

Interactions Between Energy Drink Consumption and Sleep Problems: Associations with Alcohol Use Among Young Adolescents

Naomi R. Marmorstein, PhD

Background: Energy drink consumption and sleep problems are both associated with alcohol use among adolescents. In addition, caffeine consumption (including energy drinks) is associated with sleep problems. However, information about how these three constructs may interact is limited. The goal of this study was to examine potential interactions between energy drink consumption and sleep problems in the concurrent prediction of alcohol use among young adolescents. Coffee and soda consumption were also examined for comparison.

Methods: Participants from the Camden Youth Development Study were included ($n = 127$; mean age = 13.1; 68% Hispanic, 29% African American) and questionnaire measures of frequency of caffeinated beverage consumption (energy drinks, coffee, and soda), sleep (initial insomnia, sleep disturbances, daytime fatigue, and sleep duration), and alcohol consumption were used. Regression analyses were conducted to examine interactions between caffeinated beverage consumption and sleep in the concurrent prediction of alcohol use.

Results: Energy drink consumption interacted with initial insomnia and daytime fatigue to concurrently predict particularly frequent alcohol use among those with either of these sleep-related problems and energy drink consumption. The pattern of results for coffee consumption was similar for insomnia but reached only a trend level of significance. Results of analyses examining soda consumption were nonsignificant.

Conclusions: Young adolescents who both consume energy drinks and experience initial insomnia and/or daytime fatigue are at particularly high risk for alcohol use. Coffee consumption appears to be associated with similar patterns. Longitudinal research is needed to explain the developmental pathways by which these associations emerge, as well as mediators and moderators of these associations.

Keywords: energy drinks, caffeine, sleep, alcohol, adolescents

Introduction

ENERGY DRINK CONSUMPTION and sleep-related problems are both associated with alcohol use and related problems among adolescents.¹⁻⁶ In addition, caffeine consumption is associated with sleep patterns and problems.⁷⁻⁹ However, research examining energy drink consumption, sleep, and alcohol use together is extremely limited, despite the potential for these factors to affect each other. The goal of this study was to examine whether young adolescents who consume energy drinks and also have sleep-related problems are at particularly high risk for alcohol use. We also examined coffee and

soda consumption, as a first step in understanding whether any associations found were limited to energy drinks or applied to other caffeinated beverages as well.

There are several reasons to expect that energy drink consumption and sleep-related problems may interact in the prediction of alcohol use among adolescents. Stated another way, sleep may moderate the established association between energy drink consumption and alcohol consumption among adolescents. Youth who use one substance to change how they feel (in this case, using energy drinks to feel more awake or alert) may be more likely to use another substance (in this case, alcohol) to change how they feel. Alternatively, energy drink consumption,

particularly late in the day, may interfere with sleep; youth who consume either higher amounts of caffeine through energy drinks (perhaps due to more extreme sleep problems) or consume them late in the day (e.g., after school, perhaps impairing evening sleep) may be at particular risk for alcohol use. Finally, there are a number of “third variables” that could lead to apparent interactive effects of energy drinks and sleep. For example, sleep problems and energy drinks are associated with many forms of psychopathology^{2,10,11}; comorbid psychopathology may lead to interactive associations among these constructs. Alternatively, family factors such as parental monitoring relate to energy drink use, alcohol problems, and sleep problems; low levels of monitoring (or related factors such as low family cohesion) could lead to interactive associations among these problems.^{1,12}

Previous research integrating caffeine, sleep, and substance use among adolescents is quite limited. James and colleagues¹³ examined a community-based sample of youth in Iceland and found evidence that caffeine use was responsible for a substantial portion of variance in academic achievement, even taking into account cigarette and alcohol use. In addition, daytime sleepiness was associated with caffeine, nicotine, and alcohol use and mediated the association between nicotine and alcohol use and academic achievement. They concluded that caffeine and sleep should be considered in studies of adolescent substance use, a recommendation that we follow in this study.

We know of no other studies examining sleep, caffeine use, and substance use together in an adolescent sample. Because of this, we briefly review research examining two of these three constructs. We first review previous research on caffeine use and alcohol use and problems, then we turn to previous research on sleep and alcohol use and problems, and finally to research on caffeine and sleep.

Among adolescents, energy drink consumption is significantly associated with alcohol consumption, both concurrently^{3,14} and longitudinally.¹ This pattern may not hold for other caffeinated beverages such as soda and coffee¹ (but the literature is not completely consistent^{15,16}).

Sleep patterns and problems are associated with alcohol use among adolescents.² Sleep problems may be both a cause and a consequence of alcohol use.^{4-6,17-19} Research clearly supports a link between sleep problems in childhood and substance use in adolescence⁵ and between sleep problems in adolescence and substance abuse in early adulthood.¹⁸ Insomnia may be a particular risk factor,^{2,19,20} although perceived tiredness¹⁸ and other sleep-related disturbances may be important as well. More sleep is associated with lowered risk for substance use among adolescents, although this association is attenuated when covariates are accounted for.²¹

Caffeine consumption can impair sleep and relate to daytime fatigue, and conversely, people with sleep problems may self-medicate their fatigue with caffeine.^{7-9,22}

It is unclear whether these associations differ by type of caffeinated beverage (e.g., energy drinks versus coffee) or whether one direction of effect (caffeine impairing sleep or caffeine being used as a consequence of impaired sleep and resulting fatigue) is more common among adolescents.⁹

The goal of this study was to examine possible interactions between energy drink consumption and sleep problems in the concurrent prediction of alcohol use among early adolescents. Based on previous research, we expected that energy drink use and sleep problems (particularly insomnia and daytime fatigue) would be independently associated with alcohol use frequency. Based on theoretical reasons (discussed previously in the Introduction), we expected that these factors would interact to produce particularly high risk for alcohol use among youth with both sleep problems and energy drink use. Owing to the conflicting nature of previous research on coffee consumption among youth and its association with other problem behaviors and substance use,^{1,15,16} we did not make a specific prediction regarding whether coffee would show a pattern similar to that of energy drinks or not. We did not expect similar interactive effects for soda because of the normative nature of soda consumption among youth and the absence of previous research supporting associations between alcohol use and soda consumption.

Materials and Methods

Participants

Participants were drawn from the Camden Youth Development Study, a study of students at a middle school in the mid-Atlantic region of the United States. Youth were in sixth or seventh grade at a charter school at the time of their initial participation in the study ($n = 144$; 72 males, 72 females). All youth who were in these grades at this school were recruited for participation. Parents were contacted and asked to provide consent at “report card nights” (times when parents came to the school to pick up their children’s report cards) and through sending consent forms to homes. Eighty-eight percent of parents contacted consented to their child’s participation.

Youth were followed for 16 months, until they were finishing seventh or eighth grade. Only the final assessment was used in this study because sleep was only assessed at this time point. Ninety-two percent of the original participants, plus one youth who did not assent to participation in the initial assessment but was in the participant pool because of parental consent, participated in this final assessment ($n = 127$; the decrease in sample size was because of students moving and/or transferring out of the school).

Demographic information regarding participants at this final assessment is presented in Table 1. Among students in these grades at this school, 81% qualified for free lunches (an indicator of low socioeconomic status) and 43% of families received public assistance (not including

TABLE 1. PARTICIPANTS' DEMOGRAPHIC CHARACTERISTICS AND DESCRIPTIVE STATISTICS

	Mean (SD)/ percentage	Range
Age	13.2 (0.8)	12–15
Gender (female)	50%	
Race/ethnicity		
Hispanic	68%	
African American	29%	
Asian	0%	
Native American	6%	
White	4%	
Other	6%	
Frequency of caffeine consumption		
Energy drinks	0.98 (1.20)	0–4
Coffee	1.40 (1.40)	0–4
Soda	2.83 (1.12)	0–4
Any consumption of caffeinated beverage (past 4 months)		
Energy drinks	50%	
Coffee	61%	
Soda	97%	
“Most days” consumption of caffeinated beverage		
Energy drinks	5%	
Coffee	11%	
Soda	36%	
Sleep measures		
Initial insomnia	0.70 (1.06)	0–4
Sleep disturbances	2.76 (3.45)	0–20
Daytime fatigue	5.77 (3.76)	0–16
Sleep duration	1.55 (0.93)	0–3
Alcohol use frequency	0.23 (0.62)	0–3

unemployment or social security benefits). This study was approved by the IRB of Rutgers University.

Measures

Questionnaires were administered to youth in classrooms, with privacy screens on each desk to ensure confidentiality. The questionnaire was read aloud by a master-level research assistant, and there was always at least one other research assistant in the classroom to answer students' questions.

Energy drink, coffee, and soda consumption: frequency of caffeinated beverage (energy drinks, coffee, and soda) consumption was assessed using a five-point scale asking about use in the previous 4 months (“In the past 4 months, how often did you drink...?”): 0 = not in the past 4 months; 1 = at least once in the past 4 months, but less than once per month; 2 = one to three times per month; 3 = one to three times per week; 4 = most days. Means, standard deviations, and ranges at the assessment used in this study are presented in Table 1.

Sleep. Items assessing sleep were drawn from the Pittsburgh Sleep Quality Index^{23,24} and the Child and Adolescent Sleep Habits Questionnaire. Means, standard deviations, and ranges for all items and scales are presented in Table 1.

Initial insomnia was measured with an item asking “On average, how long does it take you to fall asleep?” with five response options ranging from “0–15 minutes” (0) to “more than 1 hour” (4).

Sleep disturbances were assessed using five items assessing the frequency of snoring, talking in sleep, sleep walking, nightmares, and bed wetting. Each was scored on a five-point scale (0 = never, 4 = very often). Cronbach's alpha for this scale was 0.73.

Daytime fatigue was assessed using four items: “Do you feel tired during day?” “Is it difficult for you to get up in the morning?” “How often do you fall asleep during class?” and “Do you have trouble staying awake after school is out?” Each was scored on a five-point scale (0 = never, 4 = very often). Cronbach's alpha for this scale was 0.71.

Sleep duration was assessed using a single item asking “On average, how long do you sleep on school nights?” with five response options, ranging from “6 hours or less” to “more than 9 hours.”

Alcohol use. Youth were asked the frequency with which they may have had a drink of beer, wine, or hard liquor (“not just a sip or taste of someone else's”) in the past 4 months. A five-point scale was used: 0 = none in the past 4 months, 1 = less than once a month, 2 = at least once a month, but less than once a week, 3 = one to three times a week, or 4 = most days. Fifteen percent reported some alcohol use in the past 4 months (a score greater than 0); other descriptive statistics are presented in Table 1.

Statistical analyses

Participants' data were eliminated if they endorsed use of a fake drug or endorsed being “kind of honest” instead of “totally” or “mostly” honest. This eliminated eight questionnaires. Participants with eliminated data were slightly older than those with retained data (mean = 14.0 vs. 13.2, $t = -2.81$, $p < 0.01$) but did not differ on other variables included in this study.

Before analyses being conducted, variables measuring frequency of energy drink, coffee, and alcohol use were log-transformed because of skew.

First, Spearman correlations were conducted to examine overall associations between sleep variables and alcohol use frequency and frequency of consumption of energy drinks, coffee, and soda.

Second, regression analyses were conducted to address the hypotheses. All regression analyses adjusted for the effects of age, gender (male/female), and race/ethnicity (African American yes/no). Independent variables were sleep (insomnia, disturbances, fatigue, and duration, in separate analyses), caffeine use (energy drink, coffee, and soda consumption, in separate analyses), and the interaction between each sleep variable and each caffeine variable. The dependent variable in all analyses was frequency of alcohol use.

TABLE 2. SPEARMAN CORRELATIONS BETWEEN FREQUENCY OF CAFFEINATED BEVERAGE CONSUMPTION AND SLEEP AND ALCOHOL USE

	<i>Energy drinks</i>	<i>Coffee</i>	<i>Soda</i>
Initial insomnia	0.02	-0.05	-0.06
Disturbed sleep	0.06	-0.04	0.05
Daytime fatigue	0.21*	0.21*	0.11
Sleep duration	-0.23**	-0.18*	-0.05
Alcohol use	0.36***	0.25**	0.02

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Results

Associations between sleep, caffeine use, and alcohol use

Spearman correlations revealed associations between energy drinks and certain aspects of sleep (Table 2). Specifically, frequency of energy drink consumption was associated with daytime fatigue and shorter sleep duration. The same pattern of associations was found for frequency of coffee consumption. Both energy drink and coffee consumption were also associated with frequency of alcohol use. No significant associations between soda consumption and sleep or alcohol use were found.

Interactions between caffeine use and sleep in the concurrent prediction of alcohol use

Results of regression analyses examining sleep, caffeine use, and their interaction as concurrent predictors of alcohol use are presented in Table 3. Energy drink consumption interacted with initial insomnia and daytime fatigue to be associated with particularly frequent alcohol use among youth who used energy drinks and also experienced these sleep-related symptoms. In contrast, no significant interactions were found between energy drinks disturbed sleep or sleep duration in the prediction of alcohol use. Coffee consumption interacted with initial insomnia to be associated with particularly frequent alcohol use among youth who used coffee and also experienced initial insomnia; however, this effect was only significant at a trend level ($p < 0.10$) and other interaction effects with coffee were nonsignificant. Interaction effects between soda consumption and sleep-related constructs in the prediction of alcohol use were all nonsignificant.

Discussion

The results of this study indicate that early adolescents who consume energy drinks and also experience sleep-related problems (insomnia and daytime fatigue) are at particularly high risk for alcohol use. There was a similar pattern of effects found for coffee: youth who consume coffee and also experience insomnia appear to be at high risk for alcohol use, although the results for coffee were only significant at a trend level ($p < 0.10$). Significant effects were not found for soda consumption. In addition, there were significant cross-sectional associations between certain types of caffeine consumption (energy drinks and coffee) and daytime fatigue and shorter duration of sleep (but not insomnia or sleep disturbances).

There are several reasons that caffeine consumption, and perhaps energy drink consumption in particular, could interact with initial insomnia and daytime fatigue to be associated with particular risk for alcohol use among youth with both problems. First, adolescents who use one substance to self-medicate bothersome symptoms (in this case, using energy drinks to self-medicate fatigue, which may result from insomnia) may be at risk for using another psychoactive substance (in this case, alcohol) in an attempt to change how they feel. Alternatively, insomnia (and resulting daytime fatigue) may be a marker of a particularly risky pattern of caffeine use (e.g., use late in the day, or consuming larger quantities), which may exacerbate the baseline level of risk for alcohol use that is associated with energy drink use. It is also possible that energy drink and/or coffee use may be a reaction to particularly severe daytime fatigue and/or insomnia; youth with severe sleep-related problems may be even more at risk for alcohol use than those with less severe sleep problems.

Importantly, data used for this study were cross-sectional, so do not provide information about how these associations may have unfolded. It is even possible that alcohol use could be a causal factor in these associations; for example, alcohol could be used to self-medicate insomnia, which could lead to daytime fatigue and a perceived need for highly caffeinated beverages such as energy drinks. Future research, particularly following youth longitudinally, is needed to untangle the various developmental pathways that may be acting to produce these associations.

TABLE 3. INTERACTIONS BETWEEN CAFFEINATED BEVERAGE CONSUMPTION AND SLEEP IN THE CONCURRENT PREDICTION OF ALCOHOL USE FREQUENCY (BETA WEIGHTS)

	<i>Energy drinks</i>			<i>Coffee</i>			<i>Soda</i>		
	<i>Caffeine</i>	<i>Sleep</i>	<i>Caffeine × Sleep</i>	<i>Caffeine</i>	<i>Sleep</i>	<i>Caffeine × Sleep</i>	<i>Caffeine</i>	<i>Sleep</i>	<i>Caffeine × Sleep</i>
Initial insomnia	0.21*	0.02	0.33**	0.13	0.06	0.26 [§]	-0.02	0.03	0.23
Disturbed sleep	0.33**	-0.03	0.06	0.08	-0.13	0.23	-0.05	-0.17	0.21
Daytime fatigue	0.05	-0.10	0.43*	-0.03	0.06	0.29	-0.08	0.07	0.15
Sleep duration	-0.03	0.34 [§]	0.05	0.27	0.03	-0.07	0.10	0.11	-0.14

[§] $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$.

As expected based on previous research^{1,3,15,16} correlational analyses indicated that frequency of energy drink and coffee consumption was associated with frequency of alcohol use. In addition, consistent with previous research,⁷⁻⁹ energy drink and coffee consumption were associated with daytime fatigue and shorter sleep duration. It seems likely that youth who sleep less and are, therefore, tired during the day use these caffeinated beverages to self-medicate their fatigue, although a reverse direction of effect is also possible (youth who consume energy drinks and/or coffee during the day may go to bed later and, therefore, sleep less because of the need to wake up for school).

The differences and similarities in findings across different caffeinated beverages are complex. We did not find any significant associations between soda consumption and sleep or alcohol use. Soda consumption may be less associated with sleep patterns and problems because of its lower caffeine content, and may be less linked to problem behaviors such as alcohol use because it is so normative. Energy drinks and coffee showed some similarities and some differences in their patterns of association with sleep and alcohol use. The similarity in their overall patterns of association with sleep and alcohol use (i.e., the correlational analyses) may be because of the relatively high (compared with soda) caffeine content in both types of beverages. For this reason, both may be used to self-medicate fatigue, or may keep youth up late at night. However, there were small differences in their patterns of association with alcohol use once sleep problems were included in the model. Energy drinks interacted with both initial insomnia and daytime fatigue in the prediction of alcohol use. A similar pattern was apparent for initial insomnia and coffee (although the interaction between coffee consumption and insomnia was only marginally significant, $p=0.07$), whereas the interaction between coffee consumption and daytime fatigue was nonsignificant ($p>0.10$).

Because of the broadly similar patterns of coefficients but differences in significance levels, the evidence is equivocal as to whether energy drinks and coffee, in combination with sleep problems, are related similarly or differently to alcohol use. Previous research has been inconsistent on this topic as well.^{1,3,14-16} Considering physiological effects of the two beverages, the caffeine content of energy drinks and coffee (per ounce) is similar (energy drinks: 2.5–35.7 mg, coffee: 12.8–25 mg²⁵; serving sizes are variable^{26,27}). We do not know whether youth tend to consume different amounts of each beverage, which could lead to different amounts of caffeine consumption, and we have only minimal information on the effects of the other ingredients in energy drinks.²⁶ Considering psychosocial correlates of the two beverages, youth who choose to use energy drinks may differ from youth who consume coffee or soda in a variety of ways. For example, they are more likely to exhibit externalizing behavior²⁸ and to have families characterized by low levels of parental monitoring.¹ The two beverages may also be consumed

at different times of the day, which could lead to different associations with sleep and/or other substance use.

Future research on this topic should attempt to tease apart the amount of caffeine consumed (in milligrams) from the specific drinks consumed (energy drinks versus coffee), and address similarities and differences in psychosocial correlates of use and use patterns, in an attempt to better understand potential mechanisms behind this pattern of associations. It would also be useful to consider the broader cultural context surrounding caffeinated beverage consumption. For example, much of the research on energy drink use among adolescents has been conducted among youth in Iceland,^{13,16,22,28} where the cultural context surrounding caffeine use (or the use of specific caffeinated beverages) may differ from the low-income, predominantly minority community in the United States from which the participants in this study came.

This study has limitations. Most importantly, the cross-sectional nature of the data made it impossible to tease apart which behaviors and/or problems came first and, therefore, may have influenced risk for other problems. In addition, we were unable to ascertain whether the soda that youth drank was caffeinated or decaffeinated (we asked, but most youth did not know, so we were not able to use these data), so some of the soda use reported may have referred to decaffeinated soda. In this young sample, there were low rates of alcohol use; it is unclear how these associations may apply to older samples in which alcohol use becomes more common. Importantly, the sample was fairly small ($n=127$) and relatively few youth used coffee or energy drinks frequently (“most days”), leading to limited statistical power. Although this makes the significant findings more striking, it also means that research on this topic with larger samples is needed. Possibly further limiting the generalizability of this study, this sample comprised low-income, ethnic minority youth. Although this is a strength in that this population is under-represented in research, there is some evidence that sleep problems are associated with worse adjustment among children from low socioeconomic status backgrounds²⁹ and, therefore, it is not clear how these findings would apply to other populations.

Conclusions

In sum, young adolescents who consume energy drinks and experience initial insomnia and/or daytime fatigue are at particular risk for alcohol use; similar patterns may hold true for those who consume coffee, but not for those who consume soda. An examination of potential explanations for this finding was beyond the scope of this study. However, these results emphasize the importance of considering both caffeine use and sleep—and, importantly, their interaction—in studies of risk for alcohol use among adolescents. Longitudinal research including possible mediators and moderators of these links would be particularly useful in understanding how these inter-related behaviors unfold and in elucidating potential points of intervention.

In addition, future research examining similarities and differences in the correlates of coffee and energy drink use, and reasons for those, would be useful in understanding how these associations unfold.

Acknowledgments

This research was supported by the National Institute on Drug Abuse (DA022456). The researchers appreciate the assistance of the school administrators, teachers, and student participants who made this project possible, and the author is grateful to the research assistants who assisted with data collection and entry for this project.

Author Disclosure Statement

No competing financial interests exist.

References

- Miyake ER, Marmorstein NR. Energy drink consumption and later alcohol use among early adolescents. *Addict Behav.* 2015;43:60–65.
- Marmorstein NR. Sleep patterns and problems among early adolescents: Associations with alcohol use. *Addict Behav.* 2017;66:13–16.
- Terry-McElrath YM, O'Malley PM, Johnston LD. Energy drinks, soft drinks, and substance use among US secondary school students. *J Addict Med.* 2014;8:6–13.
- Roehrs T, Roth T. Sleep, sleepiness, sleep disorders and alcohol use and abuse. *Sleep Med Rev.* 2001;5:287–297.
- Wong MM, Brower KJ, Fitzgerald HE, Zucker RA. Sleep problems in early childhood and early onset of alcohol and other drug use in adolescence. *Alcohol Clin Exp Res.* 2004;28:578–587.
- Johnson EO, Breslau N. Sleep problems and substance use in adolescence. *Drug Alcohol Depend.* 2001;64:1–7.
- Ludden AB, Wolfson AR. Understanding adolescent caffeine use: Connecting use patterns with expectancies, reasons, and sleep. *Health Educ Behav.* 2010;37:330–342.
- Owens JA, Mindell J, Baylor A. Effect of energy drink and caffeinated beverage consumption on sleep, mood, and performance in children and adolescents. *Nutr Rev.* 2014;72:65–71.
- Owens J; Adolescent Sleep Working Group; Committee on Adolescence. Insufficient sleep in adolescents and young adults: An update on causes and consequences. *Pediatrics* 2014;134:e921–e932.
- Dahl R. The consequences of insufficient sleep for adolescents: Links between sleep and emotional regulation. *Phi Delta Kappan.* 1999;80:354–359.
- Ford DE, Kamerow DB. Epidemiological study of sleep disturbances and psychiatric disorders. *JAMA.* 1989;262:1479–1484.
- Dishion TJ, McMahon RJ. Parental monitoring and the prevention of child and adolescent problem behavior: A conceptual and empirical formulation. *Clin Child Fam Psychol Rev.* 1998;1:61–75.
- James JE, Kristjansson AL, Sigfusdottir ID. Adolescent substance use, sleep, and academic achievement: Evidence of harm due to caffeine. *J Adolesc.* 2011;34:665–673.
- Mann MJ, Smith ML, Kristjansson AL. Energy drink consumption and substance use risk in middle school students. *Prev Med Rep.* 2016;3:279–282.
- Collins L, Graham J, Rousculp S, Hansen W. Heavy caffeine use and the beginning of the substance use onset process: An illustration of latent transition analysis. In: *The Science of Prevention.* K. Bryant, M. Windle, and S. West (Eds). Washington, DC: American Psychological Association; 1997: pp. 79–99.
- Kristjansson AL, Mann MJ, Sigfusdottir ID, James JE. Mode of daily caffeine consumption among adolescents and the practice of mixing alcohol with energy drinks: Relationships to drunkenness. *J Stud Alcohol Drugs.* 2015;76:397–405.
- Roehrs T, Yoon J, Roth T. Nocturnal and next-day effects of ethanol and basal level of sleepiness. *Human Psychopharmacol.* 1991;6:307–311.
- Tynjala J, Kannas L, Levalahti E. Perceived tiredness among adolescents and its association with sleep habits and use of psychoactive substances. *J Sleep Res.* 1997;6:189–198.
- Roane BM, Taylor DJ. Adolescent insomnia as a risk factor for early adult depression and substance abuse. *Sleep.* 2008;31:1351–1356.
- Brower KJ. Insomnia, alcoholism and relapse. *Sleep Med Rev.* 2003;7:523–539.
- Terry-McElrath YM, Maslowsky J, O'Malley PM, Schulenberg JE, Johnston LD. Sleep and substance use among US adolescents, 1991–2014. *Am J Health Behav.* 2016;40:77–91.
- Kristjansson AL, Sigfusdottir ID, Allegrante JP, James JE. Adolescent caffeine consumption, daytime sleepiness, and anger. *J Caffeine Res.* 2011;1:75–82.
- Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Res.* 1989;28:193–213.
- Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh Sleep Quality Index. *J Psychosom Res.* 1998;45:5–13.
- Arria AM, O'Brien MC. The “high” risk of energy drinks. *JAMA.* 2011;305:600–601.
- Heckman MA, Sherry K, Gonzalez de Mejia. Energy drinks: An assessment of their market size, consumer demographics, ingredient profile, functionality, and regulations in the United States. *Compr Rev Food Sci Food Saf.* 2010;9:303–317.
- Mayo Clinic. 2010. Available at www.mayoclinic.com/health/caffeine/AN01211 (accessed January 28, 2016).
- Kristjansson AL, Sigfusdottir LD, Frost SS, James JE. Adolescent caffeine consumption and self-reported violence and conduct disorder. *J Youth Adol.* 2013;42:1053–1062.
- El-Sheikh M, Kelly R J, Buckhalt JA, Benjamin Hinnant J. Children's sleep and adjustment over time: The role of socioeconomic context. *Child Dev.* 2010;81:870–883.

Address correspondence to:
Naomi R. Marmorstein, PhD
Department of Psychology
Rutgers University, Camden
311 North 5th Street
Camden, NJ 08102

E-mail: marmorst@camden.rutgers.edu