

# The Tobacco 21 Movement and Electronic Nicotine Delivery System Use Among Youth

Clare Meernik, MPH,<sup>a</sup> Hannah M. Baker, MPH,<sup>b</sup> Joseph G. L. Lee, PhD, MPH,<sup>c</sup> Adam O. Goldstein, MD, MPH<sup>a,b</sup>

Cigarette smoking prevalence in the United States has significantly decreased over the past few decades to 15.1% among adults<sup>1</sup> and 9.3% among high school students.<sup>2</sup> Declines are a result of a variety of tobacco control initiatives, including limits on tobacco marketing, higher per-unit cost of tobacco products, clean air legislation, mass media campaigns, and reductions in youth access.<sup>3</sup> At the same time, use of electronic nicotine delivery systems (ENDS) has rapidly increased.<sup>2</sup> The role of ENDS in reducing or exacerbating population-level morbidity and mortality from tobacco products remains hotly contested. The increased use of ENDS, and the fact that smoking remains the leading cause of preventable death in the United States<sup>3</sup> indicate that additional policy interventions are needed to work toward the tobacco “endgame.” One such intervention is raising the minimum legal sales age (MLSA) to 21 years.<sup>4</sup> As more states and localities enact Tobacco 21 laws, it is important to consider how such policies, initially designed to decrease combustible cigarette and other tobacco use, will interact with ENDS use patterns among youth.

How ENDS are incorporated, or not, into state and local tobacco regulation, including MLSA laws, has become a key question since the issue of the Family Smoking Prevention and Tobacco Control Act deeming regulation that defined ENDS as tobacco products.<sup>5</sup> The Tobacco Control Act and the deeming rule gave the Food and Drug Administration (FDA) comprehensive regulatory authority over the manufacture, import, packaging, labeling, advertising, promotion, sale, and distribution of all tobacco products.<sup>5</sup> Such regulatory policies include the ban of free product samples, required warning labels on packages and advertisements, and the prohibition of misleading advertising.<sup>5</sup> Notably, state and local governments, not the FDA, retain authority to enact higher MLSA legislation.

Given that the majority of daily smokers (85%) begin smoking well before age 21, raising the MLSA to 21 years would be an effective strategy to prevent youth and young adult initiation of tobacco use, largely by reducing the availability of tobacco products to adolescents aged 15 to 17 years from their slightly older peers.<sup>4</sup> A report by the Institute of Medicine, commissioned on behalf of the FDA, concluded that an increase of the MLSA to 21 years would not only aid in reducing

<sup>a</sup>Department of Family Medicine, University of North Carolina School of Medicine, and <sup>b</sup>Lineberger Comprehensive Cancer Center, University of North Carolina, Chapel Hill, North Carolina; and <sup>c</sup>Department of Health Education and Promotion, College of Health and Human Performance, East Carolina University, Greenville, North Carolina

Ms Meernik and Ms Baker contributed to the conceptualization of the manuscript, drafted the initial manuscript, and critically revised the manuscript for intellectual content; Dr Lee contributed to the interpretation of the data and critically revised the manuscript for intellectual content; Dr Goldstein conceptualized the manuscript and critically revised the manuscript for intellectual content; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

**DOI:** 10.1542/peds.2016-2216

Accepted for publication Sep 9, 2016

Address correspondence to Clare Meernik, MPH, Department of Family Medicine, University of North Carolina, 590 Manning Dr, CB 7595, Chapel Hill, NC 27599. E-mail: cmeernik@email.unc.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2017 by the American Academy of Pediatrics

**FINANCIAL DISCLOSURE:** Dr Lee receives compensation from a store audit/compliance and mapping system, Counter Tools (<http://countertools.org>), owned by the University of North Carolina at Chapel Hill. The tools and audit mapping system were not used in this study; the other authors have indicated they have no financial relationships relative to this article to disclose.

**FUNDING:** No external funding.

**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

**To cite:** Meernik C, Baker HM, Lee JGL, et al. The Tobacco 21 Movement and Electronic Nicotine Delivery System Use Among Youth. *Pediatrics*. 2017;139(1):e20162216

initiation of tobacco product use among adolescents and young adults, but it would also decrease smoking prevalence at a population level, and thus lead to substantial reductions in smoking-related morbidity and mortality.<sup>4</sup>

Broad public support for higher MLSA laws has been reported; according to a 2014–2015 national survey, two-thirds of adults across the United States favor increasing the MLSA for tobacco products to 21 years.<sup>6</sup> However, legal and political barriers have hindered nationwide adoption of Tobacco 21 legislation. First, the Tobacco Control Act specifically prohibits the FDA from raising the MLSA of tobacco products higher than the current federal level of 18 years.<sup>5</sup> This prohibition has led to a push toward enactment of higher MLSA laws at the state and local levels. Hawaii and California have successfully enacted Tobacco 21 policies, and as of August 2016, at least 185 localities in 14 states have raised the MLSA to 21 years, including New York City, Chicago, and Boston.<sup>7</sup> However, 20 states currently preempt local youth access restrictions on tobacco that are stricter than state law, imposing limitations on local authority to raise the MLSA.<sup>8</sup> Although repealing preemption is one of the goals of most major tobacco control advocacy organizations, thus far, few states have successfully repealed such legislation.<sup>9</sup> Second, even with strong public support for Tobacco 21 legislation across the United States, political barriers remain due to opposition from interest groups, such as tobacco manufacturers and retailers, that argue higher MLSA laws infringe on personal liberty and harm small businesses.<sup>10</sup>

Tobacco 21 laws that have been adopted in Hawaii, California, and various localities around the country specifically incorporate ENDS into those policies, a particularly important measure given that past

30-day ENDS use among youth has risen dramatically over the past few years: from 1.5% in 2011 to 16% in 2015 among high school students.<sup>2</sup> Although the risks associated with ENDS, particularly in the long term, remain uncertain, there is no question that nicotine exposure has harmful effects on the brains of adolescents and young adults.<sup>3</sup> Areas of the brain involved in higher cognitive function, particularly the prefrontal cortex, undergo substantial development throughout adolescence and into adulthood<sup>3</sup>; nicotine exposure during this critical period can result in serious deficits in cognitive and behavioral function, including attention deficits and psychiatric disorders later in life<sup>11</sup> as well as potential long-term structural and functional changes in the brain.<sup>12</sup> Furthermore, the developing adolescent brain is particularly susceptible to the rewards associated with nicotine and is more likely to become addicted; initiation of smoking earlier in life is associated with a higher likelihood of becoming a regular smoker and smoking more cigarettes as an adult.<sup>13</sup>

Tobacco 21 laws that include ENDS should reduce initiation of these products among youth, similar to the suggested impact MLSA laws will have on initiation patterns for cigarettes.<sup>4</sup> Reduced initiation of ENDS through MLSA laws may result in reduced initiation of cigarettes, and it may also result in delayed initiation of cigarette use, because the evidence for ENDS serving as a gateway to cigarette use is increasing.<sup>4,14</sup> Regardless, it is plausible to predict that local, state, or federal MLSA laws would have a critical role in substantially reducing nicotine exposure among adolescents and young adults, particularly those aged 15 to 17 years.

Although the FDA cannot enact higher MLSA regulation to impact adolescent ENDS use without Congressional action, other actions

can now be taken by the FDA to reduce early initiation of ENDS and other tobacco products. Priorities could include developing more effective ENDS health warnings on product packages and advertisements, enacting stronger restrictions on ENDS advertising and marketing, particularly at the point of sale, and more effectively regulating ENDS sales to minors, including internet sales. Although most Tobacco 21 legislation thus far has incorporated ENDS into policies, it is not universal, because some localities have exempted ENDS from their MLSA increases. It should be possible to garner more political support for MLSA laws by including, rather than excluding, ENDS regulations along with traditional tobacco products given the strong public support for such policies and the fact that ENDS use has surpassed the use of cigarettes among high schoolers.<sup>2</sup> Legislative and regulatory actions at the state and federal level to address increasing the MLSA to 21 years for tobacco products, including ENDS, will help protect adolescents from all tobacco use, nicotine exposure, and a potential lifetime of nicotine addiction.

#### ABBREVIATIONS

ENDS: electronic nicotine delivery system

FDA: Food and Drug Administration

MLSA: minimum legal sales age

#### REFERENCES

1. Ward BW, Clarke TC, Nugent CN, Schiller JS; National Center for Health Statistics. Early release of selected estimates based on data from the 2015 National Health Interview Survey. Available at: [www.cdc.gov/nchs/data/nhis/earlyrelease/earlyrelease201605.pdf](http://www.cdc.gov/nchs/data/nhis/earlyrelease/earlyrelease201605.pdf). Accessed August 31, 2016
2. Singh T, Arrazola RA, Corey CG, et al. Tobacco use among middle and high school students—United States,

- 2011–2015. *MMWR Morb Mortal Wkly Rep.* 2016;65(14):361–367
3. US Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General.* Atlanta, GA: US 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; 2014
  4. Bonnie RJ, Stratton K, Kwan LY. *Public Health Implications of Raising the Minimum Age of Legal Access to Tobacco Products.* Washington, DC: National Academies Press; 2015
  5. US Food and Drug Administration. Deeming tobacco products to be subject to the Federal Food, Drug, and Cosmetic Act, as amended by the Family Smoking Prevention and Tobacco Control Act; restrictions on the sale and distribution of tobacco products and required warning statements for tobacco products. Final rule. Available at: <https://federalregister.gov/a/2016-10685>. Accessed August 31, 2016
  6. Lee JG, Boynton MH, Richardson A, Jarman K, Ranney LM, Goldstein AO. Raising the legal age of tobacco sales: policy support and trust in government, 2014–2015, US [published online ahead of print June 1, 2016]. *Am J Prev Med.* doi:10.1016/j.amepre.2016.04.009
  7. Campaign for Tobacco-Free Kids. States and localities that have raised the minimum legal sale age for tobacco products to 21. Available at: [www.tobaccofreekids.org/content/what\\_we\\_do/state\\_local\\_issues/sales\\_21/states\\_localities\\_MLSA\\_21.pdf](http://www.tobaccofreekids.org/content/what_we_do/state_local_issues/sales_21/states_localities_MLSA_21.pdf). Accessed August 31, 2016
  8. Centers for Disease Control and Prevention. State Tobacco Activities Tracking and Evaluation (STATE) System. Available at: [www.cdc.gov/statesystem/](http://www.cdc.gov/statesystem/). Accessed August 31, 2016
  9. Centers for Disease Control and Prevention. State preemption of local tobacco control policies restricting smoking, advertising, and youth access—United States, 2000–2010. *MMWR Morb Mortal Wkly Rpt.* 2011;60(33):1124–1127
  10. Morain SR, Winickoff JP, Mello MM. Have tobacco 21 laws come of age? *N Engl J Med.* 2016;374(17):1601–1604
  11. Goriounova NA, Mansvelter HD. Short- and long-term consequences of nicotine exposure during adolescence for prefrontal cortex neuronal network function. *Cold Spring Harb Perspect Med.* 2012;2(12):a012120
  12. England LJ, Bunnell RE, Pechacek TF, Tong VT, McAfee TA. Nicotine and the developing human: a neglected element in the electronic cigarette debate. *Am J Prev Med.* 2015;49(2):286–293
  13. Lynch BS, Bonnie RJ, eds. *Growing Up Tobacco Free: Preventing Nicotine Addiction in Children and Youths.* Washington, DC: National Academies Press; 1994
  14. Primack BA, Soneji S, Stoolmiller M, Fine MJ, Sargent JD. Progression to traditional cigarette smoking after electronic cigarette use among US adolescents and young adults. *JAMA Pediatr.* 2015;169(11):1018–1023

## The Tobacco 21 Movement and Electronic Nicotine Delivery System Use Among Youth

Clare Meernik, Hannah M. Baker, Joseph G. L. Lee and Adam O. Goldstein  
*Pediatrics* 2017;139;

DOI: 10.1542/peds.2016-2216 originally published online December 6, 2016;

<b>Updated Information &amp; Services</b>	including high resolution figures, can be found at: <a href="http://pediatrics.aappublications.org/content/139/1/e20162216">http://pediatrics.aappublications.org/content/139/1/e20162216</a>
<b>References</b>	This article cites 7 articles, 1 of which you can access for free at: <a href="http://pediatrics.aappublications.org/content/139/1/e20162216#BIBL">http://pediatrics.aappublications.org/content/139/1/e20162216#BIBL</a>
<b>Subspecialty Collections</b>	This article, along with others on similar topics, appears in the following collection(s): <b>Substance Use</b> <a href="http://www.aappublications.org/cgi/collection/substance_abuse_sub">http://www.aappublications.org/cgi/collection/substance_abuse_sub</a> <b>Smoking</b> <a href="http://www.aappublications.org/cgi/collection/smoking_sub">http://www.aappublications.org/cgi/collection/smoking_sub</a> <b>Advocacy</b> <a href="http://www.aappublications.org/cgi/collection/advocacy_sub">http://www.aappublications.org/cgi/collection/advocacy_sub</a> <b>Legislation</b> <a href="http://www.aappublications.org/cgi/collection/legislation_sub">http://www.aappublications.org/cgi/collection/legislation_sub</a>
<b>Permissions &amp; Licensing</b>	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: <a href="http://www.aappublications.org/site/misc/Permissions.xhtml">http://www.aappublications.org/site/misc/Permissions.xhtml</a>
<b>Reprints</b>	Information about ordering reprints can be found online: <a href="http://www.aappublications.org/site/misc/reprints.xhtml">http://www.aappublications.org/site/misc/reprints.xhtml</a>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



# PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **The Tobacco 21 Movement and Electronic Nicotine Delivery System Use Among Youth**

Clare Meernik, Hannah M. Baker, Joseph G. L. Lee and Adam O. Goldstein  
*Pediatrics* 2017;139;

DOI: 10.1542/peds.2016-2216 originally published online December 6, 2016;

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/139/1/e20162216>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2017 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

