

Electronic Cigarettes in Maine:

Health Effects, Marketing, Use, and Regulation

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Abstract

Electronic cigarettes (e-cigarettes) are electronic nicotine-delivery systems (ENDS) that deliver a vapor of nicotine and other potentially dangerous chemicals to the user; nonusers are also exposed. Driven by a well-funded advertising campaign, use of e-cigarettes has increased in Maine until it now exceeds the use of combustible cigarettes among youth. In 2015, 14.5 percent of female high school students and 18.8 percent of male high school students in Maine reported current use of e-cigarettes. Maine laws and city ordinances restrict e-cigarette use in some places where combustible cigarettes are banned, but legislative gaps remain. Most Maine schools, colleges, and hospitals also ban e-cigarettes, but again gaps remain. This article explores the marketing and use of e-cigarettes nationwide and in Maine and proposes policies to restrict access and use, particularly by youth.

INTRODUCTION

Electronic cigarettes (e-cigarettes) are electronic nicotine-delivery systems (ENDS) consisting of a fluid-filled chamber, a power source (battery), a heating element, which evaporates the chemicals in the fluid, and a second chamber in which the evaporated chemicals are cooled into an aerosol. The aerosol is inhaled through a mouthpiece (Orellana-Barrios et al. 2015). The fluid used in e-cigarettes does not have to contain nicotine, but it usually does. It also contains a solvent and may contain other chemicals as flavorings or contaminants (Dinakar and O'Connor 2016). Both the nicotine (Yan and D'Ruiz 2014; Lopez et al. 2016) and the other chemicals (Kosmider et al. 2014, 2016; Farsalinos, Voudris, and Poulas 2015) in e-cigarettes may present health hazards to the users and to those who inhale secondhand vapors.

E-cigarettes have been available in the United States for only a decade. Driven by a robust and effective advertising campaign (US DHHS 2016), in that short time the use of e-cigarettes by youth has increased sharply and now exceeds the use of combustible cigarettes by this age group. (For the purposes of this paper, we have adopted the terminology of two recent reports

by the surgeon general and use the term youth to refer to middle and high school students or those younger than 18 [US DHHS 2014, 2016]). E-cigarettes are also proposed, if not marketed, as harm-reduction and smoking-cessation aids for current smokers, although debate rages on this subject even in the medical literature (Avdalovic and Murin 2015; Middlekauff 2015; Yeh 2016).

Given the rapid increase in e-cigarette use, which is altering the tobacco-use landscape in Maine and nationwide, it is not surprising that legislative and regulatory efforts to control access to and use of e-cigarettes have struggled to keep up. Recent efforts nationally and in Maine have brought the use of e-cigarettes under some of the same restrictions that apply to the use of combustible cigarettes, but regulatory gaps remain. This article explores the health effects, marketing, and legislative or regulatory restrictions of e-cigarettes with a focus on Maine. It proposes policy initiatives to limit use of e-cigarettes in the state, particularly among youth, that will still allow current adult smokers of combustible cigarettes to access e-cigarettes if they choose to use them as smoking-reduction or -cessation devices. This subject is important because e-cigarettes have become available only recently, are gaining quickly in popularity, and may reverse decades of declining use of tobacco products. Given the centrality of the health impacts of e-cigarettes to any restriction efforts, we will begin with an exploration of e-cigarettes and health.

HEALTH EFFECTS OF E-CIGARETTES

Nicotine

When a person smokes an e-cigarette her blood nicotine levels rise rapidly and, depending on the

brand used, reach as high as, or even higher than, levels produced by smoking combustible cigarettes (Flouris et al. 2013; Yan and D’Ruiz 2014; Lopez et al. 2016). Consequently, use of e-cigarettes can produce similarly acute cardiovascular effects as the use of combustible cigarettes including increases in blood pressure and heart rate (Yan and D’Ruiz 2014). Chronic use of nicotine causes dependence similar to that of cocaine use. Physical signs of nicotine dependence begin rapidly with regular use, and youth are particularly vulnerable to nicotine dependence. Additionally, chronic exposure to nicotine from combustible cigarettes has negative effects on brain development in adolescent smokers; nicotine also crosses the placental barrier of a pregnant smoker and impairs brain development in the fetus (US DHHS 2016). Because some brands of e-cigarettes and combustible cigarettes produce similar nicotine blood levels, it is likely that there would be similar nicotine dependence and brain development harm with e-cigarettes.

There is ample epidemiologic evidence that nicotine use commonly precedes the use of illicit drugs such as cannabis and cocaine (Kandel, Yamaguchi, and Chen 1992). However, that association alone could either suggest a gateway model in which nicotine dependence produces specific biological changes that lower the threshold to repeated use of other drugs or a more general common-liability-to-addiction model in which multiple latent traits place an individual at risk for addiction to a range of substances. One potential criticism of the gateway model is that it lacks a specific biological mechanism (Vanyukov et al. 2012). Although more study is needed, this criticism has been partially addressed by murine studies showing that nicotine primes the reward and memory centers of the brain for enhanced effects of cocaine (Kandel and Kandel 2014).

Other Risks

The fluid used in e-cigarettes contains a solvent, usually vegetable glycerin or propylene glycol, and may also contain one of more than 7,000 flavorings (Dinakar and O’Connor 2016). The solvents and many of the flavorings used in e-cigarettes are on Food and Drug Administration’s (FDA) list of food additives generally regarded as safe (GRAS). However, chemicals on the GRAS list are considered safe for oral ingestion; their safety for inhalation in an aerosol is usually unknown. For instance, the solvent propylene glycol and the flavoring diacetyl are both on the FDA GRAS list, but exposure to a mist of propylene glycol causes eye and

upper respiratory irritation and inhalation of diacetyl is associated with the potentially serious lung disease bronchiolitis obliterans (known as popcorn lung) (Rowell and Tarran 2015). Although the amounts of harmful substances can vary depending on the brand of e-cigarette, method of testing, and voltage used in the vaporization process, researchers have identified a long list of potentially harmful substances in e-cigarette vapor including the carcinogen formaldehyde (Kosmider et al. 2014; Farsalinos, Voudris, and Poulas 2015), the respiratory irritant benzaldehyde (Kosmider et al. 2016), and metal and silicate particles probably derived from the chambers or heating element of the e-cigarette (Williams et al. 2013). Ultrafine particles (particles smaller than 2.5 micrometers in diameter capable of penetrating deep into the lung and causing a range of respiratory diseases) have been found in e-cigarette vapors (Fernández et al. 2015). In areas with ongoing heavy e-cigarette use, levels of these ultrafine particles can exceed those found in bars that allow the smoking of combustible cigarettes (Soule et al. 2017).

Secondhand smoke from combustible cigarettes is a combination of the main-stream smoke exhaled by the smoker and side-stream smoke coming directly from the burning cigarette.¹ Although e-cigarettes do not produce side-stream smoke as combustible cigarettes do, e-cigarette users exhale some of the aerosol from their device, thereby exposing nonsmokers to the aerosol. The health impacts of this exhaled aerosol on nonsmokers are difficult to measure (US DHHS 2016). However, levels of ultrafine particles are higher in the homes of e-cigarette smokers than in those of nonsmokers, but lower than in the homes of combustible cigarette smokers (Fernández et al. 2015).

Other risks related to e-cigarettes do not derive directly from their use. There is enough nicotine in e-cigarette fluid to sicken or even kill a child if it is ingested, and one intentional nicotine suicide by a 24-year-old woman has been reported (Dinakar and O’Connor 2016). Between September 2010 and February 2014, over half of the 2,405 calls to US poison control centers about e-cigarette poisonings concerned children less than five years old (Chatham-Stephens et al. 2015). E-cigarettes also cause injury when they catch fire or explode, which can happen during recharging (US DHHS 2016). Furthermore, depending on the design, users can modify e-cigarettes to deliver a range of illegal drugs including narcotics, steroids, and cannabis (Brown and Cheng 2014).

Smoking-cessation Aid

Can e-cigarettes act as a harm-reduction or smoking-cessation method for current smokers? A meta-analysis by Kalkhoran and Glantz (2016) concluded that current smokers who also smoked e-cigarettes were less likely to quit than those who did not; one of the few randomized controlled trials on this subject found that e-cigarettes were about as effective as nicotine patches in helping current smokers quit (Bullen et al. 2016). Offering free e-cigarettes to current smokers who do not intend to quit causes them to reduce their consumption of combustible cigarettes (Polosa et al. 2014), but e-cigarettes are not generally available free. A nonrandomized study found that smokers who chose e-cigarettes as a smoking-cessation device were more likely to quit successfully than were those who used over-the-counter nicotine replacement. However, the two experimental groups in this study differed in multiple ways including a higher socioeconomic status for those who chose e-cigarettes, which may have made them more likely to succeed. The authors readily admit the possibility of unmeasured confounders, and users of prescription smoking-cessation aids were excluded from the study so no comparison between these methods and e-cigarettes was possible (Brown et al. 2014).

E-cigarettes are not currently recommended by the US Preventive Services Task Force (USPSTF) or approved by the FDA for smoking cessation (Siu 2015). Nonetheless for a current smoker, switching to e-cigarettes is undoubtedly safer than continuing the use of combustible cigarettes. Some clinicians believe that they should not discourage their patients from using e-cigarettes as a smoking-cessation tool, whereas others counter that FDA-approved smoking-cessation devices already exist and that clinicians should engage in evidence-based practice (Yeh 2016). (Smoking combustible cigarettes is the largest cause of preventable death in the United States, responsible for more than 480,000 deaths per year, so saying that e-cigarettes are less dangerous than combustible cigarettes sets a rather low safety bar.)

MARKETING AND USE OF E-CIGARETTES

The current form of e-cigarettes was invented in China in 2003 (US DHHS 2016) and has been marketed in the United States since 2007. The total value of e-cigarette sales in the United States is projected to reach \$10 billion in 2017 (Global Sources 2015).

Considering that the sale of combustible cigarettes in the United States is declining, it is clear that e-cigarettes represent the future of the tobacco industry. Most of the major multinational tobacco companies are in the e-cigarette business, and 10 large companies control more than two-thirds of the US e-cigarette market (Orellana-Barrios et al. 2015). E-cigarettes are fully integrated into the overall tobacco production and marketing system, and because the nicotine in e-cigarettes is derived from tobacco, it is reasonable to consider e-cigarettes tobacco products that should be subject to all restrictions currently in place for such products. Proponents of e-cigarettes, however, dispute this idea.

E-cigarettes come in several forms: disposable models, models with replaceable nicotine-containing cartridges, and tank models that the user fills with nicotine-containing fluid (Orellana-Barrios et al. 2015; US DHHS 2016). Between 2010 and 2014, e-cigarette prices fell dramatically as sales increased (US DHHS 2016). In Maine, the value of sales of disposable e-cigarettes in food, drug, and mass merchandising stores rose from \$144,000 to \$220,000 per year (52 percent) between 2012 and 2013, while sales of starter kits rose from \$85,000 to \$106,000 per year (25 percent) and sales of cartridge refills rose from \$40,000 to \$92,000 (131 percent). In the same period, the average price of these items in Maine fell between 5.8 percent and 6.9 percent (Loomis et al. 2016). However, because e-cigarettes are also sold in convenience stores and smoke shops in Maine and sales data for those venues are not available, these figures do not provide a full accounting of e-cigarette sales in the state.

Use Trends

E-cigarettes are gaining in popularity, particularly among youth. A national study conducted in 2013 and 2014 found that 10.7 percent of 12- to 17-year-old youth used e-cigarettes while 13.4 percent used combustible cigarettes (Kasza et al. 2017). Data from the National Youth Tobacco Survey (NYTS) reveal that the percentage of high school students who reported using e-cigarettes in the previous 30 days increased from 1.5 percent in 2011 to 16 percent in 2015, with a particularly sharp increase after 2013. For middle school students, the increase was from 0.6 percent in 2011 to 5.3 percent in 2015 (US DHHS 2016). This trend occurred in a period when, according to the NYTS, use of combustible cigarettes in both of these age groups fell. By 2015, the use of e-cigarettes was about twice as high

as the use of combustible cigarettes among both high school and middle school students (Singh et al. 2016). It is possible that increasing use of e-cigarettes by youth reflects them substituting e-cigarettes for combustible cigarettes. However, this does not seem to be the case. In the US population at large, per capita consumption of tobacco and cigarette smoking rates have been falling since the 1960s, and smoking rates among high school students have been declining since the late 1990s, long before e-cigarettes were available. The rates of decline show no signs of steepening since the introduction of e-cigarettes (US DHHS 2014).

In Maine in 2015, 14.5 percent of female high school students and 18.8 percent of male high school students reported current use of electronic cigarettes. This level of use exceeded that of combustible cigarettes (10.5 percent for female and 11.7 percent for male students), but was less than the national median by state (23.5 percent) (Kann et al. 2016). There is also evidence that the use of e-cigarettes and the use of combustible cigarettes are mutually reinforcing. Youth who use e-cigarettes are more likely to become heavy smokers of combustible cigarettes (Leventhal et al. 2016), and young smokers of combustible cigarettes are more likely to become users of e-cigarettes (Wang et al. 2016).

The increase in e-cigarette use among youth has led to concern that e-cigarettes are ushering in a new epidemic of nicotine dependence that will affect other age groups. E-cigarette use rates among 18- to 24-year-olds are beginning to increase (US DHHS 2016). Among working adults, e-cigarette use was highest for those 18 to 24 years of age and those with incomes of less than \$35,000 per year. It fell progressively as age and income increased. In the Northeast in 2014, 2 percent of working adults used e-cigarettes, about half the rate found in other regions of the country (Syamlal et al. 2016).

Marketing of E-cigarettes

In the United States, e-cigarettes were initially advertised and marketed on the internet and from stalls at shopping malls. They are now advertised on television and in print media as well. Tobacco companies have also taken advantage of the widespread use of social media among youth to market e-cigarettes (US DHHS 2016). At least until recently, tobacco companies gave away free e-cigarettes at events such as music performances and automobile races (Durbin and Boehner 2015).

They also use celebrities to market their products (Dinakar and O'Connor 2016) and advertise using attractive models and sexually explicit images designed to appeal to youth in general and young males in particular (US DHHS 2016). These tactics closely mirror those used by tobacco companies to market combustible cigarettes in the past.

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Expenditures on e-cigarette ads rose to between \$115 million and \$125 million in 2014 (Kim, Arnold, and Makarenko 2014; US DHHS 2016). These ads are effective at reaching (Truth Initiative 2015) and influencing (Farrelly et al. 2015) youth. Since FDA regulations restricting the advertising of tobacco products do not apply to e-cigarettes, it is currently legal to advertise e-cigarettes on TV and radio. The appearance of such ads represents the return of advertising by multinational tobacco companies to venues from which they had been restricted since tobacco advertising was banned in 1970. The Maine Association of Broadcasters states that Maine radio and TV stations cannot advertise smoke shops, cigarettes, small cigars, or smokeless tobacco, but that they can advertise cigars, pipe tobacco, and e-cigarettes.²

Tobacco companies have taken advantage of the less stringent restrictions on e-cigarettes in another way as well. Flavorings other than menthol are banned from combustible cigarettes under the federal Family Smoking Prevention and Tobacco Control Act because they appeal to youth. However, flavored e-cigarettes are legal. Youth find the flavorings attractive (Kong et al. 2015) and commonly begin their use of e-cigarettes with a flavored brand (Ambrose et al. 2015).

LEGISLATION RESTRICTING SALE AND USE OF E-CIGARETTES

National Legislation

Federal regulation of smoking began in the late 1980s with restriction of smoking on commercial airline flights and in railroad cars.³ In the 1990s, Congress expanded these restrictions to include indoor facilities at which federally funded children's services were provided and indoor facilities that were constructed, operated, or maintained with federal funds (Pro-Child Act of 1994).

The first laws to regulate smoking in Maine, passed in 1887 and 1909, also sought to restrict the exposure of youth to tobacco.

In this period, the federal government also sought to protect children from becoming smokers by establishing minimum legal purchasing ages and regulating youth access to tobacco products from vending machines and similar unmonitored outlets (Alcohol, Drug Abuse, and Mental Health Administration Reorganization Act).

Federal laws did not directly regulate the tobacco industry until 2009 with passage of the Family Smoking Prevention and Tobacco Control Act. The FDA was given the authority to impose new warnings and labels on tobacco packaging, to limit advertising of tobacco products to minors, and to ban certain products such as flavored cigarettes altogether. For the first time, tobacco companies were required to seek FDA approval for new tobacco products. The Family Smoking Prevention and Tobacco Control Act had broad support, including from some representatives of tobacco farming states.⁴ The act passed and was signed into law by President Barak Obama on June 22, 2009.

Although e-cigarettes had been marketed in the United States since 2007, they were not mentioned in the Family Smoking Prevention and Tobacco Control Act. Nearly a decade passed before the FDA issued rules that brought e-cigarettes under the regulatory power of the federal government. The so-called deeming rule, which extended the FDA's regulatory authority to all

tobacco products including e-cigarettes, was published in the Federal Register in May 2016 and took effect in August 2016. It required new health warnings, banned free samples, and restricted youth access to newly regulated tobacco products by not allowing products to be sold to those younger than 18 and not allowing tobacco products to be sold in vending machines unless in an adult-only facility.

Maine Legislation

The first laws to regulate smoking in Maine, passed in 1887 and 1909, also sought to restrict the exposure of youth to tobacco. Tobacco legislation again appeared in Maine at about the same time it did at the national level. Between 1973 and 2015, the Maine Legislature took up some 249 separate bills and resolves addressing the topic. Of that number, about 75 substantial bills or amendments were passed into law. It often took many attempts to pass regulation concerning a tobacco-related practice. For example, the first bills to ban smoking in public places and in state government buildings were introduced in 1973, but a bill was not successfully passed until 1987.⁵

The trajectory of e-cigarette legislation in Maine is more recent and straightforward. In March 2015, An Act to Protect Children and the Public from Electronic Cigarette Vapor was introduced in the Maine House of Representatives. The bill included a definition of e-cigarettes and amended the Maine law that regulates smoking in public places so that smoking included the use of e-cigarettes.⁶ The bill was assigned to the Joint Standing Committee on Health and Human Services, which held public hearings in April and May 2015. Proponents attending the hearings included Jeff McCabe speaking for the House Democratic office, Attorney General Janet Mills, and representatives of the American Lung Association, Cancer Action Network, Maine Public Health Association, American Heart Association, Maine Nurse Practitioner Association, American Academy of Pediatrics, and Maine Medical Association. Opponents attending the hearings included State Budget Solutions (a nonpartisan, voluntary membership organization of state legislators dedicated to the principles of limited government, free markets, and federalism), RAI Services Company (Reynolds Tobacco Company), and four private citizens.

The bill barely cleared the Joint Committee on a six to five vote. After the definitions of electronic smoking device and smoking were amended slightly, the final bill

(Public Law, Chapter 318 [H.P. 769 – L.D. 1108]) passed both the House of Representatives and the Senate by large majorities and was enacted into law unsigned by Governor Paul LePage on July 4, 2015. The central effect of the new law was to include the use of e-cigarettes in the definition of smoking and to prohibit their use in public places along with combustible cigarettes. A public place includes any place not open to the sky into which the public is invited or allowed and outdoor eating areas (MRS, Title 22, Sections 1541[6], 1542, and 1550). The new law also had the effect of banning the use of e-cigarettes in state parks and historic sites where smoking has been illegal since 2009, on or within 20 feet of a beach, playground, snack bar, group picnic shelter, business facility, enclosed area, public place, or restroom (but not on trails).⁷

Maine enacted a second e-cigarette law in 2015—An Act to Require Child-resistant Packaging for Nicotine Liquid Containers. This bill amended Maine laws regulating retail tobacco sales and addressed the danger that nicotine liquid poses to children by requiring that nicotine-containing liquid be distributed in child-resistant packaging. The law also defines electronic nicotine-delivery device as a device that makes use of nicotine liquids including, but not limited to, e-cigarettes (Public Law, Chapter 288 [H.P. 290 – L.D. 423]).

There are other Maine laws that regulate cigarettes, tobacco, or smoking that were not amended by the e-cigarette laws enacted in 2015. However, some of these other laws have been interpreted to cover e-cigarettes. This includes the law regulating the distribution and sale of tobacco. Maine’s attorney general interprets the term *tobacco products* as used in that law to include electronic smoking devices and components, presumably because they contain nicotine derived from tobacco, and regulates them like combustible cigarettes. E-cigarettes also appear to fit the definition of cigarette in the Maine Tobacco Acts (MRS, Title 22, Chapters 262-A, §1551-A[1], 1555-B, 1553-A, 1551[1-B], 1555-F, 1580-G, and 1580-L) because cigarette is defined, in part, as any product that contains nicotine and is intended to be burned or heated under ordinary conditions of use and contains tobacco in any form. For the same reasons, providing e-cigarettes to minors may also be a Class D crime in Maine under statutes that prohibit furnishing cigarettes or tobacco to a child less than 16 years of age (MRS, Title 17-A, Chapter 23, §554[1-B]).

There are still several Maine laws that regulate combustible cigarettes but not e-cigarettes, including

excise tax laws on cigarettes and tobacco products (MRS, Title 36, Chapter 704). The law that covers smoking policies in rental housing also does not include e-cigarettes in the definition of smoking (MRS, Title 14, Chapter 710, §6030-E). Similarly, the law that prohibits smoking in vehicles when children under the age of 16 are present does not appear to extend to the use of e-cigarettes because it defines smoking in a way that does not include e-cigarettes. Interestingly, Maine laws that ban smoking in elementary and secondary schools and in workplaces have not been amended to explicitly prohibit the use of e-cigarettes. The law that prohibits smoking in the buildings or on the grounds of any elementary or secondary school in Maine defines smoking as “carrying or having in one’s possession a lighted cigarette, cigar, pipe or other object giving off or containing any substance giving off smoke and the use of smokeless tobacco” (MRS, Title 22, Chapter 263, §1578-B). The Workplace Smoking Act of 1985 requires employers to ban indoor smoking and prevent environmental tobacco from circulating into enclosed areas. The definition of smoking in workplaces is similar to the one for elementary and secondary schools (MRS, Title 22, Chapter 263, §1549, 1578-B[1-D], and 1580-A). However, Maine elementary and secondary schools do ban the use of e-cigarettes in their buildings and on their grounds as a matter of policy.

MAINE MUNICIPAL ORDINANCES RESTRICTING E-CIGARETTES

The interiors of Maine’s municipal buildings are all tobacco (including e-cigarette) free because they fall under the definition of public places. However, local ordinances dictate the rules for the use of tobacco products in outdoor areas owned by municipalities including parks, beaches, playgrounds, and other recreational facilities.⁸

Maine has eight cities with population greater than 20,000, based on 2010 census data and annual re-estimates since. Maine’s four largest cities (Portland, Lewiston, Bangor, and South Portland, in order of size) all include e-cigarettes in their ban on smoking in at least some public outdoor places. Portland extended its ban on smoking in city parks and other public grounds to include e-cigarettes in 2015. In another progressive step, the Portland City Council raised the minimum age for the purchase of tobacco products, including e-cigarettes, from 18 to 21 years of age in 2016.

In response to effective lobbying and educational efforts by the Maine Public Health Association and Maine Breathe Easy Coalition, the Lewiston City Council voted to extend its tobacco-free policy to include all “city-owned athletic fields, city-owned parks, city-owned playgrounds, city-owned trails and city-owned beaches” and within 20 feet of the entryways or windows of indoor city facilities in 2013. E-cigarettes are explicitly included in the Lewiston regulatory definition of tobacco products.

In Bangor, smoking, including the use of e-cigarettes, is prohibited “in a public park that has amenities specifically constructed for use by children, including, but not limited to, playgrounds, swimming pools, sporting fields and buildings” by city ordinance adopted in 2016. South Portland’s municipal code bans smoking, including the use of e-cigarettes, “at or within 20 feet of all parks, beaches and outdoor recreation facilities owned and/or maintained by the City” and “at or within 20 feet of all designated school bus stops within the City limits.” The list of specific city facilities covered by the South Portland tobacco-free policy includes trail systems. Thus, it should be noted that the inclusion of trails in Lewiston and South Portland’s smoking and e-cigarette prohibition goes well beyond the regulations currently in place at Maine state parks.

In the other Maine cities with populations greater than 20,000 (Auburn, Biddeford, Sanford, and Brunswick, in order of size), smoking regulations in general, and e-cigarette policies in particular, are more variable. In Auburn, the city council approved a resolution making city parks smoke-free in 2011. The resolution did not include enforcement provisions, however, and the current city ordinance codes do not mention the ban. By contrast, a Biddeford ordinance designates “City-owned playgrounds, sports fields, parks and beaches” as tobacco- and smoke-free zones and includes e-cigarette use in its definition of smoking and an enforcement mechanism.

In 2002, in response to lobbying by an anti-tobacco youth group, the Sanford City Council voted to adopt a tobacco-free policy for all municipal parks, athletic fields, recreational facilities, and assembly areas. However, the policy does not include e-cigarettes, which were not available in 2002, and restrictions on e-cigarettes have not found their way into the Sanford City Code. Brunswick municipal ordinances prohibit smoking in municipal buildings and designate outside smoking areas away from building doors and windows.

The regulations, however, do not specifically address e-cigarettes, and there are no regulations prohibiting smoking in city-owned outdoor areas.

MAINE INSTITUTIONAL REGULATORY RESTRICTIONS ON E-CIGARETTES

Educational Institutions

Tobacco use is prohibited in the buildings and on the grounds of Maine K–12 schools by state statute. The definition of tobacco use, however, does not explicitly include the use of e-cigarettes (MRS, Title 22, Chapter 263, §1578-B [1-D]), but these are prohibited as a matter of policy.⁹ The situation in other Maine institutions, however, is more varied. During 2016, the Maine Breathe Easy Coalition, a statewide coalition of anti-smoking groups, which is part of the Tobacco Prevention Services at the MaineHealth Center for Tobacco Independence, gathered information about smoking policies at Maine hospitals and institutions of higher education. Public higher education institutions in Maine all ban the use of e-cigarettes anywhere on campus. The six institutions of the University of Maine System (University of Maine, University of Maine at Augusta, University of Maine at Farmington, University of Maine at Fort Kent, University of Maine at Machias, University of Maine at Presque Isle, and University of Southern Maine) all have policies explicitly forbidding the use of e-cigarettes anywhere on campus, as does Maine Maritime Academy. Six of the seven institutions in the Maine Community College System (Central Maine Community College, Kennebec Valley Community College, Northern Maine Community College, Southern Maine Community College, Washington County Community College, and York County Community College) also explicitly ban e-cigarettes. Only Eastern Maine Community College does not have a specific policy banning e-cigarettes although it does include e-cigarette in its definition of tobacco products.

Interestingly, although 1,700 colleges and universities in the United States are smoke-free and nearly 1,300 explicitly ban e-cigarettes (<http://tobaccofreecampus.org/campus-list-progress>), private colleges in Maine are more evenly split on totally banning tobacco products in general and e-cigarettes in particular. Only five of the eleven private colleges surveyed by the Maine Breathe Easy Coalition (Colby College, Husson University, Kaplan University, Maine College of Art, and University

of New England) explicitly ban the use of e-cigarettes anywhere on campus, although Saint Joseph's College includes e-cigarettes under its definition of tobacco products, which it does prohibit. Bates College, Bowdoin College, Thomas College, and Unity College continue to allow smoking of both combustible cigarettes and e-cigarettes outside and away from buildings (either 25 or 50 feet), and College of the Atlantic has a designated outdoor smoking area.

Hospitals

Maine hospitals are much more homogeneous than higher educational institutions in banning e-cigarettes. Of the 36 Maine hospitals listed on the Maine Hospital Association website, all but one (St. Mary's Regional Medical Center in Lewiston) have a 100 percent tobacco-free policy. Nine of the eleven Maine hospitals with at least 100 beds (Maine Medical Center, Eastern Maine Medical Center, Central Maine Medical Center, St. Mary's Regional Medical Center, Mercy Hospital, Southern Maine Health Care, Maine General Medical Center, St. Joseph's Hospital, Spring Harbor Hospital, and New England Rehabilitation Hospital) explicitly ban e-cigarettes. Acadia Hospital in Bangor is tobacco-free, but does not explicitly ban e-cigarettes.¹⁰

Housing

Tobacco use, including the use of e-cigarettes, has also been an issue in rental housing. A national survey of adult residents of multiunit housing found that 24.4 percent reported some type of tobacco use and 0.8 percent reported using e-cigarettes exclusively, while 34.4 percent of multiunit housing residents with smoke-free homes reported incursions of secondhand smoke from smoking neighbors (Nguyen et al. 2016). This has led to efforts to restrict the use of tobacco products in rental housing. A federal rule issued by the Department of Housing and Urban Development (HUD) requiring all Public Housing Agencies (PHA) nationwide to initiate a smoke-free policy went into effect on February 3, 2017 (with an 18-month implementation period). This rule bans smoking in all living units and indoor common areas. It also bans outdoor smoking within 25 feet of PHA buildings. However, the tobacco products prohibited by this ban include cigarettes, cigars, pipes, and waterpipes, but not e-cigarettes.

Once fully implemented, the HUD ban will cover 1.2 million housing units nationwide, which are home to over 2 million residents. The ban is expected to save

PHAs \$16–38 million per year in maintenance costs and an additional \$38 million per year by reducing fire risk. The healthcare savings are projected to be even larger. During the public comment period for the rule, many commenters asked HUD to include e-cigarettes in this ban, citing health concerns about the exhaled vapor and the potential fire hazard of exploding e-cigarettes. Other comments objected to a ban on e-cigarettes citing the need for more scientific study of e-cigarette harms and the lower damage of e-cigarette vapors to the dwelling units, compared to the substantial damage caused by the smoke from combustible cigarettes. HUD ultimately decided not to include e-cigarettes in its list of banned products, mostly because the monetary savings to PHAs from an e-cigarette ban would have been small, but did give individual PHAs the option to ban e-cigarettes in their local rules.¹¹

E-cigarettes, while less lethal than combustible cigarettes, can definitely cause nicotine dependence and are probably directly harmful.

The nearly 2,700 PHA housing units in Maine's four largest cities are covered by the HUD smoking ban. This includes 1,174 units managed by the Portland Housing Authority, which have been smoke-free since 2011; 437 units managed by the Lewiston Public Housing Authority; 741 managed by the Bangor Housing authority; and 346 managed by the South Portland Housing Authority. Because e-cigarettes are not included in the HUD ban, however, none of these housing units are e-cigarette-free.¹² Many private Maine landlords also ban smoking in their buildings presumably for the same financial and health reasons, but the number of private landlords in Maine who ban e-cigarettes is unknown.

CONCLUSIONS

E-cigarettes, while less lethal than combustible cigarettes, can definitely cause nicotine dependence and are probably directly harmful. They may help

some current smokers reduce their consumption of combustible cigarettes or abstain completely; however, they are not approved as smoking-cessation devices and may not be more effective than currently approved methods. Ultimately, the fact that e-cigarettes are less lethal than combustible cigarettes is not a strong argument for lax restrictions. The risks of e-cigarettes must be weighed carefully against the proposal that e-cigarettes can be used as smoking-cessation devices before they are allowed to proliferate in society (Avdaloovic and Middlekauff 2015).

E-cigarettes are marketed aggressively and effectively by multinational tobacco companies that take advantage of what they learned marketing combustible cigarettes and the lower restrictions on e-cigarette marketing. As a result, e-cigarettes are gaining in popularity, particularly among youth, and sales of e-cigarette products are growing rapidly.

Many, but not all, Maine institutions (e.g., hospitals and colleges) have adopted policies that include e-cigarettes bans to create an environment that is 100 percent tobacco-free. These policies have the advantage of being clear and comprehensive, making the enforcement of e-cigarette bans straightforward. This may be a particular advantage in college settings where the dual use of e-cigarettes to deliver other drugs is an issue. These 100 percent tobacco-free policies also extend to other tobacco products including smokeless tobacco products (chew, snuff, snus), which have their own health risks such as nicotine dependence and oral cancers.

Federal and state laws remain a patchwork, however. They explicitly ban e-cigarette use in some—but not all—places where the use of combustible cigarettes is banned. Some of Maine's larger municipalities ban e-cigarettes from outdoor public spaces, but these restrictions are also variable. In Maine, antismoking nonprofits, health profession organizations, and youth groups have been effective at lobbying city councils to enact smoking and e-cigarette bans.

POLICY RECOMENDATIONS

- Maine should expand and better coordinate efforts to gather data about the use and marketing of e-cigarettes with the goal of identifying trends and allowing timely responses by the legislature and public health community.* National health-monitoring systems that include sufficient Maine data to allow state-specific analysis are just now catching up with the rapid growth in e-cigarette use. The NYTS has asked questions about e-cigarette use since 2011, but the YRBSS has only covered e-cigarette use since 2015. The Pregnancy Risk Assessment Monitoring System, which monitors health indicators among women who have recently given birth, asks about use of combustible cigarettes, but not about e-cigarettes. Thus, some Maine-specific data do exist, but more are needed. The Maine Department of Health and Human Services should collaborate with interested public health researchers to expand and cross-reference these data sources for a comprehensive picture of e-cigarette use in Maine. This endeavor would identify specific groups who would benefit from enhanced educational efforts and nicotine-cessation services.
- Maine should undertake a comprehensive review of its tobacco-restriction legislation with a goal of identifying and filling gaps in current state legislation that apply to e-cigarettes.* Some Maine laws that regulate combustible tobacco products explicitly include e-cigarettes; others laws that do not explicitly include e-cigarettes have been interpreted as applying to e-cigarettes. However, some Maine tobacco laws, such as excise tax laws on cigarettes and tobacco products, laws concerning smoking policies in rental housing, and laws that prohibit smoking in vehicles when children under the age of 16 are present, do not include e-cigarettes. This review (which could be undertaken by advocates for reduced tobacco use in collaboration with partners from the University of Maine School of Law) would identify gaps in legal protections against e-cigarettes that could be closed by legislative action. These legislative changes could reduce use of e-cigarettes by making them more expensive and expanding e-cigarette-free areas.
- State and local ordinances should be expanded to more effectively regulate retail sales of e-cigarettes and extend smoke-free environments.* Maine antismoking groups have effectively lobbied for e-cigarette restrictions at the state and local level. As was the case in the movement to

ban outdoor smoking in public places (Harris, Roy, and Mayberry 2012), youth groups have been central to these efforts. Antismoking groups and organizations with a public health mission should make a priority of working with youth groups to encourage initiatives before the state legislature and city councils to modify local ordinances to create restrictions on e-cigarette purchase and use. The outdoor bans on e-cigarette use that have been enacted in several Maine cities and the 2016 Portland ordinance raising the legal age for the purchase of tobacco products from 18 to 21 years old are just two example of regulations that should be adopted by other Maine municipalities. The purchase age for tobacco products could even be raised statewide. Legislation to do this is currently under consideration as LD 1170. Prohibiting the use of flavorings other than menthol in e-cigarettes would also make them less attractive to youth (although this change would probably need to occur at the national rather than the state or local level). None of these changes would make e-cigarettes unavailable to current adult smokers who choose to use e-cigarettes as smoking-cessation devices.

- *More Maine institutions should adopt tobacco-free policies that explicitly include the use of e-cigarettes.* The statewide Maine Breathe Easy Coalition has built an excellent monitoring system of e-cigarette restrictions at Maine institutions. This system should be maintained and expanded to provide a complete picture of e-cigarette restriction in Maine. These efforts would expand tobacco- and e-cigarette-free environments both indoor and outdoor. The monitoring system maintained by the Maine Breathe Easy Coalition could expand to include information about the enforcement of e-cigarette bans. Getting input from the people responsible for enforcing these bans would help determine their real-world impacts and suggest ways to make these bans more effective. 

ENDNOTES

- 1 See <https://www.cancer.org/cancer/cancer-causes/tobacco-and-cancer/secondhand-smoke.html> for a more complete discussion.
- 2 See the Maine Association of Broadcasters website (<http://www.mab.org/advertising-faqs/tobacco-advertising/>) for a full set of these recommendations.
- 3 For information on early federal tobacco product legislation see <https://history.nih.gov/research/downloads/PL100-202.pdf>, <http://uscode.house.gov/statutes/pl/101/164.pdf>, and <http://www.tobaccocontrolaws.org/files/live/United%20States/United%20States%20-%20Smoking%20on%20Passenger%20Flights%20-%20national.pdf>.
- 4 Virginia Senators Jim Webb and Mark Warner supported the measure despite the tobacco industry's presence and influence in their state.
- 5 See <http://www.maine.gov/legis/lawlib/lldl/smoking/index.html> for a detailed legislative history of smoking and tobacco laws in Maine.
- 6 House Paper (H.P.) 769 – L.D. 1108 was introduced by Jeff M. McCabe (D-Skowhegan) and cosponsored by Patricia Hymanson (D-York) and Linda Sanborn (D-Gorham).
- 7 Public Law, Chapter 65 (S.P. 26 – L.D. 67)(2009)(codified as Maine Revised Statutes, Title 22, §1580-E). E-cigarette use is prohibited in the listed areas because the law specified that smoking has the same meaning as in MRS, Title 22, Section 1541(6).
- 8 Maine city ordinances were obtained from the websites of each city:
Portland: <http://www.portlandmaine.gov/documentcenter/view/8889>
Lewiston: <http://www.ci.lewiston.me.us/DocumentCenter/Home/View/217>
Bangor: <http://ecode360.com/6893684>
South Portland: http://www.southportland.org/files/6814/7922/8044/CH_18_Parks_and_Recreation.pdf
Auburn: <http://www.auburnmaine.gov/Pages/Government/City-Charter-Ordinances>
Biddeford: <http://www.biddefordmaine.org/index.asp>
Sanford: <http://www.sanfordmaine.org/index.asp>
Brunswick: https://www.municode.com/library/me/brunswick/codes/code_of_ordinances
- 9 For example school policies:
Biddeford: <https://drive.google.com/file/d/0B5NvUuaxkjJ6ZkZycGxLSIdUNUU/view>
RSU 11 (Gardiner): <https://drive.google.com/file/d/0ByqAJqNOMUgVOHJNQilyNkVlcDA/view>
MSAD 17 (Oxford Hills): <http://wdb.sad17.k12.me.us/Action.lasso?-database=policy.fp5&-layout=basic&-response=%2fpolicy%2fDetail.htm&-recordID=6&-search>
- 10 The Maine Breathe Easy Coalition has mapped the smoking policies of educational institutions and hospitals at <http://breatheeasymaine.org/maps/>

- 11 Wording, legislative history and expected savings from HUD regulation were gathered from the federal register (<https://www.federalregister.gov/documents/2016/12/05/2016-28986/instituting-smoke-free-public-housing>; <https://www.federalregister.gov/documents/2016/12/05/2016-28986/instituting-smoke-free-public-housing>) and from the HUD website (<https://portal.hud.gov/hudportal/documents/huddoc?id=finalsmokefreeqa.pdf>).
- 12 Information about Maine's Public Housing Authorities was gathered from the websites of each city's PHA: Portland Public Housing Authority: <http://www.porthouse.org/ArchiveCenter/ViewFile/Item/53>; Lewiston Public Housing Authority: <https://affordablehousingonline.com/housing-authority/Maine/Lewiston-Housing-Authority/ME005>; Bangor Public Housing Authority: <http://www.bangorhousing.org/about-us>; South Portland Public Housing Authority: <http://www.spha.net/about/>

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