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RESEARCH ARTICLE

Adolescent Weight and Electronic Vapor Product Use: Comparing BMI-Based With Perceived Weight Status

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Introduction: This study examined the associations of BMI-based and perceived body weight status with electronic vapor product use, cigarette smoking, and dual use among U.S. adolescents.

Methods: A cross-sectional analysis was conducted in 2017 on data from 15,129 adolescents in the National Youth Risk Behavior Survey, 2015. Multiple logistic regression analyses were used to examine the associations of BMI-based and perceived weight status with electronic vapor product use, cigarette smoking, and dual use, after adjusting for all other covariates. The regression models were stratified by gender.

Results: Overall, 25.5% of males used electronic vapor products, 11.6% smoked cigarettes, and 8.1% used both; percentages among females were 22.6%, 9.8%, and 6.8%, respectively. Females who perceived themselves as overweight were more likely than those who perceived themselves as normal weight to be current electronic vapor product users (AOR=1.09, 95% CI=1.01, 1.19) and dual users (AOR=1.23, 95% CI=1.01, 1.49). When compared with normal BMI-based category, males with obese BMI status were more likely to be current cigarette smokers (AOR=1.61, 95% CI=1.06, 2.44), however, only females with overweight BMI status were more likely to be current smokers (AOR=1.89, 95% CI=1.25, 2.86).

Conclusions: Findings suggest that the influence of adolescents' body weight perceptions and BMI-based status should be accounted for when developing nicotine-containing product use prevention programs for adolescents. Specific strategies for influencing female adolescents who perceive themselves as overweight should be included to prevent emerging electronic vapor product and dual use.

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INTRODUCTION

Because of rapidly increasing prevalence, adolescent electronic vapor product (EVP) use is an emerging U.S. public health concern.[1] Prevalence of EVP use among U.S. adolescents increased nearly tenfold within the last 5 years.[2] In terms of initiation age, it appears that EVP use starts from around age 14 years and peaks at age 17 years.[3] Since 2014, EVPs surpassed tobacco cigarettes as U.S. adolescents' most commonly used nicotine-containing product.[2] In 2015, a total of 16% of U.S. high school students were current EVP users.[2]

Although some studies have reported that EVPs can be safer substitutes for tobacco cigarettes,[4–6] EVP use is controversial.[7,8] Researchers in opposition argue that EVP use has the same negative health effects as cigarette smoking, including harm to the immune system in the lungs[1] and an acute increase in blood pressure.[7] As with

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tobacco products, EVP-derived nicotine can affect the nervous system, causing addiction and serious withdrawal symptoms, including depression, anxiety, and increased appetite.[9,10]

More importantly, chronic use of EVPs among adolescents can lead to combustible tobacco product use because of nicotine addiction.[11] Prevalence of dual EVP/tobacco use among U.S. adolescents is high and rapidly increasing.[12] Approximately 76% of current adolescent EVP users also smoked tobacco cigarettes in 2011–2012.[13] In 2015, there were 2.4% of eighth, 3.5% of tenth, and 5.8% of 12th grade students that were dual users.[14] Because dual use can cause more severe health outcomes and dual users may have more difficulty quitting tobacco use,[15] the rapid increase in EVP use among adolescents should be curtailed.

As compared with cigarette smoking, fewer risk factors for adolescent EVP use have been identified. Factors influencing EVP use among adolescents that have been documented include sociodemographics,[2,12] academic performance level,[16] current use of other tobacco products,[17] peer and family influences,[16] and exposure to EVP advertisements.[18] Academic performance level is negatively associated with EVP use, whereas current use of other tobacco products, peer EVP use, and exposure to EVP advertisements are positively associated. Some EVP use risk factors are similarly associated with cigarette smoking. For example, sociodemographics, academic performance level, and peer influences are associated with both cigarette smoking and EVP use.[2,12,16,19,20] Thus, examining associations between identified risk factors of tobacco cigarette smoking and EVP use may reveal yet unknown risk factors for EVP use.

Excess body weight is a significant cigarette smoking risk factor,[20–22] as adolescents, especially females, may initiate cigarette smoking to maintain or lose weight.[22–24] This is supported by several molecular-level experimental studies that have confirmed the physiologic mechanism of nicotine in weight loss is through appetite suppression.[25–28] Previous literature has documented that both BMI-based and perceived weight status of adolescents are positively associated with smoking behavior.[19,20,23,29] Particularly, adolescents who perceive themselves as overweight are more likely to smoke cigarettes, even after adjusting for BMI.[19,29] A recent cross-sectional study of an adolescent sample in Texas reported a positive association between self-reported BMI and past 30-day EVP use.[30] To date, however, there is little evidence regarding the association of BMI and perceived weight status with EVP use among a representative sample of U.S. adolescents, despite emerging concerns about overweight and obese populations and EVP use.

Many previous studies considered gender as a moderator or effect modifier in the association between weight status and cigarette smoking.[19,20,23,29–32] Specifically, the positive association of BMI-based or perceived weight status with cigarette smoking was detected only in female adolescents or was much stronger in females than in males.[19,20,23,29,31,32] Evidence regarding the association between BMI-based weight status and EVP use is limited to one study that reported a significant positive association in male adolescents only.[30] Further, no gender difference in the association between perceived weight status and EVP use among U.S. adolescents has yet been established.

This study examines the associations of BMI-based and perceived weight status with EVP use, cigarette smoking, and dual use among U.S. adolescents by addressing the following questions: What is the association of BMI-based and perceived weight status with EVP use among U.S. adolescents? Can previous findings regarding the association of BMI-based and perceived weight status with cigarette smoking be confirmed, now that EVP use has surpassed tobacco cigarettes as U.S. adolescents' most commonly used nicotine-containing product? Given an increasing prevalence of dual users among U.S. adolescents, does an association exist between BMI-based and perceived weight status and dual use of EVPs and tobacco cigarettes? Do gender differences exist in the associations of weight status with use of each nicotine-containing product?

METHODS

Study Sample

Data from the 2015 national Youth Risk Behavior Survey (YRBS) were analyzed in 2017. YRBS is conducted biannually by the Centers for Disease Control and Prevention (CDC) to monitor health risk behaviors, including substance abuse, suicidal behavior, sexual health, eating habits, and physical activity, among students in ninth to 12th grade in U.S. public and private schools.[33] The 2015 national YRBS included EVP use variables for the first time and is one of the most recent publicly available data sources regarding EVP use among a group of nationally representative U.S. adolescents. Additionally, the YRBS also includes data on other variables of interest, including tobacco cigarette smoking, BMI status calculated from self-reported height and weight, and perceived weight status.

Of the original 2015 YRBS (N=15,624), participants who had missing values for gender (n=118), grade (n=152), and race/ethnicity (n=358) were excluded. The final analysis sample was composed of 15,129 adolescents.

Measures

EVP use and cigarette smoking were measured using the question: *During the past 30 days, on how many days did you use/smoke an electronic vapor product/cigarettes?* Adolescents who used any