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Adolescent Tobacco Use in Urban Versus Rural Areas of the United States: The Influence of Tobacco Control Policy Environments

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A B S T R A C T

Purpose: Adults and adolescents who reside in rural areas of the United States are traditionally more likely to be tobacco users. This urban-rural disparity remains largely unexplained and, more recently, it is unclear what impact the emergence of electronic cigarettes (e-cigarettes) has had on adolescent tobacco use in urban and rural areas. Our objective is to evaluate the influence of sociodemographics and tobacco control policy environments on adolescent tobacco use in urban versus rural areas, as well as to identify the effect of e-cigarettes on traditional patterns of urban-rural tobacco use.

Methods: This study analyzes repeated cross-sectional data from the National Youth Tobacco Survey for the years 2011–2014. We estimate the associations between rural residence, cigarette taxes, tobacco advertisement exposure, and ease of access to tobacco with six tobacco use outcomes: current (past 30-day) use of cigarettes, e-cigarettes, cigars, smokeless tobacco, multiple tobacco products, and any tobacco.

Results: E-cigarette use among urban youths aged 11–17 years in the United States increased from .82% in 2011 to 8.62% in 2014 ($p < .001$). Tobacco advertisement exposure was significantly positively associated with all current tobacco use outcomes ($p < .001$) except for e-cigarettes. Our predictors account for approximately 40% of the difference in urban-rural cigarette use.

Conclusions: Sociodemographics, cigarette taxes, and tobacco advertisement exposure are significant predictors of adolescent tobacco use in the United States but do not entirely explain urban-rural disparities. In addition, e-cigarettes appear to be rapidly changing traditional patterns of tobacco use, particularly in urban areas.

IMPLICATIONS AND CONTRIBUTION

This study finds that sociodemographic factors, cigarette taxes, and tobacco advertisement exposure are significant predictors of adolescent tobacco use in the United States, but these factors do not entirely explain urban-rural disparities. Electronic cigarettes appear to be rapidly changing traditional patterns of tobacco use, particularly in urban areas.

Tobacco use remains the leading cause of preventable disease and death in the United States [1]. More than 16 million Americans live with a smoking-related disease and smoking accounts for more than 480,000 deaths annually—1 of every 5 [1]. In addition to the human toll, smoking-related illness costs more than $300 billion annually in direct medical costs and lost productivity [1,2]. Although cigarette use in the United States has declined significantly over the past several decades, from 42.4% in 1965 [3] to 16.8% in 2014 [4], rates of tobacco use remain elevated in certain subpopulations. One of the more heavily impacted groups is America's rural population.

Analyses of several national adult surveys, including the Behavioral Risk Factor Surveillance System [5,6] and National Survey on Drug Use and Health [7,8], have indicated that rural

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residents are significantly more likely to use tobacco products, especially smokeless forms, compared with urban residents. A recent analysis, which used 2012–2013 National Survey on Drug Use and Health data, found current (past 30-day) adult cigarette use to be 24.1% in rural areas compared with 21.0% in urban areas and current smokeless tobacco use (chew or snuff) to be 7.8% in rural areas compared with 3.2% in urban areas [7]. Rural adults also report significantly higher rates of exposure to secondhand smoke [5], less strictly enforced clean air policies [5], and poorer tobacco cessation outcomes [9]. Characteristics of rural areas such as lower income [10], lower educational attainment [11], and targeted marketing by the tobacco industry [12] have been identified as potential contributors to these disparities, but it is unclear what percent of the overall differences in urban-rural tobacco use is explained by these characteristics versus others.

Even less research has investigated adolescent tobacco use in urban versus rural areas. One previous study of 1997–2003 Youth Risk Behavior Surveillance System data found that 37.4% of youths (aged 12–18 years) in rural areas reported having smoked regularly at some time compared with 29.6% in urban areas [13]. Several factors highlight adolescence as a critical period for tobacco use research and interventions. Tobacco use and addiction mostly begins during adolescence [14], with youth establishing smoking patterns that persist into adulthood [15]. Nearly 90% of adult smokers in the United States report smoking for the first time by age 18 [14]. Nicotine exposure during adolescence may also harm brain development [1] and is associated with attention and cognition deficits [16]. Furthermore, a recent study showed that nicotine dependence during teenage years predicts smoking frequency well into adulthood [17].

The recent emergence of electronic cigarettes (e-cigarettes) has potentially increased the risk of youth developing nicotine dependence. Since their introduction to the U.S. market in 2007, e-cigarettes have become increasingly popular among youth. In 2014, two national surveys reported that current e-cigarette use had surpassed current cigarette use among adolescents [18,19]. Although e-cigarettes are marketed as a safer alternative or form of harm reduction for current smokers, some researchers argue that baseline use of e-cigarettes among nonsmoking youth may increase the risk of subsequent progression to traditional cigarette smoking [20], which if true could raise a significant public health concern.

The objective of this study is to determine to what extent demographic, socioeconomic, and tobacco control–related factors explain differences in adolescent tobacco use between urban and rural areas in the United States. To date, only one study [13], which considered a limited number of factors, has performed a similar analysis using a nationally representative sample of youth. Our study expands the literature on this topic by considering a wide variety of tobacco products, including e-cigarettes, and controlling for a comprehensive set of measures that differ between urban and rural areas.

Methods

Data source and sampling procedure

Data were obtained from the National Youth Tobacco Survey (NYTS) over the years 2011–2014. The NYTS is a cross-sectional, nationally representative survey of middle and high school youth's tobacco-related beliefs, attitudes, behaviors, and exposure to protobacco and antitobacco influences. It employs a stratified, three-stage cluster sample design. Sampling procedures are probabilistic and conducted without replacement at all stages to select primary sampling units within each stratum, schools within each selected primary sampling unit, and classes within each selected school. Participation in the self-administered, pencil-and-paper survey at the school and student level is voluntary and student responses remain anonymous. Current NYTS data and documentation are publicly available [21]. School participation rate was 83.2% (178/214) in 2011, 80.3% (228/284) in 2012, 74.8% (187/250) in 2013, and 80.2% in 2014 (207/258) for an overall school participation rate of 79.5% (800/1,006). Student participation rate was 87.4% (18,866/21,584) in 2011, 91.8% (24,658/26,873) in 2012, 90.7% (18,406/20,301) in 2013, and 91.4% (22,007/24,084) in 2014 for an overall student participation rate of 89.4% (83,937/93,938). Overall participation rate, the product of the school-level and student-level participation rates, was 72.7% in 2011, 73.7% in 2012, 67.8% in 2013, and 73.3% in 2014, for a mean overall participation rate of 71.9%.

Inclusion/exclusion criteria

From the 83,937 total respondents, individuals aged 9 and 10 years were excluded from the analysis as outliers due to a small sample size ($n = 192$). Individuals aged 18 years and older ($n = 7,247$) were also excluded to limit the sample to respondents affected by legal minimum purchase age restrictions. Finally, individuals missing any of the tobacco use outcomes measured ($n = 5,211$) or missing age ($n = 275$) were excluded to maintain a constant sample across all multivariate regression analyses. These exclusion criteria resulted in a final sample size of 71,012.

Tobacco use outcomes

The six tobacco use outcomes measured were current use of cigarettes, e-cigarettes, cigars (defined as cigars, cigarillos, or little cigars), smokeless tobacco (defined as chewing tobacco, snuff, or dip), multiple tobacco products, and any tobacco products. Current use was determined by respondents indicating they had used the tobacco product on at least 1 day during the past 30 days (Y/N). Current use of multiple (two or more) and any tobacco products considered the following: cigarettes, e-cigarettes, cigars, smokeless tobacco, pipes, bidis, hookahs/waterpipes, snus, and/or dissolvable tobacco.

Urban-rural

Urban-rural classification from the National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties [22] was matched to NYTS data using the county where the respondent attended school. This ordinal, six-level scheme codes counties as (1) large central metro, (2) large fringe metro, (3) medium metro, (4) small metro, (5) micropolitan, and (6) noncore. Counties coded levels 1 through 4 were classified as urban, and counties coded levels 5 and 6 were classified as rural for the analysis.

Control variables

State cigarette excise taxes were obtained from the Centers for Disease Control and Prevention State Tobacco Activities Tracking and Evaluation System as a tobacco tax control. Local cigarette taxes were added for New York City as well as Chicago