

Perspective

The EVALI and Youth Vaping Epidemics — Implications for Public Health

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Since entering the U.S. marketplace in 2007, e-cigarette, or vaping, products have evolved into a diverse class of inhaled aerosol devices. Earlier generations of these products were dispo-

able, resembled conventional cigarettes in shape, and were designed to deliver nicotine to the user. Newer generations are rechargeable, don't resemble conventional cigarettes, and can be used to deliver various substances, including nicotine and tetrahydrocannabinol (THC, the psychoactive ingredient in marijuana).¹ The U.S. markets for both nicotine- and THC-containing vaping products have dramatically expanded. Recently, there has been an unprecedented increase in the use of nicotine-containing products by young people (see graph).² Simultaneously, an increasing number of U.S. states have legalized marijuana use, a shift that coincided with changes in the public perception of risk,

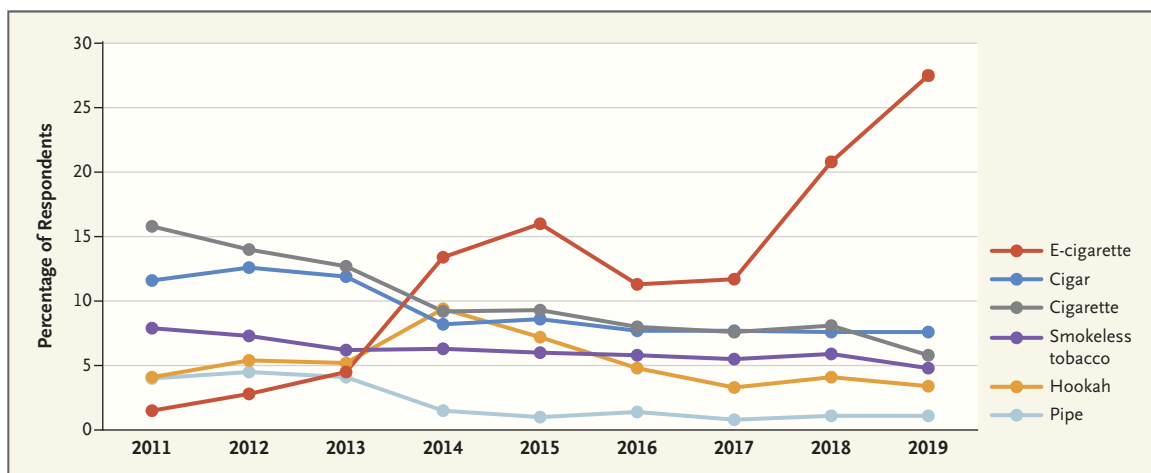
the availability of a wide variety of products containing THC or cannabidiol (CBD, a nonpsychoactive ingredient in marijuana), and increases in marijuana use among adults, especially young adults.³

As the product landscape has evolved, there has been debate about the impact of vaping products on public health. Though some nicotine-containing products may help facilitate smoking cessation and could reduce risk for adult smokers if used as a complete substitute for (and not a supplement to) conventional cigarettes, there is cause for concern about the use of these products by young people.¹ It is also critical to consider the implica-

tions of changing patterns of marijuana use, including the growing use of THC-containing vaping products, especially in light of the higher potency of such products as compared with those used in past decades. The impact of these trends on public health has received minimal research attention to date,³ even as marijuana use becomes more widespread, state regulatory approaches shift, and the market for illicit products expands.

Against this backdrop, the United States is seeing what can be considered two distinct but related epidemics connected with vaping: the recent outbreak of lung injuries and the continued surge in use by young people. The implementation of interventions aimed at curbing these epidemics should take into consideration their underlying drivers.

Since August 1, 2019, when Wisconsin reported the first



Current Tobacco Product Use among U.S. High School Students, 2011 to 2019.

Current product use is defined as use in the past 30 days. Between 2018 and 2019, there was a change in the mode of survey administration from paper and pencil to electronic tablet. Data are from the National Youth Tobacco Survey and were provided by the Centers for Disease Control and Prevention.

cluster of lung injuries to the Centers for Disease Control and Prevention (CDC), the CDC has worked with federal and state partners to address a multistate outbreak of e-cigarette, or vaping, product use–associated lung injury (EVALI). As of January 7, 2020, a total of 2602 cases of EVALI had been reported to the CDC from all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands; 57 deaths had been confirmed. All patients with EVALI have reported using vaping products. Nationally, most of these patients reported using THC-containing products, but some reported exclusive use of nicotine-containing products. The median age of patients was 24 years; 62% of patients were between 18 and 34 years old, and 16% were under 18.⁴ Most patients with EVALI reported having obtained their products from informal sources, such as friends, family, or in-person or online dealers. In addition, laboratory testing of bronchoalveolar-lavage (BAL) fluid samples from 51 patients with EVALI revealed THC

in most samples and vitamin E acetate in all samples, but did not identify these substances in BAL fluid samples from a control group. Vitamin E acetate can be used as a thickening agent in THC-containing vaping products, but the evidence is insufficient to rule out the contribution of other chemicals to the development of EVALI.⁴

The youth vaping epidemic is of longer duration. Current use of e-cigarette, or vaping, products increased by 900% among U.S. middle and high school students between 2011 and 2015, declined in 2016, and then increased again between 2017 and 2018, erasing previous progress.² In 2019, more than 5.2 million young people in the United States reported current use, including 27.5% of high school students and 10.5% of middle school students.² In contrast, current use among adults remained unchanged from 2014 to 2017, and in 2018, 3.2% of U.S. adults (8.1 million) reported current use of e-cigarettes, including 7.6% of adults 18 to 24 years of age (2.1 million).⁵ Use of these

products among young people is driven by multiple factors, including advertising, attractive flavors, and the availability of easily concealable devices that deliver high levels of nicotine.¹ Recent product innovation has also contributed; “pod mods,” including Juul, are often shaped like USB flash drives and are easily concealable. Pod mods also deliver nicotine in the form of nicotine salts, which allow high levels of nicotine to be inhaled more easily and with less irritation than the free-base nicotine used in older-generation e-cigarettes.² Increased nicotine levels are a matter of concern for young people, since nicotine is highly addictive and can harm brain development, which continues through the mid-20s.¹

Both these epidemics predominantly affect young people and probably have multiple causes. Moreover, it’s likely that the widespread use of e-cigarettes, including products that facilitate THC use, has created an environment that has fueled the EVALI epidemic. However, the epidemics also differ in some key ways. The

EVALI epidemic primarily affects young adults 18 to 34 years of age, which is the population with the highest rates of marijuana use in the United States. It is driven by the use of THC-containing products from informal and illicit sources and is linked to thickening agents or diluents in product formulations.⁴ The youth vaping epidemic, for its part, primarily affects adolescents younger than 18 years old, is driven by the use of nicotine-containing products obtained mostly from formal sources such as authorized retailers, and has been driven by multiple factors, including those that enhance the appeal and availability of these products to young people.^{1,2}

The rapid increase in EVALI cases prompted the issuance of numerous public health advisories at the national, state, and local levels; and in some cases, state-level restrictions on the sale of certain types of e-cigarette, or vaping, products have been implemented. In addition, some states with legal marijuana markets have established, or are considering, laws to limit the use of additives in THC-containing vaping products.

But these recent efforts are not the first population-based interventions designed to minimize the health risks posed by such products or substances used in them. Over the past decade, numerous states and localities have adopted interventions to reduce nicotine-containing e-cigarette use among young people, based on established strategies for conven-

tional tobacco products; such interventions include prohibiting use in indoor public areas, restricting young peoples' access in retail settings, implementing price policies, and developing educational campaigns.¹ In addition, states that have legalized marijuana use have implemented strategies to provide oversight of products, reduce inappropriate access, and realize potential health benefits while minimizing harms; the effectiveness of these strategies, however, is uncertain.³

The EVALI and youth vaping epidemics warrant immediate and decisive action to protect public health. The use of vaping products among young people is unsafe, regardless of whether they contain nicotine or THC. Both marijuana use and nicotine use can harm brain development through young adulthood; starting to use these substances at a younger age also increases the risk of tobacco and cannabis use disorders later in life.^{1,3} The risks posed by these products are further compounded by the emergence of EVALI.

The focus and scope of actions to address these epidemics must be grounded in science and must target the underlying drivers. Strategies for addressing the youth vaping epidemic include the modernization of evidence-based tobacco-control strategies to include vaping products (e.g., price increases, indoor-use restrictions, and education campaigns), and implementation of novel strategies that address key drivers (e.g., fla-

vor restrictions).¹ Strategies for addressing the EVALI epidemic include continued investigation of causes, diagnosis and treatment by health care providers, public health messages about risks, and ensuring that chemicals of concern are not introduced into the supply chain. It is also critical to monitor any consequences from long-term use of THC in these devices and long-term health outcomes in patients who survive EVALI.

The views expressed in this article are those of the authors and do not necessarily represent those of the U.S. Centers for Disease Control and Prevention.

Disclosure forms provided by the authors are available at NEJM.org.

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