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## Person-environment Transactions in Youth Drinking and Driving

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### Abstract

Drinking and driving is a significant health risk behavior for adolescents. This study tested mechanisms by which disinhibited personality traits (impulsivity and sensation seeking) and aspects of the adolescent home/social environment (parental monitoring and alcohol accessibility) can influence changes in drinking and driving behavior over time. Two hundred and two high school age youth were assessed at two time points, approximately eight months apart. Zero-inflated Poisson regression analyses were used to test 1) an additive model, where personality and environmental variables uniquely predict drinking and driving engagement and frequency; 2) a mediation model, where time 2 environmental variables mediate the influence of disinhibited personality; 3) an interaction model, where environmental factors either facilitate or constrain the influence of disinhibited personality on drinking and driving. Results supported both the additive and interaction model, but not the mediation model. Differences emerged between results for personal drinking and driving and riding with a drinking driver. Improving our understanding of how malleable environmental variables can affect the influence of disinhibited personality traits on drinking and driving behaviors can help improve and target prevention/intervention efforts.

### Keywords

Drinking and Driving; Alcohol; Personality; Adolescents

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Youth drinking and driving is a significant public health problem. Motor vehicle accidents are the most common cause of death for high school age youth in the United States (Center for Disease Control and Prevention, 2004), and statistics for 2005 indicate that 23% of drivers age 15 to 20 killed in motor vehicle crashes had a blood alcohol concentration (BAC) at or above .08 (National Highway Traffic Safety Administration, 2006). Recently, O'Malley and Johnston (2007) found that 14.2% of high school seniors report engaging in drinking and driving behavior in the past 2 weeks and 20.9% report riding with a drinking driver. Although young people are less likely to report driving after alcohol use than older drivers (Royal, 2003), they consume a greater amount of alcohol before driving and consider it safe to drive at higher BAC levels than older drivers (Hingson & Winter, 2003). This is particularly concerning, as the relative risk of fatal car accidents is higher for young drivers at all BAC levels, and risk increases faster for youth as BAC increases (Zador, Krawchuk, & Voas, 2000).

Changes in alcohol control policy, such as increasing the minimum drinking age and lowering BAC limits, have led to significant reductions in youth drinking and driving (O'Malley & Johnston, 2003; Wagenaar, O'Malley, & LaFond, 2001). The effectiveness of these policies makes clear the impact of environmental contingencies on youth drinking and driving decisions. On the other hand, there is evidence that drinking and driving prevalence has become relatively stable (O'Malley & Johnston, 2003, 2007; Sweedler et al., 2004). Drinking and driving also has a high rate of recidivism (Nochajski & Stasiewicz, 2006). The stability of this behavior highlights the potential role of individual difference characteristics that can put youth at risk for drinking and driving.

The present study tested an integrated model of personality and environmental influences on youth drinking and driving. Personality and developmental psychology theory (Buss, 1987; Caspi & Roberts, 2001; Scarr & McCartney, 1983) has emphasized the importance of mechanisms by which heritable individual difference characteristics, such as personality traits, can influence or interact with environmental/contextual factors across the lifespan. Although often referred to as gene x environment interactions, following Caspi and Roberts (2001), we use the term person-environment transactions to describe these processes, as this term is neutral regarding the genetic basis of the characteristics under study, as well as the statistical/analytic model of how person characteristics and environments are associated. The present study tested person-environment transactions between disinhibited personality traits (sensation seeking, impulsivity) and aspects of the adolescent home/social environment (parental monitoring, alcohol accessibility) in determining drinking and driving behavior.

### **Personality Characteristics: Sensation Seeking and Impulsivity**

A number of personality characteristics are associated with substance use and risk taking behaviors in adolescence (Caspi et al., 1997; Elkins, King, McGue, & Iacono, 2006). The personality domain of impulsivity/disinhibition has been found to have the strongest and most consistent relationship with alcohol-related and antisocial behaviors (Sher & Trull, 1994). Recent conceptual work has argued that two of the most studied facets of this domain, impulsivity and sensation seeking, should be considered distinct constructs (Whiteside & Lynam, 2001) that are only moderately correlated (Zuckerman, 1994). Impulsivity can be defined as the tendency to experience and act on strong impulses (Whiteside & Lynam, 2001), while sensation seeking can be defined as desiring new and intense experiences (Zuckerman & Kuhlman, 2000). Impulsivity and sensation seeking have been shown to predict different externalizing behaviors and psychiatric diagnoses (Fischer, Smith, & Anderson, 2003; Lynam & Miller, 2004; Miller, Flory, Lynam, & Leukfeld, 2003; Smith, Fischer, Cyders, Annus, Spillane, & McCarthy, 2007; Whiteside, Lynam, Miller, & Reynolds, 2005). Even when these traits predict similar risk taking behaviors, it has been argued (Whiteside & Lynam, 2001) that they may do so for different reasons. For example, individuals high in sensation seeking may engage in risk taking as a means of experiencing excitement or thrills, while an impulsive individual may engage in the same behavior in response to strong affect.

There is considerable evidence for both sensation seeking and impulsivity as predictors of alcohol-related behaviors (Hittner & Swickert, 2006; White, Bates, & Buyske, 2001). A

literature review of sensation seeking and risky driving behavior (Jonah, 1997) found that most studies reported significant relations between sensation seeking and drinking and driving behavior. Results were consistent between studies of adults and adolescents. High impulsivity has been associated with drinking and driving, riding with a drinking driver, and binge drinking (Ryb, Dischinger, Kufera, & Read, 2006). Impulsivity is also correlated with drinking and driving violations in adult men (Eensoo, Paaver, Harro, & Harro, 2005).

Relatively little is known about specific mechanisms by which personality characteristics might influence adolescent drinking and driving behavior. In adults, Stacy and colleagues conducted both cross sectional (Stacy, Newcomb, & Bentler, 1991) and prospective (Stacy & Newcomb, 1998) studies that found that disinhibited personality traits influence drinking and driving through alcohol use behavior. Turrisi, Jacaard, and McDonnell (1997) found that the influence of emotional control, a combination of impulsivity and sensation seeking, on drinking and driving was mediated by cognitions about drinking and driving and drinking and driving alternatives. To our knowledge the current study is the first to test potential mechanisms of personality risk for drinking and driving involving two aspects of the adolescent home/social environment, parental monitoring and alcohol accessibility.

### **Parental Monitoring and Alcohol Accessibility**

Parenting characteristics are thought to play a significant role in the development of problem behavior in youth. In particular, low levels of parental monitoring are associated with increased risk for a variety of adolescent risk taking behaviors, including unsafe sexual activity and drug use (Li, Stanton, & Feigelman, 2000) as well as stealing, fighting, and destroying property (Curran & Chassin, 1996). Youth report of parents' knowledge of their behavior is associated with their alcohol use (Curran & Chassin, 1996; Chassin, Pillow, Curran, Molina, & Barrera, 1993) and frequency of heavy episodic drinking (Wood, Read, Mitchell, & Brand, 2004). Longitudinal studies of drinking and driving behavior have shown that low parental monitoring in high school prospectively predicted increased likelihood of drinking and driving (Bingham & Shope, 2004) and increased rate of serious driving offenses (Shope, Waller, Raghunathan, & Patil, 2001) in young adulthood.

The accessibility of alcohol in an adolescent's social/community environment has also been shown to have considerable impact on alcohol-related behavior in youth. Self-reported ability to obtain alcohol has been found to be related to alcohol consumption in adolescence (Jones-Webb, Toomey, Short, Murray, Wagenaar, & Wolfson, 1997). At the community level, studies have shown that the number of registered alcohol vendors (Treno, Grube, & Martin, 2003), reported use of alcohol vendors, and perceived community enforcement of underage drinking laws (Dent, Grube, & Biglan, 2005) are related to youth drinking and drinking and driving behavior.

### **Integrating Environmental and Personality Risk**

The present study tested person-environment transactions in the development of youth drinking and driving behaviors. We hypothesized that disinhibited personality traits not only exert a direct influence on drinking and driving behavior, but can be mediated by or interact with other important risk factors, such as parenting factors and social/contextual variables.

A sample of high school age youth was assessed at two time points, approximately eight months apart. We first tested an additive model, where both personality (impulsivity and sensation seeking) and environmental factors (parental monitoring and alcohol accessibility) were hypothesized to make unique contributions to the prediction of drinking and driving and riding with a drinking driver, controlling for prior alcohol use, license status, gender, and drinking and driving behavior. Models were tested separately for drinking and driving and riding with a drinking driver, as prior studies have indicated that these are distinct behaviors which may have different risk mechanisms (McCarthy & Brown, 2004; Poulin, Boudreau, & Asbridge, 2007; Yu & Shacket, 1999).

We then tested a mediation model, examining potential indirect effects of personality on drinking and driving behavior through their influence on parental monitoring and alcohol accessibility. This model reflects the hypothesis that disinhibited personality traits can influence the response of others in the youth's environment, as well as the environments that youth select. For example, disinhibited youth may be more difficult for parents to monitor, or less likely to disclose information to parents. Disinhibited youth might also be more likely to select environmental contexts, such as a deviant/substance using peer group, which allow for easier access to alcohol. Although this hypothesis has not directly been tested elsewhere, recent longitudinal studies have demonstrated that youth delinquent behavior can alter parental monitoring/knowledge over time (Laird, Pettit, Bates, & Dodge, 2003), and that personality traits can influence deviant peer affiliation (Yanovitzky, 2005).

Finally, we tested an interaction model, examining whether the association of personality factors on drinking and driving behavior is moderated by parental monitoring and/or alcohol accessibility. There is some evidence that aspects of the home/social environment can constrain or exacerbate substance-related behavior in adolescents. For example, parental involvement has been found to moderate the influence of other family factors on child internalizing problems (Burstein, Stanger, Kamon, & Dumenci, 2006), while maternal support and discipline interact with peer substance use in the development of adolescent substance use over time (Marshal & Chassin, 2000). We hypothesized that high levels of parental monitoring would constrain drinking and driving behavior, such that youth high in sensation seeking or impulsivity are less likely to drink and drive when parental monitoring is high. For alcohol accessibility, we hypothesized that impulsive or sensation seeking youth would be more likely to drink and drive when alcohol is easily obtained in their environment.

## Method

### Participants

Study participants were 266 high-school age youth. Of the original sample, 202 (76%) completed the time 2 survey approximately eight months later. Participants who did not complete the second survey did not differ from those who did in age, gender, ethnicity, license status (time 1), or drinking and driving behavior (time 1). Attriters were more likely to report drinking behavior at time 1 (77% vs. 60%;  $\chi^2(1, N = 266) = 5.85, p < .05$ ) and were more likely to be African American (57% vs. 19%;  $\chi^2(1, N = 266) = 24.14, p < .01$ ).

The final sample of 202 participants was primarily Caucasian (85%), with 7% African American, and 8% of other racial backgrounds. The sample was 66% female and had a mean age of 16.15 ( $SD = 1.00$ , range 13–18) at time 1. During the first assessment, 45% of the sample were non-drivers. At time 2, 20% were non-drivers, 25% were recently licensed drivers, and the remaining 55% were established drivers, driving independently at both time points of the study.

## Procedures

Participants were recruited from local high schools through fliers passed out during lunch breaks and after school. Study fliers were also posted in locations frequented by youth (stores, theaters, etc.) throughout the community. Interested participants contacted the research lab and were given more information about the study. For participants under age 18, verbal parental consent was obtained. Participants were then mailed a packet with questionnaires, consent forms, assent forms (if under age 18), postage-paid return envelope and cover letter. Upon returning completed study materials, participants were mailed a 20 dollar gift certificate to the local mall. Participants were contacted approximately 7 months later and asked if they would like to participate in a follow-up study. Procedures were otherwise identical to those for time 1. Participants were again compensated with a 20 dollar gift certificate to the local mall upon completion. Study procedures were approved by the University of Missouri-Columbia Institutional Review Board.

## Measures

**Demographic Information**—A self-report questionnaire was used to collect demographic information, including age, gender, and ethnicity.

**Alcohol Use**—The Drinking Styles Questionnaire (DSQ; Smith, McCarthy, & Goldman, 1995) was used to assess alcohol use at time 1 and time 2. The DSQ collects information about drinking status, quantity and frequency of drinking, frequency of drinking to intoxication and typical drinking situations. Typical frequency of alcohol consumption at time 1 and past month frequency of alcohol use at time 2 were used as covariates in the present study. The DSQ has demonstrated good reliability and validity in adolescent and college-age samples (Smith et al., 1995; McCarthy, Miller, Smith, & Smith, 2001).

**Drinking and Driving Behaviors**—Participants were asked to report frequency of driving after consuming any alcohol and riding with a driver who had consumed alcohol. Participants retrospectively reported on drinking and driving behaviors over the past three months at both time points.

**Personality Characteristics**—Sensation seeking and impulsivity were measured at time 1 using the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). The ZKPQ is a 38-item self-report measure with a dichotomous response format. The 19 items that comprise the impulsivity and sensation seeking scales were included in the present study (8 items for impulsivity subscale, 11 items for sensation seeking subscale). The mean of each subscale (range 1–2) was calculated for each participant, with higher scores representing higher levels of impulsivity and sensation

seeking. Internal consistency reliabilities for the impulsivity ( $\alpha = .63$ ) and sensation seeking ( $\alpha = .71$ ) subscales in this sample were adequate.

**Alcohol Accessibility**—Alcohol accessibility was assessed at time 2. Three questions were adapted from a previous study (Smart, Adlaf, & Walsh, 1996) of perceived access to and procurement of alcohol by youth. Two questions asked youth to rate the likelihood they would be able to obtain alcohol themselves if they wanted. A six point likert-type scale was used, with responses ranging from “no chance” to “certain to happen”. Youth were also asked how often they had obtained alcohol in the past year on a six point scale, ranging from “never” to “20 or more times”. The scale mean (range 1–6) was calculated for each participant, with higher scores representing easier accessibility of alcohol. Internal consistency reliability for these items in this sample was adequate ( $\alpha = .74$ ).

**Parental Monitoring**—Parental monitoring was assessed at time 2. A six item measure used in previous studies (Li et al., 2000) asked youth to rate their parents’ knowledge of activities (e.g., “my parents know where I am after school”). A five point likert-type scale was used, with responses ranging from “disagree strongly” to “agree strongly”. The scale mean (range 1–5) was calculated for each participant, using reverse coded items so that higher scores represented lower levels of parental monitoring. This measure has been found to be internally consistent and valid in studies of adolescents (Li et al., 2000). Internal consistency reliability for these items in this sample was very good ( $\alpha = .87$ ).

### Analytic Strategy

Study hypotheses were tested using zero-inflated Poisson (ZIP) regression analyses in Mplus 4.2 (Muthén & Muthén, 2007). Poisson regression is appropriate when the dependent variable is a count of the number of events over a fixed period of time, such as the number of times engaging in drinking and driving behavior during a given time span. The ZIP model includes a correction for overdispersion that occurs when the most common frequency count is zero. Mplus estimates two components in a ZIP model. The first, a zero-inflation component, is similar to logistic regression and estimates the odds of being in the zero class or not reporting engagement in the specified behavior (e.g., the odds of not drinking and driving). The second component is a Poisson regression analysis, which estimates the predicted rate (*pr*) of engaging in that behavior if the individual is able to assume a non-zero status (e.g., the frequency of drinking and driving among those who drink and drive).

To simplify reporting, odds ratios from the logistic regression component were inverted so that higher values indicated greater likelihood of being in the non-zero class, or engaging in drinking and driving behavior. For the Poisson regression component, Poisson regression coefficients were used to calculate a predicted rate value, which indicates the expected rate of increase in the dependent variable under different combinations of the independent variables (Cohen, Cohen, West, & Aiken, 2003). For ease of interpretability of Poisson results, personality and environmental variables were standardized as Z scores. Models predicting drinking and driving behavior included only participants who were licensed drivers at time 2, while models for riding with a drinking driver included all study participants. To control for differences in license status across analyses, dummy coded

variables of license groups were created for drinking and driving models (newly licensed/established driver) and models predicting riding with a drinking driver (never licensed/licensed, new or non-licensed/established driver).

## Results

### Descriptive Statistics

Table 1 presents mean levels of sensation seeking, impulsivity, alcohol accessibility, parental monitoring, percent reporting lifetime alcohol use, percent reporting drinking and driving and riding with a drinking driver, and frequency of drinking and driving behaviors for those who engaged in the behavior. No significant gender differences were found for engagement in drinking and driving behaviors, alcohol use, personality characteristics or environmental factors at either time point.

### Additive Risk Model of Drinking and Driving Behaviors

We first tested whether impulsivity (time 1), sensation seeking (time 1), alcohol accessibility (time 2), and parental monitoring (time 2) uniquely predicted frequency of drinking and driving or riding with a drinking driver at time 2 over and above time 1 drinking and driving behaviors, license status, frequency of alcohol use (time 1) and gender. Results for the logistic regression portion of the model indicated that when all study variables were included in the model, only time 1 alcohol use frequency ( $OR = 1.63, p < .05$ ) uniquely predicted time 2 engagement in drinking and driving. Time 1 alcohol use frequency ( $OR = 1.74, p < .01$ ), frequency of riding with a drinking driver ( $OR = 1.16, p < .05$ ), and sensation seeking ( $OR = 2.12, p < .01$ ) predicted time 2 engagement in riding with a drinking driver. License status variables were not related to engagement for either drinking and driving or riding with a drinking driver.

Results for the Poisson regression portion of the model are presented in Table 2. Time 1 alcohol use frequency, gender, and sensation seeking predicted frequency of both drinking and driving and riding with a drinking driver at time 2. Frequency of riding with a drinking driver at time 1 predicted frequency of this behavior at time 2. Impulsivity predicted frequency of drinking and driving, but not riding with a drinking driver. Parental monitoring and alcohol accessibility at time 2 predicted frequency of riding with a drinking driver, but not drinking and driving.

To test whether the influence of personality and environmental variables on drinking and driving behaviors was accounted for by concurrent alcohol use, analyses were also run including frequency of past month drinking at time 2. For the logistic regression portion of the model, time 2 alcohol use frequency was not significantly associated with engagement in either behavior. As a result, the pattern of significant results for this model remained unchanged. For the Poisson regression portion of the model, time 2 alcohol use frequency was associated with frequency of both drinking and driving ( $pr = .05, p < .001$ ) and riding with a drinking driver ( $pr = .97, p < .001$ ). The inclusion of time 2 alcohol use frequency did not change the pattern of results for riding with a drinking driver; sensation seeking ( $pr = .60, p < .001$ ), alcohol accessibility ( $pr = .99, p < .001$ ), and parental monitoring ( $pr = 1.10, p$

< .001), remained significantly associated with frequency of this behavior. However, for drinking and driving, sensation seeking ( $pr = .05$ ,  $p < .01$ ) was associated with frequency over and above time 2 alcohol use frequency, while impulsivity was no longer related ( $pr = .04$ , *ns*).

### Indirect Effects of Personality on Drinking and Driving Behaviors

We then examined whether the prediction of engagement and frequency of drinking and driving behaviors by disinhibited personality traits was mediated by parental monitoring or alcohol accessibility. Several conditions must be present for mediation to be indicated (MacKinnon, Lockwood, Hoffman, West, & Sheets 2002). One condition is that the independent and mediator variables must be associated. Correlation analyses indicated that time 1 sensation seeking was moderately associated with time 2 alcohol accessibility ( $r = .21$ ,  $p < .01$ ) and parental monitoring ( $r = .18$ ,  $p < .05$ ), while impulsivity was not. Another requirement for mediation is that the mediator and dependent variable are associated. Results from the additive model indicated that neither alcohol accessibility nor parental monitoring were related to engagement in either behavior. For the Poisson regression portion of the model, both alcohol accessibility and parental monitoring predicted frequency of riding with a drinking driver, but neither predicted drinking and driving. These results indicate that the influence of sensation seeking on frequency of riding with a drinking and driver could be mediated by alcohol accessibility or parental monitoring.

A final condition for mediation is that the association between the independent and dependent variables either drops significantly or reduces to zero when the mediator is included in analyses. Results of the additive model do not support full mediation of sensation seeking's influence on riding with a drinking driver. To test potential partial mediation, we compared the Poisson regression coefficients for sensation seeking predicting riding with a drinking and driver when either parental monitoring or alcohol accessibility were included in analyses<sup>1</sup>. Mediation analyses controlled for license status, alcohol use frequency at time 1, gender, and time 1 drinking and driving behavior. Results indicated that these coefficients did not differ when either parental monitoring or alcohol accessibility was included in the model. Results therefore do not support mediation of sensation seeking's association with riding with a drinking and driver.

### Personality X Environment Interactions

Finally, we tested potential interactions between disinhibited personality traits and alcohol accessibility or parental monitoring in the prediction of drinking and driving behaviors. We estimated separate ZIP models for each of four potential interactions (sensation seeking or impulsivity X alcohol accessibility or parental monitoring). Product terms were created for each potential interaction using centered variables. For each model, study covariates, the relevant personality and environmental variables, and the corresponding product term were

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<sup>1</sup>For each mediation test, one of the component paths is assessed as a standard regression/correlation coefficient (e.g., sensation seeking - alcohol accessibility), while the other is assessed as a Poisson regression coefficient (e.g., alcohol accessibility - drinking and driving). This lack of correspondance made several of the standard methods of testing mediation (product of coefficients, estimation of indirect effects) inappropriate in the current study. Instead, Poisson regression coefficients were compared with and without the mediator included in the model. In each case, the 95% confidence interval of the two coefficients overlapped considerably. Although this method is not ideal, for the present study we believe it was sufficient to demonstrate absence of mediation.



entered as predictors. Results indicated several significant interactions in the prediction of drinking and driving behavior and one interaction in the prediction of riding with a drinking driver.

Impulsivity interacted with both parental monitoring ( $p < .05$ ) and alcohol accessibility ( $p < .05$ ) in predicting time 2 drinking and driving frequency. These interactions were probed by estimating models at 1 *SD* above and below the mean on parental monitoring and alcohol accessibility (see Figure 1). For ease of interpretability, analyses for probing and graphing interactions did not include study covariates. For youth who reported high alcohol accessibility, increases in impulsivity were associated with greater increases in drinking and driving frequency ( $pr = 6.56$ ) than those who reported low alcohol accessibility ( $pr = 3.64$ ). For youth who reported low parental monitoring, increases in impulsivity were associated with greater increases in drinking and driving frequency ( $pr = 6.55$ ) than those reporting high parental monitoring ( $pr = 4.35$ ).

Results also indicated that sensation seeking interacted with alcohol accessibility in predicting time 2 drinking and driving in both the logistic regression ( $p < .05$ ) and Poisson regression ( $p < .001$ ) components. Additionally, sensation seeking interacted with parental monitoring to predict time 2 engagement in riding with a drinking driver ( $p < .05$ ). Probing these interactions indicated that increases in sensation seeking were associated with a greater frequency of drinking and driving for youth reporting high alcohol accessibility ( $OR = 1.24$ ;  $pr = 6.54$ ) compared to youth reporting low alcohol accessibility ( $OR = .52$ ;  $pr = 4.23$ ; see Figure 2). Higher sensation seeking was also associated with increased likelihood of riding with a drinking driver for youth reporting low parental monitoring ( $OR = 1.32$ ) compared to youth reporting high parental monitoring ( $OR = .72$ ).

## Discussion

The goal of the current study was to test potential mechanisms by which personality traits and environmental risk factors might influence adolescents' drinking and driving behaviors. Our results provide support for an additive model, where both personality and environmental factors make unique contributions to drinking and driving behaviors over time. In the additive model, high sensation seeking youth reported increased frequency of both personal driving after drinking and riding with a drinking driver. Importantly, results were significant while controlling for license status, frequency of alcohol use at both time points and time 1 drinking and driving behaviors. Although impulsivity predicted frequency of drinking and driving in the additive model, it did not uniquely predict drinking and driving over concurrent alcohol use. This is consistent with prior studies in adults (Stacy et al., 1991; Stacy & Newcomb, 1998), and may indicate that the influence of impulsivity on drinking and driving is mediated by its association with drinking behavior.

There was also evidence for interaction effects, such that disinhibited personality traits led to more frequent drinking and driving in youth for whom alcohol is easily accessible or who reported low parental monitoring of their behavior. Results did not support mediation of risk from disinhibited personality traits by the aspects of the adolescent's home/social environment that were assessed in this study.

Several differences emerged between models predicting drinking and driving and riding with a drinking driver. Parental monitoring and alcohol accessibility were only related to the frequency of accepting a ride from a drinking driver and not personal drinking and driving behavior. Also, time 1 alcohol use frequency predicted later drinking and driving, but was not related to riding with a drinking driver. As noted, prior studies have found evidence for distinct risk mechanisms for these two behaviors. For example, adolescents are less likely to ride with a drinking driver when they have a driver's license (McCarthy & Brown, 2004; Poulin et al., 2007). Results of the present study provide evidence that personal drinking and driving decisions are more strongly influenced by individual difference characteristics, such as desiring intense or stimulating experiences. Riding with a drinking driver appears to be more strongly influenced by external factors such as parental monitoring, and these differences remained even after controlling for the effect of license status. However, there was also evidence for moderation of the influence of disinhibited personality traits on personal drinking and driving. The accessibility of alcohol and degree of parental monitoring either facilitated or constrained drinking and driving risk for disinhibited youth.

Personality characteristics, parental monitoring, and alcohol accessibility did not predict increased likelihood of engagement in drinking and driving behaviors once prior drinking and driving behaviors and alcohol use were accounted for. The exception was sensation seeking, which predicted engagement in riding with a drinking driver. These results may be due, in part, to the relatively brief time period of the study (approximately 8 months), which limited the number of youth who initiate drinking and driving over the course of the study. These findings may also be the result of strong bivariate associations of time 1 alcohol use frequency ( $OR = 2.20, p < .001$ ) and drinking and driving ( $OR = 1.85, p < .001$ ) with engagement in drinking and driving at time 2, making it difficult for study variables to add unique prediction.

We also did not find support for mediation of personality risk for drinking and driving by environmental factors. Impulsive personality traits do not appear to influence either parental monitoring or alcohol accessibility. Although sensation seeking youth reported lower parental monitoring and greater access to alcohol at time 2, this did not explain sensation seeking's influence on drinking and driving behaviors. However, these results provide some evidence that sensation seeking might influence changes in these environmental characteristics over time. While the magnitude of sensation seeking's bivariate association with parental monitoring and alcohol accessibility was modest, it is similar to that observed between Five Factor personality traits and parent and peer support (Asendorpf & van Aken, 2003) in longitudinal studies supporting transactional associations over time. One direction for future research is to examine whether sensation seeking is associated with changes in alcohol accessibility and parental monitoring over a longer developmental period. Having additional time points would also allow for a more stringent test of how personality may influence environmental factors and subsequent drinking and driving behaviors over time.

Another direction for future research is to examine other environmental and contextual factors that might mediate the influence of disinhibited personality traits on drinking and driving. For example, sensation seeking has been found to influence alcohol and drug use in part through influencing youth's associations with deviant or substance using peers

(Yanovitzky, 2005). Associating with deviant peers may help explain why sensation seeking was related to riding with a drinking driver in the current study. There is also evidence that drinking context (e.g., outdoors, at bars; Usdan, Moore, Schumacher, & Talbott, 2005) and lack of transportation planning prior to drinking (Nelson, Kennedy, Isaac, & Graham, 1998) are associated with drinking and driving behaviors. Further research is required to test whether disinhibited youth are more likely to drink in situations where drinking and driving is likely to occur or if they are less likely to plan for transportation prior to drinking.

The current study also showed changes in the frequency and engagement of drinking and driving over time (see Table 1). One potential reason for this pattern of results is that youth who onset to drinking and driving over the course of the study may initially engage in this behavior less frequently than those individuals with more established drinking and driving behaviors. Data from the current study tentatively supports this possibility. Youth who did not report drinking and driving at time 1, but did at time 2, reported an average of 2.8 drinking and driving occasions. Individuals who reported drinking and driving at both time points reported an average of 6.0 drinking and driving occasions at time 2. Future studies could more directly explore how the rate of increase of drinking and driving frequency changes over time.

There are several limitations to the generalizability of the current study. Participants were primarily recruited from high school campuses in the central Missouri area. There are significant regional differences in the prevalence of drinking and driving behavior, with higher rates in the Midwest (Chou et al., 2006). In addition, although efforts were made to recruit high school age youth from community sources, the use of school based recruitment can introduce sample biases due to absenteeism, truancy, or disengagement from academics by some youth, particularly disinhibited or substance involved youth. Females were also over-represented in our sample. Although there is ample evidence that adolescent males are at greater risk for engaging in and experiencing consequences of drinking and driving (Hingson & Winter, 2003; Wechsler, Lee, Nelson, & Lee, 2003), rates of drinking and driving behaviors did not differ by gender. Although gender was controlled for in study analyses, our sample size prevented us from conducting study analyses separately by gender.

The study relied on self-report for assessing all study variables. Studies have demonstrated that self-report measures of alcohol use and related behavior can be valid in youth, particularly when data collection is confidential or anonymous and when no consequences are associated with the report (Smith et al., 1995; Wilson & Grube, 1994). For parental monitoring and alcohol accessibility, youth report may not provide an accurate representation of these two constructs. However, there is some evidence that youths' perceptions of the home environment, such as parent behaviors, are most relevant in determining youth behavior (Smith, Miller, Kroll, Simmons & Gallen, 1999). Nevertheless, studies of both parental monitoring (Laird et al., 2003) and alcohol accessibility (Dent et al., 2005) have demonstrated that supplementing youth report with parent report or community level information can provide a fuller assessment of these constructs. Additionally, parental monitoring and alcohol accessibility were only assessed at time 2, which limited our ability to test how changes in these environmental factors influence drinking and driving behaviors over time.

Recent research on parental monitoring has also indicated greater complexity of this construct than is reflected in this study. Studies have found differences in the influence of what parents know (parental knowledge) and how they know it (active efforts to monitor behavior, child disclosure) on youth behavior (Kerr & Stattin, 2000). In studies of youth substance use and delinquency, youth self-disclosure and parental knowledge have been found to mediate the influence of parenting style on youth behavior (Soenens, Vansteenkiste, Luyckx, & Goossens, 2006), although there is also evidence for direct effects of parental control and monitoring (Fletcher, Steinberg, & Williams-Wheeler, 2004). It is important for future studies to test whether disinhibited personality traits have distinct influences on youth self-disclosure and parental knowledge.

Results of this study provide evidence for person-environment transactions in the development of youth drinking and driving behavior. It is well known that disinhibited personality traits predict drinking and driving and other risk taking behaviors. Results of this study suggest that the disinhibited traits of impulsivity and sensation seeking may have different implications for driving after drinking or riding with a drinking driver. This is consistent with prior research demonstrating differential prediction of externalizing behaviors by these traits (e.g., Lynam & Miller, 2004; Miller et al., 2003). Improving our understanding of mechanisms by which these personality traits lead to specific risk taking behaviors can improve prevention/intervention efforts. For example, alcohol control policies (Babor et al., 2003) and parent intervention strategies that increase communication and parental awareness (Turrissi, Jaccard, Taki, Dunnam, & Grimes, 2001) have been found to be effective in reducing youth alcohol use. Our results suggest that these may also be effective methods of adolescent drinking and driving interventions, particularly when targeted at disinhibited youth. As study results suggest that parental monitoring may be of particular importance for riding with a drinking driver, interventions that increase parental awareness and communication may also benefit from targeting youth prior to obtaining a driver's license.

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## References

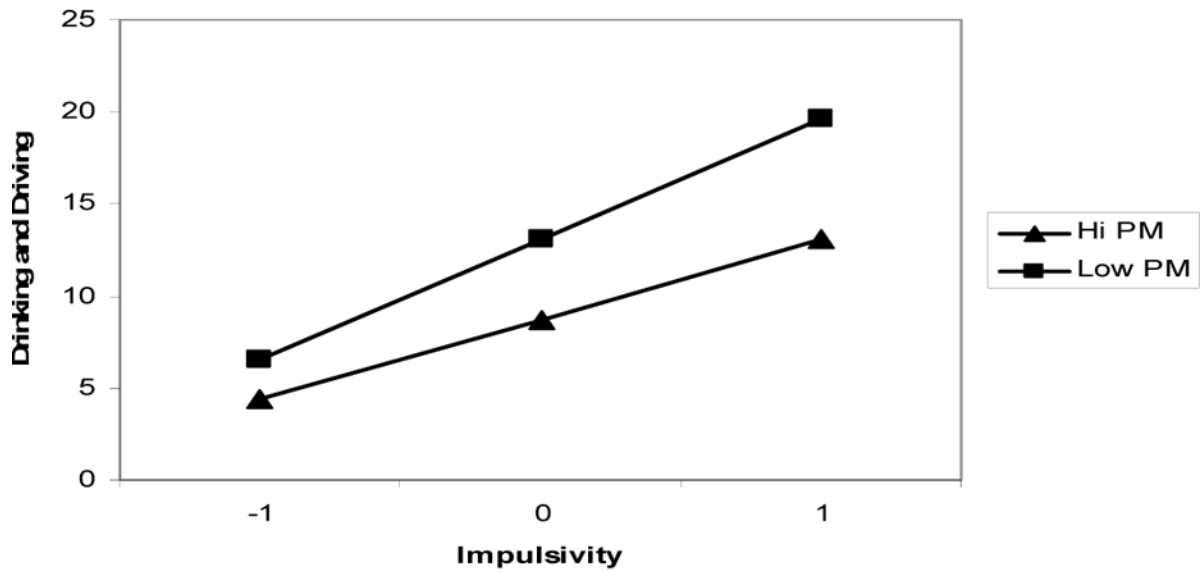
- Asendorpf JB, van Aken MA. Personality-relationship transaction in adolescence: Core versus surface personality characteristics. *Journal of Personality*. 2003; 71:629–666. [PubMed: 12901433]
- Babor, T., et al. *Alcohol: No Ordinary commodity*. New York: Oxford University Press; 2003.
- Bingham CR, Shope JT. Adolescent developmental antecedents of risky driving among young adults. *Journal of Studies on Alcohol*. 2004; 65:84–94. [PubMed: 15000507]
- Burstein M, Stanger C, Kamon J, Dumenci L. Parent psychopathology, parenting, and child internalizing problems in substance-abusing families. *Psychology of Addictive Behaviors*. 2006; 20:97–106. [PubMed: 16784351]
- Buss DM. Selection, evocation, and manipulation. *Journal of Personality and Social Psychology*. 1987; 53:1214–1221. [PubMed: 3320336]
- Caspi A, Harrington HL, Moffitt TE, Begg D, Dickson N, Langley J, Silva PA. Personality differences predict health-risk behaviors in young adulthood: Evidence from a longitudinal study. *Journal of Personality and Social Psychology*. 1997; 73:1052–1063. [PubMed: 9364760]

- Caspi A, Roberts BW. Target article: Personality development across the life course: The argument for change and continuity. *Psychological Inquiry*. 2001; 12:49–66.
- Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. WISQARS leading causes of death reports, 2004. 2004. Retrieved November 28, 2006 from <http://webapp.cdc.gov/sasweb/ncipc/leadcaus10.html>
- Chassin L, Pillow DR, Curran PJ, Molina BS, Barrera M. Relation of parental alcoholism to early adolescent substance use: A test of three mediating mechanisms. *Journal of Abnormal Psychology*. 1993; 102:3–19. [PubMed: 8436697]
- Chou SP, Dawson DA, Stinson FS, Huang B, Pickering RP, Zhou Y, Grant BF. The prevalence of drinking and driving in the United States, 2001–2002: Results from the national epidemiological survey on alcohol and related conditions. *Drug and Alcohol Dependence*. 2006; 83:137–146. [PubMed: 16364565]
- Cohen, J.; Cohen, P.; West, SG.; Aiken, LS. *Applied multiple regression/correlation analysis for the behavioral sciences*. 3rd. Mahwah, NJ: Lawrence Erlbaum Associates Publishers; 2003.
- Curran PJ, Chassin L. A longitudinal study of parenting as a protective factor for children of alcoholics. *Journal of Studies on Alcohol*. 1996; 57:305–313. [PubMed: 8709589]
- Dent CW, Grube JW, Biglan A. Community level alcohol availability and enforcement of possession laws as predictors of drinking. *Preventive Medicine: An International Journal Devoted to Practice and Theory*. 2005; 40:355–362.
- Elkins IJ, King SM, McGue M, Lacono WG. Personality traits and the development of nicotine, alcohol, and illicit drug disorders: Prospective links from adolescence to young adulthood. *Journal of Abnormal Psychology*. 2006; 115:26–39. [PubMed: 16492093]
- Ensoo D, Paaver M, Harro M, Harro J. Predicting drunk driving: Contribution of alcohol use and related problems, traffic behaviour, personality and platelet monoamine oxidase (MAO) activity. *Alcohol and Alcoholism*. 2005; 40:140–146. [PubMed: 15655093]
- Hingson R, Winter M. Epidemiology and consequences of drinking and driving. *Alcohol Research and Health*. 2003; 27:63–78. [PubMed: 15301401]
- Hittner JB, Swickert R. Sensation seeking and alcohol use: A meta-analytic review. *Addictive Behaviors*. 2006; 31:1383–1401. [PubMed: 16343793]
- Fischer S, Smith GT, Anderson KG. Clarifying the role of impulsivity in bulimia nervosa. *International Journal of Eating Disorders*. 2003; 33:406–411. [PubMed: 12658670]
- Fletcher AC, Steinberg L, Williams-Wheeler M. Parental influences on adolescent problem behavior: Revisiting Stattin and Kerr. *Child Development*. 2004; 75:781–796. [PubMed: 15144486]
- Jones-Webb R, Toomey TL, Short B, Murray DM, Wagenaar A, Wolfson M. Relationships among alcohol availability, drinking location, alcohol consumption and drinking problems in adolescents. *Substance Use and Misuse*. 1997; 32:1261–1285. [PubMed: 9286000]
- Jonah BA. Sensation seeking and risky driving: A review and synthesis of the literature. *Accident Analysis and Prevention*. 1997; 29:651–665. [PubMed: 9316713]
- Laird RD, Pettit GS, Bates JE, Dodge KA. Parents' monitoring-relevant knowledge and adolescents' delinquent behavior: Evidence of correlated developmental changes and reciprocal influences. *Child Development*. 2003; 74:752–768. [PubMed: 12795388]
- Li X, Stanton B, Feigelman S. Impact of perceived parental monitoring on adolescent risk behavior over 4 years. *Journal of Adolescent Health*. 2000; 27:49–56. [PubMed: 10867352]
- Lynam DR, Miller JD. Personality pathways to impulsive behavior and their relations to deviance: Results from three samples. *Journal of Quantitative Criminology*. 2004; 20:319–341.
- Kerr M, Stattin H. What parents know, how they know it, and several forms of adolescent adjustment: Further support for a reinterpretation of monitoring. *Developmental Psychology*. 2000; 36:366–380. [PubMed: 10830980]
- MacKinnon DP, Lockwood CM, Hoffman JM, West SG, Sheets V. A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*. 2002; 7:83–104. [PubMed: 11928892]
- McCarthy DM, Brown SA. Changes in alcohol involvement, cognitions and drinking and driving behavior after obtaining a driver's license. *Journal of Studies on Alcohol*. 2004; 65:289–296. [PubMed: 15222584]

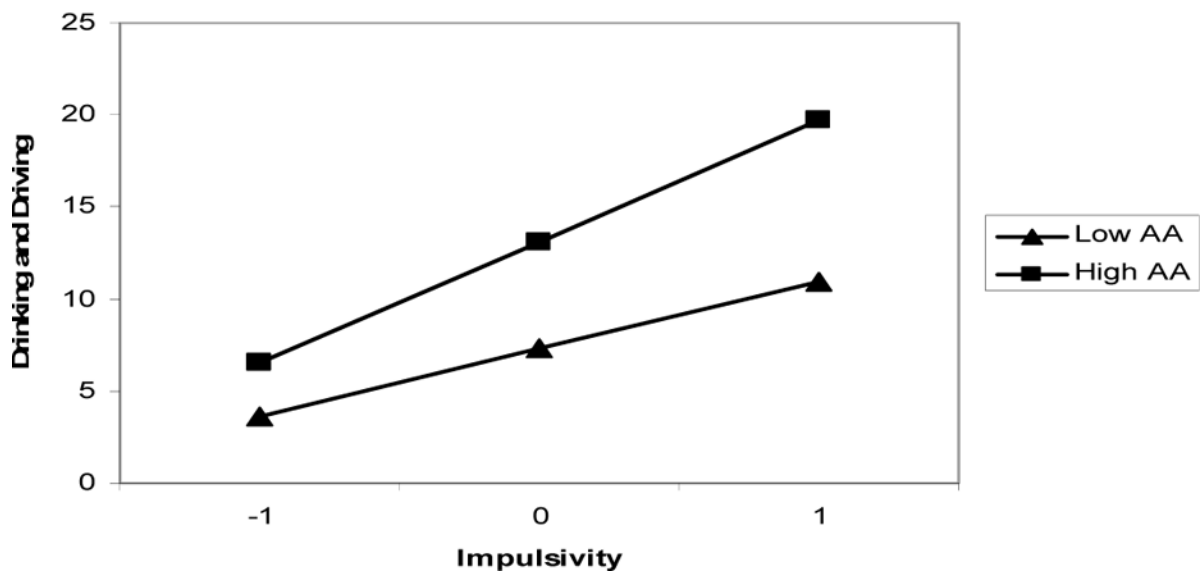
- McCarthy DM, Miller TL, Smith GT, Smith JA. Disinhibition and expectancy in risk for alcohol use: Comparing black and white college samples. *Journal of Studies on Alcohol*. 2001; 62:313–321. [PubMed: 11414341]
- Marshal MP, Chassin L. Peer influence on adolescent alcohol use: The moderating role of parental support and discipline. *Applied Developmental Science*. 2000; 4:80–88.
- Miller J, Flory K, Lynam D, Leukefeld C. A test of the four-factor model of impulsivity-related traits. *Personality and Individual Differences*. 2003; 34:1403–1418.
- Muthén, LK.; Muthén, BO. *Mplus User's Guide*. Third. Los Angeles, CA: Muthén and Muthén; 1998–2007.
- National Highway Traffic Safety Administration. Traffic safety facts 2005: Young drivers. 2006 Dec. Retrieved December 10, 2006, from <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2005/YoungDriversTSF05.pdf>
- Nelson TF, Kennedy BP, Isaac NE, Graham JD. Correlates of drinking-driving in men at risk for impaired driving crashes. *American Journal of Health Behavior*. 1998; 22:151–159.
- Nochajski TH, Stasiewicz PR. Relapse to driving under the influence (DUI): A review. *Clinical Psychology Review*. 2006; 26:179–195. [PubMed: 16364523]
- O'Malley PM, Johnston LD. Unsafe driving by high school seniors: National trends from 1976–2001 in tickets and accidents after use of alcohol, marijuana and other illegal drugs. *Journal of Studies on Alcohol*. 2003; 64:305–312. [PubMed: 12817818]
- O'Malley PM, Johnston LD. Drugs and driving by American high school seniors, 2001–2006. *Journal of Studies on Alcohol and Drugs*. 2007; 68:834–842. [PubMed: 17960301]
- Poulin C, Boudreau B, Asbridge M. Adolescent passengers of drunk drivers: A multi-level exploration into the inequities of risk and safety. *Addiction*. 2007; 102:51–61. [PubMed: 17207123]
- Royal, D. National survey of drinking and driving. Washington, DC: National Highway Traffic Safety Administration; 2003. DOT HS 809 549
- Ryb GE, Dischinger PC, Kufera JA, Read KM. Risk perception and impulsivity: Association with risky behaviors and substance abuse disorders. *Accident Analysis and Prevention*. 2006; 38:567–573. [PubMed: 16426559]
- Scarr S, McCartney K. How people make their own environments: A theory of genotypic-rightward-arrow environment effects. *Child Development*. 1983; 54:424–435. [PubMed: 6683622]
- Sher KJ, Trull TJ. Personality and disinhibitory psychopathology: Alcoholism and antisocial personality disorder. *Journal of Abnormal Psychology*. 1994; 103:92–102. [PubMed: 8040486]
- Shope JT, Waller PF, Raghunathan TE, Patil SM. Adolescent antecedents of high-risk driving behavior into young adulthood: substance use and parental influences. *Accident Analysis and Prevention*. 2001; 33:649–658. [PubMed: 11491245]
- Smart RG, Adlaf EM, Walsh GW. Procurement of alcohol and underage drinking among adolescents in Ontario. *Journal of Studies on Alcohol*. 1996; 57:419–424. [PubMed: 8776684]
- Smith GT, Fischer S, Cyders MA, Annus AM, Spillane NS, McCarthy DM. On the validity and utility of discriminating among impulsivity-like traits. *Assessment*. 2007; 14:155–170. [PubMed: 17504888]
- Smith GT, McCarthy DM, Goldman M. Self-reported drinking and alcohol-related problems among early adolescents: Dimensionality, validity and reliability over 24 months. *Journal of Studies on Alcohol*. 1995; 56:383–394. [PubMed: 7674672]
- Smith GT, Miller TL, Kroll L, Simmons JR, Gallen R. Children's perceptions of parental drinking: The eye of the beholder. *Journal of Studies on Alcohol*. 1999; 60:817–824. [PubMed: 10606494]
- Soenens B, Vansteenkiste M, Luyckx K, Goossens L. Parenting and adolescent problem behavior: An integrated model with adolescent self-disclosure and perceived parental knowledge as intervening variables. *Developmental Psychology*. 2006; 42:305–318. [PubMed: 16569169]
- Stacy AW, Newcomb MD, Bentler PM. Personality, problem drinking, and drunk driving: Mediating, moderating, and direct-effect models. *Journal of Personality and Social Psychology*. 1991; 60:795–811. [PubMed: 2072256]
- Stacy AW, Newcomb MD. Memory association and personality as predictors of alcohol use: Mediation and moderator effects. *Experimental and Clinical Psychopharmacology*. 1998; 6:280–291. [PubMed: 9725112]

- Sweedler BM, Biecheler MB, Laurell H, Kroj G, Lerner M, Mathijssen MP, Mayhew D, Tunbridge RJ. Worldwide trends in alcohol and drug impaired driving. *Traffic Injury Prevention*. 2004; 5:175–184. [PubMed: 15276918]
- Treno AJ, Grube J, Martin SE. Alcohol availability as a predictor of youth drinking and driving: A hierarchical analysis of survey and archival data. *Alcoholism: Clinical and Experimental Research*. 2003; 27:835–840.
- Turrisi R, Jaccard J, McDonnell D. An examination of the relationships between personality, attitudes, and cognitions relevant to alcohol-impaired driving tendencies. *Journal of Applied Social Psychology*. 1997; 27:1367–1394.
- Turrisi R, Jaccard J, Taki R, Dunnam H, Grimes J. Examination of the short-term efficacy of a parent intervention to reduce college student drinking tendencies. *Psychology of Addictive Behaviors*. 2001; 15:366–372. [PubMed: 11767270]
- Usdan SL, Moore CG, Schumacher JE, Talbot LL. Drinking locations prior to impaired driving among college students: Implications for prevention. *Journal of American College Health*. 2005; 54:69–75. [PubMed: 16255317]
- Wagenaar AC, O'Malley PM, LaFond C. Lowered legal blood alcohol limits for young drivers: Effects on drinking, driving, and driving-after-drinking behaviors in 30 states. *American Journal of Public Health*. 2001; 95:801–804. [PubMed: 11344892]
- Wechsler H, Lee JE, Nelson TF, Lee H. Drinking and driving among college students: The influence of alcohol-control policies. *American Journal of Preventive Medicine*. 2003; 25:212–218. [PubMed: 14507527]
- White HR, Bates ME, Buyske S. Adolescence-limited versus persistent delinquency: Extending Moffitt's hypothesis into adulthood. *Journal of Abnormal Psychology*. 2001; 110:600–609. [PubMed: 11727949]
- Whiteside SP, Lynam DR. The Five Factor Model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences*. 2001; 30:669–689.
- Whiteside SP, Lynam DR, Miller JD, Reynolds SK. Validation of the UPPS impulsive behaviour scale: A four-factor model of impulsivity. *European Journal of Personality*. 2005; 19:559–574.
- Wilson DK, Grube J. Role of psychosocial factors in obtaining self-reports of alcohol use in a DUI population. *Psychology of Addictive Behaviors*. 1994; 8:139–151.
- Wood MD, Read JP, Mitchell RE, Brand NH. Do parents still matter? Parent and peer influences on alcohol involvement among recent high school graduates. *Psychology of Addictive Behaviors*. 2004; 18:19–30. [PubMed: 15008682]
- Yanovitzky I. Sensation seeking and adolescent drug use: The mediating role of association with deviant peers and pro-drug discussions. *Health Communication*. 2005; 17:67–89. [PubMed: 15590343]
- Yu J, Shackel RW. Drinking-driving and riding with drunk drivers among young adults: An analysis of reciprocal effects. *Journal of Studies on Alcohol*. 1999; 60:615–621. [PubMed: 10487730]
- Zador PL, Krawchuk SA, Voas RB. Alcohol-related relative risk of driver fatalities and driver involvement in fatal crashes in relation to driver age and gender: An update using 1996 data. *Journal of Studies on Alcohol*. 2000; 61:387–395. [PubMed: 10807209]
- Zuckerman, M. Behavioral expressions and biosocial bases of sensation seeking. New York, NY: Cambridge University Press; 1994.
- Zuckerman M, Kuhlman DM. Personality and risk-taking: Common biosocial factors. *Journal of Personality*. 2000; 68:999–1029. [PubMed: 11130742]
- Zuckerman M, Kuhlman DM, Joireman J, Teta P, Kraft M. A comparison of three structural models for personality: The Big Three, the Big Five, and the Alternative Five. *Journal of Personality and Social Psychology*. 1993; 65:757–768.

### Impulsivity x Parental Monitoring



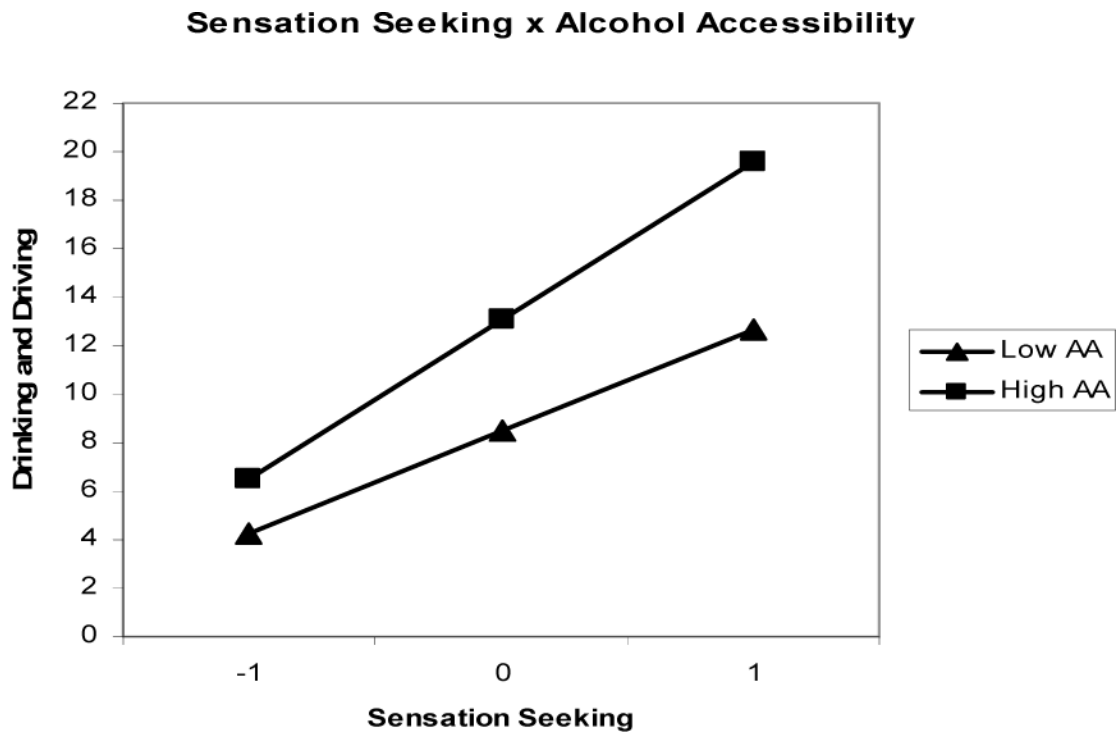
### Impulsivity x Alcohol Accessibility



**Figure 1.**

Graphs represent interactions of impulsivity with parental monitoring and alcohol accessibility from Poisson regression analyses for frequency of drinking and driving. Lines depict predicted rate differences at 1 SD above/below the mean for parental monitoring and alcohol accessibility.  $p < .05$  for impulsivity X parental monitoring,  $p < .05$  impulsivity X alcohol accessibility.





**Figure 2.**

Graph represents the interaction of sensation seeking with alcohol accessibility from Poisson regression analyses for frequency of drinking and driving. Lines depict predicted rate differences at 1 SD above/below the mean for alcohol accessibility.  $p < .001$ .

**Table 1**

Descriptive Statistics for Personality and Environmental Variables, Lifetime Alcohol Use, and Drinking and Driving Behaviors

	<b>Time 1</b>	<b>Time 2</b>
Sensation Seeking	1.66 (0.23)	—
Impulsivity	1.44 (0.27)	—
Alcohol Accessibility	—	2.14 (1.16)
Parental Monitoring	—	1.81 (0.82)
Lifetime Alcohol Use	59%	69%
Drove After Drinking	22%	29%
DD Frequency	5.31 (11.7)	4.82 (9.1)
Rode with a Drinking Driver	43%	47%
RWDD Frequency	4.95 (7.2)	3.99 (5.0)

*Note.* DD = drinking and driving, RWDD = riding with a drinking driver. Values for personality and environmental variables are means and standard deviations of raw scores for the full sample. Values for drinking and driving frequency variables are means and standard deviations for those youth engaging in the behavior.

**Table 2**

Additive Model Predicting Time 2 Frequency of Drinking and Driving Behaviors.

	Drinking and Driving	Riding w/ Drinking Driver
<b>Control Variables</b>		
DD/RWDD	0.10	1.35*
Alc. Use Freq. (time1)	0.08**	1.48*
New vs. Established Driver	1.23***	1.32
Non-licensed vs. Licensed	—	1.88
Gender	0.13***	2.05**
<b>Personality/Environment</b>		
Sensation Seeking	0.11**	0.99**
Impulsivity	0.10**	1.38
Alcohol Accessibility (time 2)	0.08	1.76***
Parental Monitoring (time 2)	0.08	1.68***

Note. Values are predicted rate ( $pr$ ) coefficients from Poisson regression analyses. For drinking and driving  $n = 162$ . For riding with a drinking driver,  $n = 202$ .

\*\*\*  
 $p < .001$ ;

\*\*  
 $p < .01$ ;

\*  
 $p < .05$ .