

Weight Status and Cigarette and Electronic Cigarette Use in Adolescents

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Introduction: Research shows that adolescents who are overweight or obese may be at greater risk of cigarette smoking, and that this relationship may vary by gender. However, this relationship is understudied for electronic cigarettes (e-cigarettes). Given the high rate of adolescent obesity and the rise in e-cigarette use in adolescents, this relationship should be investigated.

Methods: Data are from the third wave (collected October 2015–January 2016) of the Texas Adolescent Tobacco and Marketing Surveillance system. Students were in the seventh, ninth, and 11th grades ($n=2,733$) from five counties surrounding four major Texas metropolitan areas (Houston, Austin, San Antonio, Dallas). Weighted logistic regression was used to determine if weight status (healthy weight, overweight, or obese) was correlated with ever and past 30-day cigarette or e-cigarette use, controlling for sociodemographics. Models were stratified by gender. Data analyses were conducted in March 2017.

Results: Compared with healthy-weight boys, obese boys had higher odds of past 30-day e-cigarette use (AOR=3.45, 95% CI=1.34, 8.33) and cigarette smoking (AOR=4.52, 95% CI=1.32, 15.51). There was no significant relationship between weight status and cigarette or e-cigarette use in girls.

Conclusions: This study supports that there is a positive relationship between weight status and past 30-day cigarette and e-cigarette use for boys, but that there is no association for girls.

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INTRODUCTION

Obesity and tobacco use are two of the most prominent health concerns facing youth today.¹ The latest national estimates indicate that 34% of adolescents, aged 12 to 19 years, are overweight or obese.² In 2015, nationally, 9.3% of high school students had smoked cigarettes and 16.0% had used electronic cigarettes (e-cigarettes) in the past 30 days. Among middle school students, 2.3% had smoked a cigarette in the past 30 days and 5.3% had used an e-cigarette.³

Although a positive cross-sectional relationship between weight status and cigarette smoking in adolescence has been observed in many studies, the literature overall is mixed.^{4–8} Additionally, few articles have examined the theoretical basis for these relationships.^{9,10} Studies have indicated that cigarette use and physical inactivity co-occur,¹¹ whereas cigarette smoking and increased consumption of fast food and sugar-sweetened

beverages cluster together.¹² Additionally, obese youth suffer from peer victimization, depression, stress, and social marginalization at greater rates than their healthy-weight peers,^{13–16} and preliminary evidence shows this may be a factor linking obesity and cigarette smoking.¹⁰ There is also evidence that individuals, predominately females, use cigarettes as a weight control tool.^{6,17,18} Lastly, Zeller et al.⁹ reported that youth with excess weight are more likely to have risky attitudes about cigarettes, such as decreased harm perceptions, and have more friends who smoke and friends who did not disapprove of smoking.

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To date, no published studies have reported on the relationship between e-cigarette use and weight status. This study examines the associations between weight status and ever or past 30-day use of either cigarettes or e-cigarettes, and if the associations differ by gender, as past research suggest that they might.⁴⁻⁶

METHODS

Study Sample

This is a cross-sectional analysis of data from the third wave of the Texas Adolescent Tobacco and Marketing Surveillance system (TATAMS). TATAMS enrolled 3,907 adolescents at baseline in the five counties that surround the four largest cities in Texas—Austin, Houston, San Antonio, and Dallas/Ft. Worth. These students represented 461,069 in the sampling frame. Details about the study design are presented elsewhere.¹⁹ The third wave was collected from November 2015 to January 2016. It was completed by 2,733 subjects for a weighted response rate of 66.9%. Parental consent and student assent were obtained for all subjects. The University of Texas Health Science Center's IRB approved this study (reference number HSC-SPH-13-0377).

Measures

Students were asked about their ever use and past 30-day use of cigarettes and e-cigarettes. BMI percentiles were calculated using self-reported heights and weights.²⁰ Four weight status categories of underweight (<5th percentile); healthy weight (5th–84th percentile); overweight (85th–94th percentile); and obese (\geq 95th percentile) were created. Covariates include gender; grade; race/ethnicity (coded as Hispanic, white/other, and black); and a single-item SES question.²¹

Statistical Analysis

Subjects were excluded from analysis if they were in the underweight category ($n=94$); provided biologically implausible height/weight information ($n=25$);²² or provided incomplete data ($n=90$). The remaining 2,524 participants were weighted to represent 423,900 adolescents in the study area.

Twenty-four separate logistic regression models were used to test if being obese versus healthy weight or overweight versus healthy weight were associated with e-cigarette and cigarette ever and past 30-day user status. Models were adjusted for gender, race/ethnicity, SES, and grade, to estimate AORs and 95% CIs. All relationships were examined overall and stratified by gender. All analyses used sampling weights to account for the complex design, the clustering of participants within schools, nonresponse bias, and to generalize to the study population. Analyses were conducted in SAS, version 9.4, March 2017.

RESULTS

The participant demographics stratified by gender are presented in Table 1. Overweight youth, when compared with healthy-weight youth, did not have increased odds of ever or past 30-day cigarette or e-cigarette use. Additionally, there was no association between weight

status and either tobacco product use in girls. However, obese boys, when compared with healthy-weight boys, did have increased odds of past 30-day cigarette use (AOR=4.52, 95% CI=1.32, 15.51) and past 30-day e-cigarette use (AOR=3.45, 95% CI=1.43, 8.33; Table 2).

DISCUSSION

This is the first study to examine the relationship between weight status and e-cigarette use among adolescents. Positive relationships were found between weight status and past 30-day use for both e-cigarettes and cigarettes, for boys, but not for girls. Specifically, obese boys, compared with their healthy-weight peers, had increased odds of past 30-day cigarette and e-cigarette smoking.

Several studies have examined the cross-sectional relationship between weight status and cigarette use in youth. A 2004 review⁶ summarized the literature to date and reported that seven of 12 studies (>50%) that examined boys found a positive relationship between weight status and cigarette smoking, whereas only five of 16 studies (<33%) that examined girls found a positive relationship. In three more recent studies that examined the relationship in both genders, all found a positive association in girls,^{4,5,7} and only one found the association in boys.⁷ This study's findings regarding cigarettes appear to be inconsistent with the bulk of the evidence from the recent literature, but perhaps consistent with older literature.

Few articles have examined the theoretical basis for these relationships.^{9,10} Many posit that cigarette use may be a method to control weight, to help with stress, or to fit in socially, all issues that overweight or obese youth may struggle with at greater rates than their healthy-weight peers.^{5,6,8} Additionally, using cigarettes as a weight control method may appeal more to girls versus boys, as girls suffer greater negative social consequences from being overweight/obese.^{6,17,18} However, research has shown that one's dissatisfaction with their weight is a better predictor of cigarette use than their objective weight status.^{6,17,18} This may explain why the current study did not find a positive relationship in girls.

This study provides new evidence that the association between weight status and e-cigarette use warrants future research. Additionally, the inconsistency in the literature on cigarettes and weight status indicates there is still need for further research on this topic.^{4-7,9} For both products, conducting a longitudinal bidirectional analysis of the relationship is necessary to understand if weight status leads to e-cigarette/cigarette use or vice versa, or if there is not a causal association. Additionally, research is needed to determine what factors may mediate the

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