



Adequate sleep moderates the prospective association between alcohol use and consequences



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HIGHLIGHTS

- Sleep adequacy moderates the association between drinking quantity and consequences.
- Moderated effects exist concurrently and prospectively (up to five months).
- Research examining the mechanism(s) by which sleep affects alcohol risk are needed.
- Research regarding the efficacy of college sleep interventions is warranted.

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ABSTRACT

Objective: Inadequate sleep and heavy alcohol use have been associated with negative outcomes among college students; however, few studies have examined the interactive effects of sleep and drinking quantity in predicting alcohol-related consequences. This study aimed to determine if adequate sleep moderates the prospective association between weekly drinking quantity and consequences.

Method: College students ($N = 568$) who were mandated to an alcohol prevention intervention reported drinks consumed per week, typical sleep quantity (calculated from sleep/wake times), and perceptions of sleep adequacy as part of a larger research trial. Assessments were completed at baseline and one-, three-, and five-month follow-ups.

Results: Higher baseline quantities of weekly drinking and inadequate sleep predicted alcohol-related consequences at baseline and one-month follow-up. Significant interactions emerged between baseline weekly drinking quantity and adequate sleep in the prediction of alcohol-related consequences at baseline, one-, three-, and five-month assessments. Simple slopes analyses revealed that weekly drinking quantity was positively associated with alcohol-related consequences for those reporting both adequate and inadequate sleep, but this association was consistently stronger among those who reported inadequate sleep.

Conclusion: Subjective evaluation of sleep adequacy moderates both the concurrent and prospective associations between weekly drinking quantity and consequences, such that heavy-drinking college students reporting inadequate sleep experience more consequences as a result of drinking. Research needs to examine the mechanism(s) by which inadequate sleep affects alcohol risk among young adults.

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1. Introduction

Excessive alcohol use places many college students at risk for academic difficulties, injury, or even death (Blanco et al., 2008; Hingson, Zha, & Weitzman, 2009; Johnston, O'Malley, Bachman, & Schulenberg, 2012). Although some college students consume alcohol

without experiencing negative consequences (Barnett, Merrill, Kahler, & Colby, 2015; Barnett et al., 2014; Hingson, 2010), many students who drink alcohol report health concerns, including mental health problems, risky sexual behaviors, and weight concerns (Oswalt, Lederer, & Schrader, 2015). Research is needed to understand the behavioral patterns that increase risk of adverse alcohol consequences among young adults.

One potential risk factor for negative drinking-related outcomes is sleep. Poor sleep has been linked to greater alcohol misuse among adolescents (Wong, Robertson, & Dyson, 2015), college students

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Table 1
Descriptive statistics and zero-order correlations among study variables ($N = 568$).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Male gender	–									
2. Age	–0.05	–								
3. White race	–0.08	0.03	–							
4. Greek affiliation	–0.04	0.03	–0.01	–						
5. Baseline drinks per week	–0.28***	0.14**	0.20***	0.18***	–					
6. Baseline sleep adequacy	–0.10*	0.12**	0.14**	–0.01	0.06	–				
7. Problems at baseline	0.04	0.04	0.02	0.09*	0.43***	–0.17***	–			
8. Problems at 1 month	–0.08	0.01	0.17**	0.11*	0.32***	–0.07**	0.40***	–		
9. Problems at 3 months	–0.06	0.01	0.03	0.08	0.32***	–0.06	0.37***	0.50***	–	
10. Problems at 5 months	–0.02	0.11	0.08	0.03	0.28***	–0.18**	0.36***	0.57***	0.55***	–
<i>N</i> or Mean	407	19.18	475	94	12.49	2.23	5.44	3.05	3.28	3.16
% or <i>SD</i>	71.7	1.16	83.6	16.5	9.25	0.88	4.25	3.88	4.04	4.20

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

(Kenney, LaBrie, Hummer, & Pham, 2012; Kenney, Lac, LaBrie, Hummer, & Pham, 2013), community samples (Weissman, Greenwald, Nino-Murcia, & Dement, 1997), and alcohol-dependent patients (Brower, Krentzman, & Robinson, 2011). College students, in particular, tend to report irregular and insufficient sleep (Gellis, Park, Stotsky, & Taylor, 2014; Tsai & Li, 2004), with 12 to 14% of students reporting clinically significant symptoms of a sleep disorder (Gellis et al., 2014; Petrov, Lichstein, & Baldwin, 2014) and as many as 60% reporting poor sleep quality (Kenney et al., 2012; Lund, Reider, Whiting, & Prichard, 2010).

Inadequate sleep may increase risk for alcohol-related consequences among young adults. One mechanism to explain this association involves the tendency for sleep deprivation to decrease inhibition (Anderson & Platten, 2011) and impair decision-making (Killgore, Balkin, & Wsensten, 2006; Schnyer, Zeithamova, & Williams, 2009). Consistent with this hypothesis, poor sleep has been linked to increased alcohol-related consequences among college students after accounting for demographic variables and psychiatric problems (Kenney et al., 2013). Moreover, self-reported global sleep quality has been shown to moderate the association between alcohol use and related consequences in cross-sectional research, such that heavy-drinking college students experiencing worse sleep quality reported a significantly greater number of alcohol-related problems (Kenney et al., 2012). When interpreting these data, however, it is not clear whether sleep difficulty precedes alcohol-related consequences or vice versa.

The current study extends previous research by determining if inadequate sleep moderates the association between weekly drinking quantity and alcohol-related consequences both concurrently and prospectively. Consistent with previous cross-sectional research (Kenney et al., 2012), we hypothesized that subjective reports of inadequate sleep would moderate the association between drinks consumed per week and alcohol-related consequences, such that individuals who drank more and reported inadequate sleep would report a greater number of alcohol-related consequences as a result of drinking. Because sleep difficulty has been identified a predictor of problematic alcohol use in longitudinal studies of adolescents (Wong et al., 2015), we also hypothesized that this moderating effect would endure over time.

2. Materials and methods

2.1. Participants and procedure

All study procedures were approved by the university's Institutional Review Board. Undergraduate students at a public, four-year, research university in the Northeast were recruited to participate in a larger research project (Carey et al., in preparation). Students who violated campus alcohol policy and were mandated to participate in an alcohol education program by the Office of Community Standards between November 2011 and December 2013 were presented with the option of either participating in the research study (evaluating two brief interventions for alcohol use) or participating in the standard sanction. All

students who consented to participate in the larger study were included in current analyses. Data for this study were collected at baseline, one-, three-, and five-month assessments. The baseline and one-month assessments were online surveys, which were completed in a private suite and facilitated by a research assistant; the two subsequent assessments were completed online from remote locations. The final sample consisted of 568 students (72% male, 84% White) with a mean age of

Table 2
Main effects and interactions for alcohol-related consequences.

Baseline alcohol-related consequences					
	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
<i>Step 1: main effects</i>					
Age	–0.03	0.14	–0.01	–0.18	0.85
Male gender	1.59	0.37	0.17	4.35	<0.001
White race	–0.48	0.44	–0.04	–1.08	0.28
Greek affiliation	0.09	0.44	0.01	0.20	0.84
Drinks per week	0.23	0.02	0.50	12.34	<0.001
Sleep adequacy	–0.87	0.18	–0.18	–4.70	<0.001
<i>Step 2: interactions</i>					
Sleep \times drinks per week	–0.05	0.02	–0.10	–2.59	0.01
1-Month alcohol-related consequences					
<i>Step 1: main effects</i>					
Age	–0.16	0.12	–0.05	–1.40	0.16
Male gender	0.01	0.31	0.002	0.04	0.97
White race	0.42	0.38	0.04	1.10	0.27
Greek affiliation	0.97	0.36	0.10	2.66	0.008
Baseline alcohol consequences	0.25	0.04	0.30	6.78	<0.001
Drinks per week	0.07	0.02	0.20	4.16	<0.001
Sleep adequacy	–0.39	0.16	–0.10	–2.46	0.01
<i>Step 2: interactions</i>					
Sleep \times drinks per week	–0.03	0.02	–0.08	–2.02	0.04
3-Month alcohol-related consequences					
<i>Step 1: main effects</i>					
Age	–0.12	0.16	–0.04	–0.81	0.42
Male gender	–0.17	0.40	–0.02	–0.43	0.67
White race	1.28	0.48	0.12	2.65	0.009
Greek affiliation	0.35	0.48	0.03	0.72	0.47
Baseline alcohol consequences	0.26	0.05	0.30	5.57	<0.001
Drinks per week	0.07	0.02	0.18	3.03	0.003
Sleep adequacy	–0.13	0.21	–0.03	–0.62	0.54
<i>Step 2: interactions</i>					
Sleep \times drinks per week	–0.05	0.02	–0.11	–2.34	0.02
5-Month alcohol-related consequences					
<i>Step 1: main effects</i>					
Age	–0.19	0.18	–0.06	–1.07	0.28
Male gender	–0.22	0.45	–0.03	–0.49	0.62
White race	–0.28	0.57	–0.03	–0.51	0.61
Greek affiliation	0.26	0.58	0.02	0.45	0.65
Baseline alcohol consequences	0.24	0.05	0.26	4.42	<0.001
Drinks per week	0.10	0.03	0.23	3.58	<0.001
Sleep adequacy	–0.09	0.24	–0.02	–0.37	0.71
<i>Step 2: interactions</i>					
Sleep \times drinks per week	–0.05	0.02	–0.10	2.00	<0.05

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