



The role of behavioral inhibition and behavioral approach systems in the associations between mood and alcohol consequences in college: A longitudinal multilevel analysis

Jeffrey D. Wardell ^{*}, Jennifer P. Read, Craig R. Colder

The State University of New York at Buffalo, 206 Park Hall, Buffalo, NY 14260, United States

HIGHLIGHTS

- We examine within-person associations among mood and alcohol consequences.
- We model behavioral approach (BAS) and inhibition systems (BIS) as moderators.
- We examine these processes over three years of college.
- Negative mood predicts more alcohol consequences for those high on BAS and/or BIS.
- BAS and BIS interact to influence mood–alcohol consequence relations over time.

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ABSTRACT

The behavioral inhibition system (BIS) and behavioral approach system (BAS) are thought to influence sensitivity to reinforcement and punishment, making them useful for predicting mood-related drinking outcomes. This study provided the first examination of BIS and BAS as moderators of longitudinal within-person associations between mood and alcohol-related consequences in college student drinkers. Participants ($N = 637$) at two public U.S. universities completed up to 14 online surveys over the first three years of college assessing past-month general positive and negative moods, as well as past-month alcohol use and consequences. BIS and BAS were assessed at baseline. Using multilevel regression, we found that BIS and BAS moderated the within-person associations between negative mood and alcohol consequences. For students high on BIS only, high on BAS only, or high on both BIS and BAS, within-person increases in negative mood were associated with greater alcohol consequences in the first year of college. However, these negative mood–alcohol consequence associations diminished over time for students high on BIS and low on BAS, but remained strong for students high on both BIS and BAS. Within-person associations between positive mood and alcohol consequences changed from slightly positive to slightly negative over time, but were not moderated by BIS or BAS. Findings suggest that BIS and BAS impact the within-person association between general changes in negative mood and negative alcohol consequences, working jointly to maintain this relationship over time.

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1. Introduction

Alcohol use is prevalent among college students and is often associated with negative physical, social, and academic consequences (see Perkins, 2002; Wechsler & Nelson, 2008). Much research has been devoted to understanding factors that contribute to problematic drinking (i.e., alcohol use that results in negative consequences) in this population. A great deal of this research has examined the link between mood and drinking behavior, as motivational models of alcohol use (Cooper, Frone, Russell, & Mudar, 1995; Cox & Klinger, 1988) suggest that drinking to regulate mood – especially negative

mood – is strongly associated with negative alcohol consequences (Cooper et al., 1995; Merrill & Read, 2010).

Though mood-related alcohol use is known to be important to the etiology of problematic drinking in college students (e.g., Cooper et al., 1995; O'Hare, 1997; Read, Wood, Kahler, Maddock, & Palfai, 2003), the literature on both the direction and strength of the relations between mood and problematic drinking has yielded mixed findings. For example, college students experiencing negative mood (e.g., anxiety and depression) may misuse alcohol to alleviate unpleasant emotions (Martens et al., 2008; Mohr et al., 2005; Simons, Gaher, Oliver, Bush, & Palmer, 2005). Yet, negative mood (e.g., social anxiety) may also lead students to avoid social settings in which risky drinking typically occurs (Gilles, Turk, & Fresco, 2006; Ham & Hope, 2005; Rankin & Maggs, 2006). In addition, high levels of positive mood can lead to reckless

^{*} Corresponding author. Tel.: +1 716 645 0252; fax: +1 716 645 3801.
E-mail address: jwardell@buffalo.edu (J.D. Wardell).

drinking motivated by a desire to further enhance pleasure and enjoyment (i.e., celebratory drinking, [Mohr et al., 2005](#); [Simons, Dvorak, Batien, & Wray, 2010](#); [Simons et al., 2005](#)). However, low positive mood may promote drinking to increase arousal and deal with boredom ([Wills, Sandy, Shinar, & Yaeger, 1999](#)). It is clear from the complexity of this literature that the role that mood plays in drinking behavior has not been fully resolved. Thus, research has been devoted to clarifying these associations in college students, including studies of within-person associations as well as potential moderators.

1.1. Within-person associations between mood and alcohol consequences

Much of the research on the relationship between mood and negative alcohol outcomes has focused on *between-person* associations. In these studies, individual differences are examined to determine whether problematic drinking is greater among individuals who are elevated on particular mood states at a given point in time. However, this approach has been criticized for ignoring *within-person* changes in mood and corresponding changes in alcohol consequences (see [Armeli, Todd, & Mohr, 2005](#); [Rankin & Maggs, 2006](#)). Theoretical accounts of mood-related drinking suggest that changes in mood over time should be correlated with increases or decreases in the risk for problematic outcomes of drinking ([Cooper et al., 1995](#); [Cox & Klinger, 1988](#)). Thus, within-person analyses are needed to address the question of whether individuals experience more negative alcohol consequences when they experience changes in mood.

Accordingly, some recent research has examined within-person associations between mood and drinking behavior in college students (e.g., [Armeli, Tennen, Affleck, & Kranzler, 2000](#); [Hussong, Hicks, Levy, & Curran, 2001](#); [Mohr et al., 2005](#); [Park, Armeli, & Tennen, 2004](#); [Simons et al., 2005](#)). These studies generally involve repeated assessments of mood and alcohol involvement to examine whether within-person changes in mood are associated with corresponding changes in alcohol use for the same individuals. An important finding from these studies is that the associations between mood and drinking behavior may differ depending on whether a between-person or within-person level of analysis is used ([Park et al., 2004](#); [Rankin & Maggs, 2006](#)).

However, previous studies have tended to focus on alcohol consumption levels, and there have been few examinations of within-person associations between mood and negative alcohol consequences. More research on these associations is important, given that mood-related alcohol use is major risk factor for alcohol-related problems ([Kuntsche, Knibbe, Gmel, & Engels, 2005](#); [Martens et al., 2008](#)). Indeed, even after controlling for level of alcohol consumption, drinking that is linked to negative moods is associated with greater negative alcohol consequences ([Cooper et al., 1995](#); [Merrill & Read, 2010](#)). Perhaps drinkers who use alcohol to regulate their mood tend to engage in riskier drinking practices with a high potential for negative outcomes (e.g., drinking the night before an exam to cope with stress). This could result in within-person associations between mood changes and negative alcohol consequences that are not entirely a function of changes in consumption levels.

1.2. The importance of timing: Drinking over the college years

Within-person associations between mood and negative alcohol consequences could play out over different time periods. For example, moment-to-moment changes in mood state may lead to immediate alcohol use and proximal negative consequences, while broader shifts in global mood state could result in more chronic changes in the risk for alcohol-related consequences as mood-related drinking consequences accumulate over longer time frames. Most studies of within-person associations have focused on daily changes in mood and alcohol use. Yet, daily alcohol use is relatively rare in college, where the majority of students report drinking less than once per week (e.g., [Del Boca, Darkes, Greenbaum, & Goldman, 2004](#); [Rankin & Maggs, 2006](#)). Moreover,

mood not only fluctuates from moment-to-moment, but also global fluctuations in mood occur over monthly and yearly time intervals ([Murray, Allen, & Trinder, 2001](#); [Wills et al., 1999](#)). Importantly, there is some evidence from the developmental literature that within-person fluctuations in chronic mood states are related to changes in substance use among adolescents ([Wills et al., 1999](#)). However, with only a few exceptions, most of the research on the relationship between chronic mood states and alcohol use has focused on between-person changes on global mood measures over time. Currently, there is a gap in the literature between the short-term, daily studies of within-person mood-drinking associations, and the longer-term, between-person studies of mood-drinking relationships. Accordingly, this study provides an examination of *within-person* associations between more chronic changes in mood over a period of several years and corresponding changes in negative alcohol consequences.

In addition, research shows that academic level or year in college has an influence over student's alcohol involvement, with heavy drinking and alcohol problems tending to decline over the college years ([Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001](#); [Harford, Wechsler, & Seibring, 2002](#)). Further, there is some evidence that the relationship between emotional distress and alcohol consequences may change during the course of college (e.g., [Jackson & Sher, 2003](#)). The transition into college is a time of heightened instability and emotional stress for many students as they are adjusting to a new environment and new responsibilities ([Arnett, 2005](#)). Thus, the association between negative mood and problematic drinking may be stronger for some students early in college (see also [Stewart, Zeitlin, & Samoluk, 1996](#)) but may change in subsequent years¹. Given that most of the studies in this area have used brief assessment intervals (i.e., daily, weekly) over brief time periods (e.g., a month or two), little is currently known about how these associations change over the college years. Also, drinking behavior varies substantially over the course of the academic year and shows strong seasonal variation ([Del Boca et al., 2004](#)). So, longitudinal examinations of within-person associations between mood and alcohol consequences must also account for such variations. Accordingly, the present study assessed mood and alcohol consequences at various seasonal time points (early fall, late fall, early spring, and late spring).

1.3. The moderating role of behavioral approach and inhibition systems

Because alcohol use can have both rewarding (e.g., improved mood) and aversive (e.g., hangover) outcomes, mood-related drinking may depend partly on individual differences in sensitivity to reinforcement and punishment ([Cox & Klinger, 1988](#)). Among the most relevant traits to this process are the behavioral approach system (BAS) and behavioral inhibition system (BIS), which are biologically-based neural systems underlying trait sensitivity to reinforcement and punishment. As BAS and BIS are generally stable over time ([Carver & White, 1994](#); [Kasch, Rottenberg, Arnou, & Gotlib, 2002](#)), they are useful prospective predictors of alcohol use ([Lopez-Vergara et al., 2012](#)).

According to the Reinforcement Sensitivity Theory (RST), individuals with a strong BAS are thought to be sensitive to reinforcement and are motivated to approach rewards ([Corr, 2008](#); [Gray, 1987](#)). A strong BAS is a risk factor for problematic drinking among college students (e.g., [Hundt, Kimbrel, Mitchell, & Nelson-Gray, 2008](#); [O'Connor & Colder, 2005](#)) and is prospectively linked to beliefs that alcohol enhances positive mood and reduces negative mood ([Wardell, Read, Colder, & Merrill, 2012](#)). In contrast, individuals

¹ Research suggests that drinking to regulate negative mood may be less common among college students than social or celebratory drinking (see [Kuntsche et al., 2005](#)) and may increase as students transition into adult roles. However, there is evidence that drinking to cope with negative emotions still does occur for a subsample of students ([Hussong et al., 2001](#); [Mohr et al., 2005](#); [Park & Levenson, 2002](#)). For these students, the association between negative mood and alcohol consequences may be stronger early in college due to the stress of this transition period.

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