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# Binge drinking and sleep problems among young adults☆

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ABSTRACT

*Objective:* As most of the literature exploring the relationships between alcohol use and sleep problems is descriptive and with small sample sizes, the present study seeks to provide new information on the topic by employing a large, nationally representative dataset with several waves of data and a broad set of measures for binge drinking and sleep problems.
*Methods:* We use data from the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative survey of adolescents and young adults. The analysis sample consists of all Wave 4 observations without missing values for the sleep problems variables ($N$ = 14,089, 53% females). We estimate gender-specific multivariate probit models with a rich set of socioeconomic, demographic, physical, and mental health variables to control for confounding factors.
*Results:* Our results confirm that alcohol use, and specifically binge drinking, is positively and significantly associated with various types of sleep problems. The detrimental effects on sleep increase in magnitude with frequency of binge drinking, suggesting a dose–response relationship. Moreover, binge drinking is associated with sleep problems independent of psychiatric conditions.
*Conclusions:* The statistically strong association between sleep problems and binge drinking found in this study is a first step in understanding these relationships. Future research is needed to determine the causal links between alcohol misuse and sleep problems to inform appropriate clinical and policy responses.



"I'll sleep when I'm dead." – Warren Zevon

## 1. Introduction

Several studies have found significant associations between alcohol use and sleep disturbances (Roth, 2005; Vinson et al., 2010; Vitiello, 2006; Van Reen et al., 2011) as well as obstructive sleep apnea (OSA; Aldrich et al., 1993; Mamdani et al., 1989). Results of epidemiological and clinical studies show that alcohol use disorders are more prevalent in those with insomnia (Ford and Kamerow, 1989) and that individuals with alcohol abuse/dependence are more likely to suffer from sleep problems (Baekeland et al., 1974; Feuerlein, 1974; Caetano et al., 1998; Foster et al., 1998; Brower et al., 2001; Ehlers et al., 2010). These sleep disturbances can persist after months or even years of abstinence (Landolt and Gillin, 2001; Ford and Kamerow, 1989; Brower et al., 2001; Colrain et al., 2009; Landolt and Borbely, 2000; Williams and Rundell, 2008). Besides its disruptive effects on sleep, studies show that alcohol use, even in modest amounts, exacerbates snoring and sleep apnea in persons with OSA (Aldrich et al., 1993; Mamdani et al., 1989). Moreover, normal sleepers can develop snoring and OSA even after one drink (Dufour et al., 1992; Block et al., 1987).

Most studies examining the relationships between drinking and sleep problems are clinical and laboratory investigations. The analysis samples are small, and considerable heterogeneity exists in study design, sleep disturbances, and alcohol use measures. Surprisingly, we found only two studies that examine this relationship in large samples (Johnson and Breslau, 2001; Bruck and Astbury, 2012). Johnson and Breslau (2001) use data from the U.S. National Household Survey on Drug Abuse and find significant associations between sleep problems and substance use among adolescents. Adjusting for psychiatric problems reduces the magnitude of these associations, underscoring the importance of controlling for psychiatric problems. Bruck and Astbury (2012) use survey data to analyze potential predictors of 'difficulty sleeping' in a sample of

☆ Supplementary material can be found by accessing the online version of this paper. Please see Appendix A for more information.

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young women. The authors find that psychiatric disorder symptoms are the strongest predictors of sleep difficulty. A few other factors, including binge drinking, are also found to have a significant impact on sleep difficulty.

Given the scarcity of studies employing large datasets, one of the most notable contributions to the current literature is our use of the National Longitudinal Study of Adolescent Health (Add Health), a large, nationally representative data set of young adults, to examine the relationship between alcohol consumption and sleep problems. Our study makes several other contributions to the existing literature. First, we analyze a range of alcohol use patterns (any, occasional, approaching weekly, and weekly or more frequent binge drinking) to shed light on a possible dose–response relationship between alcohol use and sleep disturbances, and to identify particularly harmful patterns of use. Second, as mentioned above, several studies find that part of the associations between sleep disturbances and substance use can be attributed to psychiatric problems (Johnson and Breslau, 2001; Park et al., 2010; Bruck and Astbury, 2012). Given the comorbidity between substance use and psychiatric disorders, we include in our regressions several indicators of psychiatric problems and disorders (i.e., past year psychological or emotional counseling, depression, post-traumatic stress disorder, and panic disorder diagnoses) to further our understanding of the relationships between drinking, sleep problems, and mental health. Third, several personal characteristics, physical health conditions, and other substance use are potentially correlated with both sleep patterns and alcohol use. Ignoring these variables would lead to biased estimates of the relationships between drinking and sleep problems. The diversity of the Add Health data allows us to include a comprehensive set of confounding factors, thus avoiding the potential bias that would result from ignoring these variables or using a less comprehensive set of data. Finally, we test the robustness of our findings with several sensitivity analyses.

### 1.1. Conceptual background

The reported associations between alcohol use and sleep problems can be explained, at least in part, by the pharmacologic effects of alcohol. This effect seems to be dose-related (Stein and Friedmann, 2005). At low to moderate doses, alcohol can have a stimulating effect that might lead to problems falling asleep, usually during the first hour after its use (Stein and Friedmann, 2005; Van Reen et al., 2011). At high doses, alcohol has a sedating effect (Petrucelli et al., 1994; Roehrs et al., 1989; Zwyghuizen-Doorenbos et al., 1988; Maclean and Cairns, 1982; Roehrs and Roth, 2001). Yet, the sedative effect of alcohol wears off quickly and is followed by sleep disruptions, especially during the second half of the night (Stein and Friedmann, 2005; Vitiello, 2006; Van Reen et al., 2011; Roehrs and Roth, 2001; Landolt et al., 1996). During the first part of the sleep cycle, the body adjusts to the presence of alcohol in an effort to maintain a normal sleep pattern. Once alcohol has been eliminated from the body, however, certain physiological variables, such as REM-sleep patterns, change in the opposite direction of the body adjustments induced by alcohol. These changes result in sleep disruptions (Roehrs and Roth, 2001). Studies find that, after about a week of repeated nightly alcohol use, the sedative effect of alcohol diminishes, while its sleep disturbing effect remains (Stein and Friedmann, 2005; Roehrs and Roth, 2001; Dufour et al., 1992; Rundell et al., 1972). Some studies report that tolerance to alcohol's sedative effect can develop after only three nights (Williams and Salamy, 1972).

The association between alcohol use and sleep problems, however, might be due to more than the pharmacologic effects of alcohol. Besides causing sleep problems, the use and misuse of alcohol could also be a reaction to sleep disturbances. Alcohol is commonly perceived to aid sleep, and many individuals drink alcohol to self-treat insomnia (Vinson et al., 2010; Vitiello, 2006; Johnson et al., 1998; Kaneita et al., 2007b; Ancoli-Israel and Roth, 1999). One study found that 67% of the respondents who reported both insomnia and alcohol use as a sleep aid felt that it was effective (Costa et al., 1996). Sleep problems might be early indicators of increased risk for substance use (Shibley et al., 2008). Moreover, sleep disturbances seem to be an important cause of relapse in alcohol dependent patients (Landolt and Gillin, 2001; Le Bon et al., 2003; Mahfoud et al., 2009; Ford and Kamerow, 1989).

Finally, it is possible that a common factor influences both alcohol consumption and sleep disturbances with no direct causality between the two. Several studies show that sleep disturbances, alcohol use, and psychiatric disorders often co-exist (Johnson and Breslau, 2001; Bruck and Astbury, 2012; Merikangas et al., 1996; Roberts et al., 1999; Park et al., 2010). Psychiatric disorders could lead to increased alcohol consumption, as well as to a higher likelihood of sleep problems. The comorbidity of substance use and psychiatric disorders is well known in the literature (Jane-Llopis and Matytsina, 2009). Some of the most common symptoms of anxiety and depression are sleep problems, such as difficulty falling asleep and staying asleep (Benca et al., 1992).

The current study further investigates the associations between alcohol use and sleep problems by using a large, nationally representative dataset of young adults. Various analyses attempt to disentangle the effects of binge drinking on sleep problems while controlling for several other important variables.

## 2. Methods

### 2.1. Sample

We use data from Add Health, a nationally representative survey of adolescents in grades 7–12 at Wave 1. Four waves of Add Health data are currently available. The first wave was initiated in 1994 and was, at that time, the largest, most comprehensive school-based survey of adolescents ever undertaken in the United States. The survey randomly selected 80 high schools stratified by region, school type (e.g., public, private), demographics, size, and level of urbanization from a sample frame of 26,666 schools throughout the country. Feeder schools that sent graduates to the 80 selected high schools were also identified. The final Wave 1 sample included a total of 134 middle and high schools.

Computer-assisted self-interviews were administered to 20,746 Wave 1 respondents in 1994. Wave 2 included only those Wave 1 respondents who were still attending school in 1995–1996 (71% of the Wave 1 sample). Wave 3 was collected in 2001 and 2002 and included 15,190 respondents (all original Wave 1 respondents who could be contacted and re-interviewed) between 18 and 26 years of age. A fourth in-home interview was conducted in 2007 and 2008 with 15,701 Wave 1 respondents. At the time of the interview, the Wave 4 participants were 24- to 32-years old.

The analysis sample consists only of Wave 4 observations. Of those, we kept the observations that contained complete information for the sleep problems variables ($N = 14{,}089$). We also considered incorporating data for sleep problems using information from the other three waves. Unfortunately, the sleep patterns questions in earlier waves were different and not as detailed as those from Wave 4.

### 2.2. Variables

*2.2.1. Sleep problems.* The Add Health survey asked how often respondents had trouble falling and staying asleep in the last four weeks. The respondents could choose from the following categories: never in the past four weeks, less than once a week, one