Published in final edited form as:
Addiction. 2011 June ; 106(6): 1104–1113. doi:10.1111/j.1360-0443.2011.03411.x.

The Role of Person-Environment Interactions in Increased Alcohol Use in the Transition to College

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Abstract

Aims—Even among those at risk for problematic alcohol use, there is variability in developmental trajectories of drinking and related problems. This prospective study examined the role of person-environment interactions in increased drinking during the transition to college.

Design—The authors followed a sample of recent high school graduates to test whether protective environmental factors could delay increases in drinking among those high in trait-level risk factors.

Setting—Participants completed Web-based surveys.

Participants—A sample of 1,784 students in the incoming class of 2004 at a large public United States university completed high-school and first-semester-of-college assessments.

Measurements—Participants completed self-report measures of alcohol use, alcohol-related problems, perceived awareness and caring from parents and other adults, sensation seeking, and impulsivity.

Findings—In the transition to college, high sensation seekers from more protective high school parental environments increased their alcohol use and problems more than did other students. Increases in alcohol problems were also high among more impulsive students from less protective environments. Whereas high sensation seekers drank equivalently in college regardless of high school perceived awareness and caring, those who had greater high school perceived awareness and caring did not experience as many alcohol-related problems in college.

Conclusions—Differences in drinking trajectories may be a function of person-environment interactions. Risk associated with high sensation seeking may be masked among adolescents in protective environments, but its emergence in the college transition predicts increases in alcohol use and related problems.

Keywords

Alcohol Abuse; College Students; Sensation Seeking; Impulsivity; Parenting

Mean drinking rates in the United States (U.S.) increase as adolescence gives way to early adulthood, especially among those who attend college [1]. Alcohol use in the U.S. is most prevalent during the college years [2], leading to a range of negative consequences, both during college [3] and beyond [4,5]. Escalations of drinking in the transition to college are not uniform, however. Some individuals begin binge drinking in adolescence, whereas others do not drink heavily until the years following high school [6-8]. Some theoretical

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Conflict of Interest: None

models have posited that trajectories including increased drinking in early adolescence reflect individual-difference risk factors, whereas heavy drinking trajectories that increase later, during the college transition, are attributable to changing social and environmental factors [6,9]. Recent evidence, however, suggests that individual differences contribute to a variety of heavy drinking trajectories. In a longitudinal twin study, King and colleagues [10] found that individual differences in genetic risk for heavy drinking did not become less influential during the college years. Similarly, individuals who develop substance use disorders following adolescence (i.e., between age 17 and 20) are more impulsive than their peers who do not develop disorders [11]. In sum, increases in alcohol use and problems during both adolescence and early adulthood at least partially reflect individual-difference risk factors.

The Developmental Mismatch Model

The present research tested whether fit with protective environments explains why some individuals with at-risk personality traits do not increase their drinking until college. Stage-environment fit theory predicts that good functioning is a result of the match between environments and developmental needs [12]. To the extent that transitions, such as that from high school to college, create a mismatch between needs and environmental opportunities, they should result in increased risk-taking, including heavier drinking [13]. Moreover, the fit between environment and needs is also influenced by individual differences [14]. From this perspective, differences in trajectories of alcohol use may result from differences in the match among developmental needs, environmental factors, and personality.

This investigation incorporated person-environment interactions [15,16] into the developmental mismatch model. Because behavioral risk-taking peaks in adolescence [17], support and guidance against poor decisions is a developmental need during this period. In particular, those higher in traits such as sensation seeking and impulsivity may be at highest risk for increasing their drinking early in adolescence without the proper match with protective environmental factors [17,18]. Among possible protective factors, supervision and involvement from responsible adults, primarily parents, is crucial [19-22]. Adolescents with greater perceived awareness and caring, which synthesizes parental monitoring (i.e., awareness and regulation of behavior) and support (i.e., social and emotional involvement) drink less than do their peers [23]. Consistent with the developmental mismatch model, research demonstrates that at-risk individuals increase their substance use in early adolescence only if they lack protective parental environments [24].

Departing high school involves dramatic changes in environments, particularly among those who leave home to attend college [25]. Alcohol availability increases, as do other social predictors of drinking [26]. Whereas parental involvement in adolescence is understood to continue its protective effect into college [23,27-31], this influence may not persist among those with high levels of personality risk. As they transition into college, students higher in at-risk traits might exploit their new freedoms, dramatically increasing their drinking. In sum, the transition to college may most disrupt stage-environment fit among adolescents who carry trait risk factors but experience protective parental environments while in high school. Once trait risk is no longer constrained, students from protective environments might increase their drinking to levels comparable to those of other at-risk students.

Personality Risk Factors

The traits often grouped under the term *behavioral undercontrol* are the strongest personality predictors of alcohol use and problems [32,33]. Sensation seeking, a tendency to seek novelty and excitement, and impulsivity, a tendency to act on impulses without considering consequences, are two such traits. Sensation seeking is a well-established

predictor of alcohol use [34], whereas the literature on impulsivity and drinking is more complicated. Some studies indicate that impulsivity is more strongly associated with alcohol-related problems than with use [35,36]. Dawe and colleagues [37] explain this dissociation by proposing that individuals drawn to reward (i.e., high sensation seeking) may be more likely to initiate drinking and drink repeatedly, whereas individuals with less capacity to inhibit behaviors (i.e., high impulsivity) may be more likely to continue to drink despite experiencing negative consequences. Whereas some personality models have considered sensation seeking and impulsivity as overlapping constructs [38,39], recent self-report and behavioral evidence demonstrates that they are separate traits [36,40-43], which is consistent with the Big Five model of personality [44].

The Present Research

This prospective study of the transition to college tested whether protective environmental factors in high school might delay increases in heavy drinking among at-risk individuals. That is, we tested whether, for individuals high in at-risk traits, awareness and caring from parents and other adults buffered against drinking in high school but led to greater increases during the first semester of college. Specifically, the current study addressed the following research questions: (1) Is perceived awareness and caring protective against alcohol use and problems during high school after accounting for sensation seeking and impulsivity?; (2) In the college transition, does students' perceived awareness and caring from parents decrease?; (3) Do students high in perceived awareness and caring but also high in impulsivity or sensation seeking experience steeper increases in alcohol use and problems in the transition to college?; and (4) As a result of such increases, do these students reach similar levels of collegiate drinking and problems to those of at-risk students with lower perceived awareness and caring in high school?

Method

Participants and Procedures

Participants were students at a large U.S. public university who were part of a longitudinal study of alcohol use and other behavioral risks from high school through college. During the summer before college matriculation, unmarried, first-time students between the ages of 17 and 19 in the incoming class of 2004 (N = 3,046) were recruited and randomized to complete a high school survey and 2 subsequent assessments per academic year for 3 years plus 1 assessment in year 4. The present study is based on this sample[1]. These 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). Participants were offered the possibility of completing a paper survey if they had concerns about access or privacy regarding the Web-based survey. For a more detailed description of recruitment, see Corbin, Vaughan, and Fromme [45].

Three weeks prior to the end of their first semester in college, participants again completed Web-based surveys assessing behaviors for the preceding three months. Excluding students who reported living with family members (n = 86) or did not report with whom they lived (n = 1) in college, 1,990 students (89% of the consented sample) completed both the high-school and first-college-semester surveys and were therefore included in the current analyses. An additional 206 (10%) students were excluded due to listwise deletion for missing data on at least one study variable. The final sample (N = 1,784; 61% female; 55% White, 18% Asian-American, 15% Hispanic or Latino, 4% African-American, and 7%

[1]Of the remaining interested students not assigned to the semi-annual assessment condition, 976 were assigned to complete the high school and year-four assessment, and 810 were assigned to complete a year-four survey assessment only.

multiethnic/other) was demographically similar to the university's undergraduate population. At the high school survey, the mean age was 18.41 years (*SD* = 0.35).

Measures

Alcohol use—The Daily Drinking Questionnaire, a well-validated measure of alcohol consumption, was used to assess the number of standard drinks (i.e., 12 oz of beer, 5 oz of wine, or 1 shot of liquor straight or in a mixed drink) participants consumed in a typical week during the past three months [46]. Participants reported the number of drinks they consumed on each day of a typical week. From these responses, we calculated weekly alcohol consumption.

Alcohol-related problems—The 23-item Rutgers Alcohol Problem Index (RAPI) assessed participants' past-3-month frequency of experiencing alcohol-related consequences ranging from missing school or work to continuing to drink despite efforts to stop [47]. Although endorsement of problems among the normative population is relatively low, resulting in a heavily skewed distribution of problems, the RAPI has demonstrated moderate associations with measures of alcohol use and good reliability in adolescent and college-student samples [48,49].

Personality—The Zuckerman-Kuhlman Personality Questionnaire measured trait sensation seeking and impulsivity in the high school survey only [39]. Participants endorsed the 11 sensation seeking items and 8 impulsivity items on a dichotomous scale where 0 = *false* and 1 = *true*. Higher scores indicated greater levels of the trait.

Perceived awareness and caring—Perceived awareness and caring from parents and other responsible adults was assessed with the Parental Awareness and Caring Questionnaire [23,50]. Participants endorsed seven items such as "How often was there an adult (e.g., parent, guardian, residential assistant) who knew and cared where you were going when you went out at night and on weekends?" on five-point Likert-type scales, with greater scores indicating more awareness and caring. Adolescents' perceptions of parenting behaviors have been more strongly linked to their alcohol use than have parental reports of parenting [51]. See Table 1 for summary statistics, prevalence of the most common alcohol-related problems, and internal consistencies for the current sample.

Statistical Analyses

Alcohol use and problems were distributed non-normally (skewness ≥ 2.57; kurtosis ≥ 9.46). We therefore tested our hypotheses using generalized linear modeling (GzLM) in SPSS version 15.0, which allows for the specification of error distributions other than the normal distribution [52-54]. Interpretation of the GzLM is similar to that of the ordinary least squares regression model, although a χ^2 test assesses overall model fit. We specified the negative binomial distribution and log link. Similar to the Poisson distribution, the negative binomial is appropriate for count data (i.e., non-negative integers) with positive skew. The negative binomial distribution, however, additionally allows for the overdispersion common to alcohol use data [52,54]. Exponentiated regression coefficients, or incidence rate ratios (*IRR*s), serve as a standardized effect size, reflecting the percentage increase in number of drinks or problems [55,56]. We included gender[2] as a covariate in all models and standardized continuous predictors to aid interpretation of *IRR*s. Because we hypothesized that trait-environment interactions would result in more alcohol-related

[2]Although the results are not reported here, in supplemental analyses we found little evidence that the effects of interest differed as a function of gender.

problems over and beyond those predicted by use, we controlled for alcohol use in models predicting problems.

Results

Inclusion Analyses

Of participants who left home to attend college, two groups were excluded from these analyses. First, 257 participants were lost to follow-up. At high school, these participants did not differ from included participants on sensation seeking, impulsivity, or perceived awareness and caring (PAC) and were no more likely to abstain from alcohol, *p*s > .06. Relative to the included sample, however, they drank more, $t(2,037) = 2.75$, $p = .01$, $d = .16$, experienced more alcohol-related problems, $t(2,035) = 3.73$, $p < .001$, $d = .19$, and were more likely to be male, $\chi^2 (1) = 11.54$, $p < .001$, although these effects were small. Second, 206 participants were excluded due to missing data on at least one study variable. When available (*n*s ranging from 102-203), we compared these participants' data to data for included participants and found few differences. This group did not differ from included participants on alcohol use or problems, gender, sensation seeking, or impulsivity, *p*s > .22. Excluded participants reported lower PAC, $t(1,926) = 3.20$, $p = .001$, $d = .27$, although this effect was small-to-moderate in magnitude.

Alcohol Use and Related Problems in High School

See Table 2 for zero-order correlations. In a GzLM, high school alcohol use was positively associated with sensation seeking (*IRR* = 1.55, *b* = 0.44, *p* < .001) and negatively associated with PAC, *IRR* = 0.81, *b* = -0.21, *p* < .001. That is, a one-standard-deviation increase in sensation seeking or PAC was associated with a 55% increase or a 19% decrease in drinks consumed, respectively. Impulsivity was not related to alcohol use, *IRR* = 0.97, *b* = -0.03, *p* = .33. In a separate model, alcohol-related problems were positively associated with sensation seeking (*IRR* = 1.36, *b* = 0.31, *p* < .001) and negatively associated with PAC (*IRR* = 0.82, *b* = -0.20, *p* < .001) but were not associated with impulsivity, *IRR* = 1.00, *b* = 0.005, *p* = .90. There were no significant trait-by-PAC interactions predicting alcohol use or problems in high school.

Change in Study Variables in the Transition to College

As shown in Table 1, participants reported large decreases in PAC from high school to college. Students also reported small-to-moderate increases in alcohol use and related problems.

Trait-Environment Interactions in the Transition to College

Controlling for high school alcohol use, sensation seeking—but not PAC or impulsivity—predicted increases in alcohol use from high school to college. See Table 3. Moreover, sensation seeking significantly interacted with PAC, whereas impulsivity did not. As shown in Figure 1, high sensation seekers who reported high PAC in high school experienced the steepest increases in alcohol use.

As shown in Table 4, controlling for high school alcohol-related problems and college alcohol use, sensation seeking and impulsivity predicted greater increases in alcohol-related problems from high school to college, whereas PAC predicted smaller increases. Further, both traits significantly interacted with PAC. Individuals high in sensation seeking but also in high school PAC experienced the greatest increases in alcohol-related problems. In contrast, more impulsive students high in high school PAC experienced *less* steep increases in problems relative to more impulsive students low in PAC. See Figure 2.

Alcohol Use and Related Problems in College

Because trait-environment interactions predicted increases in drinking and related problems, we next tested whether students high in trait-level risk would experience similar levels of alcohol use and related problems in college regardless of high school PAC. Sensation seeking significantly interacted with PAC to predict college alcohol use (*IRR* = 1.08, *b* = 0.08, *p* = .02), whereas impulsivity did not, *IRR* = 1.00, *b* = 0.001, *p* = .96. A test of the simple effect of PAC among those high in sensation seeking revealed no effect on drinking in college, *IRR* = 0.97, *b* = -0.03, *p* = .39. That is, students high in sensation seeking did not differ in their drinking in college as a function of high school PAC.

Controlling for college alcohol use, both sensation seeking (*IRR* = 1.16, *b* = 0.14, *p* < .001) and impulsivity (*IRR* = 0.87, *b* = -0.14, *p* < .001) interacted with PAC to predict alcohol-related problems. A test of simple effects revealed that, whereas those high in sensation seeking but also high in PAC during high school experienced the greatest increases in alcohol problems, they did not report as many problems in college as did those low in high school PAC, *IRR* = 0.91, *b* = -0.10, *p* = .02. Similarly, there was a significant simple effect of PAC among those high in impulsivity, *IRR* = 0.86, *b* = -0.15, *p* < .001. That is, students high in sensation seeking and impulsivity but low in high school PAC experienced more problems in college than did their peers who were high in either trait and in PAC.

Discussion

This study presented several key findings for the role of person-environment interactions in increased drinking from high school to college. Regarding trait-level sensation seeking, results were largely consistent with our predictions. First, in high school, sensation seekers drank more and experienced more alcohol-related problems, whereas students with greater perceived awareness and caring (PAC) from parents and other adults drank less and experienced fewer problems. Second, PAC decreased—and drinking increased—from high school to college. Third and most importantly, in the college transition, students high in both sensation seeking and high school PAC experienced the sharpest increases in alcohol use and problems. Finally, as a result of these increases, high sensation seekers drank more in college, regardless of their high school PAC. In contrast, high sensation seekers with greater high school PAC experienced fewer college alcohol-related problems relative to those with lower PAC.

These findings extend the developmental mismatch model to help account for differing trajectories of heavy drinking among adolescents high in sensation seeking. Whereas some sensation seekers may benefit from protective parental environments in high school, others lack this match between needs and environments. Among high sensation seekers, PAC may function to restrict drinking opportunities, and/or it may permit greater guidance regarding decisions about social activities and drinking in high school. As Schulenberg and Maggs [13] proposed, the college transition can disrupt this person-environment fit via decreased PAC and increased alcohol availability. Trait-level risk, heretofore masked among those with protective parental environments, might therefore emerge in the college transition to produce more alcohol use and related problems. Heavy alcohol use, regardless of its emergence across adolescent development, may have a common underlying factor in sensation seeking, with person-environment fit distinguishing trajectories.

In contrast to our sensation seeking findings, results involving impulsivity only partially supported our predictions. Impulsivity was less strongly associated with drinking outcomes than was sensation seeking. Consistent with prior evidence that impulsivity is more strongly related to alcohol-related consequences than to drinking [35], impulsivity predicted greater increases in alcohol-related problems but not alcohol use. Critically, however, these

increases were more gradual among impulsive students from protective environments in high school. That is, the benefits associated with PAC appeared to persist into college among those high in impulsivity. This dissociation from our sensation seeking findings may reflect that greater PAC provides monitoring, which can constrain behavioral tendencies, as well as guidance and support, which can help students acquire healthy self-regulatory strategies for navigating high-risk situations. Monitoring may constrain sensation seekers from pursuing drinking opportunities, if only while in high-PAC environments. Guidance and support, however, may help provide more impulsive students with skills to avoid making poor decisions when later presented with greater alcohol availability in the transition to college. These differing patterns of results highlight the value of distinguishing the two traits in future research on college student drinking and suggest that, when examined simultaneously, sensation seeking may present greater risk than impulsivity [36,40].

Limitations and Future Directions

The principal limitation of this investigation involved missing data due to attrition and incomplete participation. Our included sample drank somewhat less heavily than did the randomized sample, but we see no theoretical reason why trait risk would be more influential among lighter drinkers. Nevertheless, sample selection limits the generalizability of our conclusions and, in particular may have resulted in attenuated coefficients due to range restriction, notably for PAC [57]. Although analytic techniques are available to account for data missing at random, they generally require multivariate normality, which cannot be assumed for these data. Our single-campus college sample also limits the degree to which the present findings can be generalized to other universities and to other populations, although we note that at least one study found no difference in the effect of parenting on drinking among those who do and do not attend college [58].

This study included only one environmental variable, but trait-environment fit may also involve other social contexts. For example, students may select into social groups on the basis of both drinking and personality upon entering college [59]. Future research is needed to determine whether increased drinking among those departing protective environments results from selection on the basis of traits. Moreover, although this investigation focused on the immediate impact of the college transition, later social-role transitions may result in additional drinking changes as a function of person-environment interactions, and these merit further examination. Finally, factor-analytic studies have demonstrated that impulsivity can be conceptualized as four distinct traits [36,40,42]. Because the impulsivity measure used in this research predates those investigations, however, we could not distinguish among those facets.

Implications

On average, students increase their drinking in the transition from high school to college [60]. The current investigation adds to previous demonstrations that lighter drinkers increase their drinking the most [61] by further specifying that increases may be greatest among high sensation seekers who experienced more protective parental environments in high school. These results suggest that the reduced drinking associated with positive adult influences may be temporally bound among high sensation seekers. Reinforcing prior findings regarding protective parental environments [23], however, among more sensation-seeking and impulsive students, greater parental awareness and caring in high school predicted fewer alcohol-related problems, even into the first year of college. Our findings therefore underscore the value of college-based interventions that engage parental [27,62,63] or other adult involvement (e.g., residential assistants, university faculty). Although likely beneficial for all at-risk students, these interventions could most benefit sensation seekers, who may require external constraints to avoid alcohol use and its consequences, and it could be

particularly valuable to target sensation seekers from protective high school environments as they matriculate to college. To the extent that parents or other adults provide supervision, guidance, and support for college-bound adolescents, they may help delay or even mitigate the emergence of trait-level risk.

Acknowledgments

The authors gratefully acknowledge Dan Neal for assistance with statistical analyses and Will Corbin for comments on an earlier draft of this manuscript. Portions of this research were supported by National Institute on Alcohol Abuse and Alcoholism Grants RO1-AA013967 and 5T32-AA07471 and the Waggoner Center for Alcohol and Addiction Research.

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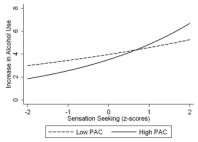

Figure 1.
Model estimated effect of sensation seeking on change in alcohol use from high school to college at one standard deviation above and below the mean of perceived awareness and caring (PAC) in high school.

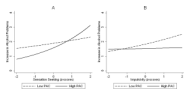

Figure 2.
Model estimated effects of sensation seeking (Panel A) and impulsivity (Panel B) on change in alcohol-related problems from high school to college at one standard deviation above and below the mean of perceived awareness and caring (PAC) in high school.

Table 1

Summary Statistics at High School and College

Variable	Senior Year of High School					First Semester of College					*d*
	Possible Range	Observed Range	*M*	*SD*	α	Possible Range	Observed Range	*M*	*SD*	α	
Trait risk factors											
Sensation seeking	0-11	0-11	5.56	2.69	.73	-		-	-	-	-
Impulsivity	0-8	0-8	2.07	2.00	.73	-		-	-	-	-
PAC	1-5	1-5	3.91	1.25	.92	1-5	1-5	2.82	1.50	.95	-.78*
Weekly alcohol use	0+	0-47	2.86	5.62	-	0+	0-77	5.12	8.19	-	.30*
Percent abstaining	-	-	48.28%		-	-	-	38.42%		-	.20*
Alcohol-related problems	0-92	0-43	1.85	4.27	.90	0-92	0-65	2.75	5.62	.91	.18*
Had a bad time	-	-	16.26%		-	-	-	20.63%		-	.10*
Change in personality	-	-	14.35%		-	-	-	22.03%		-	.21*
Fights with friends	-	-	10.65%		-	-	-	10.20%		-	-.01
Neglected responsibility	-	-	10.26%		-	-	-	18.27%		-	.21*

Note. Trait risk factors were assessed in high school only. PAC=Perceived awareness and caring. Cohen's *d* is the standardized difference between the means. Prevalence rates are for the most common alcohol-related problems.

* $p < .001$.

Table 2

Zero-Order Correlations among Study Variables in Senior Year of High School and the First Semester of College

Variable	2	3	4	5	6	7	8	9
1. Male gender	.11*	.12*	-.10*	-.02	-.08	-.20*	-.00	-.06
2. Sensation seeking	-	.52*	-.19*	.25*	.25*	-.14*	.27*	.29*
3. Impulsivity		-	-.14*	.13*	.13*	-.12*	.14*	.17*
High School								
4. PAC			-	-.20*	-.19*	.41*	-.15*	-.14*
5. Alcohol use[a]				-	.76*	-.10*	.65*	.56*
6. Alcohol problems[a]					-	-.10*	.56*	.58*
College								
7. PAC						-	-.12*	-.10*
8. Alcohol use[a]							-	.75*
9. Alcohol problems[a]								-

Note. PAC=Perceived awareness and caring.

[a]Spearman's rho correlation coefficients.

*$p < .001$.

Table 3

Summary of Generalized Linear Model Predicting First Semester College Alcohol Use

Variable	*b*	*SE b*	*IRR*	χ^2	R^{2a}
Step 1				1042.65***	.44
Alcohol use	0.77	0.03	2.16***		
Male gender	-0.04	0.06	0.96		
Sensation seeking	0.23	0.03	1.26***		
Impulsivity	0.003	0.03	1.00		
PAC	-0.05	0.03	0.95		
Step 2				1052.46***	.45
Alcohol use	0.78	0.03	2.17***		
Male gender	-0.05	0.06	0.95		
Sensation seeking	0.22	0.03	1.25***		
Impulsivity	0.00	0.03	1.00		
PAC	-0.06	0.03	0.94*		
Sensation seeking × PAC	0.09	0.03	1.09**		
Impulsivity × PAC	0.004	0.03	1.00		

Note. Generalized linear model using negative binomial distribution and log link. All predictor variables assessed senior year of high school. PAC =Perceived awareness and caring. $\Delta\chi^2(2) = 9.77$, $p = .008$.

[a]Cragg and Uhler R^2.

*$p < .05$.

**$p < .01$.

***$p < .001$.

Table 4

Summary of Generalized Linear Model Predicting First Semester College Alcohol-Related Problems

Variable	*b*	*SE b*	*IRR*	χ^2	R^{2a}
Step 1				1566.29***	.59
Alcohol problems	0.33	0.03	1.39***		
Alcohol use in college	0.87	0.04	2.39***		
Male gender	-0.36	0.07	0.70***		
Sensation seeking	0.21	0.04	1.23***		
Impulsivity	0.11	0.03	1.12**		
PAC	-0.08	0.03	0.92*		
Step 2				1576.84***	.60
Alcohol problems	0.33	0.03	1.39***		
Alcohol use in college	0.86	0.04	2.36***		
Male gender	-0.38	0.07	0.68***		
Sensation seeking	0.22	0.04	1.25***		
Impulsivity	0.09	0.04	1.09**		
PAC	-0.09	0.03	0.91**		
Sensation seeking × PAC	0.12	0.04	1.13**		
Impulsivity × PAC	-0.07	0.03	0.93*		

Note. Generalized linear model using negative binomial distribution and log link. All predictor variables except alcohol consumption in college assessed senior year of high school. PAC=Perceived awareness and caring. $\Delta\chi^2(2) = 10.55$ $p = .005$.

[a]Cragg and Uhler R^2.

*$p < .05$.

**$p < .01$.

***$p < .001$.