Published in final edited form as:
Addict Behav. 2008 February ; 33(2): 252–265.

Does Gender Moderate Associations Among Impulsivity and Health-Risk Behaviors?

Scott F. Stoltenberg[a], **Bryan D. Batien**[a], and **Denis G. Birgenheir**[a,b]

[a]*Black Hills State University, Department of Psychology, 1200 University Street, Spearfish, SD 57799*

[b]*University of Wyoming, Department of Psychology, 1000 E. University Ave., Laramie, WY 82071*

Abstract

The present study explores the relations among gender, impulsivity and three health-risk behaviors relevant to young adults (tobacco use, alcohol problems and gambling problems) in a sample of 197 college-age individuals. We sought to determine whether impulsivity is associated with health-risk behaviors in the same ways for men and women. For tobacco use and gambling problems, men were at higher risk than women, and impulsivity was not significantly associated with higher risk. Higher levels of motor impulsivity in men accounted for a significant amount of the gender difference in risk for alcohol problems. That is, impulsivity as measured by the Barratt Impulsiveness Scale (version 11), mediated the association between gender and risk for alcohol problems. For impulsivity as measured by Stop Signal Reaction Time (i.e. response inhibition), gender moderated the association between impulsivity and alcohol problems. Specifically, lower levels of impulsivity were associated with greater risk for alcohol problems in both men and women, but the effect was stronger in men. We speculate that this seemingly paradoxical result might be the result of coping drinking to deal with negative affect associated with behavioral overcontrol. These findings suggest that prevention efforts might well focus on identifying individuals at high risk for alcohol problems, especially males, by assessing response inhibition.

Keywords

Impulsivity; alcohol use disorder; tobacco use; gambling; gender

1. Introduction

Young adults are at high risk for addiction to nicotine, alcohol and gambling. Although most can be exposed to tobacco, alcohol and gambling without incurring significant problems, some individuals develop addictions.

Male gender is another risk factor for engaging in and developing problems from health-risk behaviors. This is especially true for alcohol use and for gambling, but not for tobacco use. Men tend to have more risk factors and fewer protective factors than women for alcohol use and problems (Nolen-Hoeksema & Hilt, 2006). Male college students are relatively more likely than are female college students to have drunk in the last month, and they are much more likely

Corresponding Author: Scott F. Stoltenberg, email: scottstoltenberg@bhsu.edu, Phone: 605.642.6437, FAX: 605.642.6762, Black Hills State University, Department of Psychology, 1200 University Street, Unit 9129, Spearfish, SD 57799-9129.

to drink heavily (O'Malley & Johnston, 2002). Consistent with that trend, men are more likely than women to have drinking problems (Wilsnack *et al.*, 2000). Rates of lifetime gambling are comparable in for men and women, but rates of problem and pathological gambling are higher for men than for women (Engwall *et al.*, 2004; Slutske *et al.*, 2003). Men and women pathological gamblers report different motivations for gambling (Ledgerwood & Petry, 2006). Men and women have comparable rates of tobacco use for college students (Patterson *et al.*, 2004) and adults in general (Control, 2006). However, men are more likely than women to transition from occasional smokers to regulars smokers over time (Wetter *et al.*, 2004). It seems then that there are gender differences in the motivations for, the rates of and the consequences of health-risk behaviors such as drinking, gambling and tobacco use.

Impulsivity, variously expressed as a lack of planning, too quick responding, inability to delay gratification and poor inhibitory control, is also risk factor for engaging in health-risk behaviors and for developing problems as a result. Impulsivity has been associated with increased risk for engaging in health-risk behaviors, including tobacco use (Baker *et al.*, 2004; Billieux *et al.*, 2007), alcohol abuse (Gerald & Higley, 2002), and gambling (Slutske *et al.*, 2005). It appears that impulsivity is a general factor that increases risks for engaging in health-risk behaviors, without specifically predisposing an individual toward any particular health-risk behavior. There is strong evidence that impulsivity is be an important trait-marker for a common pathway to addictive behaviors (Chambers & Potenza, 2003). It is likely that individual differences in the predisposition to engage in specific health-risk behaviors are the product of an individual's unique genes and environmental exposure (Caspi & Moffitt, 2006). Furthermore, young adults are at relatively high risk for gambling problems and other health-risk behaviors because of brain maturation events relevant to behavioral control (Chambers & Potenza, 2003). So, individual level traits, such as impulsivity and gender, are important risk factors for engaging in health-risk behaviors for young adults although the nature of these relations is not fully understood.

While there is much agreement that deficient self-control is a risk factor for behavioral problems, there is less agreement on the underlying nature of impulsivity. It is generally understood that impulsivity is not a unitary construct; rather it is likely composed of multiple varieties that may be independent. Researchers from different areas such as personality (Carver, 2005), developmental psychopathology (Nigg, 2000) and behavioral pharmacology (Evenden, 1999) have described theories of impulsivity that include two, eight and ten varieties of impulsivity, respectively. There is substantial overlap in these taxonomies and the distinction between automatic versus effortful processes appears to be especially relevant in all.

There do not appear to be consistent differences between men and women on impulsivity (Feingold, 1994; Patton et al., 1995; Reynolds et al., 2006). Gender may moderate the associations between impulsivity and some health risk behaviors but not others. For example, one study found that high impulsivity was associated with increased alcohol use in both men and women, but only in women was high impulsivity associated with increased nicotine use (Waldeck & Miller, 1997). A more recent study also found impulsivity to be associated with smoking in women, but not in men (Grano *et al.*, 2007). Therefore, while gender is an important factor for understanding the propensity to engage in health-risk behavior, the relationship does not appear to be simple.

To better understand the relations among gender, impulsivity and health-risk behaviors we sought to characterize a college-age population on these constructs in a cross-sectional study. In recognition that impulsivity is not unidimensional (Reynolds et al., 2006), we assessed it using two well-validated measures of impulsivity: the Barratt Impulsiveness Scale (BIS-11; self-report) and the Stop Task (behavioral). We hypothesized that higher levels of impulsivity would be associated with increased levels of health-risk behaviors (i.e. tobacco use, drinking problems, and gambling problems) but that the expression of these relations would be different for men and women.

2. Methods

2.1. Participants

For the present study, participants were college-age individuals (*N* = 200; 73 men/124 women; three did not report gender and were not included in the study sample) attending a small midwestern university. Based on self-reports, the sample was composed of the following distribution of ethnicities: 95.9% (*n* = 189) Caucasian/White; 2.5% (*n* = 5) American Indian/Alaska Native; 0.5% (*n* = 1) Hispanic/Latino; and 1.0% (*n* = 2) Multiracial. This distribution of ethnicities is consistent with the local demographics. The mean age of participants was 22.67 years of age (SD = 5.69, range = 18-47). Participants were recruited using flyers and in-class presentations. Participants received $5 for approximately one hour of their time. The study protocol was approved by the Institutional Review Board and all participants provided informed consent.

2.2. Procedure

Each participant completed a self-report questionnaire (that included the instruments listed below), two computerized tasks (only Stop Task results will be reported here), and donated a cheek cell sample for later genetic analysis. Results of the genetic analyses and of the other assessments will be reported elsewhere.

2.3. Measures

2.3.1. South Oaks Gambling Screen (Lesieur & Blume, 1987)—The South Oaks Gambling Screen (SOGS) assess possible pathological gambling problems. While the SOGS cannot be used to diagnose Pathological Gambling, items on the SOGS are correlated with DSM-IV symptoms for Pathological Gambling (*r* = .80). The usual DSM-IV cutoff of five symptoms identifies fewer pathological gamblers than does the cutoff SOGS score of 5 (Cox *et al.*, 2004; Stinchfield, 2002). Higher scores on the SOGS denote more gambling problems. Internal consistency of the SOGS is high (Cronbach's α = .97) and the test-retest reliability is acceptable r = .71) for classifying pathological gamblers (Lesieur & Blume, 1987).

2.3.2. Barratt Impulsiveness Scale, Version 11 (Patton et al., 1995)—The Barratt Impulsiveness Scale, Version 11 (BIS-11) is a widely used 30-item questionnaire that assesses levels of impulsivity. Scores on the BIS-11 can be broken down into three subscales: Motor impulsiveness (e.g. “I do things without thinking”), Nonplanning impulsiveness (e.g. “I plan for the future”—reversed scored), and Attentional impulsiveness (e.g. “I am a careful thinker”—reversed scored). Higher scores on the BIS-11 denote higher levels of impulsivity. Internal consistency of BIS-11 Total score for college students is acceptable (Cronbach's α = .82) (Patton et al., 1995).

2.3.3. Michigan Alcoholism Screening Test (Selzer, 1971)—The Michigan Alcoholism Screening Test (MAST) is a 23-item questionnaire used to assess alcohol-related problems such as negative social consequences (e.g. “Have you ever lost friends because of your drinking?”), alcohol dependence (e.g. “Do you drink before noon fairly often?”), and general loss of control over drinking (e.g. “Can you stop drinking without difficulty after one or two drinks?”). Each item is scored either 0 or 1 and summed for the total score. Total MAST scores are interpreted as: 0-2 “no apparent problem”, 3-5 “early middle or problem drinker”, 6 or more “problem drinker”. Internal consistency of the MAST is acceptable (Cronbach's α > .80) as is test-retest reliability (r >.80) (Selzer, 2000).

2.3.4. Tobacco Use—Two items were used to determine tobacco use status. Participants providing an affirmative response to either "Do you regularly smoke cigarettes?" or "Do you regularly chew tobacco?" were coded as "Tobacco Users".

2.3.5. Stop Task (Logan et al., 1997)—The Stop Task is a computerized task used to assess levels of impulsivity (i.e. response inhibition). This task consists of pressing the "M" key on the keyboard when an "X" appears on the screen or pressing the "Enter" key when an "O" appears. Go Reaction time (GoRT) is an index of speed of responding to these "Go" Trials. During this task, a tone (the stop signal) occurs on 25% of the trials and signals to the participant that they should not press a key on that trial. The tone initially occurs 250 ms (the stop delay) after the presentation of the visual stimulus, and is dynamically adjusted based on the response by the participant to either make it harder or easier to withhold responding. Specifically, the stop delay was increased by 50 ms following trials in which the participant inhibited responding. The stop delay was decreased by 50 ms following trials in which the participant was unable to inhibit responding. These dynamic stop delay adjustments result in response inhibition on approximately 50% of stop trials. The stop signal reaction time (SSRT) is an index of response inhibition calculated by subtracting the mean stop delay from the mean GoRT. Higher SSRTs are interpreted as indicating higher levels of impulsivity. That is, higher levels of SSRT indicate a slower "stopping system" (i.e. less response inhibition), which is interpreted as higher levels of impulsivity. Split-half reliabilities for individuals between ages 18-59 is good ($r \geq .90$) (Williams *et al.*, 1999). Children with Attention-deficit/Hyperactivity Disorder have significantly longer SSRTs than children without the disorder, suggesting that those with ADHD have deficient inhibitory control (Schachar *et al.*, 2000). Individuals with higher impulsivity according to self-reports have longer SSRTs (Logan et al., 1997).

2.4. Analysis

Because tobacco use, number of drinking problems and number of gambling problems were not normally distributed we used non-parametric tests (i.e. chi-square and Mann-Whitney U test) to examine gender differences. We used independent sample t tests to compare mean performance on Stop Task and on mean BIS-11 scores for groups defined by gender and problem behavior (i.e. tobacco use, drinking problems and gambling problems). Individuals were assigned scores (1 = yes, 0 = no) for three variables to represent whether (1) they indicated using tobacco, (2) they indicated having more than two alcohol problems on the MAST, and (3) they indicated having any gambling problems. These scores were used as the dichotomous outcome variables in separate logistic regressions to test whether gender moderated the influence of impulsivity on reported tobacco use, alcohol and gambling problems. Significance of the "gender x impulsivity" interaction term would be evidence for a moderation effect (Frazier *et al.*, 2004). To avoid interpretation difficulties that could be due to multicolinearity among variables, we decided to test only the Total score of the BIS-11 and Stop Signal Reaction time (Cohen *et al.*, 2003). To prepare the impulsivity measures for the logistic regressions we removed outliers and transformed scores into z-scores. Gender was dummy coded, men = 0 and women = 1 and interaction terms were created as the product between gender and the z-score of the impulsivity measure (Cohen *et al.*, 2003). For each of the logistic regressions gender and impulsivity (either BIS-11 Total or Stop Signal Reaction Time) were entered at Step 1. At Step 2, gender, impulsivity and the gender x impulsivity interaction term were entered. To assess the effect of including the interaction term in the model, we performed a likelihood ratio test (G = 2*(log-likelihood model 1 – log-likelihood model 2) with one degree of freedom).

3. Results

3.1. Overall Descriptive Statistics

Of the 124 women participants responding to both tobacco questions, 11.3 % (14/124) reported using tobacco. Of the 73 men participants responding to both items, 21.9% (16/73) reported using tobacco. A higher proportion of men than of women reported using tobacco ($\chi^2 = 4.02$, *df* = 1, *p* = .045).

Score distributions for men and women on the MAST were statistically different (Mann-Whitney U = 3327.5, *p* = .002). Table 1 presents the percentages of men and women in three MAST scoring categories that represent levels of drinking problems. Men were 1.5 times more likely than were women to be classified as having some drinking problems (i.e. MAST scores > 2). Nearly 55% of men and nearly 38% of women were classified as having some drinking problems.

Score distributions for men and women on the SOGS were statistically different (Mann-Whitney U = 2291.0, *p* = .000). Table 1 presents the percentages of men and women in three SOGS scoring categories that represent levels of gambling problems. Men were 3.1 times more likely than were women to be classified as having any gambling problem (i.e. SOGS score > 0).

Table 1 presents the means and standard deviations for measures of impulsivity (BIS-11, Stop Task). The mean score for the total BIS-11 and for each of the three subscales (attentional, nonplanning, motor) was significantly higher for men than for women (*p* < .003). There was no difference between men and women on mean Go Trial Accuracy, speed of responding for Go Trials (GoRT), or mean Stop Signal Reaction Time (SSRT).

3.2. Tobacco Use, Gender & Impulsivity

The results of the regression analyses on tobacco use are summarized in Table 2. For impulsivity as measured by the BIS-11 Total score, at Step 1, gender and BIS-11 Total score were entered. This model accounted for 4.2% of the variance (Naglekerke's R^2) in tobacco use. In Step 2, the gender x impulsivity interaction was added. This model accounted for a 0.2% increment in variance explained ($R^2 = 4.4\%$). The likelihood ratio statistic indicated that the addition of the interaction term did not account for more variance in tobacco use than the model in Step 1; G (1) = 0.22, *p* = .64. The effect of gender was significant in the initial model (*p* = .05) with females being less likely to use tobacco (odds ratio = 0.43). For impulsivity as measured by Stop Signal Reaction time, at Step 1, gender and SSRT were entered. This model accounted for 5.9% of the variance in tobacco use. In Step 2, the gender x impulsivity interaction was added. This model accounted for no change in variance explained ($R^2 = 5.9\%$). The likelihood ratio statistic indicated that the addition of the interaction term did not account for more variance in tobacco use than the model in Step 1; G (1) = 0.03, *p* = .87. The effect of gender was significant in the initial model (*p* = .02) with females being less likely to use tobacco (odds ratio = 0.36).

3.3. Alcohol Problems, Gender & Impulsivity

The results of the regression analyses on alcohol problems are summarized in Table 3. For impulsivity as measured by the BIS-11 Total score, at Step 1, gender and BIS-11 Total score were entered. This model accounted for 8.8% of the variance (Naglekerke's R^2) in tobacco use. In Step 2, the gender x impulsivity interaction was added. This model accounted for a 0.9% increment in variance explained ($R^2 = 9.7\%$). The likelihood ratio statistic indicated that the addition of the interaction term did not account for more variance in alcohol problems than the model in Step 1; G (1) = 1.33, *p* = .25. The effect of impulsivity was significant in the initial model (p = .005) with an odds ratio of 1.57 (higher levels of impulsivity increase odds of having some alcohol problems). However, adding the gender x impulsivity interaction term in Step 2 eliminated the impulsivity effect.

Given that we did observe a significant difference in the MAST score distribution for men and women, we found the results of the moderation test curious. We decided therefore to test whether impulsivity mediated the association between gender and MAST score that we report above in section 3.1. Table 4 summarizes the results of our mediation tests. In Step 1 we tested whether gender was a significant predictor of alcohol problems using logistic regression. The effect of gender was significant (p = .02) and explained 3.6% of the variance in alcohol problems. In Step 2 we tested whether gender was a significant predictor of impulsivity using an ordinary least squares regression. The effect of gender was significant (p = .000) and explained 7.9% of the variance in BIS-11 Total scores. The first two mediation tests showed that gender was a predictor of both alcohol problems and BIS-11 Total scores. In the final mediation test (Step 3), we conducted a logistic regression on Alcohol problem status, first entering impulsivity, then gender. The effect of impulsivity was statistically significant (p = .005) and the effect of gender was not (p = .17), which is evidence that the effect of gender observed in Step 1 on alcohol problems can be explained by gender differences in impulsivity. An estimate of the proportion of the total gender effect on alcohol problems that is mediated by impulsivity is 38%, so the mediation is significant, but does not appear to be complete (Frazier et al., 2004).

For impulsivity as measured by Stop Signal Reaction time, at Step 1, gender and SSRT were entered (see Table 3). This model accounted for 4.0% of the variance in alcohol problems. In Step 2, the gender x impulsivity interaction was added. This model accounted for an increment of 5.1% in variance explained (R^2 = 9.1%). The likelihood ratio statistic indicated that the addition of the interaction term accounted for more variance in alcohol problems than the model in Step 1; G (1) = 6.88, p = .01. The effect of gender was significant in the initial model (p = .02) and in Step 2 (p = .04) with females being less likely to have alcohol problems (odds ratios = 0.52 and 0.50, respectively). In Step 2, both the main effect for Stop Signal Reaction Time (p =.03) and the gender x SSRT interaction (p = .01) were statistically significant, evidence of a gender moderation. The predicted probabilities of having alcohol problems for mean, low (-1 SD) and high (+1 SD) levels of impulsivity as measured by SSRT for men and women are shown in Figure 1. Predicted logit scores for each group were obtained by multiplying the unstandardized regression coefficients with appropriate values in the regression equations for Step 2 (Frazier et al., 2004). Logit scores were then converted to probability values, which were then plotted. At mean levels of SSRT, men have a higher probability of being assigned to the alcohol problem group than women (.53 versus .37), but at the high impulsivity level, there is no apparent difference between men and women (.23 versus .27). It is at the low impulsivity level where the gender difference is the greatest with the men having a predicted probability of alcohol problems of .81 and women .47.

3.4. Gambling Problems, Gender & Impulsivity

The results of the regression analyses on gambling problems are summarized in Table 5. For impulsivity as measured by the BIS-11 Total score, at Step 1, gender and BIS-11 Total score were entered. This model accounted for 25.2% of the variance (Naglekerke's R^2) in gambling problems. In Step 2, the gender x impulsivity interaction was added. This model accounted for no change in variance explained (R^2 = 25.2%). The likelihood ratio statistic indicated that the addition of the interaction term did not account for more variance in tobacco use than the model in Step 1; G (1) = 0.01, p = .93. The effect of gender was significant in the initial model (p = .000) with females being less likely to have gambling problems (odds ratio = 0.16). For impulsivity as measured by Stop Signal Reaction time, at Step 1, gender and SSRT were entered. This model accounted for 27.1% of the variance in gambling problems. In Step 2, the gender x impulsivity interaction was added. This model accounted for a 0.6% increment in variance explained (R^2 = 27.7%). The likelihood ratio statistic indicated that the addition of the interaction term did not account for more variance in gambling problems than the model in Step 1; G (1) = 0.89, p = .35. The effect of gender was significant in the initial model (p = .000) with females being less likely to have gambling problems (odds ratio = 0.13).

4. Discussion

The most important result of this study is that gender moderates the association between impulsivity (response inhibition) and alcohol problems. Specifically, at high levels of impulsivity there was no difference between men and women on probability of having alcohol problems. However, as levels of impulsivity decreased, the risk for alcohol problems increased for both men and women, but more dramatically in men. In addition, we found evidence that impulsivity (BIS-11 total scores) mediates the association between gender and alcohol problems. We did not find impulsivity to be associated with tobacco use or with gambling problems. Although these findings do not fully support out initial hypothesis, they are in line with our thinking that the relations among impulsivity, gender and health-risk behaviors are not straightforward.

Our finding that higher levels of impulsivity, as measured by scores on the Barratt Impulsiveness Scale (version 11), partially accounted for the increased risk for alcohol problems experienced by males, is consistent with our initial hypothesis, but is more nuanced. Our results with the BIS-11, therefore, are largely consistent with the literature on impulsivity and alcohol use/problems such that higher impulsivity is associated with more use and/or problems (Caspi *et al.*, 1997; Gerald & Higley, 2002; Simons *et al.*, 2005). On further inspection of the BIS-11 results, we found that the neither the Non Planning nor the Attention subscales were associated with alcohol problem status, but the Motor impulsivity subscale was (data not shown). The items on the Motor subscale assess the extent to which people report that they "act without thinking". So, the analyses with BIS-11 Total scores were essentially displaying the effects of the Motor subscale.

This appears to be the first report of a gender moderation of the effect of response inhibition on alcohol problems. Much of the research literature has focused on behavioral inhibition following alcohol consumption (Fillmore & Weafer, 2004), but we were unable to find studies that specifically examined response inhibition and alcohol problems. At first, the results reported in Figure 1 seem paradoxical and they do not support our initial hypothesis that higher levels of impulsivity would be associated with greater risk for health-risk behaviors. It may be that young men who are behaviorally overcontrolled have higher levels of negative affect and may drink to cope. There is evidence that low impulsivity in males is related to coping drinking motives (Kuntsche *et al.*, 2006) and that coping motives in males are more related to alcoholism diagnosis than are enhancement motives (Carpenter & Hasin, 1998). In our study, we did not assess drinking motives or affect, so we are unable to test this hypothesis. However, the connection between impulsivity and motives appears to be a logical interpretation of the pattern of results we observed in Figure 1.

Our results are consistent with the view that impulsivity is not a single construct, but is composed of multiple traits and predispositions that may be independent (Evenden, 1999; Reynolds et al., 2006). Further, we provide evidence that the automatic (i.e. Motor impulsivity) and controlled (i.e. response inhibition) types of impulsivity have different relations to risk for alcohol problems (i.e. mediation versus moderation) for men and women. These data seem to fit with a recent theoretical model on adolescent drinking that details an imbalance between appetitive motivation and self-control (Wiers *et al.*, 2007). Considering gender and using both questionnaires and behavioral tasks may be necessary to assess aspects of impulsivity relevant for understanding propensity to engage in health-risk behaviors.

In order to fully understand the etiologic mechanisms for behavioral disorders such as substance abuse, and gambling, a detailed view of impulsivity's role must be achieved. Substantial empirical evidence indicates that varieties of impulsivity exist and should be considered. The present study provides additional evidence that gender should be considered when examining the influence of impulsivity on behavioral outcomes. A great deal of work remains before a complete understanding of the pathways from genes to the propensity for engaging in health-risk behaviors via impulsivity is achieved, but it is clear that gender must be considered.

In our sample, we observed gender differences in impulsivity as assessed by the BIS-11 questionnaire (mean scores for males were higher than mean scores for women), which contrasts with other studies (Feingold, 1994; Patton et al., 1995; Reynolds et al., 2006). Mean BIS-11 total scores for women in the present study were significantly lower than reported norms ($t = 2.478$; $df = 242$, $p = .01$), whereas mean scores for males in the present study were not different ($t = -0.986$; $df = 160$, n.s.) from reported norms (Patton et al., 1995). Reported rates of tobacco use in this study (11.3% of women and 21.9% of men) were substantially lower than those reported in other college-age samples in which 29% identify themselves as current smokers with no substantial gender difference (Patterson *et al.*, 2004). The relatively high percentage of men endorsing more than two items on the MAST (54.8%) is likely a reflection of the high levels of alcohol use in South Dakota. In a recent survey, 72.4% of South Dakotans aged 18-25 reported drinking in the past month compared to the national average of 60.7% (Wright & Sathe, 2006). In the same age group, 52.2% of South Dakotans reported binge drinking (five or more drinks in a drinking occasion) compared to the national average of 41.5% (Wright & Sathe, 2006). The impulsivity and tobacco use differences observed in our sample could represent under-reporting in our study or a recruitment bias, especially for women. We are unable to determine the source of this discrepancy, but interpretations of our results, especially with respect to tobacco use, should consider this potential bias. In addition, the study sample is not ethnically diverse, which might affect the generalizability of the results to non-Caucasian groups. There is no obvious reason that these results would not generalize to other similar populations (young, primarily Caucasian adults). There remains much to learn regarding the relations among impulsivity, gender and health-risk behaviors, because although we studied important health-risk behaviors in a population at high risk, there are other relevant health-risk behaviors (e.g. risky sex, risky driving) and other aspects of impulsivity (e.g. boredom susceptibility) that we did not assess.

Theoretical models of the etiology of nicotine dependence, alcohol use disorders and pathological gambling should consider the gender moderation of the influence of impulsivity on these behaviors. And efforts should be undertaken to better characterize these relations and to better understand the role of impulsivity in the propensity to engage in health-risk behaviors. Efforts at preventing alcohol problems in adolescents may benefit by focusing attention on males with high levels of response inhibition (i.e. low impulsivity).

Acknowledgements

This project was made possible by Grant Number 2 P20 RR016479 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH); by a Governor's 2010 Individual Research Seed Grant (SDBOR/BHSU 2010-06-01); by a Nelson Summer Research Fellowship (BDB) and by a grant by the BHSU Faculty Research Committee (SFS). The authors would like to thank Dr. Parthasarathi Nag, for statistical advice, anonymous reviewers for comments and Kelley Aline, Melissa Lehmann, Ben Roman, Jeanie Stockland and Joanna Vandever for assistance with data collection; and the volunteer participants, without whose efforts this research could not have been conducted.

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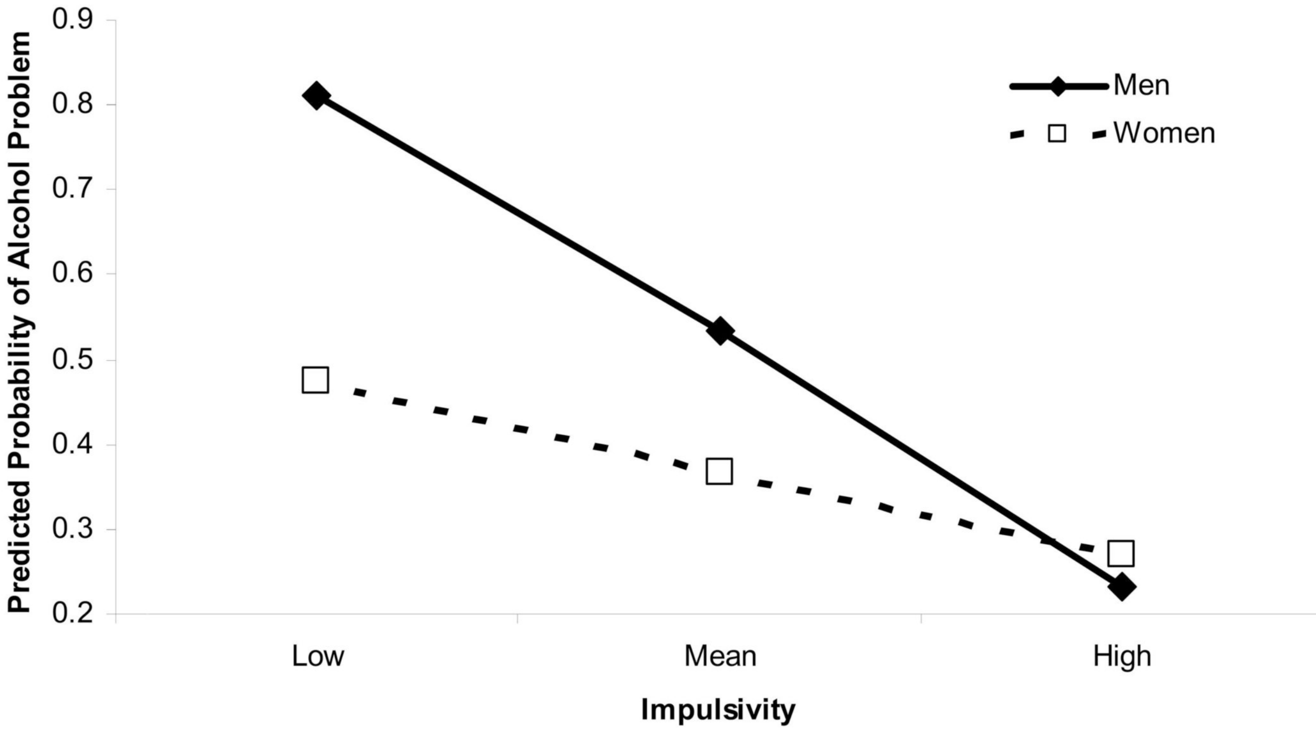

Figure 1.

Plot of significant gender x impulsivity interaction. Probabilities of being assigned to the alcohol problem category are plotted for men and women at the mean, low (-1 SD) and high (+1 SD) values of impulsivity as measured by Stop Signal Reaction Time (SSRT). Note that greater SSRTs indicate higher levels of impulsivity (i.e. it takes longer to inhibit a prepotent behavior).

Table 1

Participant characteristics for main outcomes. Percent of participants in scoring categories of the Michigan Alcoholism Screening Test (MAST) and the South Oaks Gambling Screen (SOGS). Means (standard deviations) of impulsivity measures for men and women. The total score and the subscale scores are given for the Barratt Impulsiveness Scale version 11, as are three outcomes from the Stop Task.

Measure		Men	Women
MAST	Score	N=73	N=124
	0-2[a]	45.2	62.1
	3-5[b]	28.8	25.8
	6-14[c]	26.0	12.1
SOGS	Score	N=73	N=124
	0[d]	32.9	78.2
	1-4[e]	56.2	21.0
	5+[f]	11.0	0.8
BIS-11	Subscale (N_{men}, N_{women})		
	Total (72, 122)	66.33 (9.31)	60.66 (9.85)***
	Attentional (70, 122)	18.26 (4.51)	16.78 (3.63)**
	Non Planning (73, 124)	24.53 (4.64)	22.77 (4.35)*
	Motor (73, 123)	23.53 (3.72)	21.61 (3.76)***
Stop Task	Measure (N_{men}, N_{women})		
	Go Trial Accuracy (70, 120)	.96 (.03)	.97 (.03)
	Go RT (73, 124)	468.66 (100.15)	496.28 (99.64)
	SSRT (64, 108)	201.69 (56.47)	193.86 (63.15)

Note: Different sample sizes across impulsivity measures reflect removal of outliers. Data are presented with out respect to health-risk behavior status. Go RT = Go Trial Reaction Time, SSRT = Stop Signal Reaction Time.

[a] No apparent problem with drinking,

[b] Early or middle problem drinker,

[c] Problem drinker,

[d] No problem with gambling,

[e] Some problems with gambling,

[f] Probable pathological gambler.

* p =.05,

** p=.01,

*** p=.001.

Table 2

Logistic regression analyses for tobacco use.

Variable	B	SE B	β	*p*
	Barratt Impulsiveness Scale Total Score (BIST)			
Step 1				
Gender	-0.85	0.43	-1.99	.05
BIST	0.05	0.21	0.24	.81
Step2				
Gender	-0.83	0.44	-1.90	.06
BIST	0.15	0.30	0.50	.62
Gender x BIST	-0.20	0.43	-0.47	.64
	Stop Signal Reaction Time (SSRT)			
Step 1				
Gender	-1.02	0.45	-2.27	.02
SSRT	-0.18	0.24	-0.74	.46
Step2				
Gender	-1.01	0.45	-2.24	.03
SSRT	-0.30	0.76	-0.39	.70
Gender x SSRT	0.08	0.48	0.17	.87

Note: For BIS: N = 194; Step 1 Log-Likelihood = -79.50; Step 2 Log-Likelihood = -79.39; G = (df = 1) 0.22, p = .64. For SSRT: N = 172; Step 1 Log-Likelihood = -66.66; Step 2 Log-Likelihood = -66.65; G = (df = 1) 0.03, p = .87.

Table 3

Logistic regression analyses for alcohol problems.

Variable	B	SE B	β	*p*
		Barratt Impulsiveness Scale Total Score (BIST)		
Step 1				
Gender	-0.44	0.32	-1.38	.17
BIST	0.45	0.16	2.80	.005
Step2				
Gender	-0.50	0.32	-1.55	.12
BIST	0.22	0.25	0.86	.39
Gender x BIST	0.38	0.33	1.16	.25
		Stop Signal Reaction Time (SSRT)		
Step 1				
Gender	-0.66	0.32	-2.04	.04
SSRT	0.15	0.16	0.34	.36
Step2				
Gender	-0.69	0.33	-2.09	.04
SSRT	-1.33	0.61	-2.19	.03
Gender x SSRT	0.89	0.35	2.55	.01

Note: For BIS: N = 194; Step 1 Log-Likelihood = -126.36; Step 2 Log-Likelihood = -125.69; G (df = 1) = 1.33, p = .25. For SSRT: N = 172; Step 1 Log-Likelihood = -114.96; Step 2 Log-Likelihood = -111.52; G (df = 1) = 6.88, p = .01.

Table 4

Testing whether impulsivity mediates the gender effect on alcohol problems.

Testing steps in mediation model	B	SE B	β	*p*
Step 1				
Outcome: AlcProb				
Predictor: Gender	-0.69	.30	-2.29	.02
Step 2				
Outcome: BIST				
Predictor: Gender	-0.58	.14	-4.09	.000
Step 3				
Outcome: AlcProb				
Mediator: BIST	0.45	.16	2.80	.005
Predictor: Gender	-0.44	.32	-1.38	.17

Note: AlcProb = Alcohol Problem status (i.e. MAST score > 2); BIST = Barrat Impulsiveness Scale Total score. Gender was dummy coded 0 = Men, 1 = Women. Testing Steps 1 and 3 used logistic regression and Testing Step 2 used linear regression.

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Table 5

Logistic regression analysis for gambling problems.

Variable	B	SE B	β	*p*
		Barratt Impulsiveness Scale Total Score (BIST)		
Step 1				
Gender	-1.85	0.34	-5.42	.00
BIST	0.22	0.17	1.26	.21
Step2				
Gender	-1.85	0.34	-5.38	.00
BIST	0.20	0.27	0.74	.46
Gender x BIST	0.03	0.35	0.09	.93
		Stop Signal Reaction Time (SSRT)		
Step 1				
Gender	-2.07	0.36	-5.76	.000
SSRT	-0.22	0.18	-1.22	.22
Step2				
Gender	-2.09	0.36	-5.77	.000
SSRT	0.34	0.63	0.54	.59
Gender x SSRT	0.35	0.38	-0.93	.35

Note: For BIS: N = 194; Step 1 Log-Likelihood = -109.52; Step 2 Log-Likelihood = -109.51; G = (df = 1) .01, p = .93. For SSRT: N = 172; Step 1 Log-Likelihood = -96.20; Step 2 Log-Likelihood = -95.75; G = (df = 1) 0.89, p = .35.