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Is Risk-Taking Propensity a Familial Vulnerability Factor for Alcohol Use? An Examination in Two Independent Samples

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Abstract

Research indicates that increased risk-taking propensity (RTP) is associated with higher alcohol use. There is also some evidence to suggest that it is not just a state factor or 'scar,' but instead a vulnerability factor. If this is the case, increased RTP should be evident in healthy individuals that are at risk for alcohol use. To date, few studies have examined whether RTP is a familial vulnerability factor and thus, the aim of the current study was to test whether RTP aggregates within families and if increased RTP is evident in biological family members at risk for alcohol use. Sample 1 included 87 biological, adult sibling pairs and Sample 2 included 111 biological mother and adolescent dyads (total *N*=396). All participants completed a behavioral measure of RTP and were assessed for alcohol use. Results in both samples were strikingly consistent. In Sample 1, RTP was correlated among siblings and greater frequency of proband alcohol use predicted greater sibling RTP, over and above sibling alcohol use. In Sample 2, RTP was correlated among mothers and their offspring and greater maternal alcohol use problems predicted greater adolescent RTP over and above adolescent substance use. Together, these findings suggest that RTP may be a familial vulnerability factor for alcohol use as it aggregates within families and is increased in relatives of individuals with higher levels of alcohol use.

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Contributors

Stewart Shankman and Stacey Daughters were the principal investigators of Sample 1 and Sample 2, respectively. Huiting Liu and Daniel Klein assisted with the literature review and made important contributions to the editing of the manuscript. Stephanie Gorka developed the rationale for the paper, conducted the statistical analyses, and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Keywords

alcohol use; risk-taking propensity; vulnerability factor

1. Introduction

Individual differences in risk-taking propensity (RTP), defined as the behavioral tendency to seek rewards despite the probability of negative consequences, are associated with substance use and abuse (Alkin et al., 2008; Hopko et al., 2006; Lejuez et al., 2003). RTP overlaps with other externalizing constructs, such as impulsivity and sensation seeking, but has separable neurobiological components and specifically captures sensitivity to approach-motivation (Lejuez et al., 2002; Reynolds et al., 2013). Several studies have demonstrated that measures of RTP are more robustly associated with substance use than other facets of disinhibition (Hopko et al., 2006; Fernie et al., 2010). RTP may therefore represent a core construct for engagement in substance use (Lejuez et al., 2006, 2007; Meda et al., 2009).

RTP has been linked to the use of a variety of substances (Lejuez et al., 2005; Bornovalova et al., 2005; Hopko et al., 2006), and has most consistently been implicated in alcohol use. Several cross-sectional studies indicate that RTP is positively associated with frequency of alcohol consumption, number of binges, and alcohol use problems (Lejuez et al., 2002, 2007; Fernie et al., 2010; Weafer et al., 2011). It has also been shown that RTP moderates the impact of exposure to alcohol-using peers on drinking behaviors in adolescents (Henry et al., 2005).

Although acute intoxication (Rose et al., 2014) and chronic exposure to alcohol (deWit, 2009) can increase RTP, it is also possible that RTP may be a vulnerability factor for alcohol use. Vulnerability factors directly and indirectly promote the onset of disorder and unlike state effects or consequences, are present *prior* to disorder onset and are evident in healthy individuals at risk for the disorder and its symptoms (Ingram & Luxton, 2005). Information regarding vulnerability is extremely useful as it provides insight into the etiology of the syndrome and can suggest important prevention and intervention targets. It can also be assessed in several ways including prospective designs, family studies and genetic twin studies.

To date, there have been several studies examining whether personality constructs related to RTP are vulnerability factors for problematic alcohol use. For instance, prior investigations have shown that impulsivity predicts the onset of alcohol use disorders, is higher in individuals with a family history of alcohol problems relative to those without a family history, and may mediate the association between family history of alcoholism and individual substance use (de Wit, 2009; Verdejo-Garcia et al., 2008). There have been similar findings reported for the constructs of behavioral undercontrol and disinhibition (King et al., 2004; Ohannessian & Hesselbrock, 2007).

Despite these studies on personality constructs related to RTP, surprisingly, very few studies have examined whether RTP is itself a vulnerability factor. Using a prospective design, MacPherson et al. (2010) demonstrated that RTP at age 9 predicted greater odds of alcohol

use at ages 10–12 years. Meanwhile, a few studies have shown that self-reported risk-taking (Miles et al., 2001), and more specific subconstructs of RTP like economic risk-taking and social risk-taking (Cesarini et al., 2008; Zhong et al., 2009) are moderately heritable and thus may be influenced by genes and/or gene by environment interactions rather than being a sole consequence of alcohol use. Consistent with this notion, Anokhin et al. (2009) assessed the heritability of RTP using a behavioral task in a sample of adolescent twins and found that it was moderately heritable at age 12, but by age 14, the heritable influences were only significant in males.

Although these studies provided valuable preliminary evidence suggesting that RTP may indeed function as a vulnerability factor, there are several limitations worth noting. First, many of the initial studies assessing the heritability of RTP relied on self-report measures of RTP which have known limitations (Hunt et al., 2005), or explored very specific aspects of RTP (e.g., economic risk-taking). In addition, although Anokhin et al. (2009) suggested that RTP may be heritable and evident in 'healthy' adolescents (i.e., those without substance use disorders) using a behavioral task, the moderating influences of gender and age raise concerns about its explanatory power. Given the relatively restricted age range (i.e., 12–14 years), it is also unclear whether the findings generalize to other age groups. Second, the sample in MacPherson et al. (2010) was young (i.e., ages 9–12 years) and consequently, reported very low levels of alcohol use. Alcohol use was also assessed using only a single Likert-scale item inquiring about past year use. This literature implies that RTP may be associated with risk for future alcohol use; however, additional research is critically needed to corroborate these preliminary findings.

As was mentioned above, another way to examine vulnerability is using a family study design. Traditionally, family studies are used to test whether a particular disorder aggregates within first-degree relatives of an 'ill' (i.e., has the disorder) proband more so than in a control group (Andreasen et al., 1987; Raulin et al., 1999). If the prevalence of the disorder is greater in first-degree relatives than in the general population, it can be concluded that the disorder is familial.

Another way that family studies can be useful is to examine whether a characteristic or trait is found in 'healthy' first-degree relatives of ill probands. As an example, several studies have found that individuals with schizophrenia and their healthy biological siblings exhibit eye-tracking dysfunction (Takahashi et al., 2008; Ettinger et al., 2006) and concluded that this characteristic may be a vulnerability factor for schizophrenia. In regards to RTP, if increased levels of RTP are found in healthy (i.e., no problematic drinking) first-degree relatives of probands with higher levels of alcohol use, it would strongly suggest that RTP is a potential vulnerability marker for alcohol use as the findings would be independent of disease status in the relatives.

Family studies have traditionally defined "ill" and "healthy" siblings based on discrete, *Diagnostic and Statistical Manual of Mental Disorders* (DSM)-defined diagnoses (American Psychiatric Association [APA], 1994). However, the limitations of categorical diagnoses have been widely recognized, precipitating a shift towards more dimensional measures of psychopathology (Helzer et al., 2009; Insel et al., 2010; Shankman & Gorka, in

press). In fact, the most recent version of the DSM (5th edition; APA, 2013) has collapsed alcohol abuse and dependence diagnoses into a single spectrum of 'alcohol use disorders' (AUD) that vary in terms of severity. The most valid way of defining a 'symptomatic' versus 'healthy' relative may therefore not be based on whether or not the individual meets DSM criteria for an AUD. Instead, it may be best to utilize measures of alcohol use behaviors and problems that are consistent with a dimensional conceptualization of psychopathology.

Another important methodological consideration is the way RTP is assessed. In the past, studies have utilized both self-report (Colder et al., 2002) and behavioral measures of RTP (MacPherson et al., 2010). Because RTP is a multifaceted construct which is inherently difficult to capture using introspection, Lejuez et al. (2002) developed the laboratory-based behavior task called the Balloon Analog Risk Task (BART). In many ways it simulates real-world risk-taking in that risk-taking up to a certain point leads to positive outcomes but past a certain point, it is detrimental. Over the past decade, the BART has been shown to have good construct validity (Aklin et al., 2005; Lejuez et al., 2003; Hunt et al., 2005) and is one of the only measures of RTP that is not influenced by issues of self-report or recall bias (Harrison et al., 2005). Notably, while the BART is modestly correlated with other self-report measures commonly used to assess risk-taking (Aklin et al., 2005), it also explains unique variance in real-world risk-behaviors above and beyond self-report questionnaires (Hopko et al., 2006; Lejuez et al., 2007).

Taken together, RTP has repeatedly been linked to alcohol use and there is preliminary evidence to suggest that it may be a familial characteristic which predisposes individuals to subsequent alcohol use and abuse. The aim of the current study was to test these questions using data from two separate family studies using different familial relationships (sibling pairs and mother-child pairs) conducted in two different geographic regions, which both assessed RTP using the BART (Lejuez et al., 2002). Sample 1 included 87 biological, young-adult sibling pairs and tested the hypotheses that: 1) RTP is related among adult siblings and 2) greater proband alcohol use (i.e., average number of drinks consumed per week and alcohol binges in the past 30 days) predicts greater sibling RTP, when controlling for sibling alcohol use. In other words, increased RTP aggregates within sibling pairs and is evident in healthy (or low symptom) siblings of frequent alcohol users.

Sample 2 included 111 biological mother and adolescent offspring dyads that similarly completed the BART and measures of problematic alcohol use. This sample was included to explore the generalizability of the findings from Sample 1, as the adolescents in Sample 2 had not reached the peak risk window for onset of alcohol use disorders and reported very low levels of substance use. We hypothesized that: 1) RTP is related among mothers and their adolescents and 2) greater maternal alcohol use predicts greater adolescent RTP, when controlling for adolescent substance use. Thus, in both samples we aimed to test whether RTP aggregates within families and is evident in healthy (or low symptom) relatives of probands who report drinking.

2. Methods

2.1 Sample 1: Participants and Procedure

Data collection for Sample 1 took place at the University of Illinois at Chicago. The sample included 87 adult sibling pairs (*N*=174) enrolled in a larger study on familial emotional processes. Individuals were recruited from the community via advertisements designed to capture a wide-range of psychopathology, including frequent alcohol use (*M* global assessment of functioning [GAF] assessed during the diagnostic clinical interview=74. 5, *SD*=14.3). As part of the inclusion criteria for the larger study, which sought to assess individuals in the peak risk window for psychopathology, participants were required to be between the ages of 18 and 30 and have at least one full biological sibling within the same age range who was eligible to enroll. For the purposes of the larger study, individuals were excluded if they had a lifetime diagnosis of a psychotic or bipolar disorder; were unable to read or write English; had a history of head trauma with loss of consciousness; or were left-handed. The rationale for these criteria included ensuring ability to provide consent and complete all measures and minimizing potential confounds to psychophysiological data. Participant demographics and clinical characteristics are presented in Table 1.

Participants provided written informed consent after review of the protocol and all procedures were in accordance of the Declaration of Helsinki and approved by the University of Illinois at Chicago Institutional Review Board. Following informed consent, participants completed a structured clinical interview, a set of laboratory tasks, and a battery of questionnaires. Laboratory tasks and questionnaires were administered in a counterbalanced order to eliminate potential order effects. Participants received cash as payment for participation.

2.2 Sample 1: Alcohol Use

Current frequency of alcohol use was assessed during a structured clinical interview. Specifically, participants were asked to indicate their average number of standard alcoholic beverages consumed per week (over the past month) and number of binge episodes within the past 30 days. Binge episodes were defined as having ≥5 standard drinks in one sitting for males and ≥4 drinks for females (Wechsler & Nelson, 2001). Questions were probed using a Time-Line Follow-Back technique (Sobell & Sobell, 1992) such that participants were presented with a calendar of the past 30 days and asked to indicate on what days they consumed alcohol and how many standard drinks they had.

Because the current sample was recruited from the community rather than treatment clinics, the continuous alcohol use variables were skewed and kurtotic. To correct for these distribution issues, we chose to re-code the variables. Specifically, number of binges in the past 30 days was re-coded as 0 = no binges and 1 = one or more binges. Number of drinks per week was re-coded into 0 = no drinks per week, 1 = one to five drinks per week, and 2 = five or more drinks per week.

2.3 Risk Taking Propensity

Participants completed the BART-Auto Pump (Pleskac et al., 2008) – a modified version of the original BART (Lejuez et al., 2002). During the task, participants were presented with 30 computerized balloons one at a time. They were instructed to inflate the balloon by typing in the total number of desired "pumps" between 1 and 128. For each pump, they received two cents such that the higher the number of entered pumps, the greater the amount of potential earnings. Participants were also told that the balloons may explode at any given pump though they were unaware of the actual explosion point for each balloon. If the participant typed in a number which exceeded the balloon's explosion point, the balloon on the screen popped and the participant did not receive any money for that balloon. If the number they entered did not exceed the explosion point, the balloon on the screen inflated and the money they earned was deposited into their "bank account." For all trials, the explosion point for the previous balloon was displayed in the left hand corner of the screen. Participants were told that the amount of their prize money at the end of the session was dependent on the amount of money they accumulated throughout the task.

2.4 Sample 1: Data Analysis Plan

Mean number of entered pumps across all 30 balloons on the BART was used as an indicator of RTP. To test the first hypothesis of familial aggregation, we calculated an intraclass correlation (ICC) for proband and sibling RTP. For our second hypothesis, each individual within a sibling pair was designated the 'proband' or the 'sibling.' Specifically, the member of the pair that reported higher frequency of alcohol use within the past month was labeled 'proband' and the member of the pair that reported lower frequency of alcohol use within the past month was labeled 'sibling.' If the two members reported the same frequency of alcohol use, the specification of 'proband' versus 'sibling' was chosen at random. To test whether proband's alcohol use predicted sibling's RTP, we conducted two multilevel mixed models – one for average number of drinks consumed per week and one for having an alcohol binge within the past 30 days. Multilevel mixed modeling is a regression technique that is applied to data that is hierarchically clustered or non-independent, such as siblings clustered within families (Raudenbush & Bryk, 2002). Compared with standard linear regression techniques that assume error terms are independent and have equal variances, multilevel mixed models account for the structure of the data by modeling the interdependence of observations within higher-level units (e.g., families). For both models, sibling's gender, sibling's age, and sibling's current alcohol use were entered as covariates. Probands' binges and drinks per week were the primary independent variables and sibling RTP was the dependent variable.

2.5 Sample 2: Participants and Procedure

Data collection for Sample 2 took place at the University of Maryland, College Park. A total of 161 adolescents and their primary caregiver were recruited from the local community for a larger study on adolescent emotional processes. Participants were only excluded from the larger study if they could not read and write English or the adolescent was not between the ages of 15 and 18 years. A small sample size of adolescent-father (n=14) and adolescent-legal guardian dyads (n=2) were originally recruited but excluded from the current study to

eliminate parental gender effects and to ensure a biological relationship, respectively. An additional 34 dyads were excluded due to technical errors during data collection. The final sample included 111 adolescents and their biological mothers (*N*=222). Detailed demographic information and clinical characteristics of participants is presented in Table 1.

Mothers and adolescents provided written informed consent and assent, respectively. All aspects of the study were in accordance with the Declaration of Helsinki and the consent forms were approved by the University of Maryland Institutional Review Board. All participants were administered the BART-Auto Pump to assess RTP. Notably, the version of the BART used in Sample 2 was identical to the version used in Sample 1. Afterwards, all participants completed additional behavioral tasks and a battery of self-report questionnaires (order counterbalanced). Mothers were provided cash and adolescents were given gift cards as payment for participation.

2.6 Sample 2: Alcohol and Substance Use

Adolescents completed the 16-item Substance Problem Scale (SPS) from the Global Appraisal of Individual Needs (GAIN; Dennis et al., 2003). The GAIN is a standardized measure designed to assess *DSM-IV* substance abuse and dependence symptoms and substance-related problems within the past month. It has been normed in adolescent populations and has demonstrated good psychometric properties (Dennis et al., 2003). Reliability within the current study was good (α=.76).

Mothers completed the widely-used Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 1989), which was developed by the World Health Organization (WHO) to assess hazardous and harmful alcohol use. The AUDIT total score is a combined measure of alcohol consumption frequency (including binges), alcohol use problems, and dependence symptoms. It has been shown to be a sensitive measure in diverse populations and has demonstrated good internal consistency (Saunders et al., 1993a,b). Reliability within the current study was good (α=.75).

Like Sample 1, Sample 2 was a non-clinical sample and thus the distribution of AUDIT total scores was skewed and kurtotic. We therefore re-coded AUDIT total scores into 0 = total score of zero, 1 = total score of one, and 2 = total score of two or more. Recoding the variable this way fit our data best and created a 3-level variable reflecting no alcohol use problems, minimal alcohol use problems, and low to high levels of alcohol use problems.

2.7 Sample 2: Data Analysis Plan

Identical to our analyses for Sample 1, BART mean pumps was used as the indicator of RTP. We first calculated the ICC for mother and adolescent RTP to examine familial aggregation. To test our hypothesis that mother alcohol use predicted adolescent RTP, we conducted a multilevel mixed model analysis. Adolescent gender, adolescent age, and adolescent SPS total scores (i.e., current level of substance use) were entered as covariates. Mother AUDIT scores were the primary independent variable whereas adolescent RTP was the dependent variable.

3. Results

3.1 Descriptives of both samples

In Sample 1, 49% of probands reported having at least one alcohol binge in the past 30 days. For average number of drinks per week, 28% reported no drinks, 37% reported 1–5 drinks per week, and 35% reported more than 5 drinks per week. In Sample 2, 29% of mothers reported no alcohol use problems (AUDIT total score = 0), 34% reported low levels of alcohol use problems (AUDIT total score = 1), and 37% reported low to high levels of alcohol use problems (AUDIT total score > 2).

For descriptive purposes, we ran a series of one-way analyses of variance (ANOVA) testing associations between proband alcohol use and proband RTP and similarly, mother alcohol use and mother RTP. Results indicated that among probands in Sample 1, binge drinking within the past 30 days was positively associated with RTP ($F(1, 86) = 3,79$, $p < 0.05$); however, average number of drinks within the past 30 days was not ($F(2, 85) = 1.87$, *ns*). Among mothers in Sample 2, AUDIT total scores were not associated with RPT ($F(2, 109) = 0.31$, *ns*).

3.2 Sample 1

Analyses indicated that proband and sibling RPT was positively related (ICC = 0.42, 95% CI: 0.11–0.62, $p < 0.05$). The results of the model for average number of drinks consumed per week indicated that proband alcohol use was positively associated with sibling BART performance, adjusted for number of drinks consumed by the siblings (see Table 2). Sibling gender (i.e., being male) was also positively related to sibling BART performance.

The results for the binges model indicated that for probands, binge drinking within the past 30 days was positively associated with sibling BART performance, adjusted for whether the sibling had a binge within the past 30 days. Sibling gender (male) was again positively related to sibling BART performance.

3.3 Sample 2

Consistent with Sample 1, RTP was significantly associated among mothers and adolescents (ICC = 0.37, 95% CI: 0.09–0.56, $p < 0.05$). Results also indicated that mother AUDIT scores were positively associated with adolescent BART performance, adjusted for adolescent SPS scores (see Table 2). There was no significant effect of adolescent gender, age, or adolescent substance use.

4. Discussion

There is a small literature suggesting that RTP may be a familial vulnerability factor for alcohol use problems; however, very few studies have directly addressed this question. Therefore, the aim of the current study was to extend this literature by examining whether RTP aggregates within families and whether increased RTP is evident in ‘healthy’ individuals at risk for future alcohol use. Family history of alcohol use is a robust risk factor for personal alcohol use (Chassin et al., 2004). At-risk individuals were therefore conceptualized as those with a biological family member with greater levels of alcohol use.

We used data from two separate family studies using different age groups and familial relationships and collected in different geographic locations and found that our hypotheses across both samples were supported. We found that RTP was correlated among biological young-adult, sibling pairs and mother-adolescent dyads. Moreover, individuals' RTP was predicted from their first-degree relatives' alcohol use, independent of their own use. This was demonstrated in several ways. In Sample 1, frequency of proband alcohol use (i.e., drinks consumed per week and binge drinking within the past 30 days) was positively associated with sibling RTP after controlling for frequency of sibling alcohol use. In Sample 2, maternal alcohol use was positively associated with adolescent RTP, after controlling for adolescent substance use problems. Together, these findings provide strikingly consistent, albeit still preliminary, evidence suggesting that RTP is a familial construct that may be a vulnerability factor for alcohol use.

Given that individual differences in RTP were correlated among both sets of relatives, the current findings imply that RTP aggregates within families to some extent. This is consistent with a few studies demonstrating heritability of risk-taking behaviors and related constructs (Anokhin et al., 2009, Cesarini et al., 2008; Miles et al., 2001; Zhong et al., 2009). It is important to highlight, however, that there have been mixed findings in this small literature and several studies have found moderators (e.g., age, gender) of the genetic influence on risk-taking (Anokhin et al., 2009; Amstadter et al., 2012). In the current study, we found no evidence that age moderated familial aggregation of RTP as the within-family correlations were similar in both samples despite their different age ranges. Although our findings are consistent with a view that RTP is genetically mediated, it is essential to highlight that the aggregation of RTP within family members could also be due to a variety of environmental factors. Nevertheless, the current findings are a critical step in this line of work and are meant to stimulate future research into the etiology of RTP given its potential clinical relevance.

Beyond demonstrating that RTP is correlated amongst family members, results from the current study indicate that an individual's alcohol use predicts their first-degree relative's RTP, over and above that relative's own alcohol use. Given that siblings (Sample 1) and adolescents (Sample 2) had very low levels of current use, those with elevated RTP may indeed be at risk for future escalation in their drinking behaviors (especially given their young age). This conclusion is also supported by the findings from MacPherson et al. (2010) in which individual differences in RTP were positively associated with future alcohol use behaviors. It is necessary to note that both the present study and MacPherson et al. (2010) included community samples and the current findings need to be replicated in clinical populations that contain higher levels of problematic drinking. We would suspect that RTP is a vulnerability factor for both alcohol use behaviors and subsequent problems but this should be directly tested. Nevertheless, based on the current data, it can be concluded that RTP is not entirely state-dependent and other factors also account for individual differences in risk taking propensity.

Although the ICCs for the aggregation of RTP within families and the current effect sizes may be considered modest, it is important to highlight several points. First, alcohol use and abuse is a heterogeneous construct and there are likely multiple pathways (and thus,

vulnerability factors) to problematic alcohol use (Zucker, 2008). Second, only a minority of first-degree relatives of individuals who misuse substances will develop substance use problems themselves. Third, in the current study, alcohol use behaviors were assessed via self-report whereas RTP was assessed via a lab-based measure. Though this third point has the virtue of minimizing method variance, it also limits the magnitude of the associations (Patrick et al., 2013). For these reasons, we would not expect large effect sizes and the observed findings are noteworthy.

Another important point to consider about the current study is that although binge drinking was positively associated with RTP among probands in Sample 1, for many of the analyses, an individuals' own drinking behavior did not predict their own RTP. Although contradictory to prior findings (Fernie et al., 2010; Weafer et al., 2011), it is important to note that the restricted range of drinking in the current sample may have limited the ability to detect individual differences resulting in some, but not all, of our predicted associations being observed. This highlights the need for future studies utilizing a clinical population to corroborate the present findings.

The current study has numerous strengths, including replication in two independent samples that differed on age, biological relationships, geographic region, and measures of alcohol use. The use of a behavioral assessment of RTP is also considered a strength. However, there are also several limitations. First, as was noted above, individuals in both samples were recruited from the community and reported lower levels of current alcohol use problems than what would be reported from treatment-seeking samples. It is therefore unclear whether the results would generalize to more clinical populations. Second, both studies were cross-sectional and we are unable to make inferences about the directionality of the present findings. This is a noteworthy limitation as we could not test whether elevated RTP preceded alcohol use in our samples. Third, it is possible that cultural differences in the use of alcohol may limit the generalizability of the findings. However, the use of two samples with different ethnic and racial compositions partially mitigates this concern. Fourth, in Sample 2, we did not have a specific measure of adolescent alcohol use analogous to the AUDIT. It is possible that our measure of broad substance use problems (i.e., the SPS scale) captured different variance than a specific measure of alcohol use, which may have impacted the results. Fifth, we did not have a large enough sample of father-adolescent dyads in Sample 2 to test the test the influence of paternal alcohol use on adolescent RTP. Additional studies are needed to examine whether fathers' alcohol use behaviors have a similar, or possibly stronger, impact on offspring RTP. Lastly, although the current findings shed light onto the etiology of RTP, the mechanisms underlying these effects are still unclear. Future research is needed to elucidate if there are potential components of RTP (e.g., decision-making, salience of rewards) that specifically connote risk for alcohol use problems.

In sum, the current study suggests that RTP is a familially transmitted trait and individuals' RTP is associated with their first-degree relatives' alcohol use, independent of their own use. These features suggest that RTP (like impulsivity and behavioral undercontrol) may be a vulnerability factor (Ingram et al., 2005). Because of the clear clinical implications of

understanding risk for alcohol use, future studies should continue to explore the mechanisms underlying the associations between RTP and future drinking behaviors.

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Highlights

- In two studies, tested if risk-taking is a vulnerability factor for alcohol use
- In both samples, risk-taking propensity was correlated amongst family members
- Probands' alcohol use predicted siblings' risk-taking propensity
- Mothers' alcohol use predicted adolescents' risk-taking propensity
- Findings support notion that risk-taking propensity is a vulnerability factor

Table 1

Demographics and Characteristics of Sample 1 and Sample 2

	Sample 1		Sample 2	
	Proband (*n*=87)	**Sibling (*n*=87)**	**Adolescent (*n*=111)**	**Mother (*n*=111)**
Demographic variables				
Age (*M* years; *SD*)	22.4 (3.1)$_a$	22.8 (3.4)$_a$	16.0 (1.2)$_a$	45.7 (6.1)$_b$
Sex (% female)	54.5$_a$	60.2$_a$	56.1$_a$	100$_b$
Ethnicity (%)				
Caucasian	40.9$_a$	40.9$_a$	31.8$_a$	31.8$_a$
African American	13.6$_a$	13.6$_a$	57.3$_a$	57.3$_a$
Hispanic	27.3$_a$	27.3$_a$	6.4$_a$	6.4$_a$
Asian	12.5$_a$	12.5$_a$	5.5$_a$	5.5$_a$
Other	5.7$_a$	5.7$_a$	6.4$_a$	6.4$_a$
Study Variables				
BART Mean Pumps (*M; SD*)	56.7 (14.4)$_a$	58.5 (14.7)$_a$	47.8 (18.7)$_a$	48.3 (17.5)$_a$
Drinks per Week (*M; SD*; range)	5.2 (7.8; 0–40)$_a$	2.3 (3.0; 0–12)$_b$	-	-
Binge Episodes in Past Month (*M; SD*; range)	2.0 (2.6; 0–14)$_a$	0.4 (0.8; 0–3)$_b$	-	-
AUDIT Total Score	-	-	-	1.5(1.7)
GAIN SPS Total Score	-	-	2.5 (2.6)	-

Note. Means or percentages with different subscripts across rows, within Samples, were significantly different in pairwise comparisons ($p < .05$, chi-square test for categorical variables and Tukey's honestly significant difference test for continuous variables). BART = Balloon Analog Risk Task; AUDIT = Alcohol Use Disorders Identification Test; SPS = Substance Problem Scale. The sum of ethnicity percentages for Sample 2 exceeds 100% because participants had the option of choosing more than one ethnicity.

Table 2

Multilevel Mixed Model Analyses from Sample 1 and Sample 2

	df	*F*	*p*
Sample 1 – Number of Drinks Predicting BART			
Intercept	1, 82	30.69	<0.00
Sibling Gender	1, 82	12.51	<0.00
Sibling Age	1, 82	2.61	0.11
Sibling Number of Drinks	1, 82	0.60	0.44
Proband Number of Drinks	1, 82	6.49	<0.00
Sample 1 – Alcohol Binge Predicting BART			
Intercept	1, 82	33.26	<0.00
Sibling Gender	1, 82	13.17	<0.00
Sibling Age	1, 82	2.52	0.12
Sibling Binge	1, 82	1.70	0.20
Proband Binge	1, 82	4.84	0.03
Sample 2 – Alcohol Use Problems Predicting BART			
Intercept	1, 106	5.76	0.02
Adolescent Gender	1, 106	1.36	0.25
Adolescent Age	1, 106	0.31	0.58
Adolescent SPS Total Scores	1, 106	0.24	0.62
Mother AUDIT	1, 106	3.96	0.04

Note. BART = Balloon Analog Risk Task; AUDIT = Alcohol Use Disorders Identification Test; SPS = Substance Problem Scale.