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Self-Regulation as a Protective Factor against Risky Drinking and Sexual Behavior

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Abstract

Prior research suggests that high dispositional self-regulation leads to decreased levels of risky drinking and sexual behavior in adolescence and the early years of college. Self-regulation may be especially important when individuals have easy access to alcohol and freedom to pursue sexual opportunities. In the current one-year longitudinal study, we followed a sample of N = 1,136 college students who had recently reached the legal age to purchase alcohol and enter bars and clubs in order to test whether self-regulation protected against heavy episodic drinking, alcohol-related problems, and unprotected sex. We tested main effects of self-regulation and interactions among self-regulation and established risk factors (e.g., sensation seeking) on risky drinking and sexual behavior. High self-regulation inversely predicted heavy episodic drinking, alcohol-related problems, and unprotected sex, even when taking into account gender and risk factors. Moreover, in predicting unprotected sex, we found three-way interactions among self-regulation, sensation seeking, and heavy episodic drinking. Self-Regulation buffered against risk associated with heavy drinking but only among those low in sensation seeking. The protective effects of self-regulation for risky drinking and sexual behavior make it a promising target for intervention, with the caveat that self-regulation may be less protective among those who are more drawn to socially and emotionally rewarding stimuli.

Keywords

Self-Regulation; Alcohol Abuse; Sexual Behavior; Sensation Seeking; College Students

Following adolescence, in the period that Arnett (2000) has termed *emerging adulthood*, individuals engage in behavioral risks at the highest rates across the lifespan. Although many adolescents drink and some drink heavily, rates of heavy alcohol use increase following high school, especially among those who attend college (Baer, Kivlahan, & Marlatt, 1995). Mean rates of heavy episodic drinking are highest in emerging adulthood. At least occasional heavy drinking is the norm during this period (Bachman, Wadsworth, O'Malley, & Johnston, 1997). Increased heavy drinking in emerging adulthood results in negative physical, behavioral, and psychiatric consequences (O'Neill, Parra, & Sher, 2001; Schulenberg, O'Malley, Bachman, Wadsworth, & Johnston, 1996). Additionally, rates of risky sexual behavior increase during this period, with approximately 70% of college students sexually

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active (Douglas et al., 1997). Compared with adolescents, college students are more likely to have multiple sexual partners (Fromme, Corbin, & Kruse, 2008). Despite this increase in partners, fewer than 30% of college students regularly use condoms as a means of protection against sexually transmitted infections (STIs; Douglas et al., 1997; Seidman & Rieder, 1994). Nearly half of all new STI diagnoses are made among those aged 15–24 (Weinstock, Berman, & Cates, 2004).

Sensation Seeking and Heavy Drinking as Risk Factors

Sensation seeking, defined as a tendency to seek and enjoy novelty and excitement, reliably predicts a variety of behavioral risks, including drinking and unsafe sexual behavior (Hittner & Swickert, 2006; Hoyle, Fejfar, & Miller, 2000; Steinberg, 2008). High sensation seekers also experience more negative alcohol-related consequences, a relationship which may be mediated at least in part by their greater alcohol consumption (Magid, MacLean, & Colder, 2007). A meta-analysis demonstrated that sensation seeking is the strongest trait-level predictor of risky sexual behavior (Hoyle et al., 2000). Sensation seeking was associated with multiple indices of risk, including number of partners and frequency of high-risk sexual encounters and unprotected sex. Further, sensation seeking is associated—both cross-sectionally and prospectively—with risky sexual behavior in populations with high HIV incidence, even when taking into account the effects of other risk factors (Kalichman, Simbayi, Jooste, Cain, & Vermaak, 2008; Kalichman, Simbayi, Jooste, Cain, & Cherry, 2006).

Heavy drinking is another important predictor of behavioral risks (Neal & Fromme, 2007). Alcohol use increases aggressive responding (Bushman & Cooper, 1990), and drinking has been linked to gambling (Barnes, Welte, Hoffman, & Tidwell, 2009) and sexual activity (Neal & Fromme, 2007). In contrast, there is conflicting evidence for the role of alcohol use in risky sexual behavior. Whereas some studies have found event-level associations between alcohol intoxication and unprotected sex, others have found no relation (for a review, see Cooper, 2002). These mixed findings suggest that other, untested variables may influence the association, and recent research has identified several such moderators. Specifically, event-level alcohol intoxication appears to more strongly increase the likelihood of unprotected sex with casual than with regular partners (Brown & Vanable, 2007; LaBrie, Earleywine, Schiffman, Pedersen, & Marriot, 2005). Among those in more stable or steady relationships, alcohol intoxication appears to influence the likelihood of unprotected sex earlier rather than later in the relationship (Corbin & Fromme, 2002; Goldstein, Barnett, Pedlow, & Murphy, 2007). Whereas the evidence from event-level studies suggests that situational variables such as partner type influence the association between alcohol use and unprotected sex, individual differences in self-regulatory skill may also moderate the relation, with those low in self-regulation at greater risk for unprotected sex after consuming alcohol.

Self-Regulation as a Protective Factor

High levels of dispositional self-regulation are broadly understood to be protective against drinking and risky sex among adolescents and emerging adults (Hull & Slone, 2004; Wiederman, Baumeister, & Vohs, 2004). Self-regulation refers to the effortful control of thoughts, emotions, and behaviors in the service of a goal; it includes such capacities as planning and the ability to delay gratification but is separate from and only modestly related to behavioral impulsivity (Hofmann, Friese, & Strack, 2009; Reynolds, Penfold, & Patak, 2008). Although meaningful individual differences in self-regulation can be identified among preschool students (e.g., Mischel, Shoda, & Peake, 1988), self-regulatory skills continue to develop through young adulthood (Steinberg et al., 2009). Research on resilience has identified multiple mechanisms through which protective factors such as self-regulation can influence outcomes (Luthar, 1993; Luthar, Cicchetti, & Becker, 2000). Specifically, protective factors

may exert main effects on risky behaviors or they may moderate the effects of risk factors. That is, one category of protective factors is negatively associated with risky behaviors, regardless of risk factors. A second category of protective factors interacts with—or buffers against the effects of—risk factors to influence behaviors. Although these factors may not relate directly to behavioral risks, they protect against the harmful influence of other variables.

Regarding risky drinking and sexual behavior, self-regulation meets the criteria for at least the first type of protective factor. Among adolescents and college students, high levels of dispositional self-regulation negatively predict alcohol use (Wills & Stoolmiller, 2002), alcohol-related negative consequences (Hustad, Carey, Carey, & Maisto, 2009), and sexual risk-taking (Gailliot & Baumeister, 2007; Raffaelli & Crockett, 2003). Laboratory manipulations to deplete self-regulation result in increased alcohol consumption (Muraven, Collins, & Neinhaus, 2002) and decreased sexual restraint (Gailliot & Baumeister, 2007), and daily-diary research supports the ecological validity of the depletion effect on alcohol use (Muraven, Collins, Shiffman, & Paty, 2005).

Moreover, several studies have demonstrated that self-regulation may also buffer against risk factors. In studies of adolescent alcohol and other substance use, Wills and colleagues (2008; 1998) found that the impacts of peer substance use, negative life events, and impulsivity were meliorated among adolescents high in self-regulation. That is, self-regulation buffered against environmental and dispositional risk factors for substance abuse. Further, Neal and Carey (2007) found that high self-regulation weakened the association between alcohol intoxication and negative consequences. Although it is theoretically consistent that self-regulation also buffers against risk factors for risky sexual behavior, to our knowledge no study has tested this hypothesis.

Self-Regulation in Emerging Adulthood

Recent research suggests that there is some continuity in the etiological contributions of risk factors for heavy drinking across developmental periods (King, Burt, Malone, McGue, & Iacono, 2005; Merline, Jager, & Schulenberg, 2008). Key developmental milestones, however, may change the trajectories of risky behaviors (Rutter, 1996; Schulenberg & Maggs, 2002). As emerging adults reach age 21 and gain the ability to purchase alcohol and drink in bars and restaurants, they have the potential to exert greater control over when, where, and how much they choose to drink. Access to bars and nightclubs also introduces opportunities for new sexual encounters and relationships, some of which may be fraught with temptations and incentives to engage in risky behaviors. As Arnett (2000) notes, emerging adults can pursue new, intense, and risky experiences with greater freedom than can individuals in any other developmental period. For example, after reaching age 21, quantity of alcohol consumed per occasion decreases, whereas driving after drinking increases (Fromme, Wetherill, & Neal, 2009). The years following the 21st birthday may therefore be a crucial time in which to test the effects of self regulation.

Whereas much existing research on the protective effects of self-regulation involves adolescents and college underclassmen, the current one-year prospective study tested self-regulation in relation to alcohol use and problems and unprotected sex among college students who had reached the legal age to purchase alcohol. We examined whether self-regulation was a protective factor against heavy episodic drinking, alcohol-related problems, and unprotected sex among emerging adults in two ways: directly (i.e., as a main effect) and as a buffer (i.e., as a moderator of risk factors). In addition to testing the predictive validity of self-regulation for the three outcomes, we tested whether high self-regulation could buffer against the effects of known risk factors. Specifically, we tested the following hypotheses: (1) self-regulation will predict lower heavy episodic drinking, alcohol-related problems, and unprotected sex with

monogamous and non-monogamous partners, even when controlling for risk factors; (2) self-regulation will also buffer against the effects risk factors (i.e., sensation seeking for heavy episodic drinking; sensation seeking and heavy episodic drinking for alcohol-related problems and unprotected sex).

We also explored one-year change and gender differences in study variables. We expected that alcohol use and related problems would decrease as students mature beyond their 21st birthday (Fromme et al., 2009), but we had no *a priori* hypotheses concerning change or stability in unprotected sex. Because sensation seeking peaks in adolescence following puberty, we expected that sensation seeking levels would be stable by the early twenties. We predicted, however, that self-regulation would continue to develop with age (Steinberg et al., 2009). We also predicted that men would report lower levels of self-regulation (e.g., Duckworth & Seligman, 2006) and higher levels of sensation seeking (e.g., Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). We did not expect to find gender differences in risky drinking or unprotected sex (e.g., Corbin, Vaughan, & Fromme, 2008).

Method

Participants and Procedures

Participants were members of the University of Texas at Austin (UT) entering class of 2004 who were part of "The UT Experience!" study, a longitudinal study of alcohol use and other behavioral risks during the transition from high school through college. First-time students between the ages of 17 and 19 were invited to participate (N = 6,391). Seventy-six percent of students (N = 4,832) expressed interest in the study and further met the final participation criterion of being unmarried. Of these students, 3,046 were then randomly assigned to complete surveys for high school, for each semester of the first three years following high school, and in the fall of the fourth and fifth years following high school. Eligible students were given access to a secure Web server, on which they provided informed consent and completed the high school survey (N = 2,245, 74% of the randomized sample). The present study is based on this sample[1]. For a more detailed description of participant recruitment and other procedures, see Corbin, Vaughan, and Fromme (2008) and Hatzenbuehler, Corbin, and Fromme (2008).

In the fall of years four and five of the longitudinal study, participants completed Web-based surveys that included measures of self-regulation, sensation seeking, alcohol use and problems, and other behavioral risks. Whereas measures of alcohol use and other behavioral risks were included in all surveys throughout the longitudinal study, self-regulation was only assessed in the year-four and year-five surveys. Survey responses were collected and stored by DatStat (Seattle, Washington). Participants received $40 for the completion of each survey. A total of 1,136 participants (51% of the longitudinal sample) completed both the year-four and year-five surveys and were therefore included in this study. The final sample (66% female; 54% White, 21% Asian-American, 13% Hispanic or Latino, 4% African-American, and 8% multiethnic/other) was demographically similar to UT's undergraduate population. At the year-four survey, the mean age was 21.75 years (SD = 0.35).

Measures

Self-Regulation—Participants completed the Brief Self-Control Scale (BSCS; Tangney, Baumeister, & Boone, 2004). This 13-item scale assesses trait self-regulation with items such as "People would say that I have iron self-discipline" and "I am good at resisting temptation" on 5-point scales where 1 = *not at all* and 5 = *very much*. The BSCS is associated with behavioral

[1]Of the remaining participants, 976 were assigned to complete surveys prior to starting college and again in year four, and 810 were assigned to complete a survey in year four only.

measures of self-regulation and a wide range of theoretically relevant outcomes (Schmeichel & Zell, 2007; Tangney et al., 2004). In previous research with college students, the BSCS demonstrated good internal consistency (αs ranging from .83 to .85; Tangney et al., 2004). See Table 1 for summary statistics and internal consistencies for the present sample.

Sensation seeking—Participants completed an 11-item measure of sensation seeking taken from the Zuckerman-Kuhlman Personality Questionnaire (Zuckerman et al., 1993). Participants endorsed items such as "I like doing things just for the thrill of it" and "I like to explore a strange city or section of town by myself, even if it means getting lost" on dichotomous scales where 0 = *false* and 1 = *true*. In previous research with adolescents, the sensation seeking scale demonstrated adequate internal consistency (α = .71; Pedersen & McCarthy, 2008).

Heavy episodic drinking—The standard definition of heavy episodic drinking—four or more drinks in a sitting for women and five or more drinks in a sitting for men—does not take into account individual differences in weight, alcohol tolerance, alcohol metabolism, and body fat and muscle composition. Jackson and colleagues (2001) proposed a subjective alcohol effect measure as an alternative to the standard objective measure, yet subjective definitions of intoxication may differ between individuals. Consistent with previous research (Leonard & Homish, 2008; Testa, Livingston, & Leonard, 2003), we therefore created a composite variable by summing responses to objective and subjective indices of heavy episodic drinking. Participants reported past-three-month frequency of binge drinking (i.e., four or more standard drinks in a sitting for women and five or more standard drinks in a sitting for men; Wechsler & Isaac, 1992). Participants also reported the number of times in the past three months that they became "drunk (not just a little high) on alcohol" (Jackson et al., 2001; Midanik, 1999). In the current research, the two components were highly correlated at both assessments, average $r = .84$.

Alcohol-related problems—We used the 23-item Rutgers Alcohol Problem Index to assess past-3-month frequency of alcohol-related consequences ranging from missing school or work to continuing to drink despite efforts to stop (RAPI; White & Labouvie, 1989). We summed responses to all 23 items for each participant. In previous research in a college student population, the RAPI demonstrated moderate associations with measures of alcohol use and good internal consistency (α = .92; Simons & Carey, 2006).

Unprotected sex—Participants reported the number of past-three-month occasions on which they had unprotected sex with a monogamous partner (i.e., sex without protection against STDs and pregnancy with an exclusive dating partner) and a non-monogamous partner (i.e., sex without protection against STDs and pregnancy with a non-exclusive dating partner) (Wetherill, Neal, & Fromme, in press). Participants endorsed both items on 7-point scales, where 0 = *0* and 6 = *more than 20*.

Statistical Analyses

Heavy episodic drinking, alcohol-related problems, and unprotected sex were all distributed non-normally at both assessments (skewness ≥ 2.46, $SE = 0.07$; kurtosis ≥4.67, $SE = 0.14$). We therefore tested our hypotheses using generalized linear modeling (GzLM) in SPSS version 15.0. GzLM allows for the specification of error distributions other than the normal distribution (Byers, Allore, Gill, & Peduzzi, 2003; Gardner, Mulvey, & Shaw, 1995; Neal & Simons, 2007). Interpretation is similar to that of the ordinary least squares regression model, although a χ^2 test of overall model fit is used rather than an F test. Exponentiated regression coefficients, or incidence rate ratios (*IRR*s), are used as a standardized effect size. For all four dependent variables, we specified the negative binomial distribution with a log link. Similar to the Poisson

distribution, the negative binomial is appropriate for count data (i.e., non-negative integers) with positive skew. Use of the Poisson distribution, however, additionally assumes that the mean is equal to the variance, whereas the negative binomial distribution allows for overdispersion, which is common in alcohol use data (Gardner et al., 1995; Neal & Simons, 2007). We included gender in all models to ensure that gender differences did not confound the hypothesized relations, and we standardized all continuous predictor variables prior to analyses to ease interpretation of *IRR*s.

The most stringent tests of study hypotheses permitted by our data were tests of whether self-regulation protected against change in risky drinking and sexual behavior across time. As shown in Table 1, however, we found little change in risky behaviors from year four to year five. We therefore conducted two sets of analyses. In the first, we tested the protective effects of year-four self-regulation on year-five outcomes controlling for outcomes at year four. In the second, we removed year-four risky drinking and sexual behavior from the models. Whereas the first set of analyses permitted us to model change in risky behavior as a function of the protective effects of self-regulation, the second permitted us to test the theoretical relations of interest without the requirement that they predict over and beyond past behavior. Because the results of the two sets of analyses were for the most part similar, we report only the first set (i.e., controlling for year-four behavior) but report findings for the second when results differed.

We tested our hypotheses separately for each risky drinking and sexual behavior (i.e., heavy episodic drinking, alcohol-related problems, unprotected sex with a monogamous partner, and unprotected sex with a non-monogamous partner). We first tested whether self-regulation would protect against heavy drinking. We estimated a model predicting year-five heavy episodic drinking in which year-four heavy drinking, sensation seeking, and self-regulation were included in step one of a GzLM. In step two, we tested whether self-regulation buffered against the effect of sensation seeking by including a sensation seeking X self-regulation interaction term. Next, we tested whether self-regulation would protect against alcohol-related problems and unprotected sex one year later. Specifically, we estimated three separate GzLMs predicting year-five alcohol-related problems, unprotected sex with a monogamous partner, or unprotected sex with a non-monogamous partner. In each model, main effects of year-four alcohol-related problems or unprotected sex, self-regulation, sensation seeking, and heavy episodic drinking were entered in step one, all two-way interactions among self-regulation, sensation seeking, and heavy episodic drinking were entered in step two, and a three-way interaction among the predictors was entered in step three. We probed all interactions using the method employed by Neal and Fromme (2007), which is an extension of the Aiken and West (1991) procedure.

Results

Participants included in this investigation (i.e., those who completed both year-four and year-five surveys) did not differ from the remainder of the longitudinal sample (n = 1,109) at the baseline high school survey on unprotected sex with a non-monogamous partner (*IRR* = 0.88, $b = -0.12$, $p = .37$). Included participants did, however, report fewer heavy drinking episodes (*IRR* = 0.76, $b = -0.28$, $p < .001$), alcohol-related problems (*IRR* = 0.74, $b = -0.30$, $p < .001$), and instances of unprotected sex with a monogamous partner (*IRR* = 0.85, $b = -0.16$, $p = .03$). Additionally, they were more likely to be White and Asian-American, χ^2 (4) = 19.54, $p < .001$, younger, t (2,245) = 2.37, $p = .02$, $d = .10$, female, χ^2 (1) = 32.29, $p < .001$, and higher in sensation seeking, t (2,128) = 3.60, $p < .001$, $d = .16$. Self-Regulation was not assessed at the baseline survey, but included participants did not differ from those who completed the year-four survey but not the year-five survey (n = 299) on self-regulation at the year-four assessment, t (1,433) = 0.13, $p = .90$, $d = .01$.

Change and Stability in Self-Regulation, Sensation Seeking, and Behavioral Risks

Participants experienced a small increase in self-regulation from year four to year five, but sensation seeking remained stable. Participants reported small decreases in heavy episodic drinking and alcohol-related problems over the same time period (see Table 1). There was no significant change, however, in unprotected sex with either monogamous or non-monogamous partners. See Table 2 for bivariate correlations among study variables.

Gender Differences and Similarities in Self-Regulation, Sensation Seeking, and Behavioral Risks

As shown in Table 3, women reported greater levels of self-regulation, whereas men reported greater levels of sensation seeking. These effects were small in size. Men and women generally did not differ as a function of risky drinking and sexual behaviors, including heavy episodic drinking and unprotected sex with monogamous and non-monogamous partners. Men reported experiencing more alcohol-related problems at year five only, although this difference was very small in size.[2]

Self-Regulation as a Protective Factor against Heavy Episodic Drinking

In step one of a generalized linear model (GzLM) with gender (*IRR* = 0.85, *b* = −0.17, *p* = .02) and year-four heavy episodic drinking (*IRR* = 2.44, *b* = 0.89, *p* < .001) as covariates, sensation seeking (*IRR* = 1.21, *b* = 0.19, *p* < .001), and self-regulation (*IRR* = 0.92, *b* = −0.08, *p* = .02) significantly predicted heavy episodic drinking. That is, a 1-standard-deviation increase in sensation seeking was associated with a 21% increase in the incidence rate of heavy episodic drinking, whereas a 1-standard-deviation increase in self-regulation was associated with an 8% decrease in the incidence rate of heavy episodic drinking. In step two, self-regulation did not moderate the effect of sensation seeking on heavy episodic drinking, *IRR* = 1.01, *b* = 0.01, *p* = 71.

Self-Regulation as a Protective Factor against Alcohol-Related Problems

In a GzLM with gender (*IRR* = 1.19, *b* = 0.17, *p* = .04) and year-four alcohol-related problems (*IRR* = 1.76, *b* = 0.57, *p* < .001) as covariates, heavy episodic drinking (*IRR* = 0.25, *b* = 1.28, *p* < .001), sensation seeking (*IRR* = 1.12, *b* = 0.11, *p* = .008), and self-regulation (*IRR* = 0.80, *b* = −0.22, *p* < .001) significantly predicted year-five alcohol-related problems. In step two, self-regulation significantly interacted with heavy episodic drinking such that the association between heavy drinking and alcohol-related problems was stronger among those low in self-regulation, *IRR* = 1.11, *b* = 0.11, *p* = .01. There were no other significant two-way interactions. In step three, the three-way interaction among heavy episodic drinking, sensation seeking, and self-regulation did not reach significance, *IRR* = 1.06, *b* = 0.06, *p* = .15. See Table 4 for the final model.

In contrast to the above analyses, in a model predicting year-five alcohol-related problems without controlling for year-four problems, we found a significant three-way interaction among heavy episodic drinking, sensation seeking, and self-regulation, *IRR* = 1.09, *b* = 0.09, *p* = .03. High self-regulation buffered against the risk for alcohol-related problems associated with heavy drinking in this less-stringent model, but the effect was stronger among those low in sensation seeking.

[2]Although the analyses are not reported in this article, the protective effects of self-regulation generally did not differ as a function of gender.

Self-Regulation as a Protective Factor against Unprotected Sex with a Monogamous Partner

In step one of a GzLM with gender (*IRR* = 0.65, *b* = −0.43, *p* < .001) and year-four unprotected sex with a monogamous partner (*IRR* = 1.57, *b* = 0.45, *p* < .001) as covariates, heavy episodic drinking (*IRR* = 1.17, *b* = 0.16, *p* < .001) and sensation seeking (*IRR* = 1.19, *b* = 0.18, *p* = .001) significantly predicted year-five unprotected sex with a monogamous partner, whereas self-regulation (*IRR* = 0.93, *b* = −0.07, *p* = .20) did not. In step two, we added all three two-way interactions among heavy episodic drinking, sensation seeking, and self-regulation but found no significant two-way interactions. In step three, the three-way interaction among heavy episodic drinking, sensation seeking, and self-regulation was again significant, *IRR* = 1.11, *b* = 0.10, *p* = .03. See Table 4 for the final model. As shown in Figure 1, high self-regulation protected against the effect of heavy drinking but only among those low in sensation seeking.

Self-Regulation as a Protective Factor against Unprotected Sex with a Non-Monogamous Partner

In step one of a GzLM with gender (*IRR* = 0.91, *b* = −0.10, *p* = .62) and year-four unprotected sex with a non-monogamous partner (*IRR* = 1.30, *b* = 0.26, *p* < .001) as covariates, heavy episodic drinking (*IRR* = 1.32, *b* = 0.28, *p* < .001), sensation seeking (*IRR* = 1.32, *b* = 0.28, *p* = .007), and self-regulation (*IRR* = 0.69, *b* = −0.37, *p* < .001) significantly predicted year-five unprotected sex with a non-monogamous partner. In step two, we added all three two-way interactions among heavy episodic drinking, sensation seeking, and self-regulation but again found no significant interaction effects. In step three, the three-way interaction among heavy episodic drinking, sensation seeking, and self-regulation was marginally significant, *IRR* = 1.14, *b* = 0.13, *p* < .06. As shown in Figure 2, self-regulation buffered against the risk for unprotected sex with a non-monogamous partner associated with heavy episodic drinking, but this effect was stronger among those low in sensation seeking. See Table 4 for the final model.

In a less-conservative model predicting year-five unprotected sex with a non-monogamous partner without controlling for year-four unprotected sex, we replicated this three-way interaction among heavy episodic drinking, sensation seeking, and self-regulation at a conventional level of significance, *IRR* = 1.17, *b* = 0.16, *p* = .03.

Discussion

The results of this investigation support a conceptualization of self-regulation as a protective factor against risky drinking and sexual behavior in two ways. First, we found evidence that high self-regulation continues to (inversely) predict risky outcomes beyond age 21. Taking into account the effects of gender and sensation seeking, high self-regulation predicted fewer heavy drinking episodes. In addition, when taking into account gender, sensation seeking, and heavy episodic drinking, high self-regulation predicted fewer alcohol-related problems and fewer instances of unprotected sex with non-monogamous partners. Beyond the direct effects of self-regulation on behavioral risks, we found evidence that self-regulation also buffers against the influence of other risk factors. Specifically, high self-regulation buffered against the risk associated with heavy episodic drinking for unprotected sex with both monogamous and non-monogamous partners, although only among those low in sensation seeking. We also found some limited support for a similar effect on alcohol-related problems, but self-regulation did not significantly interact with heavy episodic drinking and sensation seeking when accounting for past alcohol-related problems. Thus, the current study suggests that self-regulation may play dual roles in the etiology of behavioral risks. Luthar and colleagues (2000) distinguished among protective factors by their mechanisms of action (i.e., main effects vs. interactions with risk factors). Our findings suggest that self-regulation is protective against heavy drinking, alcohol-related problems, and unprotected sex with non-monogamous partners

among all college students. Regarding unprotected sex, however, it is particularly beneficial among heavier drinkers who lack another dispositional risk factor (i.e., high sensation seeking).

In our analyses of unprotected sex, we found support for three-way interactions among two risk factors and the protective effect of self-regulation. These results underscore the importance of considering protective factors in the broader context of etiology. Risky drinking and sexual behavior are likely the result of the additive and interactive effects of many variables, and studies considering protective influences in a vacuum or with a single risk factor may not fully capture these processes. Although the present study included only the two risk factors of sensation seeking and heavy episodic drinking, we were nevertheless able to conclude that self-regulation can exert a buffering effect under certain specific conditions. Had we included only heavy episodic drinking, for example, we would have concluded that self-regulation is equally protective against unprotected sex among all emerging adults.

The current study suggests that self-regulation may protect against risk factors for sexual risk-taking. Although impossible to explore in this investigation, an interesting possible explanation is that high self-regulators who are also at risk for unprotected sex are able to avoid this behavior by controlling the context and timing of heavy drinking episodes. Self-Regulation involves capacities for planning, goal setting, and delaying gratification. Among heavy drinkers, high self-regulation may entail avoiding individuals or social groups who are likely to offer opportunities to engage in unsafe sexual practices. Similarly, high self-regulators may plan ahead by carrying condoms or other prophylactics when attending parties or otherwise consuming alcohol. In this way, individuals who have stronger self-regulatory skills—in particular those also low in sensation seeking—may prevent themselves from engaging in unprotected sex even when drinking heavily. Future research concerning self-regulation's role in risky sexual and drinking behavior could explore this hypothesized protective mechanism.

An interesting and unexpected finding was that high sensation seeking disrupted the buffering effect of self-regulation against the risk associated with heavy episodic drinking. That is, as shown in Figures 1 and 2, self-regulation's buffering effect for unprotected sex was greatly attenuated among high sensation seekers. Recent evidence from social neuroscience suggests that individual differences in sensation seeking may reflect differences in limbic and paralimbic sensitivity to socially and emotionally rewarding stimuli (Casey, Getz, & Galvan, 2008; Steinberg, 2008; Zald et al., 2008). Moreover, this brain system is distinct from the cognitive control system, which may in part underlie self-regulation (Steinberg, 2007). As the current results suggest, sensitivity to rewarding stimuli may render self-regulatory skill less relevant, particularly in the context of risky sex.

Strengths and Limitations

This study's conclusions are circumscribed by several methodological limitations. The external validity of our results is restricted by the college sample. Levels of self-regulation likely differ between college students and their peers who do not attend college, and mechanisms of risk and protection may plausibly differ as well. The vast majority of studies of self-regulation and risky behaviors have been conducted among introductory psychology college students, many of whom are in their first or second year of college. In fact, the present study is strengthened relative to this literature in that it expands self-regulation research to include older college students, who have reached the minimum legal drinking age and therefore experience a different set of opportunities, options, and self-regulatory challenges.

Additionally, the sample included in our analyses was biased relative to the full longitudinal study sample, with included participants generally reporting fewer behavioral risks. Although this restricted sample limits the degree to which we can generalize our findings, we see no theoretical reason why self-regulation would matter more among those who engage in

behavioral risks less often. Indeed, if the sample selection biased our findings at all, the reduced variance in sensation seeking, alcohol use and related problems, and unprotected sex with monogamous partners should have resulted in attenuation of regression coefficients as a result of range restriction (Hunter & Schmidt, 2004). Thus, the estimates of association reported herein may represent lower bounds of the true magnitudes of the protective effects of self-regulation.

One strength of the present study is its longitudinal design. Self-Regulation protected against change in heavy episodic drinking, alcohol-related problems, and unprotected sex one year later. These prospective findings permit us to draw stronger—if not causal—conclusions about the role of self-regulation in behavioral risks. Nevertheless, because measures of self-regulation were only included in two assessment waves of a longer study, in the current research we were unable to take full advantage of the entire longitudinal study. Had self-regulation been included in prior assessments, we could have directly tested, for example, whether the effects of self-regulation differ before and after turning 21.

Finally, the measures of sexual risk-taking included in this study have two limitations. First, because both measures were single items, they may have had poor reliability. In results from earlier waves of the parent longitudinal study, however, both measures were moderately correlated with other indices of risky sexual behavior and displayed significant associations with other theoretically meaningful variables (Wetherill et al., in press). Second, the items did not make explicit the type of sexual activity (i.e., vaginal, anal, oral) to which they referred. Because they specified the use of protection against STIs *and* pregnancy, however, we are confident that they imply vaginal intercourse.

Conclusions

This investigation demonstrates that self-regulation remains an important protective factor into emerging adulthood. Among a sample of college upperclassmen, high self-regulation was relevant to heavy drinking and its consequences, in addition to risky sex. This study is among the first to indicate that self-regulation may buffer against risk factors for unprotected sex with both monogamous and non-monogamous partners. Previously negative findings relating alcohol use to unprotected sex with monogamous partners may reflect the fact that self-regulation had not been considered as a potential moderator of this relation.

Our results suggest that self-regulation is protective in two ways. We found protective overall effects of self-regulation on heavy episodic drinking, alcohol-related problems, and unprotected sex. Second, we found strong evidence for a buffering effect of self-regulation against the risk for unprotected sex associated with heavy episodic drinking among those low in sensation seeking, along with weaker evidence for a similar buffering effect against alcohol-related problems. Additionally, whereas women reported greater dispositional self-regulation, the protective effects of self-regulation did not differ as a function of gender. Self-regulatory skill may therefore be a crucial target for intervention. As an important caveat, however, the disruptive force of high sensation seeking on self-regulation's buffering effect illuminates the importance of considering multiple dispositional factors in designing prevention programs.

Although trait-level individual differences may seem difficult to change, the mean-level growth in self-regulation demonstrated in this study suggests that this may not be the case. Brief, simple manipulations to increase the use of self-regulation strategies for goal-achievement, such as mental contrasting and implementation intentions, improve some academic outcomes (Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2009). Moreover, interventions targeting personality factors such as sensation seeking have recently demonstrated efficacy in reducing adolescent heavy drinking (Conrod, Castellanos, & Mackie, 2008). Whereas the current study suggests that self-regulatory-skills-based interventions may have promise for reducing risky

drinking and sexual behavior, it also reaffirms the value in selectively targeted prevention efforts among those high in sensation seeking.

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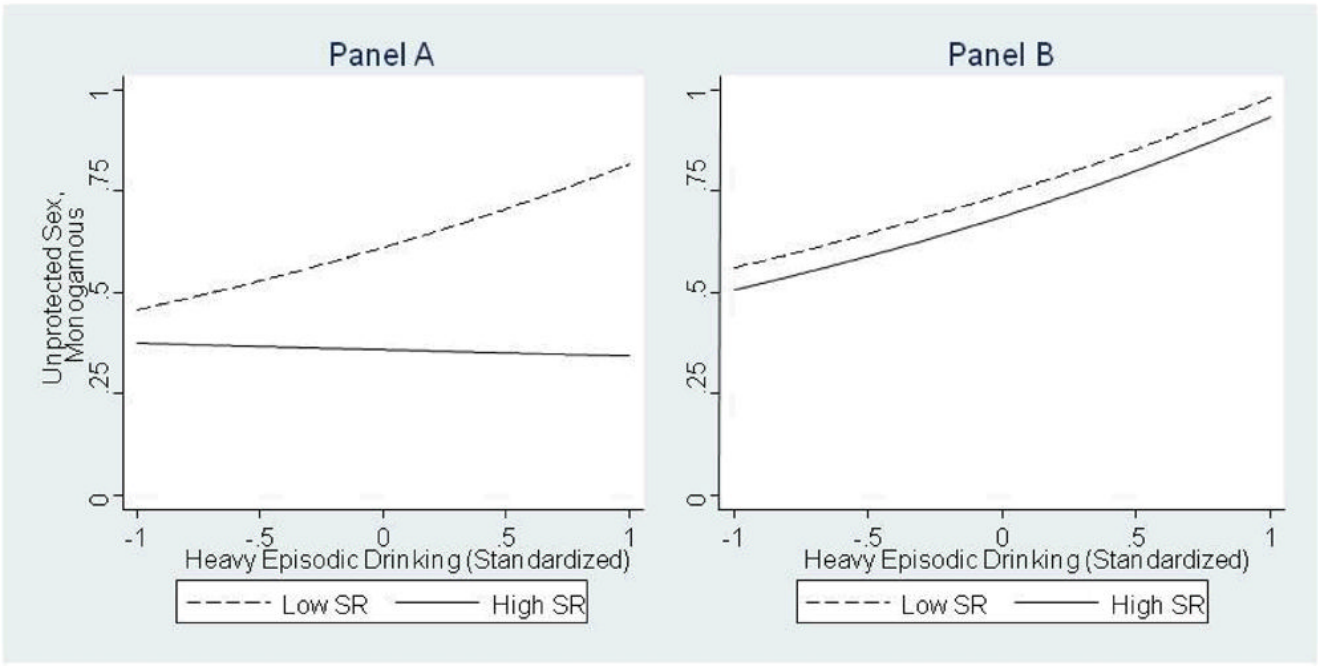

Figure 1.
Unprotected sex with monogamous partners as a function of year-four heavy episodic drinking one standard deviation below and above the mean of self-regulation (SR) among those one standard deviation below (Panel A) and above (Panel B) the mean of sensation seeking.

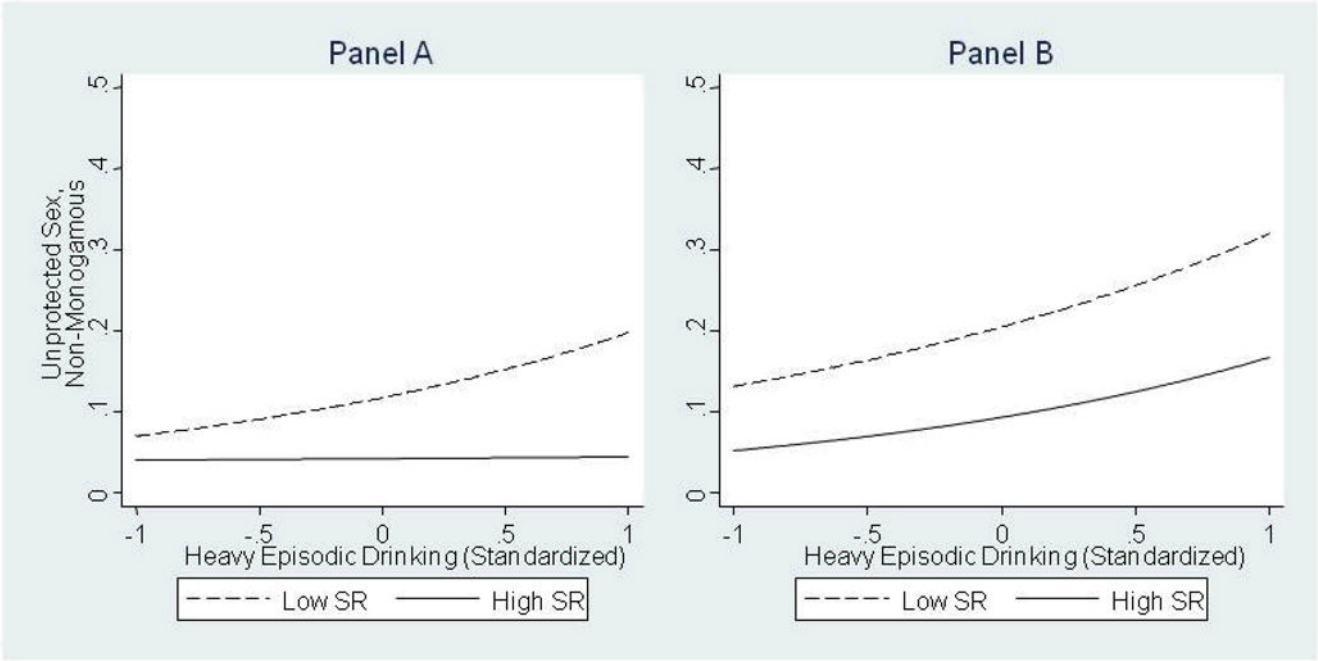

Figure 2.
Unprotected sex with non-monogamous partners in year five as a function of year-four heavy episodic drinking one standard deviation below and above the mean of self-regulation (SR) among those one standard deviation below (Panel A) and above (Panel B) the mean of sensation seeking.

Table 1

Summary Statistics at Years Four and Five

Variable	Possible Range	Year Four			Year Five			*d*
		M	*SD*	*α*	*M*	*SD*	*α*	
Self-Regulation	13–65	44.42	8.08	.83	45.11	8.28	.84	0.08‡
Sensation seeking	0–11	5.26	3.02	.79	5.20	3.06	.80	−0.02
Heavy episodic drinking	0–180	7.63	13.38	.89	6.38	11.25	.85	−0.10‡
Alcohol-related problems	0–92	2.61	5.61	.91	1.88	4.22	.89	−0.15‡
Unprotected sex								
Monogamous partner	0–6	0.60	1.56	-	0.62	1.58	-	0.02
Non-monogamous partner	0–6	0.12	0.60	-	0.14	0.63	-	0.02

‡ $p < .001$.

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Table 2

Bivariate Correlations among Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. Male gender	-	−.11‡	.13‡	.03	.03	.02	.02	−.02	.03
2. Self-Regulation	−.11‡	-	−.29‡	−.19‡	−.17‡	−.18‡	−.29‡	−.11‡	−.14‡
3. Sensation seeking	.16‡	−.28‡	-	.23‡	.22‡	.24‡	.24‡	.10‡	.12‡
Heavy episodic drinking (HED)[a]									
4. Binge episodes	.02	−.15‡	.23‡	-	.85‡	.96‡	.65‡	.13‡	.21‡
5. Times drunk	−.003	−.16‡	.23‡	.83‡	-	.95‡	.66‡	.12‡	.23‡
6. HED composite	.01	−.16‡	.25‡	.96‡	.94‡	-	.68‡	.13‡	.22‡
7. Alcohol-related problems[a]	.04	−.27‡	.21‡	.57‡	.60‡	.61‡	-	.13‡	.22‡
Unprotected sex[a]									
8. Monogamous partner	−.06	−.01	.05	.09†	.13‡	.10‡	.13‡	-	.09†
9. Non-monogamous partner	−.004	−.13‡	.10‡	.22‡	.23‡	.23‡	.24‡	.08†	-

Note. Correlations among study variables in year four are above the diagonal, and correlations in year five are below the diagonal.

[a]Spearman's rho correlation coefficients.

†$p < .01$.

‡$p < .001$.

Table 3

Gender Differences and Similarities in Self-Regulation, Sensation Seeking, and Risky Drinking and Sexual Behavior

Variable	Women		Men		*d*
	M	*SD*	*M*	*SD*	
Year Four					
Self-Regulation	45.10	8.05	43.26	8.01	0.23‡
Sensation seeking	4.99	3.02	5.81	2.96	−0.27‡
Heavy episodic drinking	7.12	12.89	8.60	14.23	−0.11
Alcohol-related problems	2.43	5.26	2.95	6.22	−0.09
Unprotected sex, monogamous partner	0.60	1.53	0.59	1.60	0.01
Unprotected sex, non-monogamous partner	0.11	0.56	0.15	0.68	−0.06
Year Five					
Self-Regulation	45.71	8.13	43.95	8.46	0.21‡
Sensation seeking	4.85	2.98	5.86	3.12	−0.33‡
Heavy episodic drinking	6.12	10.38	6.89	12.75	−0.07
Alcohol-related problems	1.69	3.80	2.25	4.88	−0.13*
Unprotected sex, monogamous partner	0.68	1.63	0.50	1.46	0.12
Unprotected sex, non-monogamous partner	0.12	0.56	0.16	0.75	−0.06

Note. Positive Cohen's *d* scores indicate greater scores for women relative to men.

*$p < .05$.

‡$p < .001$.

Table 4

Summary of Generalized Linear Models Predicting Year-Five Alcohol-Related Problems and Unprotected Sex

Variable	Alcohol-Related Problems				Unprotected Sex							
					Monogamous				Non-Monogamous			
	b	*SE b*	*IRR*	$\Delta\chi^2$	*b*	*SE b*	*IRR*	$\Delta\chi^2$	*b*	*SE b*	*IRR*	$\Delta\chi^2$
Step 1				543.70‡				200.34‡				129.15‡
Year-four outcome	0.57	0.06	1.77‡		0.46	0.04	1.58‡		0.27	0.05	1.31‡	
Male gender	0.18	0.08	1.20*		−0.44	0.11	0.64‡		−0.09	0.20	0.91	
Heavy episodic drinking (HED)	0.32	0.06	1.38‡		0.19	0.06	1.21‡		0.26	0.10	1.30*	
Sensation seeking (SS)	0.13	0.04	1.14†		0.19	0.06	1.21‡		0.29	0.11	1.34†	
Self-Regulation (SR)	−0.26	0.05	0.77‡		−0.12	0.06	0.89*		−0.41	0.11	0.66‡	
Step 2				14.09†				7.80				2.37
SR X SS	0.04	0.04	1.04		0.11	0.06	1.12*		0.08	0.10	1.08	
SR X HED	0.04	0.06	1.04		−0.05	0.07	0.95		−0.08	0.09	0.92	
SS X HED	−0.01	0.06	0.99		0.13	0.07	1.14		0.18	0.11	1.20	
Step 3				2.04				5.04*				3.52^
SR X SS X HED	0.06	0.04	1.06		0.10	0.05	1.11*		0.13	0.07	1.14^	
R^{2a}				.40				.19				.20

Note. Generalized linear models using negative binomial reference distribution and log link. All continuous predictor variables are standardized. Coefficients, standard errors, and incidence rate ratios (*IRR*s) are from the final model.

[a] Cragg and Uhler R^2 for the final models.

^ $p < .06$.

* $p < .05$.

† $p < .01$.

‡ $p < .001$.