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Associations of mental health problems with waterpipe tobacco and cigarette smoking among college students

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Abstract

Associations between the emerging trend of waterpipe tobacco smoking and mental health among college students have not been sufficiently explored. This study analyzed data collected from 152 academic institutions that participated in the National College Health Assessment during the 2008–2009 academic year to examine associations between mental health and waterpipe tobacco smoking among college students (N=100,891). For comparison, cigarette smoking was also examined. Associations with mental health variables were very strong for cigarette smoking but only moderate for waterpipe smoking. Study implications and limitations are noted. Funding was provided by NCI Grant [removed for blind version].

Keywords

Cigarette smoking; College students; Tobacco use; Waterpipe smoking

INTRODUCTION

Smoking tobacco is a leading cause of morbidity and mortality in the United States (Mokdad, Marks, Stroup, & Gerberding, 2004). Despite this, one-third of college students have ever smoked cigarettes, and one-sixth are current users (Johnston, O'Malley, Bachman, & Schulenberg, 2011). It is now established that college students are increasingly using waterpipes instead of cigarettes to smoke tobacco. Nationally, college students' use of a waterpipe ever ("ever use") is now nearly as high as the use of cigarettes ever (30.5% vs. 34.1%) (Primack et al., 2012), and in some institutions waterpipe smoking is more prevalent than cigarette smoking (Primack et al., 2008). Cigarette use and waterpipe use are perceived differently. For example, waterpipe use is often perceived as less harmful because of the sweet smell of its flavored tobacco, the erroneous belief that the water somehow filters out

DECLARATION OF INTERESTS

The authors have no conflicts of interest to report.

toxins, and the recognition that it is not subject to the same public health policies as cigarette use (Martinasek, McDermott, & Martini, 2011; Maziak, Ward, Afifi Soweid, & Eissenberg, 2004; Nakkash, Khalil, & Affifi, 2011; Primack, Fertman, Rice, Adachi-Mejia, & Fine, 2010).

The college years are also known to be turbulent ones emotionally for students, who frequently report problems such as depression, anxiety, poor sleep, and high levels of perceived stress (Bhave & Nagpal, 2005). According to a recent National Institute of Mental Health report, as many as 30% of college students report that they have been too depressed to function over the past year (National Institute of Mental Health, 2010). Associations between cigarette smoking and poor emotional health in adolescent and adult populations are well-established (Hughes, Hatsukami, Mitchell, & Dahlgren, 1986; Lasser et al., 2000). Studies have demonstrated that cigarette smokers have lower self-reported mental function than nonsmokers (Woolf, Rothemich, Johnson, & Marsland, 1999) and exhibit higher levels of anxiety or depressive symptoms and a higher incidence of depression (Anda et al., 1990; Fergusson, Goodwin, & Horwood, 2003; Glassman et al., 1990; Johnson, Rhee, Chase, & Breslau, 2004; Levine, Marcus, & Perkins, 2003; Martini, Wagner, & Anthony, 2002; Murphy et al., 2003; Shiesha, 1999).

However, the association between waterpipe tobacco smoking and mental health problems is unclear. Waterpipe smoking might at present be only weakly associated with mental health problems, as was the case with cigarette smoking in the United States prior to the 1970s. During the 1970s and 1980s, as the public became more aware of the harmful effects of cigarettes, their use became less prevalent in the healthy population, and people with mental health disorders began to represent a greater proportion of cigarette smokers (Murphy et al., 2003). However, by the early 1990s, the incidence of cigarette smoking in individuals with a mental health disorder was 2.7 times that of individuals without a mental health disorder (Lasser et al., 2000) and thus, because waterpipe tobacco smoking may be already more common among those with mental health problems.

Therefore, the purpose of our study was to assess associations between common mental health problems and the use of waterpipe tobacco among college students. We also aimed to assess these associations for cigarettes, for comparison with waterpipe smoking and for confirmation of prior findings. The a priori hypothesis of our study was that waterpipe tobacco smoking would not be associated with anxiety and depression. However, we hypothesized that anxiety and depression would be positively associated with cigarette smoking.

METHODS

Survey data

Each year, the NCHA of the American College Health Association (ACHA) assesses a wide variety of content areas, including substance use, in over 100,000 university students over 18 years of age at about 150 institutions (American College Health Association, 2011). A representative from each institution participating in the NCHA is also required to complete a survey describing a variety of institutional characteristics. Each institution is responsible for securing human subjects approval, and the ACHA keeps copies of the approvals on file. All responses are confidential, and deidentified data are publicly available. The NCHA is considered to be a reliable and valid assessment of college student health perceptions and behaviors, and its data have been examined frequently in peer-reviewed journal articles (Bernert, Ding, & Hoban, 2012; Trieu, Bratton, & Hopp Marshak, 2011; Primack et al., 2010; Seo & Li, 2009; Primack et al., 2008).

Recently, the survey began to be administered in two forms. A paper-based form was administered to students in randomly selected classrooms, and a Web-based form was sent via an e-mail invitation to a random sample of students whose e-mail addresses were provided by their institution to the ACHA. The e-mail invitation included an embedded unique respondent identification number, which allowed the ACHA to prevent duplicate responses from the same student or students outside the random sample. The paper-based survey accounted for about 20% of respondents and had a mean response rate of approximately 90%. Although the Web-based survey accounted for about 80% of respondents, it had a mean response rate of only about 22%. Despite its lower response rate, the Web-based survey is favored by institutions because it is less labor-intensive to administer and its results are virtually identical to those of the paper-based survey (Dillman, Smyth, & Christian, 2008).

Participating institutions typically encourage survey completion by providing a small incentive to students or having a random drawing for a larger prize. Web-based surveys were generally administered over a period of 2–4 weeks, and nonresponders were periodically sent reminders.

Measures

Characteristics of institutions and participants—For our analyses, we used data from the most recent full year of data available—i.e., data collected in fall 2008 and spring 2009.

Institutional items that were assessed included geographic region of the United States and population of the campus locale. Individual items included student-reported data on age, sex, race/ethnicity, undergraduate versus graduate student status, sexual orientation, and relationship status and living arrangement.

We excluded participants if they attended schools outside the United States and if they were older than 30 years, because we wished to focus on the United States and on the more traditional undergraduate and graduate students for whom our health behaviors of interest tend to have greater impact. We also excluded students who reported a sex other than male or female, because these groups were too small to allow for robust estimation of their model coefficients. Our analysis of the ACHA data was approved by the University's Pittsburgh's Institutional Review Board.

Waterpipe and cigarette use, mental health, and well-being—Our two primary outcome variables were current waterpipe tobacco use and cigarette use.

The NCHA survey assessed waterpipe tobacco use with the following item: “Within the past 30 days, on how many days did you use tobacco from a water pipe (hookah)?” The response options were (a) never used; (b) have used, but not in the past 30 days; (c) 1–2 days; (d) 3–5 days; (e) 6–9 days; (f) 10–19 days; (g) 20–29 days; and (h) all 30 days. For cigarette smoking, the question was similarly worded, and the response options were identical (American College Health Association, 2011). For each type of tobacco use, we grouped response options c through h into the category called “current use,” and we grouped response options b through h into the category called “ever use.” For waterpipe and cigarette use, we defined our primary outcome variable as current use (in the past 30 days) because of its improved clinical importance over ever use, which may have occurred in the distant past.

Our primary independent variables pertained to six different mental health conditions that commonly affect the college population. In particular, we assessed whether students reported having been diagnosed or treated by a professional during the last 12 months for

depression, anxiety (anxiety, obsessive-compulsive disorder, panic attacks, or phobia), sleeping disorder (insomnia or other), eating disorder (bulimia or anorexia), attention-deficit and hyperactivity disorder (ADHD), and addictive disorder (substance abuse, substance addiction, or other addiction).

Our secondary measures of mental health were three items concerning general well-being. The first item asked participants to rate their overall health as “poor,” “fair,” “good,” or “excellent.” For analysis, we dichotomized responses into poor/fair versus good/excellent. The second item asked participants: “How many days of the past 7 did you get enough sleep so that you felt rested when you woke up in the morning?” For analysis, we defined severely inadequate sleep as 0–1 nights. And the third item asked participants to subjectively judge their stress level over the past 12 months. For analysis, we dichotomized the highest level (“tremendous”) versus all other responses. Thus, all nine mental health variables were dichotomous.

Analyses

We computed frequencies and percentages for institutional variables, personal variables, mental health variables, and substance use outcomes. We examined prevalence of substance use outcomes according to presence of each of the nine mental health variables. We conducted chi-squared tests to determine whether mental health problem rates differed by sex.

We used logistic regression models to predict current waterpipe use and cigarette smoking for each of the independent variables, and we included a random effect to account for correlation among students from the same institution. In addition to bivariable analyses, we performed multivariable analyses that adjusted for clustering by school and for previously established predictors of substance use (Primack et al., 2008), including geographic region and population size of school locale and the following sociodemographic factors: age (continuous), sex, race/ethnicity, undergraduate status, sexual orientation, and relationship/marital status. We report the results in terms of odds ratios (ORs) and 95% confidence intervals (CIs). Specifically, we report the odds that a given behavior (e.g., current cigarette smoking) will be reported by a student who has a particular mental health or well-being status versus a student who does not have the particular mental health or well-being status.

To confirm the robustness of our results, we conducted additional analyses. Although earlier studies of NCHA data did not show differences in outcome or predictor variables for respondents completing the paper-based versus Web-based form of the survey (Leino, 2004), we tested whether this held true for our multivariable analyses, and we found that it did. We also performed influence analyses to examine standardized DFBETA values for extreme cases, and we found that these values were all below our a priori cutoff of 1.96, indicating that our results were not unduly influenced by extreme cases. In addition, we conducted sensitivity analyses using bootstrapping methods with 1000 repetitions. Because all of the results (point estimates, standard deviations, and levels of significance) were similar in our primary analyses and bootstrapping analyses, we are reporting only the results of primary analyses.

Statistical analyses were performed with SAS version 9.2 (Cary, NC) and Stata version 11.1 (Stata Corp, College Station, Texas), and two-tailed *P* values of <0.05 were considered to be significant.

RESULTS

Study sample

Data were available for 113,786 students from 152 institutions. Of the students, 5865 were from non-U.S. schools, 8341 were aged 30 years or older, and 174 were transgendered. After these students were excluded, the final study sample consisted of 100,891 participants.

Characteristics of institutions and participants

Of the 152 institutions, most were located in the Northeast (28.9%) or Midwest (27.6%) (Table 1). The greatest proportions of institutions were in cities with populations of 50,000–249,999 (43.4%) and 10,000–49,999 (21.7%).

Of the 100,891 participants, most were under 22 years old (70.7%), female (65.7%), non-Hispanic white (70.2%), and undergraduate (87.3%). Most were unmarried and in no relationship (50.7%) (Table 2).

Substance use, mental health, and well-being

Regarding current substance use behaviors, 8,969 (9%) reported waterpipe smoking, 16,994 participants (17%) reported cigarette smoking, and 4,354 (4%) reported both waterpipe and cigarette use. Regarding mental health problems, the most common were depression, reported by 9,562 participants (10%), and anxiety, reported by 11,108 (11%). Regarding general well-being, 8,992 participants (9%) reported tremendous stress, 7,245 (7%) reported overall health that was fair or poor, and 21,175 (21%) reported severely inadequate sleep.

Women were less likely than men to have smoked a waterpipe (7% vs. 12%; $P<.001$) and to have smoked cigarettes (15% vs. 20%; $P<.001$). Although men were more likely to have experienced ADHD and addictive disorder, women were more likely to have experienced depression, anxiety, sleeping disorder, and eating disorder ($P<.001$ for each).

Of participants who reported depression, the rates for waterpipe and cigarette use were 11% and 28% respectively (Table 3). The rate for engaging in the both behaviors in this population was 7%.

Of participants who reported anxiety, the rates for waterpipe and cigarette use were 10% and 26%, with 6% endorsing both behaviors.

Substance use was particularly high among participants with ADHD and participants with addictive disorder.

Results of adjusted multivariable analyses

In adjusted multivariable analyses (Table 4), having been diagnosed with or treated for depression was moderately associated with waterpipe use (OR, 1.4; 95%CI, 1.3–1.5) but strongly associated with cigarette use (OR, 2.0; 95%CI, 1.9–2.1). The pattern was similar for having ever been diagnosed with or treated for anxiety.

In general, all mental health diagnoses were associated with significantly increased rates of waterpipe smoking (ORs ranging from 1.3 to 2.4) and cigarette smoking (ORs ranging from 1.8 to 5.2). Point estimates were generally higher for cigarette smoking.

Reporting tremendous stress was minimally associated with waterpipe smoking (OR, 1.1; 95%CI, 1.02–1.2) and moderately associated with cigarette smoking (OR, 1.4; 95%CI, 1.3–1.5). Overall health being fair or poor was associated with moderately increased odds of waterpipe use (OR, 1.4; 95%CI, 1.2–1.5) and strongly increased odds of cigarette use (OR,

2.0; 95% CI, 1.9–2.1). Severely inadequate sleep was associated with waterpipe use (OR, 1.08; 95% CI, 1.02–1.14) and cigarette use (OR, 1.21; 95% CI, 1.16–1.27).

DISCUSSION

This large study of a national sample of college students found that current waterpipe tobacco smoking was reported by 9% of the sample. The most commonly reported mental health problems were depression (in 10%) and anxiety (in 11%) and cigarette use was reported by 17% of the sample. All of the examined mental health variables were associated with increased rates of both types of tobacco use. However, the odds for cigarette smoking were of greater magnitude. Measures of poor well-being, such as tremendous stress, low perceived health status, and inadequate sleep, were associated with both types of tobacco use.⁴

Rates of substance use and mental health problems in our study were comparable to those in other studies of college students and other young adults in the United States (Johnston et al., 2011; Kessler & Walters, 1998), which lend increased confidence in the generalizability of these results.

Waterpipe smoking is a serious public health concern because of its rising popularity and its underappreciated risks of exposure to toxicants such as carbon monoxide, polyaromatic hydrocarbons, volatile aldehydes, nitric oxide, and tar (Primack, Kim, Shensa, Sidani, Barnett, Switzer, 2012). Eissenberg & Shihadeh, 2010; Shihadeh, 2003; Shihadeh & Saleh, 2005). The fact that mental health problems have a somewhat weaker association with waterpipe smoking than with cigarette smoking might suggest that there is a population of otherwise healthy users who might be receptive to public health information and policy interventions, such as those associated with the dramatic decrease in cigarette smoking seen over the past decades in the United States (Guide to Community Preventive Services, 2011).

Our study found that mental health problems were more strongly associated with cigarette smoking than with waterpipe smoking. This pattern is consistent with the notion that the latter behavior is currently perceived as more normative than cigarette use in the college population and are engaged in by emotionally healthy as well as unhealthy college students. It is also consistent with other research showing that anhedonia associated with mental health conditions such as depression can lead to isolation from social activities such as waterpipe use (Bhave & Nagpal, 2005).

In our study, tremendous stress and inadequate sleep, both of which are common to college students, were associated with increased rates of cigarette smoking but were only modestly associated with increased rates of waterpipe smoking. It may be that for students suffering from stress and inadequate sleep due to excessive workload or time-management issues, cigarettes serve as convenient self-medication, whereas waterpipe tobacco is used more commonly during scarce leisure time.

Our study found relatively few significant sex interactions in the associations of health problems and substance use behaviors. Previous studies found that depression predicted cigarette smoking only among female college students (Morrell, Cohen, & McChargue, 2010), but our data did not support this finding. Moreover, we found no sex interactions in predictions of waterpipe smoking, suggesting that the mental health-related mechanisms that lead to this behavior are similar in men and women.

We primarily considered tobacco use as endpoints predicted by mental health problems. However, there is also evidence that cigarette smoking might increase the risk of depression

(Boden, Fergusson, & Horwood, 2010) and that common factors may make a young adult more vulnerable to both smoking and mental health problems (Fergusson et al., 2003).

Understanding the causal links between tobacco use and mental health disorders may help with development of effective interventions for college aged youth. For example, it may be valuable to ensure that substance use treatment algorithms also at least somewhat address mental health issues, and vice versa. At this point, these associations are probably most relevant to health practitioners, who are likely to consider mental health diagnoses in those who present with complaints related to substance use. However, in the future it may be a valuable opportunity to consider population-based case-finding interventions among this population. The transition period to adulthood provides an acute window during which appropriate treatment approaches may help prevent future problems.

Limitations

Although our study sample was national and large, schools self-select to participate, so its findings may not be necessarily nationally representative. For example, the ACHA sample has a high proportion of female students, who are generally less likely to be tobacco users, so our overall estimates for cigarette and waterpipe use are likely to be conservative. However, it should be noted that ACHA-NCHA data showed strong reliability and validity when compared in formal analyses with three separate major nationally representative surveys, the CDC's National College Health Risk Behavior Survey CDC, the Harvard School of Public Health College Alcohol Study (CAS), and the United States Department of Justice's National College Women Sexual Victimization Study 2000 (Leino, 2004; American College Health Association, 2009).

Second, because this study was cross-sectional, no determination of causality can be made based upon these findings. For example, while the findings may indicate that depressed individuals are more likely to take up cigarette smoking, it is also possible that those who begin to smoke cigarettes subsequently become more susceptible to depression.

Third, it was a necessary limitation of using this large, national data set that certain constructs had to be assessed with parsimonious measures which were less intensive than they could have been. For example, the ACHA survey relied on self-report of substance use and mental health conditions. Although it would have been preferable to confirm psychiatric diagnoses, it is common for large, population-based studies to rely on self-report of these types of conditions (Bernert, Ding, & Hoban, 2012; Trieu, Bratton, & Hopp Marshak, 2011).

Finally, the overall response rate for the Web-based form of the survey was only about 1 in 5. However, this is a standard response rate for e-mail surveys (Morrell, Cohen, Bacchi, & West, 2005; Sax, Gilmartin, & Bryant, 2003; White, Jamieson-Drake, & Swartzwelder, 2002), and our Web-based results were similar to those of paper-based results, which had nearly 80% response rates.

Conclusions

The findings of our study shed light on associations between tobacco use and mental health problems among college students in the United States, a population in which both of these problems are common. Associations with mental health variables were strong for cigarette smoking but only moderate for waterpipe tobacco smoking. This may be because waterpipe use is perceived as more socially acceptable and normative than cigarette smoking in this population.

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Table 1

Participant Characteristics.

Characteristic	Frequency *	Percent
Age		
18–19	35,189	35.7
20–21	34,469	35.0
22–25	20,786	21.1
>=26	8120	8.2
Gender		
Female	64,806	65.7
Male	33,855	34.3
Sexual orientation		
Straight or unsure	93,391	95.0
Gay/Lesbian	2105	2.1
Bisexual	2810	2.9
Undergraduate		
Yes	85,909	87.3
No	14,982	13.7
Race/Ethnicity		
White	70,772	70.2
Black	4839	4.8
Hispanic	6093	6.1
Asian	9819	9.7
American Indian, Alaskan Native, Hawaiian Native, Other or Mixed Race	9250	9.2
Relationship and Living Status		
Not married and no relationship	49,161	50.7
Not married and in a relationship but not living together	36,702	37.8
Not married and in a relationship and living together	6326	6.5
Married and in a relationship living together	4819	5.0

* N=100,891, but some columns may not sum to this because of missing data.

Table 2

Campus Characteristics.

	Students		Schools	
	Frequency	Percent	Frequency	Percent
Region of the U.S.				
Northeast	31,016	30.7	44	29.0
Midwest	24,499	24.3	42	27.6
South	25,316	25.1	38	25.0
West	20,060	19.9	28	18.4
City Population				
>= 500,000	24,847	24.6	24	15.8
250,000–499,999	5379	5.3	9	5.9
50,000–249,999	43,343	43.0	66	43.4
10,000–49,999	17,925	17.8	33	21.7
< 10,000	9397	9.3	20	13.2

Table 3

Waterpipe, cigarette, and binge alcohol use by presence of mental health and general well-being measures.

	n	Row % [*]	Current Waterpipe Use Column % [†]	Current Cigarette Use Column %
Mental Health				
Depression	9101	10 (12 [‡] , 6 [§])	11	28
Anxiety	10701	11 (14 [‡] , 7 [§])	10	26
Sleeping Disorder	3993	4 (5 [‡] , 3 [§])	12	30
Eating Disorder [§]	1512	2 (2 [‡] , 1 [§])	14	27
Attention-Deficit Disorder	3527	4 (4 [‡] , 4 [§])	15	33
Addictive Disorder	1163	1 (1 [‡] , 2 [§])	20	51 (52 [‡] , 50 [§])
General Well-Being				
Tremendous Stress	8557	9 (10 [‡] , 72 [§])	9	22
Overall Health Fair or Poor	6895	7 (8 [‡] , 6 [§])	11	27
Severely Inadequate Sleep	20164	21 (23 [‡] , 19 [§])	9	19
All	94930		9 (7[‡], 12[§])	17 (15[‡], 20[§])

^{*} For example, 10% of the total population had been diagnosed with and/or treated for depression, and 11% had anxiety.

[†] For example, 11% of those with depression were waterpipe tobacco smokers, while 20% of those with addictive disorder were waterpipe smokers.[‡]

[‡] Women only; shown separately due to significant interactions. All gender differences in rates of mental health problems were significant at $P < .001$.

[§] Men only; shown separately due to significant interactions. All gender differences in rates of mental health problems were significant at $P < .001$.

// Rate shown for eating disorder and binge drinking is for women only; interaction test was significant, and fewer than 1% of men reported eating disorders.

Table 4

Odds ratios for tobacco use as a function of mental health.

	Current Waterpipe Use		Current Cigarette Use	
	Unadjusted OR	Adjusted OR (95% CI)*	Unadjusted OR	Adjusted OR (95% CI)*
Mental Health				
Depression	1.3 (1.2, 1.4)	1.4 (1.3, 1.5)	2.1 (2.0, 2.2)	2.0 (1.9, 2.1)
Anxiety	1.2 (1.1, 1.3)	1.3 (1.2, 1.4)	1.9 (1.8, 2.0)	1.8 (1.7, 1.9)
Sleeping Disorder	1.5 (1.3, 1.6)	1.5 (1.4, 1.7)	2.2 (2.0, 2.3)	2.0 (1.9, 2.1)
Eating Disorder [§]	1.6 (1.3, 1.8)	1.7 (1.4, 1.9)	1.8 (1.6, 2.0)	1.8 (1.6, 2.1)
Attention-Deficit Disorder	1.8 (1.6, 1.9)	1.7 (1.5, 1.8)	2.5 (2.3, 2.7)	2.2 (2.0, 2.4)
Addictive Disorder	2.5 (2.2, 2.9)	2.4 (2.0, 2.8)	5.1 (4.5, 5.7)	5.2 (4.4, 6.1) [‡] 3.6 (3.0, 4.3) [‡]
General Well-Being				
Tremendous Stress	1.0 (0.9, 1.1)	1.1 (1.02, 1.2)	1.4 (1.3, 1.5)	1.4 (1.3, 1.5)
Overall Health Fair or Poor	1.3 (1.2, 1.4)	1.4 (1.2, 1.5)	1.9 (1.8, 2.1)	2.0 (1.9, 2.1)
Severely Inadequate Sleep	1.05 (0.99, 1.1)	1.08 (1.02, 1.14)	1.18 (1.13, 1.23)	1.21 (1.16, 1.27)

* Multivariable analyses account for gender, sexual orientation, undergraduate status, race, relationship status, region, population size, and clustering by school.

[‡] Women only;

[‡] Men only; shown separately due to significant interaction.

[§] OR for eating disorder and binge drinking is for women only; significant interaction and fewer than 1% of men reported eating disorders.