Adolescent Sleep Deprivation and Adult Alcohol Consumption Between Sexual Minorities & Non-Sexual Minorities

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Abstract

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Adolescence is a significant time for changes in the body and mind that have lifelong impacts on health and behavior. Sexual minorities experience poorer health outcomes than their heterosexual counterparts, including increased risk of substance misuse and poorer sleep quality and duration. This analytic study used data from three waves of the National Longitudinal Study of Adolescent to Adult Health (Add Health). We sought to explore if sleep deprivation during adolescence impacted alcohol consumption in adulthood between sexual minorities and non-sexual minorities and if sexual minority adolescents experienced different sleep quality than heterosexuals.

Introduction

Adolescence is a significant time for changes in body, mind and behavior that can have lifelong impacts. Adolescent sleep deprivation can be influenced by social, educational, biologic and environmental factors that can have lifelong impacts on sleep, as well as other health problems and behaviors. The American Academy of Pediatrics and the National Sleep Foundation both recommend that adolescents receive nine or more hours of sleep each night. In 2006, The National Sleep Foundation reported that only 20% of adolescents receive the optimal amount sleep of nine hours or more on school nights, 76% of respondents received inadequate sleep (45% receiving insufficient sleep defined as less than eight hours) and 31% receiving borderline sleep (sleeping more than eight but less than nine hours). In 2014, the American Academy of Pediatrics declared adolescent sleep deprivation a public health epidemic.[1]

Sleep and Health

Short term symptoms of sleep deprivation include: impaired judgment, difficulty remembering/learning new things, increased impulsivity, difficulty concentrating, lower grades, irritability, anger, being physically tired, depression, and becoming impatient.[2] It is not only the number of hours slept, but also the quality of sleep received that have an impact on health status. Sleep deprivation among adolescents is associated with increased rates of major depressive disorder, mood disturbances and suicidal ideation which can persist into adulthood and have lifelong ramifications.[2,3,6,8] Among adults', inadequate sleep was also associated with increased risk of cardiovascular disease, hypertension and chronic obstructive pulmonary

disease.[4] The existing literature shows that insufficient sleep has both short and long-term impacts on health. Sleep problems that arise during adolescence often continue on into young adulthood where sleep problems increase the risk of chronic disease development and substance use.[5]

The correlation between sleep deprivation and substance use is bidirectional, that is individuals may use substances to sleep, and the use of substances may negatively impact both sleep quality and sleep duration.[2-4] The relationship between sleep duration/quality and substance use is complicated but, both teens and adults who receive either too much or too little sleep are at increased risk for substance use and abuse[2-6]. A 2017 study of adults found that inadequate sleep was associated with increased tobacco and alcohol consumption as well as increased the risk for several chronic health conditions.[4] Adults who received less than five hours of sleep each night reported higher consumption of alcohol and tobacco products than those who received more sleep.[4] Alcohol reduces the quality of sleep received by disrupting sleep cycles, however, individuals with sleep problems have reported using alcohol as a sleeping aid and believe it to be effective.[6] This use of alcohol to "treat" insomnia might actually be exacerbating the existing sleep problems.[6] Additionally, the impacts of inadequate sleep can lead to increased drinking in response to stress or fatigue.[6] This can lead to a cycle where individuals drink to sleep and also drink because they are not receiving enough sleep.[6]

Sexual Orientation, Sleep and Substance use

Young adult sexual minorities (gay, lesbian, bisexual, asexual) are among the most vulnerable populations in the United States for mental and physical health conditions.[13,14] A

recent study used data from the National Health Interview Survey and compared sleep quality and duration by sexual orientation among US adults. The authors found that both men and women who identify as sexual minorities had poorer sleep quality and duration than their heterosexual counterparts.[11] Similarly, a 2018 study found that sexual minority adults experience higher rates of insomnia and shorter sleep duration than non-sexual minorities.[11] The results of these studies support other nationally representative studies that show sexual minorities experience poorer sleep quality and duration than heterosexuals.[4,11,12]

On a population scale, it is widely accepted that sexual minorities consume higher volumes of alcohol than non-sexual minorities. [9,10] Additionally, they have an increased risk for excess alcohol consumption, substance use, depression, and suicide compared to their non-sexual minority counterparts.[9],[10,13,14] Gay and bisexual women have the highest prevalence of excessive alcohol use and individuals that identify as bisexual, regardless of gender, have the highest rate of substance use among all sexual minorities.[9,10] Men who identity as gay consume the second highest volume of alcohol and also the highest rate of drug use.[9] A 2013 study using wave four of the National Longitudinal Study of Adolescent to Adult Health (Add Health) found statistically significant findings that sexual minority women had between two and five times the odds of alcohol dependency or abuse compared to non-sexual minority women.[10] The study also showed that sexual minority men were at higher risk of alcohol and nicotine dependency than their non-sexual minority counterparts, but their risk was not as high as sexual minority women.[10] This study supported the existing literature that sexual minorities consume more alcohol in adulthood than non-sexual minorities and they are at increased risk of alcohol use disorder.[9,10,13,14]

Purpose

To the author's knowledge, no study has assessed the association between sexual orientation, adolescent sleep/sleep deprivation and adult alcohol use. The purpose of this research is to better understand the differences in adolescent sleep deprivation between sexual minorities and non-sexual minorities and to explore a connection between these sleep problems during adolescences to adult alcohol consumption. This study has two aims. First, we sought to explore whether adolescent sexual minorities have a different prevalence of insomnia and total sleep duration than their heterosexual counterparts. Our second goal was to determine whether there was a different relationship between adolescent sleep duration and young adult alcohol consumption between sexual minorities and non-sexual minorities.

Methods

Dataset

The data used for this research was obtained from The National Longitudinal Study of Adolescent to Adult Health (Add Health)[15]. Beginning in 1994, this nationally representative study continues to follow the initial cohort who enrolled as adolescents while in grades 7-12. The survey collects a myriad of information capturing social, environmental, behavioral and biologic data and allows researchers to track health conditions, chronic disease development, health behaviors and numerous other factors and health outcomes as the cohort progresses through the life course. In 2018, researchers began collecting information for wave five of the

Add Health dataset. For this research, we used data from waves one, two and four. All data are self-reported

Variables

Descriptive statistics including gender and race were collected from the wave one survey. Data from waves one, two and four of the in-home surveys were used to determine whether an association between adolescent sleep deprivation and adult alcohol use was different between sexual minorities and heterosexuals. Sexual orientation information was collected from the wave four survey data. Anyone who identified their sexual orientation as "mostly heterosexual" or "100% heterosexual" was categorized as a non-sexual minority. Sexual minorities were those who reported any of the following as their sexual orientation: bisexual, mostly homosexual, 100% homosexual, and asexual.

Three questions from they wave two (mean age 15.9 years) survey that addressed sleep where used as the predictive variables. The ordinal variable to establish frequency of insomnia used the question "In the past 12 months, how often have you had trouble falling sleep?" The question "Do you get enough sleep" was used to create a binary variable of the same name. And the continuous variable data used the question "How many hours of sleep do you usually get".

Two questions from wave four (mean age 28.5 years) were used as the outcome variables that addressed alcohol consumption. Our three outcomes were: do you drink three

days a week or more, how many drinks do you usually have when you drink, and estimated number of drinks per month.

We created the variable “drinking three days a week or more” by dichotomizing ordinal survey data that reported the number of days drank per month. The survey question “during the past 30 days, how many days did you drink” provided the following ordinal data: none, one day, 2-3 days, 1 day a week, 2 days a week, 3-5 days a week, everyday/almost everyday. The variable used in the analysis classified people as those who responded with 3-5 days a week or more vs. everyone else. The outcome variable “how many drinks per episode” was used as reported in the survey.

The variable “estimated number of drinks per month” was created by combining the two previously mentioned questions (number of days drank in the last month and usual number of drinks per time). The data that reported the frequency of alcohol consumption in the last month included different units (i.e. one day per month verse 3-5 days per week). For this reason, the data was converted to “drinking days per month”. We multiplied the mean number of days drank per week by the average number of weeks per month (4.33) and rounded to the nearest integer (see Figure 1). This provided an estimate of drinking days per month which we multiplied by the usual number of drinks per episode to approximate the number of alcoholic drinks per month.

Monthly drinks = Estimated monthly drinking days * usual number of drinks consumed per time

Analysis

All statistical analyses were conducted using STATA SE/15.1. Every analysis included the cohort survey weight GSWGT4_2 and used the STATA survey commands to generate results as representative as possible of the national population.[15] The descriptive statistics were calculated by linearized proportion analysis and respective p-values were generated using survey linearized logistic analysis. Age statistics were generated using linearized survey means.

A total of 12 regression models were conducted that tested the relationship between sleep and sexual minority status. We conducted regression analyses that used the three sleep predictive variables; Do you get enough sleep, frequency of insomnia and average number of hours of sleep received. We then used additional regression analysis to test whether the relationship between adolescent sleep and adult alcohol consumption was different based on sexual minority status. Logistic regression models were used for binary and ordinal outcomes (Do you get enough sleep, three or more drinking days per week and frequency of insomnia) and linear regression analyses were conducted for outcomes with continuous variables (average number of hours of sleep received, average number of drinks consumed per episode, and estimated monthly drinks). Statistical significance was defined at p value less than 0.05. We did not adjust for confounding due to limitations in the timepoints at which key constructs were captured; as such, including such variables in the models as potential confounders would run the risk of unintentionally adjusting for mediating pathways and obscuring the main effect.

Exclusion criteria

Any respondent that was not surveyed in both wave two and four, did not report sexual orientation, or answered "I don't know" to any of the varibles of interest were excluded from our analysis. After we merged the data sets and verified that all variables of interest were reported, there were a total of 5,086 survey respondants, including 214 (4.2%) who self-identified as sexual minorities.

Results

Descriptive Statistics

Table 1 displays the descriptive statistics for respondents included in the statistical analysis. The mean age of participants during wave two and four was 15.9 years (SD 0.1) and 28.5 years (SD 0.1) respectively. While 49% of the study sample were female, females were overrepresented among sexual minorities accounting for 61.5% of the population ($p<0.001$). A statistically significant difference was found with 31% of sexual minorities having a history of depression compared to 16% of non-sexual minorities (p-value <0.001). Additionally, there were significant differences in annual income between the two groups with nearly 60% of sexual minorities making less than $50k per year compared to 45% of non-sexual minorities. Significantly more individuals of Latino/Hispanic background identified as a sexual minority (16%) than non-sexual minorities (10.6%). Sexual minorities showed higher rates of ADHD, history of marijuana use and current tobacco use than non-sexual minorities, but these differences were not statistically significant.

Aim 1

Table 2 shows the sleep and alcohol consumption variables by sexual minority status. Compared to non-sexual minorities, sexual minorities showed higher prevalence of having insomnia once a week or more, lower levels of receiving enough sleep, and received less hours of sleep; however, none of these results were statistically significant. Similarly, sexual minorities had more number of days drank in the past month, higher number of drinks consumed per episode and a greater number of drinks per month than non-sexual minorities. These results were also not statistically significant, with p greater than 0.05. These results suggest that sexual minorities do not experience significantly higher prevalence of insomnia or differences in total sleep duration compared to non-sexual minorities.

Aim 2

Tables 3-5 show the results of the regression models in which we tested the relationship between adolescent sleep and alcohol consumption. No statistically significant relationships were found in the majority of our models. A significant relationship was observed in the model which tested the relationship between the frequency of insomnia during adolescence and the usual number of alcoholic beverages consumed per sitting during adulthood. This result suggests that sexual minorities without insomnia had lower alcohol consumption on average than non-sexual minorities without insomnia (Beta = -0.72, 95%CI -1.30 - -0.15). Sexual minorities who experienced insomnia every day consumed more alcoholic beverages (Beta =3.38, 95%CI 0.02 -6.79) than the referent group (non-sexual minorities without insomnia). Another significant finding was in the model that tested the relationship between the number

of hours of sleep received during adolescence and usual number of drinks per sitting, where receiving more sleep was associated with more alcohol consumption for both sexual minorities. On average, for every additional hour of sleep, drinks per sitting increased by 0.17 (95%CI 0 – 0.35) among sexual minorities and 0.10 (95%CI 0 – 0.20) for non-sexual minorities. Although these differences were statistically significant, the size of the effect is quite small when one considers the number of hours of additional sleep it would take to be associated with even 1.0 additional drinks per sitting later in young adulthood. All other models did not result in statistically significant findings.

Discussion

Sexual minorities are among the most vulnerable populations in the United States and continued efforts to further understand the mechanisms behind these health disparities are required for the successful development of targeted programs and interventions to reduce the gaps. Across the literature, sexual minorities, regardless of their age, had increased risk of chronic health conditions, consumed more alcohol and received poorer sleep than their heterosexual counterparts.[4,9-14] The results of this study support this existing knowledge that sexual minorities are at increased risk for negative health behaviors (i.e. excess alcohol consumption) and adverse health outcomes (i.e. depression) than non-sexual minorities.[4,7,9,13,14] We also found that females were over represented among sexual minorities, which other studies have also reported.[10]

The primary aim of whether sexual minorities have a higher prevalence of insomnia and differences in sleep duration than nonsexual minorities was explained in Table 2. The results of

our analysis do not suggest a statistically significant difference on sleep deprivation between sexual minority groups, which does not support the published literature on both adults and adolescents.[9] The second aim that explored the influence of adolescent sleep on adult alcohol consumption by sexual minority status are displayed in Tables 3-5. Our results from suggest that sexual minorities who never experienced insomnia during adolescence consume less alcohol as adults on average than non-sexual minorities who never had insomnia. The results also suggest that sexual minority adolescents who experience insomnia every night are at increased risk of consuming more alcohol per sitting, although the 95% CI includes zero. Based on these results, there may be a difference in adult alcohol consumption between sexual minorities and non-sexual minorities influenced by sleep deprivation during adolescence.

The results of this study suggest that the relationship between adolescent sleep and adult alcohol consumption might be different based on sexual orientation. These results support existing literature that sexual minorities consume more alcohol than non-sexual minorities. The results also support the existing literature that sexual minorities receive lower levels of quality sleep and shorter sleep duration than heterosexuals, although these results were not significant.

While the results study did not suggest a significant difference in adult alcohol consumption associated with adolescent sleep deprivation based on sexual minority status, this doesn't exclude the possibility of a relationship. While many factors are associated with adolescent sleep and adult alcohol consumption, these data are consistent with pervious findings and current knowledge that sexual minorities experience higher rates of depression,

attention deficient hyperactive disorder, marijuana usage, tobacco use and alcohol consumption than non-sexual minorities. Sexual minorities also received less sleep that non-sexual minorities. All of the aforementioned factors are associated with increased alcohol consumption.

Strengths and Limitations

A strength of this study is the use of a large nationally representative survey that provided longitudinal data that allowed for comparison over the life course. This study has several limitations that must be considered. Confounding was not adjusted in the analysis because temporality of potential confounders (i.e. depression) could not be established. All of the survey data was self-reported and subject to several types of bias. Recall bias is likely in the survey questions regarding alcohol consumption and insomnia frequency. Additionally, it is widely accepted that self-reporting of alcohol consumption is subject to reporting bias. The alcohol variables were reported as averages which do not typically capture binge drinking behavior, which possibly introduced information bias. Sexual orientation and attraction are still considered by some to be very personal and stigma around identifying as a sexual minority remains a common phenomenon which increases the likelihood this survey was subjected to reporting bias of sexual orientation. In this sample, greater than 61% of individuals who identified as sexual minorities were women. The low sample size for sexual minorities likely decreases the statistical power and as a result sub analysis on specific sexual orientations could not be performed due to the small cell size.

Additional research into the differences between health behaviors and health outcomes by sexual orientation is required to better understand the health disparities of sexual minorities. Future bodies of work should include not only alcohol consumption as the outcome, but also marijuana, opiate and illicit substance use. The inclusion of adult sleep deprivation/sleep quality in the analysis may also prove beneficial in the understanding of the relationship between adolescent sleep and adult substance use. When possible, qualitative interviews should be conducted to provided additional insight and context for the data obtained through quantitative measures.

Tables and Figures

Figure 1.

Survey Data: Days drank in last month	Estimated drinking days per month
None=0	0 days per month
One day = 1	1 day per month
2 or 3 days = 2.5	3 days per month
One day per week = 1*4.33	4 days per month
2 days per week = 2*4.44 = 8.67	9 days per month
3-5 days per week = 4*4.33 = 17.32	17 days per month
Everyday/Almost every day = 6.5* 4.33 = 28.15	28 days per month

Table 1: Descriptive Statistics

Demographics	**All participants**	**Sexual Minority**	**Non sexual minority**	**P-Value**
Female	49%	61.5%	49%	<0.001**
Age (mean and SD)				
Wave 2	15.9 (0.1)	15.7 (0.19)	15.9 (0.1)	0.13
Wave 4	28.5 (0.1)	28.2 (0.18)	28.5 (0.1)	0.02
Highest education				0.59
Less than HS	9%	14.2%	8.5%	
High School	17.7%	18.8%	17.4%	
Some college	42.8%	42%	43%	
College or more	30.5%	24.8%	30.8%	
Veteran	7%	4%	7.2%	0.32
History of depression	16.4%	31%	16%	<0.001**
Annual income				< 0.001**
Less than $29k	23.2%	34.8%	22.7%	
$30-$49K	22.8%	24%	22.7%	
$50-$74K	24.1%	20%	24.3%	
>$75k	29.9%	21.2%	30.3%	
Race *				
White	75%	69.5%	75.3%	0.84
Black	16.5%	21.3%	16.2%	0.81
Latino/Hispanic	10.9%	16%	10.6%	0.04
Asian	3%	1.7%	3%	0.37
AN/AI	3.6%	4.3%	3.5%	0.51
Current smoker	70.5%	77.4%	70.2%	0.83
Ever used Marijuana	56.4%	61.4%	56.3%	0.86
ADHD	6.2%	8.2%	6.1%	0.32

*Categories are not exclusive

**Statistically significant p<0.001

Table 2. Insomnia and Alcohol consumption – Regression analysis

	All participants	**Sexual Minority**	**Non-sexual minority**	**P-Value**
Insomnia*				0.15
Never (referent)	35%	35%	35%	
A few times	41%	32%	41%	
Once a week	16%	22%	16%	
Almost every day	6%	8%	6%	
Every day	1%	3%	1%	
Gets enough sleep **	71%	66%	71%	0.32
Hours Slept*	7.6 (0.04)	7.5 (0.13)	7.6 (0.04)	0.50
Days drank in last month*	4.9 (4.7 – 5.2)	5.7 (4.3 – 7.2)	4.9 (4.7 – 5.2)	0.58
None	17.5%	12%	17.5%	
One day	17.5%	20%	17.5%	
2 or 3 days	25%	25%	25%	
Once a week	10%	10%	10%	
2 days per week	16%	17%	16%	
3-5 days per week	11%	10%	11%	
Daily/almost daily	3%	6%	3%	
Number of drinks each time*	3.7 (3.6 – 3.9)	4.3 (3.4 – 5.1)	3.7 (3.6 – 3.9)	0.16
Drinks per month*	28.0	35.8	27.7	0.22

*Linear regression

**Logistic regression

p-values generated via chi-squared test

Table 3: Drinking 3 days a week or more – Logistic regression

Insomnia Model 1	OR	95% CI	P value
NON-SEXUAL MINORITY			
Never	(REF)	(REF)	(REF)
A few times	0.94	0.72 – 1.24	0.70
Once a week	1.14	0.81 – 1.61	0.42
Almost every day	0.78	0.44 – 1.36	0.38
Everyday	1.30	0.47 – 3.55	0.60
SEXUAL MINORITY			
Never	1.11	0.24 - 5.11	0.89
A few times	1.94	0.91 - 4.16	0.08
Once a week	0.38	0.09 - 1.67	0.19
Almost every day	0.47	0.07 - 3.21	0.40
Everyday	0.20	0.02 - 2.12	0.18
Getting enough sleep Model 2	OR	95% CI	P value
NON-SEXUAL MINORITY			
Yes	(REF)	(REF)	(REF)
No	1.23	0.94 – 1.62	0.13
SEXUAL MINORITY			
Yes	1.19	0.50 – 2.85	0.70
No	1.23	0.60 – 2.50	0.57
Hours of Sleep Model 3	Beta	95% CI	P value
NON-SEXUAL MINORITY	0.97	0.89 – 1.06	0.52
SEXUAL MINORITY	0.98	0.88 – 1.09	0.65

*No statistically significant findings in models 1-3

Table 4: Usual number of drinks per episode of drinking – Linear regression

Insomnia Model 4	Beta	95% CI	P value
NON-SEXUAL MINORITY			
Never	(REF)	(REF)	(REF)
A few times	-0.25	-0.58 – 0.07	0.13
Once a week	-0.19	-0.64 - 0.25	0.40
Almost every day	0.01	-0.58 - 0.60	0.97
Everyday	0.62	-0.93 - 2.18	0.43
SEXUAL MINORITY			
Never	-0.72	-1.30 - -0.15	0.01**
A few times	0.61	-1.25 - 2.47	0.51
Once a week	0.04	-1.13 – 1.21	0.94
Almost every day	2.27	-2.06 – 6.60	0.30
Everyday	3.38	0.02 - 6.79	0.05*
Getting enough sleep Model 5	Beta	95% CI	P value
NON-SEXUAL MINORITY			
Yes	(REF)	(REF)	(REF)
No	-0.24	-0.56 – 0.08	0.14
SEXUAL MINORITY			
Yes	0.07	-0.80 – 0.95	0.87
No	1.13	-0.71 – 2.99	0.23
Hours of Sleep Model 6	Beta	95% CI	P value
NON-SEXUAL MINORITY	0.10	0 – 0.20	0.04**
SEXUAL MINORITY	0.17	0 – 0.35	0.05**

Models 4 and 6 display statistically significant findings

**Statistically significant $p<0.05$

Table 5. Number of drinks per month – Linear regression

Insomnia Model 7	Beta	95% CI	P value
NON-SEXUAL MINORITY			
Never	(REF)	(REF)	(REF)
A few times	-3.65	-8.39 – 1.08	0.12
Once a week	-3.61	-9.34 – 2.11	0.21
Almost every day	3.10	-8.46 – 14.67	0.59
Everyday	10.77	-21.02 – 42.57	0.50
SEXUAL MINOIRY			
Never	-2.84	-21.59 – 15.90	0.76
A few times	19.32	-17.84 – 56.49	0.30
Once a week	-6.68	-16.81 – 3.43	0.19
Almost every day	28.76	-35.74 – 53.28	0.69
Everyday	2.70	-17.31 – 22.72	0.79
Getting enough sleep Model 8	Beta	95% CI	P value
NON-SEXUAL MINORITY			
Yes	(REF)	(REF)	(REF)
No	-0.70	-5.40 – 3.95	0.77
SEXUAL MINORITY			
Yes	8.83	-13.30 – 30.91	0.43
No	5.97	-14.20 – 26.13	0.60
Hours of Sleep Model 9	Beta	95% CI	P value
NON SEXUAL MINORITY	1.35	-0.45 – 3.15	0.14
SEXUAL MINORITY	2.41	-0.48 – 5.31	0.10

No statistically significant findings in models 7-9

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