988).

1.2. Relations between behavioral economic variables and college student drinking

Four primary behavioral economic variables are described below. In each subsection we define the variable, review evidence of its relevance to college student drinking, and discuss implications for prevention and intervention.

1.2.1. Price

Behavioral economic theory defines price broadly as the monetary, time, and personal costs (e.g., legal, social, or health consequences) associated with use. For most reinforcers, including alcohol and other psychoactive drugs, increases in price are associated with decreased consumption, a principle known formally as the Law of Demand (DeGrandpre & Bickel, 1996). Elasticity quantifies the sensitivity of consumption to price changes: Demand is *unit-elastic* when increases in price lead to proportional decreases in consumption; *elastic* when increases in price lead to greater-than proportional decreases in consumption; and *inelastic* when increases in price lead to less-than proportional decreases in consumption.

Murphy and MacKillop (2006) used a hypothetical Alcohol Purchase Task to construct demand curves that directly quantified the influence of drink price on consumption in a sample of 267 college student drinkers. Participants reported the number of standard drinks they would consume at various drink prices during an evening at a bar. Average reported consumption was 7 standard drinks when drink price was $0.25 or less and remained at or above 5 drinks at prices up to $1.50 per drink; however, the plotted demand curves revealed that consumption was elastic in that it decreased by approximately 1.5 standard drinks per dollar price increase in the $1 to $4 price range. Fig. 1 plots the reported sample prevalence of heavy drinking (5/4 drinks for men/women) as a function of drink price. These results are consistent with epidemiological surveys and naturalistic observation studies and indicate that increasing drink prices on college campuses could result in decreased consumption (Chaloupka, Grossman, & Saffer, 2002; Kuo, Wechsler, Greenberg, & Lee, 2003).

In light of the high rates of alcohol consumption among college students, it is not surprising that the behavioral and monetary price of alcohol is generally quite low on and around college campuses. Bars and package-shops often surround college campuses, making alcohol both inexpensive and convenient for students. Indeed, the density of alcohol outlets (Weitzman, Folkman, Lemieux Folkman, & Wechsler, 2003) and drink special advertisements predict campus-wide rates of heavy episodic drinking (Kuo et al., 2003). Within fraternity and sorority houses, there are minimal constraints on drinking, intoxication is
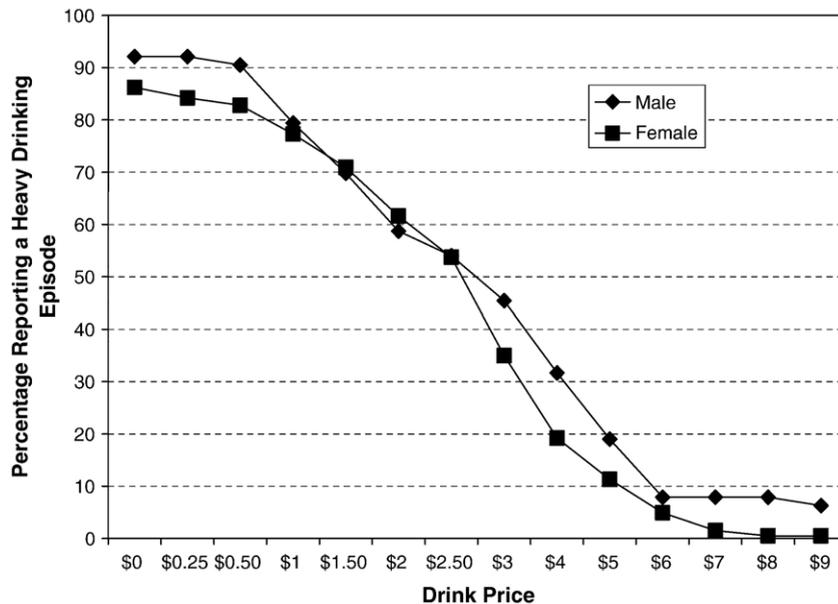
Fig. 1. Percentage of men ($n=65$) and women ($n=202$) who reported that they would engage in a heavy drinking episode (4/5 drinks for females/males) at fourteen levels of price. Participants were college student drinkers recruited from undergraduate courses. Consumption estimates were generated from a hypothetical alcohol purchase task (Murphy & MacKillop, 2006).

tolerated, and assistance is given to those who experience negative consequences of alcohol use (Borsari & Carey, 1999). All of these factors serve to decrease the monetary and behavioral costs of alcohol consumption, and likely contribute to the elevated drinking rates on college campuses (Toomey, Lenk, & Wagenaar, 2007). In addition, many college students' income, defined broadly as the total amount money, time, energy, or other resources that can be allocated to various reinforcers, is high, at least with respect to discretionary leisure time (Wechsler, Dowdall, Devenport, & Castillo, 1995). According to behavioral economic theory, this combination of low costs and high income creates a context that fosters heavy alcohol consumption.

Several environmental or policy-level strategies can be implemented to increase the behavioral, monetary, and legal costs of alcohol consumption on and around campus. A recent National Institute of Alcohol Abuse and Alcoholism panel (NIAAA; DeJong & Langford, 2002; see also Toomey et al., 2007) recommended the following set of environmental policies that are consistent with behavioral economic theory: banning alcohol on campuses, prohibiting kegs, increasing the cost of liquor licenses, limiting days and hours of alcohol sales, limiting container size, increasing state alcohol taxes, and enforcing minimum legal drinking age laws and campus sanctions against alcohol use and/or intoxication. These price-increasing strategies should result in decreased alcohol consumption.

Another way to raise the price of alcohol is to intensify the natural negative consequences associated with drinking. Most college students attend class for fewer than 20 hours per week and have an abundance of leisure time, which is a risk factor for heavy drinking (Wechsler et al., 1995) that might enable students to drink heavily with only minimal impact on their academic performance (Paschall & Freisthler, 2003). Increasing mandatory class time or instituting significant service learning requirements would reduce

students' leisure time and might increase the real price of drinking by making it more difficult to drink heavily without infringing upon academic demands. The "cost" associated with a hangover, for example, would be greater if a student had a significant next day responsibility (e.g., a test or internship) than if he/ she could "sleep in" with impunity. Indeed, there is evidence that 1) students' drinking levels are highest when academic demands are low (i.e., early in the semester and during semester breaks) and lowest when academic demands are high (i.e. during finals; Del Boca, Darkes, Greenbaum, & Goldman, 2004), 2) students who have early classes on Friday morning drink significantly less on Thursday nights than students with later class times (Wood, Sher, & Rutledge, 2005), and 3) students who devote time to volunteer work are at lower risk for binge drinking (Weitzman & Kawachi, 2000). Although it would be challenging to alter students' academic and community service requirements, such drastic measures might be necessary to affect a change in the deeply embedded culture of leisure and heavy drinking that exists on many campuses (Borsari, Murphy, & Barnett, in press). There are also relatively easily implemented strategies that might reduce unstructured leisure time, such as stronger contingencies on class attendance, a greater number of Friday class offerings, and increased requirements for internship and service-learning experiences.

Brief motivational interventions (BMIs) are an empirically supported approach to reduce consumption among college students (Walters & Neighbors, 2005). Although BMIs do not increase the actual price of alcohol consumption, they foster awareness of the costs and consequences of heavy drinking through decisional balance exercises and objective feedback on alcohol-related risks and negative consequences (Henslee, Irons, & Correia, 2007; Walters & Neighbors, 2005). Some personalized feedback intervention protocols also include summaries of the monetary, time, and caloric costs associated with drinking. Future research is needed to determine whether intervention components that focus specifically on summarizing these costs result in improved treatment outcomes, and whether changes in perceptions of the costs and benefits of drinking mediate outcomes.

1.2.2. Substance-free reinforcement

Behavioral economic theory predicts that the relative availability and value of substance-related and substance-free reinforcement are important determinants of alcohol use. Consistent with this postulate, laboratory alcohol administration studies with college students have demonstrated that the amount of alcohol students' consume is inversely related to the amount of an alternative monetary reinforcer (Little & Correia, 2006; Vuchinich & Tucker, 1988). Similarly, large survey studies have documented an inverse relationship between alcohol use and students' engagement in a variety of naturally occurring substance-free alternatives including studying, engaging in volunteer work, and participating in campus activities (excluding fraternity/sorority activities; Fenzel, 2005; Weitzman & Kawachi, 2000).

Several researchers have examined the relationship between college student substance use and attitudes and expectancies regarding substance-free activities. For example, college students who hold positive expectancies for activities such as studying (Levy & Earleywine, 2004) and substance-free social/recreational opportunities (Turrisi, 1999) drink less frequently. These studies are noteworthy for their synthesis of social cognitive and behavioral economic approaches and suggest that interventions attempting to alter positive attitudes and expectancies toward heavy drinking should also attempt to increase positive expectancies related to substance-free activities. Other studies have used reinforcement surveys such as the revised Pleasant Events Schedule (Correia, Carey, & Borsari, 2002; MacPhillamy & Lewinsohn, 1982) or the revised Adolescent Reinforcement Survey Schedule (Murphy, Correia, Colby, & Vuchinich, 2005) to quantify the relations between substance use and levels of substance-free

reinforcement. Reinforcement surveys measure the frequency and subjective pleasure of potentially reinforcing events and activities; reinforcement is generally defined as the product of activity participation and pleasure ratings (Correia et al., 2002). These studies suggest that (1) the frequency, quantity, and negative consequences of alcohol use are negatively related to overall levels of reinforcement derived from substance-free activities (Correia et al., 2002), (2) heavy drinking is associated with lower levels of reinforcement from substance-free nonsocial, passive-outdoor, and introverted activities (Correia, Carey, Simons, & Borsari, 2003), (3) experimentally manipulated increases in substance-free activities (in particular exercise and creative activities) can lead to decreases in alcohol use (Correia, Benson, & Carey, 2005), and (4) students who reduced their drinking following a BMI reported increased substance-free reinforcement from academic activities but also reported decreased substance-free social reinforcement (Murphy, Correia et al., 2005). Together these studies indicate that reinforcement from substance-free activities is negatively related to alcohol use and can be manipulated in targeted interventions. However, drinking reductions may have a deleterious social impact, a factor that might portend a return of heavy drinking.

As a first step in identifying enjoyable alternatives to drinking among college students, and to further explore the relations between drinking and social/leisure activities, we conducted a study that used a timeline follow-back interview to compare enjoyment ratings for specific substance-related and sub-stance-free evening activities in a sample of 108 college students (56% female) who were mandated to complete an alcohol intervention (Murphy, Barnett, & Colby, 2006). We focused on evening activities as likely substitutes for drinking, which, for college students, generally occurs in the evening. Although enjoyment was positively related to the amount of alcohol consumed during the evening (Fig. 2),
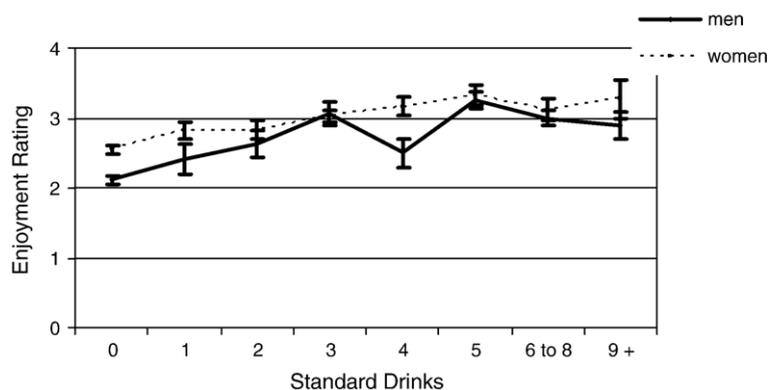

Fig. 2. Mean (±SEM) enjoyment ratings for alcohol-free and drinking activities among men ($n=48$) and women ($n=60$). Participants were college students who participated in a clinical trial of a brief alcohol intervention in order to satisfy a university mandate following an alcohol-related incident (Murphy et al., 2006). Activity enjoyment was rated using a 5-point scale: 0=unpleasant/neutral, 1=mildly pleasant, 2=moderately pleasant, 3=very pleasant, 4=extremely pleasant. The data points represent the mean enjoyment rating as a function of gender and the number of standard drinks consumed during the activity. The data point for the standard drink value of 0 is the mean of all alcohol-free activities. Women reported significantly greater enjoyment from alcohol-free activities than did men. Drinking activities were, on the whole, significantly more enjoyable than abstinent activities. There was a significant positive, linear relation between drinking quantity and enjoyment among women. There was a significant positive, curvilinear relation between drinking quantity and enjoyment among men (reprinted from Murphy et al., 2006).

students reported a number of substance-free activities that were as enjoyable as drinking, including watching movies, going to the theatre or museums, going to parties, eating at restaurants, and creative activity. The number of peers present was a significant predictor of activity enjoyment: substance-free activities that included two or more peers or a romantic partner were generally as enjoyable as drinking activities. Interestingly, men were less likely to socialize when they were not drinking and reported lower overall enjoyment from alcohol-free activities than did women. Moreover, an analysis of the relations between mean levels of substance-free enjoyment (across the substance-free evening activities sampled) and past-month alcohol consumption revealed that the expected inverse relationship between substance-free enjoyment and substance use held only for women (Murphy, Barnett, Goldstein, & Colby, 2007). College men may derive social benefits from drinking that carry over into substance-free contexts and mitigate the expected inverse relation between drinking and substance-free reinforcement (Murphy, McDevitt-Murphy, & Barnett, 2005). Mean levels of substance-free enjoyment were positively related to motivation to change alcohol use (for all participants), however, which suggests that students who have enjoyable social alternatives to drinking may be more likely to reduce their drinking.

A primary policy-level implication of behavioral economic research is that colleges and universities should create substance-free activities that are appealing to students. This recommendation is consistent with the conclusion of the NIAAA panel that colleges should offer more alcohol-free options such as coffeehouses and movies, and expanded hours for student centers and gyms (DeJong & Langford, 2002). Prevention programs should facilitate first-year students' social transition to college through structured evening activities that allow students to make friends within an enjoyable, but substance-free context. This may be especially important for male students. The success of these programs in attracting students and reducing drinking should be evaluated empirically. The NIAAA panel also recommended publicizing service learning opportunities and mandating community service as part of the academic curriculum.

A primary treatment implication of behavioral economics is to assess students' levels of substance-free reinforcement in important life domains (e.g., academics, social, dating, family, health/fitness). Reinforcement surveys could be used to help students identify activities that are typically incompatible with alcohol use (e.g., studying, attending class) or highly pleasurable but engaged in infrequently. Some students might benefit from extended interventions to increase substance-free reinforcement such as behavioral activation or social skills training (Lejuez, Hopko, & Hopko, 2001). Interventions should also help students to compensate for the potential loss of social reinforcement associated with drinking reductions (Murphy, Correia et al., 2005). Although consistent with behavioral economic theory, these intervention approaches have not been evaluated with populations of college drinkers.

Another intervention approach that is consistent with behavior economic theory is Contingency Management (CM; Higgins et al., 2004). CM interventions attempt to reduce substance use by providing substance-free reinforcers that are contingent on evidence of abstinence or moderate consumption. The potential for CM to reduce alcohol consumption among college students was recently demonstrated among a sample of over 700 students attending fraternity parties (Glindermann, Ehrhart, Drake, & Geller, 2007). Three fraternities were randomly assigned to host a baseline party and then an experimental intervention party at which participants who had a measured blood alcohol concentration below 0.05% were entered into a $100 cash lottery. Mean blood alcohol concentration was lower at the intervention party than either the baseline party or at control parties hosted by three fraternities at which incentives for moderate drinking were not provided. Other studies have tested the efficacy of CM in reducing cigarette smoking among college students (Correia & Benson, 2006), and in reducing the use of other drugs

commonly used by college students (e.g., marijuana, Higgins et al., 2004). Although studies with drug abusers suggest that reductions in drug use (relative to control conditions) persist even after the monetary contingencies have been removed (Higgins et al., 2004), more research is needed to further explore the feasibility and effectiveness of using CM procedures to produce meaningful and lasting changes in patterns of alcohol consumption.

1.2.3. Relative reinforcement value

Behavioral economic researchers use the term relative reinforcement value (RRV) to describe the strength of preference for a reinforcer such as alcohol or drugs (Bickel, Marsch, & Carroll, 2000). There are several laboratory measures of RRV, including absolute levels of behavioral output (e.g., lever presses) or drug consumption, sensitivity of consumption to price increases (e.g., elasticity), or the relative rate of responding for drugs compared to other available reinforcers. Several recent studies have developed naturalistic measures of RRV that assess relative behavioral allocation and enjoyment related to substance use. The ARSS-SUV (Murphy, Correia et al., 2005) measures past-month reinforcement from 45 different activities (e.g., going class, socializing, exercise, dating). Reinforcement is quantified as the "cross product" of activity frequency [range=0 (*zero times per week*) to 4 (*more than once per day*)] and enjoyment ratings [range=0 (*unpleasant or neutral*) to 4 (*extremely pleasant*)]. Participants rate each activity frequency and enjoyment twice: once for times they engaged in the activity while drinking or using drugs (substance-related), and once for times they engaged in the activity when they were not drinking or using drugs (substance-free). The RRV index is derived from Herrnstein's (1970) matching law: Mean cross product for substance-related activities/(mean cross product for substance-free activities+mean cross product for substance-related activities). This yields a ratio with higher values representing greater proportional reinforcement from substance-related activities. For example, a person who receives most of his/her total enjoyment from substance related activities, and very little from substance-free activities, would have a high RRV.

We examined whether RRV predicted drinking outcomes among heavy drinking college students who completed a brief motivational intervention (Murphy, Correia et al., 2005). RRV accounted for unique variance in students' drinking at the 6-month follow-up: Participants who derived a smaller proportion of their total reinforcement from substance use at baseline (i.e., had a lower RRV) reported lower levels of follow-up drinking, even after controlling for their baseline drinking level. Thus, college students who have access to a number of enjoyable alternatives to drinking may have an easier time reducing their consumption following an intervention (see also Tucker et al., 2006). Interestingly, moderation analyses revealed that this RRV measure was not a significant predictor of outcomes among men, which is consistent with the aforementioned finding that substance-free reinforcement may not show the expected inverse relation with the drinking patterns of college men. Men and women who reduced their drinking by at least 5 drinks per week showed increased proportional reinforcement from substance-free activities at follow-up, which suggests that successful drinking reductions are associated with more global changes in lifestyle and activity participation.

Another analysis from this treatment trial examined an RRV measure derived from the hypothetical Alcohol Purchase Task described earlier (MacKillop & Murphy, 2007). Reported alcohol consumption and expenditures were plotted as a function of price (demand curves) and used to generate several indices of RRV (Jacobs & Bickel, 1999; Murphy & MacKillop, 2006), such as maximum level of alcohol consumption at low cost (intensity of demand), maximum level of alcohol expenditure (O_{max}), and several measures that reflect the degree to which consumption decreases with increasing price (breakpoint, P_{max},

and elasticity of demand;[1] Bickel et al., 2000). As hypothesized, a number of the facets of reinforcement predicted weekly alcohol consumption at the 6-month follow-up assessment. Participants (both men and women) who at baseline reported greater maximum expenditure (i.e., O_{max}) for alcohol and lower price sensitivity (i.e., breakpoint, P_{max}, and elasticity) reported greater weekly drinking at follow-up (MacKillop & Murphy, 2007). Little and Correia (2006) provided further evidence for the construct validity and potential utility of self-report reinforcement measures that utilize hypothetical alcohol purchases. In a sample of college student drinkers, hypothetical alcohol purchases were significantly correlated with measures of alcohol consumption and problems. Thus, simulated alcohol purchases appear to show meaningful relations to real world patterns of substance use and problems.

RRV operationalizes several important features of young adult substance abuse not captured by existing measures of alcohol consumption, alcohol-related risk behaviors, or negative consequences, including (1) the allocation of considerable resources to substance use (e.g., time, money), (2) insensitivity to the increasing costs of substance use (i.e., inelastic demand), and (3) the relative prominence of substance use in the student's overall lifestyle. Although further research is needed to more conclusively establish their validity, these measures of strength of preference may demonstrate utility in discriminating between young adults with similar substance use patterns, who are at differential risk for progression and need for intervention (Murphy, Correia et al., 2005; Tucker et al., 2006). Students who engage in a number of reinforcing activities other than substance use may reduce their drinking relatively easily in response to a brief intervention or life event (Miller & Rollnick, 2002; Vuchinich & Tucker, 1996); a change that would be facilitated by a reallocation of behavior towards already established reinforcing activities (e.g., academic or extra-curricular activities, a rewarding relationship or hobby). If substance use accounts for a large proportion of total reinforcement, conversely, and there are few valued alternatives, students may be unlikely to respond to a BMI and may instead require an intervention that actually increases substance-free sources of reinforcement (some potential interventions were described in the previous section). In addition to assessing substance abuse problem severity, RRV measures might also be examined as an element of motivational feedback that demonstrates the student's reliance on substance use relative to other activities.

1.2.4. Delayed reward discounting

Delayed reward discounting (DRD) refers to the level of decrease in value associated with reward delay. Although the value of all rewards decreases as their receipt is delayed, there are substantial individual differences in the degree that delayed rewards are discounted, and this discounting phenomenon may be a core feature of substance abuse (Bickel & Marsch, 2001). Researchers have quantified DRD with a hypothetical choice task wherein individuals make choices between smaller amounts of money available immediately and a larger delayed monetary amount (Green, Fry, & Myerson, 1994). Numerous studies have demonstrated that substance abusers, including college student heavy drinkers, discount the value of delayed

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[1] Breakpoint is defined as the first price increment at which no alcohol would be consumed. P_{max} is defined as the price associated with the first decrease in total expenditure. There are two steps required to calculate elasticity. The first step is to regress reported consumption onto price using the following demand curve equation (Jacobs & Bickel, 1999): Ln $C = \mathrm{Ln}L + b$ (LnP) $- aP$, where C is predicted consumption at a unit price of P, L is the price intercept, and parameters b and a determine the slope and acceleration, respectively, of the resulting function. The a and b parameters are used to determine the elasticity of demand at each price: $e = b - aP$. Overall elasticity of demand is calculated by calculating the mean of the individual price elasticities (Hursh & Winger, 1995).

rewards more steeply than light drinkers (Kollins, 2003; Vuchinich & Simpson, 1998). Whereas alcohol generally provides immediate reinforcement (e.g., anxiety reduction, euphoria, social facilitation), many substance-free activities do not. Attending class and studying, for example, are generally not enjoyable activities for students (Murphy et al., 2006), but they are associated with delayed reinforcement such as academic and eventual career and financial success. Students who sharply discount the value of delayed academic and career outcomes may be less likely to engage in the behaviors necessary for success in these domains (e.g., attending class, studying, internships), and may instead allocate their behavior towards more immediately reinforcing activities such as consuming alcohol. DRD may be a particularly relevant risk factor for college drinking in light of the fact that many of the academic and career-related activities that would presumably compete with drinking are associated with extremely delayed outcomes (e.g., college graduation, admission to graduate school, career success) relative to the fairly immediate contingencies present in high school (e.g., mandatory attendance, regular homework and tests) and most employment settings (e.g., penalties for absences, regular paychecks). Moreover, the capacity to value delayed outcomes increases throughout the lifespan and may be rather limited in young adults (Green et al., 1994).

At a policy level, the DRD literature would suggest that colleges and universities might consider increasing the immediacy of academic/career-related rewards by providing more frequent testing or performance feedback and by encouraging students to participate in internship or service learning programs beginning in their first year. Short of actually decreasing the delay associated with substance-free rewards, laboratory research suggests that increasing the salience of delayed rewards can increase preference for those rewards and reduce impulsive response patterns (Logue, 2000). Thus, interventions that increase the salience of delayed academic and career rewards might increase college students' investment in academic and career-related goals. This may be especially beneficial for first-year students, who may spend little time contemplating the impact of their current behavior on distal outcomes such as graduation and career success. Logue (2000) suggested a technique for counteracting DRD wherein people are taught to analyze a choice situation in terms of all of the possible costs and benefits associated with each possible outcome, including what opportunities may be lost through making a particular choice (i.e., opportunity cost). Similarly, the decisional balance exercise, often used in BMIs, may help clients to consider the extended negative and positive consequences of their behaviors (Miller & Rollnick, 2002). Personalized feedback about the health risks, financial costs, and negative consequences associated with an addictive behavior pattern might also help to increase the salience of the delayed outcomes associated with substance abuse (Walters & Neighbors, 2005). Indeed, the goals of feedback-based interventions are consistent with basic behavioral economic research suggesting that self-control choices are more likely when behavior is seen as part of a cohesive pattern, rather than a discrete choice (Heyman & Dunn, 2002). Further research is needed to evaluate interventions that explicitly target DRD, and to determine if changes in DRD mediate drinking outcomes.

1.3. Summary

Behavioral economics assumes that individuals are rational consumers and will allocate their behavior in accord with the relative price and value of available reinforcers. Young adults show a drastic increase in drinking upon beginning college and generally decrease drinking following graduation, and the studies reviewed above suggest that this may be due in part to the fact that during college there are generally minimal constraints on alcohol use, important social benefits associated drinking, an abundance of discretionary leisure time, and a paucity of substance-free activities that provide fairly immediate

reinforcement and are at least partially incompatible with heavy drinking. Prevention programs should attempt to (1) increase the monetary and behavioral price of alcohol, (2) increase engagement in academic, career, and service-related activities, (3) increase the salience of delayed health, academic and career-related outcomes, and (4) develop compelling social/leisure alternatives to drinking. Although some of these recommendations have been included in previous prevention programs and are also consistent with other theoretical approaches, behavioral economics provides a comprehensive theoretical basis for these strategies that is grounded in basic laboratory research. The behavior economic focus on drinking as choice suggests that it is important to target these variables simultaneously. Programs that increase engagement in substance-free activities should also attempt to increase the behavioral and monetary price of drinking and should include activities that are carefully selected on the basis of students' reported preference and the extent to which the activity is incompatible with drinking. Future research might evaluate the specific contributions of behavioral economic theory by determining the incremental efficacy of more uniquely behavioral economic strategies such as counteracting delay discounting, stepped care approaches based on students' baseline RRV, or BMIs that attempt to increase engagement in substance-free alternative activities.

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