Alcohol Use and Problem Severity: Associations With Dual Systems of Self-Control*

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ABSTRACT. Objective: The current study tested the associations between a dual-systems model of self-control and alcohol use and problem severity. **Method:** The sample consisted of 491 college students (77.0% women) from a rural state university. Participants completed a series of online surveys that assessed aspects of self-control, alcohol consumption, and alcohol-related problems. **Results:** A confirmatory factor analysis model indicated two moderately correlated factors of poor control and good self-control. Poor control was positively associated with both alcohol use and problem severity. Good self-control had a negative association with problem severity. Good self-control moderated the association between poor control and alcohol use as well as between poor control and problem severity. The association between poor control and alcohol use was stronger at low levels of good self-control, whereas at high levels of good self-control, the effect of poor control was weaker and not significant. The interaction predicting problem severity was different: There was a negative association between good self-control and problem severity at low levels of poor control, and this effect diminished as poor control increased. **Conclusions:** The results suggest that multidimensional models of self-control may be useful in understanding problematic alcohol use and may be beneficial for prevention and intervention efforts. (*J. Stud. Alcohol Drugs, 72,* 678–684, 2011)

SELF-REGULATION OF BEHAVIOR is central to understanding alcohol use and problems (Hull and Slone, 2004; Wills et al., 2002). Some theorists propose that self-control comprises a single-order factor structure, with good self-control abilities at one end of a spectrum and poor self-control abilities at the other (Tangney et al., 2004). Others have proposed that self-control is the product of dual systems of behavioral regulation. Several dual-system models exist in the literature, such as X- and C-systems (Lieberman, 2007), impulsive and reflective systems (Strack and Deutsch, 2004), and effortful and reactive control (Eisenberg et al., 2004). Although these models have important differences, they share a similar conceptual framework (Carver, 2005).

In general, each of these theories proposes two separate systems of control. The first, an effortful or controlled system, is more deliberative, is slower, and relies heavily on executive processing. The second, often referred to as the impulsive system, is relatively automatic in nature, is fast acting, and requires little to no effortful processing (Lieberman et al., 2007; Strack and Deutsch, 2004). In the current study, we have adopted the nomenclature of Wills and colleagues (2001, 2006, 2007a) for the two systems, referring to the effortful process as *good self-control* and the impulsive process as *poor control.*

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Several factor analytic studies among adolescents have supported a structure consisting of two distinct dimensions of control (Wills and Dishion, 2004; Wills and Stoolmiller, 2002; Wills et al., 2006, 2007a). In general, good self-control has been associated with adaptive functioning, such as decreased externalizing symptoms, healthy dietary intake, increased physical activity, increased academic competence, more positive life events, decreased substance use, and fewer substance use–related problems (Wills et al., 2006, 2007a, 2007b). Furthermore, it attenuates the relationship between stressful life events and substance use (Wills et al., 2008). In contrast, poor control has been associated with involvement in deviant peer groups, negative life events, increased internalizing and externalizing symptoms, poor dietary intake, a sedentary lifestyle, friends who use substances, adolescent substance use, and substance use problems (Wills et al., 2006, 2007a, 2007b). Thus, examining the relationship between these constructs and problematic alcohol use is important.

Good self-control is associated with future orientation, planning, and consideration of long-term goals (Wills et al., 2006). These characteristics make the deleterious aspects of substance use more salient and foster anticipation of negative consequences. At the same time, individuals with good self-control possess the ability to control behavior and avoid such costs to maximize adaptive outcomes (Hustad et al., 2009).

In contrast, poor control is associated with appetitive drives and a tendency to respond rapidly without consideration of potential negative consequences (Wiers et al., 2007). This increases pursuit of salient rewards, such as alcohol, despite potential risks and increases the likelihood

of reactive behavior while intoxicated that may incur negative consequences. Most dual-system theories also posit that the two processes interact to regulate behavior (Hofmann et al., 2009). For example, good self-control attenuates the association between poor control and adolescent substance use (Wills et al., 1998). Similarly, in a study by Dvorak and Simons (2009), good self-control was associated with increased task persistence during an unsolvable anagrams task, but this association was diminished at high levels of poor control. Thus, good self-control may reduce the effects of behavioral demands, at least at low levels of poor control.

Study overview

The current study had three primary goals. First, research has shown that the dual systems of self-control change over time (Steinberg et al., 2008). Thus, the association between these systems and substance use and problems may also change as a person ages (Wills and Stoolmiller, 2002). The current study extends this model by replicating the factor structure of the two systems in a young adult population. Second, we examined associations of good self-control and poor control with alcohol use and problem severity, as well as relationships with abstaining from drinking and never experiencing problems. Third, we propose that good self-control will attenuate the effects of poor control on alcohol use and problem severity.

Method

Participants

Participants were undergraduate college students (N = 491) attending a state university. They were recruited through the university research pool and ranged in age from 18 to 31 years (M = 20.2, SD = 2.36). Women (n = 378) comprised 77.0% of the sample; 95.3% were White, 1.6% were Native American, 1.0% were Asian, and 2.1% were of other races or did not respond. Eight participants (1.6% of the sample) identified themselves as Hispanic.

Measures

Alcohol use. Typical weekly alcohol use was assessed by the Modified Daily Drinking Questionnaire (Dimeff et al., 1999). The Modified Daily Drinking Questionnaire consists of a grid with each day of the week. Participants entered the number of standard drinks consumed for each day during a typical week over the past 6 months. The number of drinks was summed to provide a count of total drinks consumed in a typical week over the past 6 months.

Alcohol problem severity was assessed by the Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ; Kahler et al., 2005). The B-YAACQ was developed using Rasch modeling of the original YAACQ questionnaire (Read et al., 2006) and includes 24 dichotomously (yes/no) scored items of progressing alcohol problem severity. The sum of the number of problems endorsed on the severity index served as an index of increasing problem severity. The severity scores showed high internal consistency (α = .92).

Measures of self-control were assessed by several scales adapted from existing measures, including a problem coping inventory (Wills, 1986; Wills et al., 2001), the Kendall–Wilcox inventory (Kendall and Williams, 1982), and research by Chen et al. (2004). Previous research has shown that these measures form a reliable two-factor model of self-control (Wills et al., 1998, 2006, 2007a). All measures have 5-point scales (1 = *not at all true for me,* 2 = *a little true for me,* 3 = *somewhat true for me,* 4 = *pretty true for me,* and 5 = *very true for me*).

Good self-control was assessed by four scales pertaining to self-control in everyday situations: a seven-item scale for future time perspective (α = .81; adapted from Kendall and Williams, 1982), a six-item scale for problem solving (α = .86; Wills et al., 2001), a seven-item scale for planning (α = .81; adapted from Kendall and Williams, 1982), and an eight-item scale for good delay of gratification (α = .81; Chen et al., 2004).

Poor control was assessed by three scales pertaining to self-control in everyday situations: a six-item scale for distractibility (α = .87), a seven-item scale for present time perspective (α = .79; both adapted from Kendall and Williams, 1982), and an eight-item scale for poor delay of gratification (α = .83; Chen et al., 2004).

Procedure

Questionnaires were completed online in 16 different counterbalanced orders to prevent ordering effects. All responses were anonymous. Participants provided informed consent and received course credit for participation. All participants were treated in accordance with American Psychological Association ethical guidelines (Sales and Folkman, 2000).

Analysis overview

All analyses were conducted using maximum likelihood estimation in Mplus 6.1 (Muthén and Muthén, 2010). First, we compared two measurement models of self-control to determine if a two-factor model was the best fit to the data. Next, we specified the model depicted in Figure 1. The full model contained two latent variables, a latent variable interaction, and two zero-inflated negative binomial (ZINB) distributions (alcohol use and problem severity were count variables with excess zeros). We then examined the moderating effects of good self-control on associations between poor control and alcohol use and problem severity. Finally,

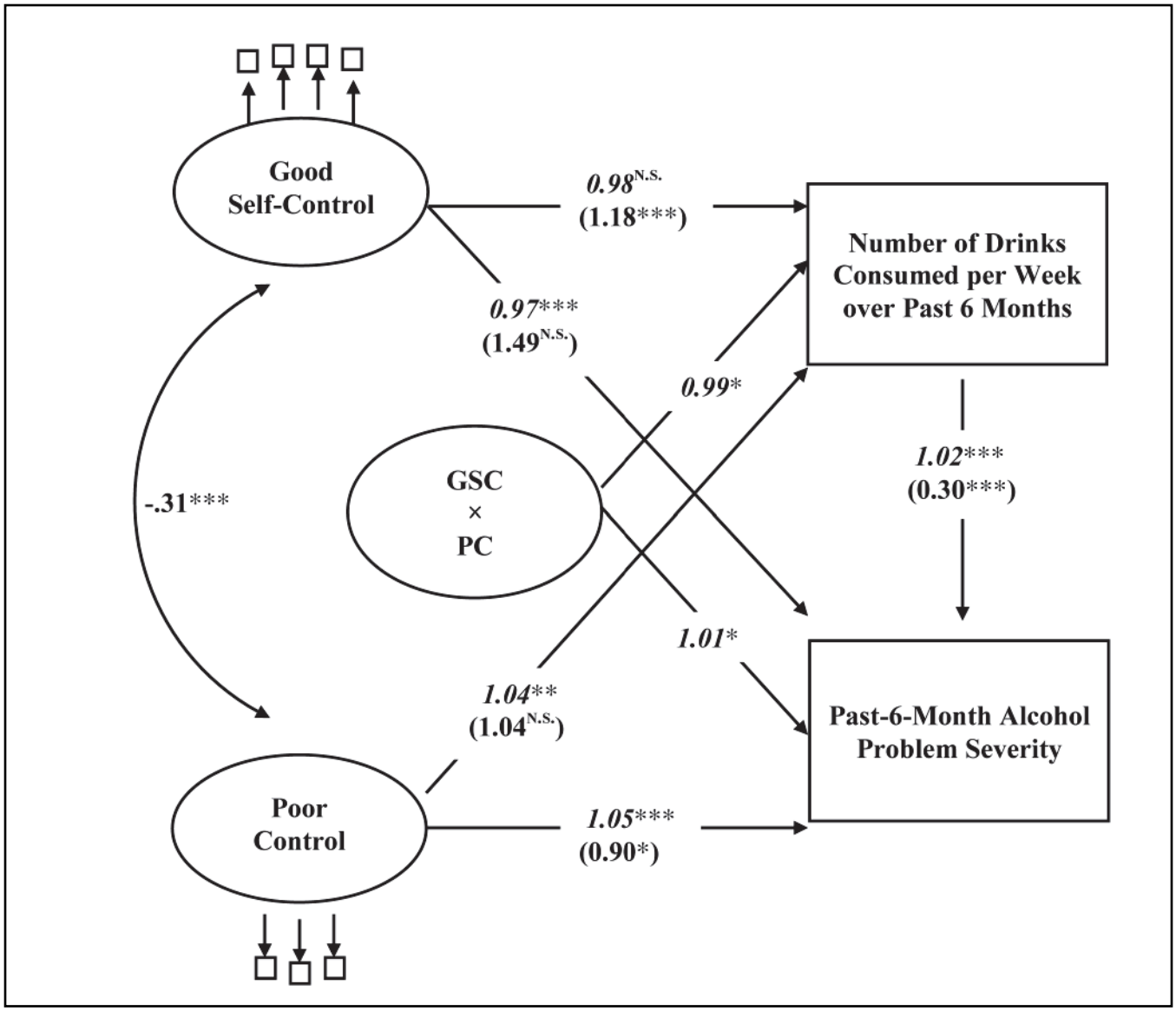

FIGURE 1. Structural model depicting pathways from good self-control and poor control to number of standard alcoholic drinks consumed per week and number of alcohol-related problems over the last 6 months. Italicized coefficients are incident rate ratios. Coefficients in parentheses are odds ratios representing the likelihood of being in the always-zero groups. Correlation between latent variables is $r = -.31$, $p < .001$. Gender is included in the model although not depicted in the diagram. Good Self-Control (GSC) × Poor Control (PC) is a latent variable interaction between good self-control and poor control. N.S. = not significant. *$p < .05$; **$p < .01$; ***$p < .001$.

we examined predictors of inflated zeros in the alcohol use and problem severity distributions (i.e., abstainers and those who never report alcohol problems).

Results

Descriptive and bivariate statistics

All factor loadings were significant at $p < .001$. Participants reported drinking an average of 10.9 ($SD = 11.32$) standard alcoholic drinks per week over an average of 1.9 ($SD = 1.54$) days per week over the past 6 months. Participants reported experiencing an average of 6.2 ($SD = 5.74$) alcohol-related problems over the past 6 months. Compared with women, men consumed significantly more drinks per week ($r = .32$, $p < .001$) but did not differ in alcohol problem severity ($r = .09$, N.S.). Good self-control and poor control were moderately inversely correlated ($r = -.31$, $p < .01$). Good self-control was inversely associated with alcohol use ($r = -.27$, $p < .001$) and problem severity ($r = -.22$, $p = .005$). Poor control was positively associated with alcohol use ($r = .27$, $p < .001$) and problem severity ($r = .29$, $p < .001$). Alcohol use and problem severity were positively correlated ($r = .50$, $p < .001$).

Confirmatory analysis of the factor structure of self-control

First, a two-factor model of good self-control and poor control was specified. This model showed reasonable fit, $\chi^2(13, N = 491) = 67.39$, $p < .001$, comparative fit index (CFI) = .97, Tucker–Lewis index (TLI) = .97, root mean square error of approximation (RMSEA) = .092 [90% CI = .071–.115], standardized root mean square residual (SRMR) = .041. Examination of modification indices indicated significant correlated errors between some of the observed variables. Error term covariances with modification indices greater than 20 were sequentially freed, and the model was re-estimated, resulting in a model with two correlated errors. This model showed good fit to the data, $\chi^2(11, N = 491) = 34.50$, $p = .0003$, CFI = .99, TLI = .97, RMSEA = .066 [90% CI = .042–.091], SRMR = .033. The correlation between factors was moderate ($r = -.30$, $p < .01$). Next, a one-factor model of self-control with the two correlated errors was specified. This model, $\chi^2(12, N = 491) = 499.13$, $p < .0001$, CFI = .70, TLI = .47, RMSEA = .288 [90% C.I. = .266–.309], SRMR = .151, did not fit the data as well as the two-factor model, $\Delta\chi^2(1, N = 491) = 464.63$, $p < .0001$.

Evaluation of full model

The final model is depicted in Figure 1. A Vuong test (Vuong, 1989) of a model with ZINB distributions, over a model with negative binomial distributions without inflated zeros, suggested that the ZINB model was most appropriate ($V = 8.51$, $p < .001$). Additionally, Bayesian information criterion (BIC) for a model with negative binomial distributions (BIC = 25,975.68) was larger than the BIC for a model with ZINB distributions (BIC = 25,683.05; ΔBIC = 292.63), suggesting that the ZINB model was a better fit. Both alcohol use ($z = 10.16$, $p < .001$) and problem severity ($z = 8.79$, $p < .001$) had significant overdispersion, indicating that ZINB was more appropriate than zero-inflated Poisson.

Negative binomial portion of model

In the count portion of the model, male gender was positively associated with alcohol use (incident rate ratio [IRR] = 1.76, $p < .001$) but negatively associated with problem severity (IRR = 0.83, $p = .031$). Alcohol use was positively associated with problem severity. At mean levels of good self-control, there was a significant positive association

FIGURE 2. Simple slopes of alcohol problem severity over the last 6 months on poor control at ±1 *SD* good self-control.

between poor control and both alcohol use and problem severity. Given the significant latent variable interaction, we probed the simple slopes of the two outcome variables on poor control at ±1 *SD* good self-control (Aiken and West, 1991).

We examined the simple slopes of alcohol use on poor control. The effect of poor control was stronger at -1 *SD* good self-control (IRR = 1.07, $p < .001$), whereas at +1 *SD* good self-control, the effect of poor control was weaker and not significant (IRR = 1.01, $p = .497$). Figure 2 depicts the simple slopes of problem severity on poor control. At low levels of poor control, high good self-control served as a protective factor against problem severity. However, as poor control increased, this protective effect was diminished.

Zero-inflated portion of model

In the zero-inflated portion of the model, gender was not associated with an increased likelihood of never drinking (odds ratio [OR] = 0.71, $p = .298$) or never experiencing problems (OR = 1.43, $p = .503$). The interaction between good self-control and poor control was not significant in predicting inflated zeros and thus was dropped from the model. Alcohol use was associated with a decreased likelihood of never experiencing problems. Poor control was not associated with never drinking but was associated with a decreased likelihood of never experiencing problems. Good self-control was associated with an increased likelihood of never drinking but was not associated with the probability of never experiencing problems.

Discussion

The current study examined a dual-systems model of self-control to understand alcohol use and problem severity in a young adult sample. In general, the hypotheses were supported. A two-factor model of good self-control and poor control provided good fit to the data. The two factors showed a moderate negative correlation, consistent with previous research among adolescents (Wills et al., 2002, 2006). Poor control was positively associated with alcohol use and problem severity and negatively associated with the likelihood of never experiencing problems. Good self-control was negatively associated with problem severity but was not associated with alcohol use among potential drinkers. However, it did increase the likelihood of being in the "abstainers" group and weakened the association between poor control and use. Good self-control also served to reduce problem severity. However, this effect diminished as poor control increased. Each of these findings is discussed in turn below.

The study results are consistent with previous research in adolescents and young adults indicating significant positive associations between poor control and alcohol use and problems (Simons et al., 2009; Wills et al., 2002, 2006; Wills and Stoolmiller, 2002). Furthermore, the current study shows that poor control has little association with whether a person abstains from drinking but is associated with an increase in the likelihood of experiencing problems. Poor control is associated with rash and impulsive action, which may lead to increased behavioral problems. However, it is not necessarily related to whether one drinks, particularly in a college student sample where drinking is normative. In contrast, good self-control was associated with an increased likelihood of being in an abstainers group. This is an interesting finding considering that use initiation and experimentation are typically associated with socio-environmental factors (Glantz and Pickens, 1992). However, Wills and colleagues (2006, 2007a) have shown that good self-control is associated with numerous adaptive social environmental factors (e.g., more competent peer groups, more positive life events). Thus, good self-control may increase the likelihood of abstinence via associations with socio-environmental factors. Future research is needed to better understand the role of good self-control and drinking abstinence.

The associations between poor control and both alcohol use and problem severity were complex, varying as a function of good self-control. Poor control was positively associated with alcohol use. However, good self-control acted as a buffer, reducing this association. This is consistent with previous research among adolescents, which has shown that the association between poor control and substance use is diminished at high levels of good self-control (Wills et al., 1998).

Consistent with prior research, poor control also exhibited significant positive associations with problem severity, even after controlling for alcohol use (Simons et al., 2009). Good self-control moderated this association as well. However, the form of the interaction was different. At high levels of poor control, individuals exhibited elevated problem severity irrespective of levels of good self-control. In contrast, at low levels of poor control, good self-control was inversely associated with problem severity. This interaction was similar in form to that found by Dvorak and Simons (2009), in which good self-control was associated with increased task persistence, but only at low levels of poor control. There are several possible explanations for this effect. Good self-control may represent an individual's reserve of self-control resources. Previous research has shown that alcohol may deplete effortful control resources (Hofmann and Friese, 2008) and increase reliance on "hot" cognitive processing (Ostafin et al., 2008). Alcohol intoxication, combined with a tendency toward impulsive action, may override the ability of slower-acting, deliberative processes to inhibit behavior and avoid consequences.

Limitations

Research with adolescents has shown that the association between good self-control and alcohol use is mediated

by prosocial behavior. However, the current study did not evaluate these associations. Future research should begin to identify mediators of the relationship between good self-control and problematic alcohol use in adult populations.

Next, the current study used young adult college students who were primarily female and White. Thus, generalization to other populations should be done with caution. Additionally, the current study was cross-sectional, precluding temporal interpretation.

Finally, the form of the interaction for the problems analysis is similar to that observed in predicting task persistence (Dvorak and Simons, 2009). However, it is inconsistent with some recent preliminary data predicting failure to fulfill social responsibilities as a result of alcohol use (Simons et al., 2010). In the Simons et al. (2010) data, good self-control served to attenuate associations between poor control and neglecting social responsibilities (similar to the alcohol use interaction here). Across samples and outcomes, the precise form of the interaction may vary, but it generally reflects a meaningful and interpretable pattern and remains a consistent predictor of behavior. Further research is needed to identify more precise conclusions regarding the specific expected form of these interactions.

Conclusions

The current study tested a dual-systems model of self-control in predicting alcohol use and problem severity. The self-control constructs showed expected associations with the outcomes and suggest that multidimensional models of self-control may be useful in understanding the development of alcohol-related problems.

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