

# Substance and Hookah Use and Living Arrangement Among Fraternity and Sorority Members at US Colleges and Universities

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**Abstract** Hookah tobacco smoking is associated with substantial toxicant exposures and is increasing among college students in the United States. Greek (fraternity/sorority) students, especially those living in Greek housing, have high rates of risky alcohol use. The extent to which this is true for other substances, including hookah tobacco smoking, is not well known. The objective of this study is to examine associations between Greek involvement and living arrangement (non-member, non-resident member, resident member) and rates of hookah tobacco smoking, in relation to other substances, among US college students. We used national data from 82,251 student responses from the 2008 to 2009 administration of the National College Health Assessment. Generalized estimating equations were utilized to determine adjusted odds ratios for substance use outcomes based on involvement and living arrangements, while adjusting for covariates and clustering of students within institutions. Among resident members, ever use was highest for marijuana (52.4 %), hookah (48.5 %) and cigarettes (46.6 %). In multivariable models, adjusted odds were lowest for non-Greeks and highest for Greek resident members. Compared to non-Greeks, Greek resident members had nearly double the odds for current use of hookah, cigars, and marijuana, as well as two and a half times the

odds for current use of smokeless tobacco and three times the odds for alcohol bingeing. Similar to other substances, hookah tobacco smoking is highest among Greek resident members, compared with both Greeks living outside Greek housing and non-Greeks. It is valuable for substance use surveillance and intervention to focus on Greek resident members.

**Keywords** Tobacco · Substance abuse · College · Hookah · Greek-letter

## Introduction

Substance abuse among college students has long been a concern for college health professionals. This is especially true for students who are members of fraternities and sororities in US colleges, which are typically defined as undergraduate fraternal social organizations. Research shows that members of fraternities and sororities have riskier substance use-related health behaviors than their non-member college student peers [1]. For example, not only do they have higher rates of risky alcohol use [2–6], they also have higher rates of tobacco use [7–9], marijuana use [1, 8], and exposure to environmental tobacco smoke (ETS) [10]. Compared to non-member peers, members of fraternities and sororities (also called Greek-letter organizations, or Greeks) have higher rates of substance abuse and risk factors for substance abuse before even entering college [8, 11–13], although these rates tend to decrease upon either disaffiliation from the organization or graduation [13–15]. Recent studies suggest that the singular act of joining a fraternity or sorority raises the risk of substance abuse, and that the type of involvement (i.e. leader vs.

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member) does not affect substance abuse rates among this population [16, 17].

In addition, being a resident member (i.e. living in a fraternity or sorority house) is in itself a risk factor for higher rates of substance abuse. A number of studies have shown that living in Greek housing is correlated with higher rates of risky alcohol use [18–23]. However, although there is some evidence that resident members have higher rates of marijuana use [24, 25] and cigarette smoking [25, 26] compared to other college students, the literature on these substances and others (i.e. smokeless tobacco, cigar smoking, hookah tobacco use) is relatively sparse or non-existent.

Rates of smoking tobacco from a hookah (also known as a waterpipe) are currently on the rise in the college student population, rivaling the use of cigarettes [27–30]. College hookah users are more likely to be younger, white, male, and members of fraternities or sororities [31, 32]. Of particular concern is that hookah smoking is generally perceived by these students to be safer and more socially acceptable than cigarettes [28–30, 33–35], while in reality hookah smoking can expose users to higher volumes of smoke, higher levels of tar, and higher levels of carbon monoxide [36–38]. It is interesting to note that while cigarette tobacco smoking is on a decline, it is still viewed by college students as socially acceptable when in the context of drinking or partying [7, 39, 40]. Likewise, college students have reported that they smoke hookah more on the weekends and that the top two motivating factors for using hookah were to socialize/party and peer influence [27, 41]. Thus, hookah smoking is presenting itself as a “party” or “hangout” activity in the college population.

Although the topic of hookah tobacco smoking among college students is becoming more popular in the public health and medical literature, a number of questions regarding specific high-risk populations remain. First, although hookah use rates in fraternity and sorority members have been reported in studies examining the college population as a whole, they have not been studied independently. Considering the high use rates for other substances and the evidence that being part of a fraternity or sorority increases the odds of smoking hookah, this population deserves its own examination. Additionally, it is not well known whether rates of hookah use differ by living arrangement among Greek members. Thus, we sought to examine associations between level of Greek involvement (non-member, non-resident member, resident member) and hookah use.

Second, it is not well known how the rates of hookah use compare with those of other substances (alcohol, marijuana, cigarettes, smokeless tobacco and cigars) among Greek (both resident and non-resident) members. For example, living in Greek housing may carry more risk for

alcohol use than for smoking tobacco or marijuana. However, hookah use is known to attract a cohort of individuals who consider themselves non-smokers [28, 42], so it is not clear to what extent fraternity and sorority housing may be associated with hookah use. Knowing which particular substances are more strongly associated with Greek housing may help focus interventions.

## Methods

### Participants and Procedures

The National College Health Assessment (NCHA), conducted by the American College Health Association (ACHA), is a large-scale survey of college student health behaviors and beliefs. The NCHA is administered by approximately 150 institutions annually and is completed by approximately 100,000 students. Institutions that choose to participate in the NCHA have the choice to use a paper-based classroom survey or a web-based e-mail survey [43]. Although the average response rates for the paper-based survey differ from the average response rates for the web-based e-mail survey (63–93 % and 19–23 %, respectively, during the time periods of Spring 2008 through Fall 2010) [44, 45], a comparison of the two types of surveys determined that differences in results between the two are negligible [44]. In order to increase response rates, many institutions choose to offer small monetary incentives and have the option to send reminder e-mails for the web-based e-mail survey [43, 44].

In 2008, the NCHA became the first large-scale health survey of college students to include items about hookah smoking. For this study, we conducted a secondary data analysis that examined data from the fall 2008/spring 2009 administrations of the NCHA, the first full academic year in which hookah smoking items were included. While institutions participating in the NCHA are independently responsible for gaining human subjects approval from their respective institutional review boards to collect data, we obtained human subjects approval for an exempt study from the University of Pittsburgh Institutional Review Board in order to analyze the data for this particular study.

### Measures

#### *Demographic Information*

Participants that completed the NCHA were asked to complete twenty demographic questions. The demographic questions used for our analyses included: age, sex, race/ethnicity, year in school, current living situation, and

membership in a Greek-letter organization (identified as a social fraternity or sorority). We categorized individuals as “resident members” if they answered that they were (1) a member of a social fraternity or sorority and (2) identified “fraternity or sorority house” as where they currently lived. We categorized individuals as “non-resident members” if they answered that they were (1) a member of a social fraternity or sorority and (2) lived anywhere other than a fraternity or sorority house. All others were considered “non-members.”

### *Measures of Smoking Behavior*

Tobacco and marijuana use behaviors (including “tobacco from a waterpipe (hookah)”, “marijuana (pot, weed, hashish, hash oil)”, “cigars, little cigarettes, clove cigarettes”, “cigarettes” and “smokeless tobacco”) were measured by items that asked subjects how often they used a particular substance within the past 30 days. The response categories were: (a) never used; (b) used, but not in the last 30 days; (c) 1–2 days; (d) 3–5 days; (e) 6–9 days; (f) 10–19 days; (g) 20–29 days; and (h) used daily [43]. For our analysis, we considered “ever use” to be a response of (b) through (h). We considered “current use”, or at least one day over the past month, to be a response of (c) “1 time” through (h). This is considered to be a gold standard of the measurement of substance use behavior in this population [46].

### *Measure of Alcohol Use*

We decided to measure alcohol use as “alcohol bingeing,” which has been shown to be more clinically relevant than “current” or “ever” use of alcohol in young adults [47–49]. This was measured by an item that asked subjects how many times they had consumed five or more alcoholic drinks in a sitting over the past two weeks, with response categories ranging from (a) “N/A, don’t drink” and (b) “None” through (l) “10 or more times”. For our analysis, we considered “alcohol bingeing” to be a response of (c) “1 time” through (l).

### *Data Analysis*

Analyses were performed using Stata 11.1. Descriptive statistics, such as frequencies and percentages, were calculated to determine ever and current use of hookah, cigarettes, cigars, smokeless tobacco and marijuana as well as alcohol bingeing and to compare these percentages based on fraternity/sorority membership and living situation. As described above, students were categorized into one of three levels of fraternity/sorority membership: “non-members”, “non-resident members” (i.e. a member not living in Greek

housing) and “resident members” (i.e. a member living in Greek housing). Non-members were used as a reference group for the analyses. Generalized estimating equations were utilized to determine adjusted odds ratios for substance use outcomes based on Greek-letter status and living arrangements, while adjusting for clustering of students within institutions and all measured covariates.

## **Results**

### *Demographic Information*

A total of 107,921 students from 152 U.S. institutions completed surveys during the study period. Completion rates were 78 % for paper-based and 21 % for Web-based surveys. In our study, respondents were excluded if over the age of 25 ( $N = 17,357$ ), self-identified as transgender ( $N = 166$ ), not undergraduate ( $N = 16,164$ ), and with missing data on study outcomes ( $N = 2,891$ ). We excluded non-undergraduates because the Greek-letter organizations in which we were most interested served undergraduates. We also excluded the transgender variable because of its extremely small size (0.2 %), which could lead to model instability if included in our analyses. These exclusions yielded a study sample of 82,251 students.

The majority of the respondents (89.9 %) indicated that they were not members of a Greek-letter organization, while 8.8 % reported being non-resident members and 1.5 % reported being resident members. In addition, the majority of respondents were female (66.1 %), aged 20 or under (63.7 %), White, non-Hispanic (72.9 %), and full-time students (96.8 %). Class year was somewhat evenly divided, although slightly more 1st year undergraduates (30.5 %) were represented in the sample (Table 1).

### *Prevalence of Substance Use*

For all substances, the percentage of students reporting ever use and current use of each substance was higher among non-resident members compared to non-members and then further increased for resident members (Table 2). Among resident members, ever use was highest for marijuana (52.4 %), followed by hookah (48.5 %) and then cigarettes (46.6 %). Patterns were similar for non-resident members and non-members as well. Current use among resident members was highest for binge alcohol use (70.4 %), followed by marijuana (25.6 %), cigarettes (24.6 %), and then hookah (16.6 %). Again, patterns were similar among non-resident members and non-members, although overall percentages were lower.

**Table 1** Demographic information

	n (%)
<i>Personal characteristic</i>	
Age	
18	15,273 (18.6)
19	19,287 (23.4)
20	17,844 (21.7)
21	15,900 (19.3)
22–25	13,947 (17.0)
Sex	
Female	54,165 (66.1)
Male	27,748 (33.9)
Sexual orientation	
Straight/unsure	77,786 (95.2)
Gay/lesbian	1,597 (2.0)
Bisexual	2,294 (2.8)
Year in school	
1st year undergraduate	24,902 (30.5)
2nd year undergraduate	19,014 (23.3)
3rd year undergraduate	18,854 (23.1)
4th year undergraduate	15,072 (18.4)
5th year or more undergraduate	3,857 (4.7)
Race/ethnicity	
White, non-hispanic	59,958 (72.9)
Black, non-hispanic	3,981 (4.8)
Hispanic	5,088 (6.2)
Asian	7,013 (8.5)
Other	6,205 (7.5)
Full-time student	
No	2,609 (3.2)
Yes	79,283 (96.8)
International student	
No	76,253 (93.3)
Yes	5,469 (6.7)
Relationship/marital status	
Single/not in a relationship	43,071 (53.3)
In a relationship, not cohabitating	31,733 (39.3)
In a relationship and cohabitating	4,335 (5.4)
Married/partnered and cohabitating	1,599 (1.2)
Residence	
Campus residence hall	40,100 (48.8)
Fraternity/sorority house	1,227 (1.5)
Parent/guardian's home	9,179 (11.2)
Off-campus	31,580 (38.5)
Members of fraternity/sorority	
No	73,923 (89.9)
Yes	8,328 (10.1)
Grades	
A	28,236 (34.5)

**Table 1** continued

	n (%)
B	41,293 (50.4)
C and below	12,334 (15.1)
<i>Environmental characteristic</i>	
Region	
Midwest	23,717 (28.8)
Northeast	20,829 (25.3)
South	21,174 (25.7)
West	16,531 (20.1)
Locale population	
<10,000	15,317 (18.6)
10,000–49,999	4,309 (5.2)
50,000–249,999	37,484 (45.6)
250,000–499,999	16,289 (19.8)
≥500,000	8,852 (10.8)
Institution type	
Private	31,593 (38.4)
Public	50,658 (61.6)
Religious affiliation	
No	67,162 (81.6)
Yes	15,089 (18.4)
Two-year institution	
No	78,246 (95.1)
Yes	4,005 (4.9)
Student population	
<2,500	9,327 (11.3)
2,500–4,999	8,699 (10.6)
5,000–9,999	18,560 (22.6)
10,000–19,999	19,660 (23.9)
≥20,000	26,005 (31.6)

### Multivariable Models

Generalized estimating equations, with resulting adjusted odds ratios, were utilized in order to explore associations between Greek-letter status and living arrangements while adjusting for covariates and clustering of students within institutions (Table 3). For all substances, the adjusted odds ratios (AOR) for both ever and current use were greater in both non-resident members and in resident members compared to non-members. Adjusted odds for ever use among resident members, compared with non-members, ranged from 1.67 to 2.05, while adjusted odds for ever use among non-resident members, also compared with non-members, ranged from 1.32 to 1.53. In general, there was little variation in these numbers between substances. With regard to current use, however, alcohol bingeing had the strongest association with living arrangement, with adjusted odds of 3.35 (95 % CI = 2.91, 3.85) and 2.11 (95 %

**Table 2** Prevalence of substance use

Substance	All participants n = 82,251* (%)	Fraternity/sorority membership and residence			P
		Non-member n = 73,923 (89.9 %) (%)	Non-resident member n = 7,242 (8.8 %) (%)	Resident member n = 1,086 (1.3 %) (%)	
<b>Ever use</b>					
Hookah	26,801 (32.7)	31.7	40.8	48.5	<.001
Cigarette	27,512 (33.6)	32.7	40.1	46.6	<.001
Cigar	24,136 (29.5)	28.8	34.2	42.9	<.001
Smokeless tobacco	8,943 (11.0)	10.5	14.5	22.1	<.001
Marijuana	29,055 (35.5)	34.5	43.5	52.4	<.001
<b>Current use</b>					
Hookah	8,123 (9.9)	9.5	13.0	16.6	<.001
Cigarette	13,882 (16.9)	16.5	20.2	24.6	<.001
Cigar	7,000 (8.6)	8.3	10.7	15.1	<.001
Smokeless tobacco	3,186 (3.9)	3.7	5.5	10.4	<.001
Marijuana	13,698 (16.7)	16.2	20.7	25.6	<.001
Binge Alcohol	31,539 (38.5)	36.3	55.4	70.4	<.001

\*Total does not include: transgender, age>25, institutions outside U.S., and non-undergraduates

CI = 2.00, 2.33) for resident members and non-resident members, respectively, compared with non-members. After binge alcohol, the strongest associations between living arrangement and substance use were noted for smokeless tobacco, followed by hookah, cigars, marijuana, and then cigarettes. Compared to non-Greeks, Greek resident members had nearly double the odds for current use of hookah, cigars, and marijuana, as well as two and a half times the odds for current use of smokeless tobacco.

## Discussion

Our analysis of data from the 2008 to 2009 National College Health Assessment suggests that use of all substances is highest among Greek-letter organization members living in Greek housing, followed by members who are not living in Greek housing, followed by non-members. Additionally, this analysis found that ever use of substances was generally highest for marijuana, hookah, and then cigarettes, while current use of substances was highest for alcohol bingeing, marijuana, cigarettes, and then hookah.

Although it is considered to be merely an emerging trend within the college population, a greater percentage of Greek students reported ever use of hookah than cigarettes, cigars, and smokeless tobacco. This result is interesting, considering the popularity of this substance has only been apparent recently, while the other substances have been popular for decades. It may be that, while the negative health effects of cigars, smokeless tobacco and cigarettes have become well-known, negative health effects of

hookah smoking are less apparent. College students tend to perceive hookah smoking to be less harmful and less addictive than cigarettes [28–30]. This could lead students who would normally avoid traditional tobacco products on a path to addiction. It will be important for future studies to assess whether initial experimentation with hookah predicts progression to more frequent use of tobacco products.

It is also possible that lenient health policies may be contributing to increases in hookah use [50, 51]. For example, clean air laws provide specific exemptions for tobacco retail establishments [52], a category under which many hookah-smoking establishments fall. Similarly, while the recently enacted Family Smoking Prevention and Tobacco Control Act bans flavoring of cigarettes, it does not ban flavoring of hookah tobacco.

Although ever use of hookah was often higher than ever use of cigarettes, current use was higher for cigarettes. Although this may suggest that hookah tobacco smoking is less addictive than cigarettes, the ratio of ever use to current use was similar to hookah for cigars and smokeless tobacco, both of which are known to be addictive. Also, because one hookah session can involve inhalation of 100 times the smoke volume of a single cigarette, even infrequent hookah users may be exposed to a greater amount of toxicants than cigarette smokers [53].

An important implication of these findings is that it would be particularly valuable to develop substance use prevention or policy interventions tailored for Greek students and/or actually delivered in Greek-letter organization housing, especially for hookah use. The riskiest time for hookah initiation is during the first 2 months of a student's

**Table 3** Multivariable odds of substance abuse based on Greek membership and residence

Substance/behavior by fraternity/sorority membership and residence	Ever use		Current use	
	OR (95 % CI)	AOR <sup>a</sup> (95 % CI)	OR (95 % CI)	AOR <sup>a</sup> (95 % CI)
<b>Hookah</b>				
Non-member	1 [reference]	1 [reference]	1 [reference]	1 [reference]
Non-resident member	1.49 (1.41–1.56)	1.51 (1.44–1.60)	1.43 (1.32–1.53)	1.53 (1.42–1.65)
Resident member	2.05 (1.81–2.31)	1.87 (1.65–2.12)	1.90 (1.62–2.24)	1.94 (1.64–2.30)
<b>Cigarette</b>				
Non-member	1 [reference]	1 [reference]	1 [reference]	1 [reference]
Non-resident member	1.38 (1.31–1.45)	1.42 (1.35–1.50)	1.28 (1.20–1.36)	1.33 (1.25–1.42)
Resident member	1.81 (1.60–2.04)	1.69 (1.49–1.91)	1.66 (1.44–1.91)	1.60 (1.38–1.85)
<b>Cigar</b>				
Non-member	1 [reference]	1 [reference]	1 [reference]	1 [reference]
Non-resident member	1.29 (1.22–1.36)	1.32 (1.25–1.40)	1.33 (1.23–1.44)	1.43 (1.31–1.55)
Resident member	1.87 (1.66–2.12)	1.67 (1.47–1.90)	1.98 (1.68–2.35)	1.92 (1.60–2.29)
<b>Smokeless tobacco</b>				
Non-member	1 [reference]	1 [reference]	1 [reference]	1 [reference]
Non-resident member	1.45 (1.36–1.56)	1.47 (1.37–1.59)	1.55 (1.39–1.72)	1.56 (1.39–1.75)
Resident member	2.43 (2.10–2.82)	2.05 (1.75–2.41)	3.08 (2.52–3.76)	2.49 (2.00–3.10)
<b>Marijuana</b>				
Non-member	1 [reference]	1 [reference]	1 [reference]	1 [reference]
Non-resident member	1.46 (1.39–1.53)	1.53 (1.45–1.61)	1.34 (1.26–1.43)	1.46 (1.37–1.56)
Resident member	2.11 (1.87–2.38)	1.94 (1.71–2.20)	1.79 (1.56–2.05)	1.68 (1.45–1.95)
<b>Binge alcohol</b>				
Non-member	N/A	N/A	1 [reference]	1 [reference]
Non-resident member	N/A	N/A	2.17 (2.07–2.28)	2.11 (2.00–2.23)
Resident member	N/A	N/A	4.21 (3.69–4.81)	3.35 (2.91–3.85)

<sup>a</sup> Adjusted for sex, age, race, and clustering within institutions

first year on campus [54]. Although there are many possible factors contributing to this, one may be that this can also be a common time period during which students rush fraternities or sororities. A systematic search of Web sites related to hookah revealed some messages specifically aimed at Greek members [55]. Anecdotally, a hookah can be inexpensively purchased or rented from local hookah cafes for a special fraternity recruitment rate. These types of events can be enticing for students organizing recruitment, especially when alcohol is banned by the national chapter or the University. Considering smoking rates are lower in smoke-free housing [56], a ban on hookah smoking within Greek housing may have an impact on smoking rates. Additionally, educational hookah prevention programs, particularly within the Greek system, may help to curtail the rates of hookah smoking initiation and progression. Because the topic of hookah smoking is relatively new to the literature, there is scant data on effective prevention and intervention efforts. A pilot study of college hookah users found that a Web-based intervention focused on changing perceptions towards hookah may have some effect on decreasing hookah use [57]. However, this topic

needs more attention in the literature and strategies to prevent hookah initiation are still unstudied.

#### Limitations

Because the data used in this study were from a cross-sectional national survey, no cause-and-effect relationship can be determined. Thus, we cannot infer whether being a member of a fraternity or sorority causes a student to become a hookah smoker, or vice versa. Second, the results from this study are not necessarily generalizable to all Greek undergraduates, because institutions self-select to participate in the National College Health Assessment. However, because the ACHA sample has a high proportion of female students, who are generally less likely to be tobacco users, our overall estimates for substance use are likely to be conservative. Although the response rate for the Web-based form of the survey was only about 1 in 5, this is a standard response rate for e-mail surveys [58–60]. Additionally, prior studies have shown that ACHA data tend to match nationally representative data [61], and our Web-based results were similar to those of paper results, which had nearly 80 % response rates.

## Conclusions

This study demonstrates the rising popularity of hookah tobacco smoking among all college students, but particularly Greek students. This study also provides valuable insight into the strong, independent associations between living arrangement and substance use, including hookah, which progressively increases from non-Greek students to Greek students living in Greek housing. These findings suggest that it may be valuable for intervention efforts to focus on these populations.

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