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Associations between tobacco and nicotine product use and depressive symptoms among college students in Texas

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Abstract

Background—There is a well-established link between cigarette smoking and depression; less is known about the potential association between alternative tobacco products, such as hookah, cigars, smokeless tobacco, and electronic cigarette (e-cigarette use) with depression. The Food and Drug Administration (FDA) is now regulating tobacco products and is interested in tobacco product use among those with mental health problems and other special populations such as college students.

Methods—Cross-sectional statewide convenience sample study of 5438 college students in 24 colleges and universities in Texas. Past 30-day use of hookah, cigar, smokeless tobacco, cigarette, and e-cigarette use were measured by self-report. Depressive symptoms were measured by the 10-item short form of the Center for Epidemiologic Studies scale.

Results—Only e-cigarette use was positively associated with depressive symptoms, even after accounting for all other tobacco products and socio-demographics. There were no significant interactions between race/ethnicity or gender with each of the tobacco products on depressive symptoms.

Conclusions—E-cigarette use was positively associated with depressive symptoms among college students in Texas. Further research is needed to determine causality, which may inform FDA regulatory planning.

Keywords

Tobacco products; Depression; College students; Texas

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Contributors

Frank Bandiera, Alexandra Loukas, and Anna Wilkinson conceived of the paper. Frank Bandiera wrote an initial draft of the paper. Alexandra Loukas, Anna Wilkinson, and Cheryl Perry reviewed drafts and added appropriate portions to the manuscript.

Conflict of interest

The authors have no conflict of interest.

1. Introduction

The Food and Drug Administration (FDA) regulates the manufacturing, distribution, and marketing of tobacco products (Food and Drug Administration, 2009) and one of its research priorities is to examine and determine etiological associations in the use of alternative tobacco and nicotine products (hereafter referred to as ATPs), such as electronic cigarettes (e-cigarettes) and hookah, among special populations, such as youth and college students, and vulnerable populations, including those with mental health problems, such as depression (Food and Drug Administration, 2014).

There is a well-established link between cigarette smoking and depression (Prochaska, 2011). However, the exact etiology is not clear. Depressed persons may smoke to alleviate their depressive symptoms or “self-medicate (Gehricke et al., 2007)” or a common factor, such as familial predisposition (Dierker, Avenevoli, Stolar, & Merikangas, 2002) may link cigarette smoking to depression. Alternatively, smoking could lead to the onset of depression (Boden, Fergusson, & Horwood, 2010).

There is a weaker established link between depression and ATP use, including cigars, smokeless tobacco (Fu, Vaughn, Wu, & Heath, 2014), hookah (Goodwin et al., 2014; Heinz et al., 2013) and e-cigarettes (Cummins, Zhu, Tedeschi, Gamst, & Myers, 2014). One study using the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) found that persons with lifetime mental illness, panic disorder and alcohol use disorder were more likely to be lifetime smokeless tobacco users than persons without a mental illness (Fu et al., 2014). Cummins et al. (2014) found that among a nationally representative sample of adults in the United States, persons with “mental health conditions” were more likely to be e-cigarette users. However, most existing studies are limited to the examination of a single alternative product, even though most tobacco users report use of multiple products (Butler, Ickes, Rayens, Wiggins, & Hahn, 2016). Moreover, most studies have examined the tobacco use-depression association among adults (>18 years old), yet young adults, including college students, report the highest prevalence of ATP use (Johnston, O’Malley, Miech, Bachman, & Schulenberg, 2015).

The purpose of the present study is to test the unique associations between four ATPs (cigars, smokeless tobacco, hookah, and e-cigarettes) and depressive symptoms in a young adult college sample. College students are an important population because they constitute 40% of the young adult population (United States Department of Education, 2015) and report transitions in tobacco use behaviors, including initiation of new products and tobacco addiction (White, Bray, Fleming, & Catalano, 2009). Yet, no studies have examined the unique associations between various types of tobacco products and depressive symptoms among young adults, while controlling for cigarette use. *We hypothesize that ATPs are uniquely positively associated with depressive symptoms in college students, over and above cigarette use and a variety of socio-demographics.*

2. Methods

2.1. Participants

Participants were 5438 18–29 year old students attending one of 24 colleges in Texas and involved in the baseline wave (November 2014–February 2015) of the Marketing and Promotions across Colleges in Texas Project (Project *M-PACT*), a rapid response surveillance study. Participants were full- or part-time degree- or certificate-seeking undergraduate students attending a 4-year college or a vocational/technical program at a 2-year college. Recruitment at 2-year colleges was limited to students enrolled in vocational/technical programs (e.g., welding, air conditioning and cooling, etc.) because they have an elevated prevalence of cigarette use (Loukas, Murphy, & Gottlieb, 2008), and in turn use of ATPs (Biener, McCausland, Curry, & Cullen, 2011; McMillen, Maduka, & Winickoff 2012). Secondly, participants were required to be 18–26 years old if they were a lifetime non-tobacco user or 18–29 years old if they were a lifetime tobacco user. Lifetime tobacco use was defined by having ever smoked at least 100 cigarettes, or at least 20 cigars, or having ever used smokeless/spit/chewing tobacco at least 20 times. Because the study examines transitions in tobacco use, and initiation is unlikely to occur after the age of 26 (United States Department of Health and Human Services, 2012), lifetime non-tobacco users over the age of 26 were excluded from participation.

2.2. Procedure

The 24 colleges were located in five counties that included the four largest metropolitan areas in Texas (Austin, Dallas/Fort Worth, Houston, and San Antonio). Students attending the colleges were recruited to participate in the online survey via email invitation (Loukas et al., 2016). Eligible students who wished to participate provided informed consent and then completed the online survey. Upon completion of the survey, each student received a \$10 e-gift card and all students were entered into a drawing to win one of twenty \$50 e-gift cards. >13,000 students ($n = 13,714$) were eligible to participate in the study and of these, 5482 (40%) provided consent and completed the survey. Forty-four students were missing data on the study measures. Thus, the final sample for the present analyses was 5438.

2.3. Measures

2.3.1. Socio-demographic covariates—Sex (0 = male; 1 = female), age, type of college (0 = 2-year; 1=4-year), and race/ethnicity were included in study models as covariates. Race/ethnicity was measured with two items, one that assessed ethnicity and the other that assessed race. A race/ethnicity variable was created by combining these two questions. Students who reported as Hispanic or Latino/a were coded as Hispanic and the remaining students were given codes that represented the selected race (“White,” “Black or African American,” “Asian,” “American Indian or Alaska Native,” Native Hawaiian or other Pacific Islander,” and “Other.” Students who indicated more than one race were coded as “other”.

2.3.2. Current cigarette and ATP use—Use of five types of tobacco/nicotine products were examined in the present study. The items were adapted from the Youth Tobacco Survey (Starr et al., 2005) and the Population Assessment of Tobacco and Health Study (National

Institutes of Health, 2015), and assessed current or past 30-day use of cigarettes, smokeless/snus tobacco, large cigars/cigarillos/little cigars, hookah, and e-cigarettes. Current use of cigarettes, smokeless tobacco, and hookah were assessed with the questions “During the past 30 days, on how many days did you smoke/use ____?” Current use of large cigars/cigarillos/little cigars and hookah were assessed with questions “During the past 30 days, how many days did you smoke ____ as intended (i.e. with tobacco)?” Current use of e-cigarettes was assessed with the question “During the past 30 days, have you used any ENDS product (i.e., an e-cigarette, vape pen, or e-hookah), even one or two puffs, as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice)?”

2.3.3. Depressive symptoms—Depressive symptoms were assessed with the 10-item short-form Center for Epidemiologic Studies Depression 10 Scale (CES-D 10) (Andresen, Malmgren, Carter, & Patrick, 1994). This scale assesses frequency of symptoms of depression occurring over the past week, including depressed affect, positive affect, and somatic complaints. Each of the items is scored on a scale from 0 “rarely (<1 day)” to 3 “most of the time (5–7 days).” The 10 items were summed and higher scores reflected higher levels of depressive symptoms. A cutoff score of 10 was used to create two groups; one that reported clinically significant symptoms of a depression (score of 10 or more) and one that did not (score of 9 or less). The CES-D 10 is a reliable and valid measure of depressive symptoms for community-based adolescents (Bradley, Bagnell, & Brannen, 2010) and older adults (Andresen et al., 1994). For the present sample, internal consistency reliability was 0.81.

2.4. Data analysis

A multilevel logistic regression model was fit using MPlus 7.3 (Muthen & Muthen, 1998–2015) to examine the associations between each of the ATPs and the dichotomous dependent variable of depressive symptom. Each model included current cigarette use and the socio-demographic factors of gender, age, race/ethnicity, and school type (2-year versus 4-year) as covariates, and all four ATPs as predictor variables. Simultaneous inclusion of all ATPs in one model allows for the examination of the unique association of each to depressive symptoms. A multilevel model was conducted to accommodate the non-independence of participants nested within the 24 colleges. Interaction terms between race/ethnicity and gender with each tobacco product were examined in separate models to determine if the associations were consistent across these socio-demographic characteristics.

3. Results

Table 1 presents the descriptive characteristics of our study participants. Participants were 20.49 years old ($SD = 2.36$ years) on average and 63.8% were female. Almost 40% (36.3%) identified as non-Hispanic white, 31.3% as Hispanic, 16.9% of Asian ancestry, 8.1% as non-Hispanic black, and 7.5% identified as other. The majority attended a four-year college (92.6%). Cigarettes were the most commonly used tobacco product and just over 30% of participants (31%) reported a CES-D score of 10 or more.

Results from the multilevel logistic regression model are presented in Table 2. E-cigarettes were the only ATP that were uniquely associated with depressive symptoms. The association

was significant even after controlling for current cigarette use, socio-demographic characteristics, and current use of the other three ATPs. None of the interactions between each of the tobacco products and race/ethnicity or gender were significant, all $p > 0.05$. The model fit without any interaction terms included was evaluated using the Hosmer and Lemeshow goodness of fit test, and was not significant [Chi-square(8) = 4.57, $p = 0.802$], indicating that the model is correctly specified. Finally, the final model was re-analyzed using a continuous, rather than dichotomous, depressive symptoms dependent variable. Findings from this model indicated the same pattern of findings, e-cigarettes were the only ATP uniquely associated with level of college students' depressive symptoms.

4. Discussion

Findings from the current study indicated that among the ATPs examined, only current e-cigarette use was uniquely and positively associated with depressive symptoms. This association was present even after controlling for a number of covariates including current cigarette and other ATP use. To our knowledge only one study has found an association between e-cigarette use and mental health problems (Cummins et al., 2014). However, this study used a single item to measure "mental health conditions," whereas our study used a well-validated questionnaire of depressive symptoms, increasing validity and specificity (Andresen et al., 1994).

Consistent with our findings, there have been a few studies finding a null association between hookah and mental health problems (Goodwin et al., 2014; Heinz et al., 2013). However, one study using the NESARC found that persons with lifetime mental illness, panic disorder and alcohol use disorder were more likely to be lifetime smokeless tobacco users than persons without a mental illness (Fu et al., 2014). Inconsistent findings between the current study and the NESARC could be attributed to differences in measurement. For example, the study using the NESARC used DSM-IV lifetime psychiatric disorders, while our study did not use a diagnostic instrument.

As with cigarettes (Boden et al., 2010), it may be that e-cigarette use may lead to depressive symptoms, and thus depression may be a side effect of e-cigarette use. Alternatively, (Gehricke et al., 2007), the reverse may also be true; e-cigarette use may temporarily alleviate distress associated with mental health problems and persons may therefore "self-medicate." An alternative possibility unique to e-cigarette use is that depressed persons may be using e-cigarettes to quit smoking cigarettes, although we controlled for smoking status in the current study as did Cummins et al. (2014). Nonetheless, some researchers have suggested the use of e-cigarettes in mental health treatment settings as smoking cessation devices (Ratschen, 2014) and one longitudinal study (Caponnetto, Auditore, Russo, Cappello, & Polosa, 2013) found that e-cigarettes reduced cigarette consumption among schizophrenic adults.

Although the current analysis is based on a large epidemiologic study, the findings must be interpreted with caution. First, the current study only sampled college students and thus future studies should replicate our findings in the general young adult population. Second, although the CES-D (Andresen et al., 1994) is widely used, well validated, and reliable, it

does not provide a clinical diagnosis of depression. Also, our study was cross-sectional, so temporality cannot be established. Longitudinal studies are needed to determine if e-cigarette use elevates risk for depression or vice versa. Despite these limitations, our findings are unique and important because they indicate that even after controlling for all types of tobacco products and a variety of socio-demographics, e-cigarette use among young adults, the population with the highest prevalence of ATP use, is associated with heightened depressive symptoms.

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References

- Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: Evaluation of a short form of the CES-D. *American Journal of Preventive Medicine*. 1994; 10(2): 77–84. [PubMed: 8037935]
- Biener L, McCausland K, Curry L, Cullen J. Prevalence of trial of snus products among adult smokers. *American Journal of Public Health*. 2011; 101(10):1874–1876. <http://dx.doi.org/10.2105/AJPH.2010.200097>. [PubMed: 21330582]
- Boden JM, Fergusson DM, Horwood LJ. Cigarette smoking and depression: Tests of causal linkages using a longitudinal birth cohort. *The British Journal of Psychiatry*. 2010; 196(6):440–446. <http://dx.doi.org/10.1192/bjp.bp.109.065912>. [PubMed: 20513853]
- Bradley KL, Bagnell AL, Brannen CL. Factorial validity of the Center for Epidemiological Studies Depression 10 in adolescents. *Issues in Mental Health Nursing*. 2010; 31(6):408–412. <http://dx.doi.org/10.3109/01612840903484105>. [PubMed: 20450343]
- Butler KM, Ickes MJ, Rayens MK, Wiggins AT, Hahn EJ. Polytobacco use among college students. *Nicotine & Tobacco Research*. 2016; 18(2):163–169. <http://dx.doi.org/10.1093/ntr/ntv056>. [PubMed: 25770131]
- Caponnetto P, Auditore R, Russo C, Cappello GC, Polosa R. Impact of an electronic cigarette on smoking reduction and cessation in schizophrenic smokers: A prospective 12-month pilot study. *International Journal of Environmental Research and Public Health*. 2013; 10(2):446–461. <http://dx.doi.org/10.3390/ijerph10020446>. [PubMed: 23358230]
- Cummins SE, Zhu SH, Tedeschi GJ, Gamst AC, Myers MG. Use of e-cigarettes by individuals with mental health conditions. *Tob Control*. 2014; 23(Suppl 3):iii48–iii53. <http://dx.doi.org/10.1136/tobaccocontrol-2013-051511>. [PubMed: 24824516]
- Dierker LC, Avenevoli S, Stolar M, Merikangas KR. Smoking and depression: An examination of mechanisms of comorbidity. *The American Journal of Psychiatry*. 2002; 159(6):947–953. <http://dx.doi.org/10.1176/appi.ajp.159.6.947>. [PubMed: 12042182]
- Food and Drug Administration. Tobacco Control Act, 2009. 2009. (Retrieved July 6, 2016, from) <http://www.fda.gov/TobaccoProducts/GuidanceComplianceRegulatoryInformation/ucm246129.htm>
- Food and Drug Administration. FDA Center for Tobacco Products research interest areas, updated 2014. 2014. (Retrieved July, 6 2016, from) <https://prevention.nih.gov/tobacco-regulatory-science-program/research-priorities>
- Fu Q, Vaughn MG, Wu LT, Heath AC. Psychiatric correlates of snuff and chewing tobacco use. *PLoS One*. 2014; 9(12):e113196. <http://dx.doi.org/10.1371/journal.pone.0113196>. [PubMed: 25535739]

- Gehricke JG, Loughlin SE, Whalen CK, Potkin SG, Fallon JH, Jamner LD, Leslie FM. Smoking to self-medicate attentional and emotional dysfunctions. *Nicotine & Tobacco Research*. 2007; 9(Suppl 4):S523–S536. <http://dx.doi.org/10.1080/14622200701685039>. [PubMed: 18067030]
- Goodwin RD, Grinberg A, Shapiro J, Keith D, McNeil MP, Taha F, Hart CL. Hookah use among college students: Prevalence, drug use, and mental health. *Drug and Alcohol Dependence*. 2014; 141:16–20. <http://dx.doi.org/10.1016/j.drugalcdep.2014.04.024>. [PubMed: 24882367]
- Heinz AJ, Giedgowd GE, Crane NA, Veilleux JC, Conrad M, Braun AR, Kassel JD. A comprehensive examination of hookah smoking in college students: Use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addictive Behaviors*. 2013; 38(11):2751–2760. <http://dx.doi.org/10.1016/j.addbeh.2013.07.009>. [PubMed: 23934006]
- Johnston, LD.; O'Malley, P.; Miech, RA.; Bachman, JG.; Schulenberg, JE. Monitoring the future national survey results on drug use: College students and adults ages 19–55. 2015. (Retrieved July 6, 2016, from) http://www.monitoringthefuture.org/pubs/monographs/mtf-vol2_2014.pdf
- Loukas A, Murphy JL, Gottlieb NH. Cigarette smoking and cessation among trade or technical school students in Texas. *Journal of American College Health*. 2008; 56(4):401–407. <http://dx.doi.org/10.3200/jach.56.44.401-408>. [PubMed: 18316284]
- Loukas A, Pasch KE, Li X, Hinds JT, Marti CN, Harrell MB, Creamer MR, Perry CL. College students' polytobacco use, cigarette cessation, and dependence. *American Journal of Health Behavior*. 2016; 40(4):514–522. [PubMed: 27338998]
- McMillen R, Maduka J, Winickoff J. Use of emerging tobacco products in the United States. *Journal of Environmental Public Health*. 2012; 2012:989474. <http://dx.doi.org/10.1155/2012/989474>. [PubMed: 22654922]
- Muthen, LK.; Muthen, BO. Mplus User's Guide. 7th. Los Angeles, CA: Muthen & Muthen; 1998–2015.
- National Institutes of Health. Population assessment of tobacco and health. 2015. (Retrieved August 31, 2015, from) <https://pathstudyinfo.nih.gov/UI/HomeMobile.aspx>
- Prochaska JJ. Smoking and mental illness—breaking the link. *The New England Journal of Medicine*. 2011; 365(3):196–198. <http://dx.doi.org/10.1056/NEJMp1105248>. [PubMed: 21774707]
- Ratschen E. Electronic cigarettes in mental health settings - solving a conundrum? *Psychiatr Bull* (2014). 2014; 38(5):226–229. <http://dx.doi.org/10.1192/pb.bp.114.047431>. [PubMed: 25285221]
- Starr, G.; Rogers, T.; Schooley, M.; Porter, S.; Wiesen, E.; Jamison, N. Key outcome indicators for evaluating comprehensive tobacco control programs. Atlanta, GA: Centers for Disease Control and Prevention; 2005.
- United States Department of Education. National Center for Education Statistics. Fast Facts. 2015. (Retrieved July 6, 2016, from) <http://nces.ed.gov/fastfacts/display.asp?id=372>
- United States Department of Health and Human Services. Preventing tobacco use among youth and young adults: A report of the surgeon general. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2012.
- White HR, Bray BC, Fleming CB, Catalano RF. Transitions into and out of light and intermittent smoking during emerging adulthood. *Nicotine & Tobacco Research*. 2009; 11(2):211–219. <http://dx.doi.org/10.1093/ntr/ntn017>. [PubMed: 19246434]

Table 1

Demographic characteristics of study sample, overall and by level of depressive symptoms.

Demographic characteristic	Total sample	Low depressive symptoms ^a	CESD high depressive symptoms ^a
Mean age in years (SD)	20.49 (2.36)	20.53 (2.38)	20.4 (2.32)
Female	63.8%	62.0%	67.9%
White	36.3%	37.2%	34.4%
Hispanic/Latino	31.1%	31.0%	31.5%
Asian ancestry	16.9%	16.2%	18.3%
African ancestry	8.1%	8.3%	7.7%
Other	7.5%	7.3%	8.1%
Four-year institution	92.6%	92.7%	92.3%
Current smoker	21.2%	18.8%	26.4%
Current ENDS user	17.2%	15.6%	20.9%
Current hookah user	16.8%	15.7%	19.0%
Current cigar user	9.7%	9.3%	10.3%
Current smokeless tobacco user	3.0%	2.9%	3.1%
High depressive symptoms	31.0%		

^aLow depressive symptoms = CES-D score > 10; High depressive symptoms = CES-D score > 10.

Table 2

Examining the unique associations between alternative tobacco products and depressive symptoms^a, over and above socio-demographic characteristics and current cigarette use.

Parameter	Odds ratio	95% CI
Age (z score)	0.93	0.88–0.99
Female	1.39	1.22–1.57
Hispanic/Latino	1.08	0.94–1.25
Asian ancestry	1.31	1.10–1.56
African ancestry	1.03	0.81–1.29
Other race/ethnicity	1.19	0.95–1.50
Current cigarette smoker	1.58	1.36–1.86
Current ENDS user	1.25	1.05–1.48
Current hookah user	1.01	0.85–1.19
Current cigar user	0.97	0.79–1.20
Current smokeless tobacco user	0.95	0.67–1.36

^aScored 0 = CES-D score > 10 and 1 = CES-D score ≤ 10.