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## Arguments for amending smoke-free legislation in U.S. states to restrict use of electronic nicotine delivery systems

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### ABSTRACT

The uneven diffusion of local and state laws restricting the use of electronic nicotine delivery systems (ENDS) in the United States may be a function of inconclusive scientific evidence and lack of guidance from the federal government. The objective of this study was to assess whether the rationale for amending clean indoor air acts (CIAAs) is being conflated by issues that are not directly relevant to protecting the health of ENDS non-users. Online sources were used in identifying bills ( $n = 25$ ) that were presented in U.S. state legislatures from January 2009 to December 2015. The bills were categorized into one of three groups: 1) bills amending comprehensive CIAAs ( $n = 11$ ), 2) bills prohibiting use of ENDS in places frequented by youth ( $n = 5$ ), and 3) remaining bills that varied between the two categories ( $n = 9$ ). Arguments presented in committee hearings were coded as scientific, public health, economic, enforcement, freedom, or regulatory. Arguments pertaining to amendment of clean indoor air acts spanned several categories, many of which were not directly relevant to the aims of the legislation. This finding could assist lawmakers and expert witnesses in making arguments that yield greater success in amending legislation. Alternatively, inconclusive scientific data on the hazards of ENDS aerosols might encourage lawmakers to propose legislation that prohibits ENDS use in places frequented by youths.

### 1. Introduction

The publication of two prominent reports in 1986, the U.S. Surgeon General's Report and the National Research Council Report, outlined the link between exposure to secondhand smoke and the development of lung cancer (Eriksen and Cerak, 2008). By 1992, the U.S. Environmental Protection Agency had designated secondhand smoke as a Group A Carcinogen, a decision based in part on the epidemiologic studies showing elevated lung cancer risks in the non-smoking spouses of smokers (Dockery and Trichopoulos, 1997). Local clean indoor air acts (CIAAs) proliferated in the U.S. from the late 1980s through the first decade of the 21st century (Eriksen and Cerak, 2008). In contrast to this sequence of events, legislation restricting the use of electronic nicotine delivery systems (ENDS), or more commonly known as electronic cigarettes, was enacted prior to discovery of long-term health effects from exposure to ENDS secondhand vapor (Kadowaki et al., 2015).

Results from studies comparing the hazardous constituents of secondhand vapor versus secondhand smoke (e.g., heavy metals) have been inconsistent, leading researchers to suggest that scientific data on the safety of ENDS are inconclusive (Pisinger and Dossing, 2014; Callahan-Lyon, 2014). Given the inconclusive scientific data, the

enactment of legislation restricting the use of ENDS suggests that lawmakers are using a precautionary approach in developing policy. In the words of Kadowaki et al. (2015), “policy is outpacing science” regarding ENDS restrictions in public spaces. Proponents of the precautionary approach warn that original CIAAs took too long to be implemented, leaving the public exposed to harmful secondhand smoke for many years. Given epidemiologic evidence of the hazards of cigarette smoking dating back to the 1950s, the proponents argue that it would have been sensible to take precautionary action on limiting secondhand smoke exposure prior to establishment of conclusive scientific evidence. Opponents of the precautionary approach argue that passage of legislation in the absence of scientific evidence is a form of government overreach.

The lack of federal guidance, accompanied by inconclusive scientific data, may have contributed to the uneven diffusion of ENDS clean air policies from local municipalities to U.S. states (Kadowaki et al., 2015). The patchwork is evident from the concentration of policies in municipalities in Massachusetts and Mississippi, for example, and the large gaps in the Great Plains region. One argument for the uneven diffusion is the variability in the way smoking is defined in existing clean indoor air laws (Hardin, 2011). Efforts to amend the laws to include ENDS

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have encountered obstacles in cases where smoking is narrowly defined as inhaling a combustible tobacco product. The inconsistencies in legislating ENDS use are not likely to abate anytime soon as the FDA's final ruling on tobacco products, which took effect on August 8, 2016, addresses youth access issues, but not issues pertaining to places where ENDS can be used.

One trend in legislating ENDS use is the focus on protecting youth from access and exposure to ENDS (Gourdet et al., 2014; Tremblay et al., 2015). Gourdet et al. (2014) reported that as of November 2013, 22 U.S. states had enacted laws prohibiting minors' access to ENDS. Today, federal law prohibits the sales of e-cigarettes and other ENDS products to minors in the 50 U.S. states. Among the twelve U.S. states that applied smoke-free provisions to ENDS by November 2013, (Gourdet et al., 2014) seven prohibited ENDS use in venues frequented by minors and young adults (e.g., schools, childcare centers). Tremblay et al. (2015) had also reported that U.S. state legislation prohibiting minors' use of ENDS in limited venues was enacted more frequently than comprehensive ENDS bans. The authors suggested that the higher frequency of youth-specific ENDS legislation reflects acceptance of restrictions on a targeted group at high risk (i.e. youth), versus the general population that is at a lower risk of the potential harms of ENDS use. The concern for youth has been expressed by U.S. adults who were surveyed about their support for ENDS regulations (Wackowski and Delnevo, 2015; Tan et al., 2015). Wackowski and Delnevo (2015) reported that the majority of adult smokers favored laws prohibiting ENDS sales to minors (87.7%), while the minority favored restrictions on indoor use (41.2%). Support for the latter is increasing over time as a likely function of public health advocacy campaigns, such as the California Department of Health's campaign "Still Blowing Smoke" (<http://stillblowingsmoke.org>). Yet, the increased support does not appear to be translating to comprehensive restrictions on the public use of ENDS at the state level, the reason for which is unclear. The objective of this study was to assess whether the rationale for amending clean indoor air acts in U.S. states is being conflated by issues that are not directly relevant to protecting the health of ENDS non-users. This hypothesis could potentially explain the challenges in amending comprehensive CIAAs.

## 2. Methods

### 2.1. Selection of ENDS legislation

The terms 'electronic cigarette', 'e-cigarette', 'vapor product', 'alternative nicotine inhalant', and 'electronic nicotine delivery systems' (Lempert et al., 2014) were used in searching ENDS bills proposed between January 2009 and December 2015. The searches were conducted via the 50 state legislative websites, LegiScan, and archives of bill alerts from the Consumer Advocates for Smoke-Free Alternatives Association (CASAA), an advocacy group tasked with alerting ENDS users of restrictions on taxes, clean indoor air acts, and other legislation. We identified 67 bills whose objective was to restrict ENDS use in public spaces; among them, only 25 had records of legislative hearings and floor debates that were publicly available. Bills proposing a tax or age restriction on the purchase of ENDS were excluded from our analysis. Each bill was coded for the state in which the bill was proposed, year, bill number, status in the legislative process (pass/fail), category of the bill, and location targeted for restriction. The bills were then categorized into one of three groups: 1) amendment to a comprehensive clean indoor air act, which prohibited use of ENDS in workplaces, bars, and restaurants; 2) bills prohibiting use of ENDS in places frequented by youth, which included schools, playgrounds, other facilities used by minors, and motor vehicles (when a minor is present); and 3) remaining bills that did not fit into either of the two categories. An example of the latter is AK SB1 which prohibits smoking in specified places such as public transportation. The legislation is not comprehensive and does not target venues frequented by youths, thus, qualifying as the third

**Table 1**  
Occurrence of arguments supporting and opposing U.S. state legislation (2009–2015) aimed at restricting use of ENDS.

Argument <sup>a</sup>	Amend CIAA <sup>b</sup> (n = 11 bills)		Youth exposure <sup>c</sup> (n = 5 bills)		All other bills <sup>d</sup> (n = 9 bills)	
	Support	Oppose	Support	Oppose	Support	Oppose
Public health						
Gateway to smoking	16	8	4	0	8	1
Smoking renormalization	19	6	1	0	6	3
Harm reduction	6	59	0	2	2	26
ENDS > NRT <sup>e</sup>	12	77	3	3	6	27
Youth marketing/access	32	21	12	0	28	7
Vapor constituents						
Nicotine	34	11	3	2	13	6
Propylene glycol/glycerol	2	14	0	0	5	1
Other constituents	38	56	5	0	18	14
Adverse health events						
Pulmonary effects	6	2	0	0	9	1
Cardiovascular effects	3	1	0	0	3	0
Other health effects	17	16	4	0	9	8

<sup>a</sup> Argument is counted only once for a given individual.

<sup>b</sup> Clean indoor air act.

<sup>c</sup> Bills aimed at prohibiting ENDS in places frequented by youths (e.g., educational facilities).

<sup>d</sup> Bills aimed at prohibiting ENDS in other venues (e.g., public transportation).

<sup>e</sup> Nicotine replacement therapy.

type of bill restricting ENDS use. The terms comprehensive (category 1) and non-comprehensive (categories 2, 3) legislation were used throughout the remainder of the manuscript. The term amendment to a CIAA refers to inclusion of ENDS as part of an existing clean indoor air act. Audio and video testimonies presented in the hearings were transcribed into text and independently coded by three students, resulting in a total of 38 transcripts (~902 pages). Discrepancies in coding were resolved upon a group discussion and subsequent vote.

### 2.2. Classifying arguments according to bill objective

Arguments from the transcripts were first grouped into one of the following six categories: science, public health, economics, enforcement, freedom, regulation. Subcategories for scientific and public health arguments are listed in Table 1. The six categories were derived from a literature review of hearings on clean indoor air legislation (Apollonio and Bero, 2009) and an initial reading of the transcribed testimony. If an individual at a committee hearing made the same argument repeatedly, then the argument was counted only one time. If the individual made multiple but separate arguments, then each argument was counted one time.

The arguments were first coded as being supportive or unsupportive of the legislation, and then coded in terms of the relevance of the bill's population-level effect (viewed from a public health perspective). Relevant arguments in support of amending CIAAs pertained to potential population-level harms of using ENDS in public spaces, which included hazards of being exposed to secondhand vapor; (Bauld et al., 2017) the re-normalization of smoking in society; (Fairchild et al., 2014) the challenges of enforcing existing CIAAs due to the inability to distinguish ENDS from conventional cigarettes; and the gateway from ENDS use to cigarette smoking. Any one of the four arguments was considered relevant to amendment of the legislation irrespective of whether the scientific data was conclusive or inconclusive. For example, some studies found high levels of tobacco-specific nitrosamines

in ENDS vapor, while others detected levels lower than that found in smoke from conventional cigarettes (Pisinger and Dossing, 2014).

Arguments considered less relevant to amendment of a comprehensive CIAA pertained to harm reduction because any amended law would place the same restrictions on cigarettes and ENDS. Legislation prohibiting ENDS use in public would not preclude a smoker from using ENDS for harm reduction in a private setting. The option of smoking cigarettes or using ENDS as a safer alternative would still be available under the legislation, making harm reduction a less relevant argument in terms of its population-level benefit. This reasoning does not account for the rights or preferences of cigarette smokers. Similarly, harm reduction was not considered a valid argument for prohibiting use of ENDS in places frequented by adolescents because the majority of adolescents are not cigarette smokers.

### 3. Results

A total of 67 bills prohibiting use of ENDS, 16 of which passed into law, were proposed in state legislatures between January 2009 and December 2015. Among the bills with available audio/video hearings ( $n = 25$ ), 11 attempted to amend comprehensive CIAAs to include prohibition of the use of ENDS in public spaces; 5 proposed to prohibit use of ENDS in locations frequented by minors; and 9 proposed a variation of the two categories. The number of individuals whose arguments supported and opposed the bills were 119 and 123, respectively.

Arguments presented before the legislative committee hearings spanned several categories ranging in degree of relevance to the amendment of CIAAs. As indicated in Table 1, several relevant arguments on both sides of the issue pertained to the chemical constituents of secondhand vapor. Users of ENDS and ENDS retailers frequently argued that the vapor is analogous to the emissions from fog machines. In contrast, representatives from organizations such as the American Heart Association, American Lung Association and local health departments argued that ENDS vapor contains carcinogenic chemicals that can cause adverse health effects. Mark Leno, a California state senator, noted that ENDS vapor contains 10 toxic chemicals listed on Proposition 65; hence, it is not akin to water particles (refer to Table 2).

The arguments pertaining to the adverse health effects often referred to the effects on an ENDS user, not the effects of secondhand exposure on an ENDS non-user. Consequently, some participants at the committee hearings were less convinced that secondhand exposure to ENDS vapor is hazardous. For example, in debating HB5 in the Delaware State Legislature, one representative stated that the health hazards from inhaling secondhand vapor are based on anecdotal reports unsubstantiated by scientific studies. The sentiment on lack of scientific studies was commonly expressed by individuals testifying at the hearings.

Table 1 identifies arguments presented at committee hearings that either supported or opposed passage of legislation. The most frequent arguments at the hearings pertained to public health issues, notably harm reduction and the perceived effectiveness of using ENDS over nicotine replacement therapy (NRT) for smoking cessation. The majority of arguments challenged the amendment of CIAAs on the basis that ENDS is an effective aid for quitting smoking (refer to Table 1). Edward Anselm, a member of the Health Republic Insurance of New Jersey, testified that adults' successful use of ENDS for smoking cessation is an important public health consideration. While the statement may be true for many adult smokers, the statement does not suggest that prohibition of ENDS in certain public spaces would preclude ENDS from serving as an effective cessation aid in other settings. Similar arguments opposing the legislation stated that secondhand vapor reduces harm for both the ENDS user and non-using bystanders (e.g., Consumer Advocates for Smoke-Free Alternatives Association—Table 2). But, this argument is not relevant to the amendment of a CIAA because cigarette smoking is already prohibited in the places specified by the legislation. The argument for harm reduction is even less tenable as it pertains to bills prohibiting ENDS use in places frequented by adolescents. For example, Representative David Alexander of the Connecticut State Legislature supported HB5219 with the argument that smokers could be misled by false claims of the safety and efficacy of ENDS for smoking cessation. Yet, the individuals most affected by the bill (i.e. adolescents) were unlikely to be cigarette smokers.

Other public health arguments were more relevant to the legislation's objective of protecting youth from exposure to ENDS. For

**Table 2**  
Examples of arguments considered relevant and less relevant to the overall objective of the U.S. state legislation (2009–2015).

State/bill no.	Bill type	Argument	Argument
RI SB4889	Amend CIAA <sup>a</sup>	Relevant	"The World Health Organization. They say especially in smoke free environments, electronic smoking devices should not be used in order to minimize the risk to bystanders of breathing in the aerosol emitted by the devices and to avoid undermining the enforcement of smoke-free laws." – Representative from the American Lung Association
DE HB5	Amend CIAA	Relevant	"But there does seem to be at least a reasonable amount of information out that the vapors that come out could have negative ramifications." – Delaware State Representative
UT HB245	Amend CIAA	Less relevant	"And if people have the incentive to use that [e-cigarettes] because it's allowed in certain public places, I think that's something that we as a people and you as lawmakers should get behind. Because it not only reduces the harm to the person who's using that product, it reduces the harm to everyone else that's exposed to them." – Representative from Consumer Advocates for Smoke-Free Alternatives Association
NJ AB4227	Youth exposure <sup>b</sup>	Relevant	"Public health officials worry that electronic cigarettes could increase nicotine addiction among youth and may lead kids to try other tobacco products, including conventional cigarettes, which are known to cause disease and lead to premature death." – Representative for the New Jersey Health Officers Association
NJ AB4227	Youth exposure	Relevant	"Our concerns with e-cigarettes being permitted in indoor places is that they look exactly like regular cigarettes so it will complicate enforcement of smoke free air laws." – Representative from the American Heart Association
CT HB5219	Youth exposure	Less relevant	"I think a lot of consumers are ingesting these products, thinking they're safe, thinking that it would help them get off tobacco products." – David Alexander, CT State Representative
CA SB140	All other bills <sup>c</sup>	Relevant	"The industry would suggest that the emission is just vapor as in water particles, in fact the CA Department of Public Health has identified 10 toxic chemical particles within these aerosols which are listed among Prop 65 that are known to cause cancer..." – Mark Leno, CA State Senator
HI HB525	All other bills	Relevant	"...secondhand aerosol, incorrectly called vapor, from ESD contains nicotine, ultrafine chemicals, and levels of toxins." –Susan Moir, Coalition for a Tobacco Free Hawaii
CA SB140	All other bills	Less relevant	"... lots of adults adopted the use of electronic nicotine delivery systems to either curb or eliminate their tobacco use and I certainly think that that's an important public health consideration." –Edward Anselm, Member of Health Republic Insurance of New Jersey

<sup>a</sup> Clean indoor air act.

<sup>b</sup> Bills aimed at prohibiting ENDS in places frequented by youths (e.g., educational facilities).

<sup>c</sup> Bills aimed at prohibiting ENDS in other venues.

example, a representative from the New Jersey Health Officers Association argued that ENDS could serve as a gateway to conventional cigarettes. Unexpectedly, the gateway argument was used only four times in supporting legislation that prohibited ENDS use in places frequented by youths. In contrast, the gateway argument was frequently used in supporting and challenging amendments to CIAAs that were not specifically intended to protect adolescents from exposure to ENDS.

Economic arguments were predominantly made in opposition to legislation on the basis that regulating ENDS would impede business interests. These arguments were commonly made by business owners and other ENDS stakeholders. Surprisingly, the effectiveness of enforcing the legislation was sparingly discussed during committee hearings. One such example occurred during the hearing of New Jersey's AB4227 when a representative from the American Heart Association argued in favor of amending the CIAA. The freedom argument was more often used by supporters of legislation on the grounds that people should not have the freedom to choose where they use ENDS.

#### 4. Discussion

The primary finding of this study was the frequent use of harm reduction and smoking cessation as the basis for opposing amendments to comprehensive CIAAs. The arguments were not directly relevant to protecting the health of ENDS non-users, and, thus, served as a distraction from the primary objective of the amendments. Several relevant arguments cited evidence for harmful aerosol constituents, but were obfuscated by conflicting scientific data and lack of long-term studies. In contrast to the amendments, the arguments supporting non-comprehensive legislation focused on the youth marketing and access issues that were highly relevant to the legislation's aim of eliminating exposure of ENDS to adolescents.

Comprehensive clean indoor air legislation was historically enacted on the basis of epidemiologic evidence of the adverse health effects of secondhand smoke exposure (Hyland et al., 2012). Thus, it was not unexpected that arguments at the committee hearings on ENDS legislation addressed the chemical constituents of ENDS vapor (e.g., propylene glycol). But, an equal number of arguments on both sides of the issue pointed to a general lack of consensus over whether the constituents in vapor produce adverse health effects. The scientific arguments were limited by the fact that only the short-term effects of ENDS have been studied (Callahan-Lyon, 2014). Furthermore, most of the existing studies have assessed the health impact of ENDS use on ENDS users, not the health impact of exposure to secondhand vapor on ENDS non-users. Assessing the latter is critical for establishing whether existing CIAAs should be amended with inclusion of ENDS. To properly assess effects of exposure to secondhand vapor, an ideal observational study would compare health outcomes between non-smokers from discordant and concordant couples (Taylor et al., 2007). To our knowledge, no such study has been conducted.

A question of great interest to public health policymakers is whether the absence of long-term studies on ENDS has contributed to the difficulty in amending comprehensive CIAAs. Our study did not attempt to answer to this question. But, it would be reasonable to suggest the relationship given the positive correlation between presentation of scientific evidence and the passage of CIAAs in U.S. states (Apollonio and Bero, 2009). The absence of long-term studies on ENDS has led legislators to acknowledge the need for taking a precautionary approach in regulating the products. From a public health perspective, there is strong rationale for taking such an approach. But, the amendment of CIAAs throughout the U.S. could have the unintended consequence of further restricting ENDS use (e.g., through higher taxes) in such a way that smokers no longer use the alternative product as a smoking cessation device. A potential solution to the dilemma is to regulate ENDS less stringently than combustible tobacco, an approach referred to as the proportionality principle (Ribisl et al., 2016).

In the absence of epidemiologic data on the long-term health effects

of ENDS, many testimonials at the committee hearings focused on the renormalization of smoking in society and the potential for adolescents' transition from ENDS use to cigarette smoking. Previous research has acknowledged the importance of arguments on youth protection, (Kadowaki et al., 2015) which include child-proof packaging, limits on marketing to youth, and the elimination of vending machines. A survey of the general public found that participants were more likely to cite prevention of youth access as a reason to support regulations as opposed to other non-youth oriented arguments (Sanders-Jackson et al., 2016). Whether the legislative intent of a bill is solely to deter youths' use of ENDS or to protect the general public, arguments for youth protection are popular among policymakers and the public. Our study observed that the youth protection arguments were frequent at hearings for both comprehensive and non-comprehensive CIAAs.

Our study benefited from an empirical analysis of legislative arguments during a time when precautionary policymaking on ENDS predominated. The preponderance of public health arguments was a likely function of the inconclusive scientific data on the harmful constituents of ENDS vapor. Our study, however, was not without limitations. First, audiotapes from the legislative committee hearings were available for only a subset of bills ( $n = 25$ ). The audio recordings for most bills were unavailable for reasons ranging from the absence of recordings to the rejection of bills that preceded any committee hearings. Second, we did not examine hearings from voter-enacted policies or local regulations on ENDS use. Third, we did not account for factors that may have influenced passage of ENDS legislation, such as lobbying, political party affiliation of legislators, and other political considerations.

Despite the limitations of this study, we demonstrated that legislators and expert witnesses frequently make arguments for amending CIAAs that are tangential to the protection of the health of ENDS non-users. The tangential arguments focus largely on the benefits of using ENDS for smoking cessation. While the use of ENDS for such purposes is laudable, the prohibition of ENDS in public spaces would not preclude ENDS use as a cessation aid for cigarette smoking. The arguments for smoking cessation and harm reduction are likely to be ineffective because they do not address the health concerns that are central to CIAAs. Opponents of amending CIAAs have argued that prohibiting the use of ENDS in public spaces would force smokers and ENDS users to congregate in restricted areas, thus, contributing to the latter's relapse to cigarette smoking. But, recent data suggests that the majority of ENDS users are able to refrain from their use in places where ENDS is prohibited (Yingst et al., 2017). Thus, supporters of the legislation should focus on issues relevant to the health of ENDS non-users, such as the constituents of secondhand vapor. But, given conflicting information on the aerosol constituents, legislators may want to propose legislation prohibiting ENDS use in places frequented by youths. This recommendation stems largely from the concern about adolescents who are susceptible to nicotine dependence and the gateway to combustible tobacco products. The recommendation is consistent with the current trend in ENDS legislation, (Tremblay et al., 2015) reflecting the ease with which youth-specific bills are passed relative to the comprehensive bans. The emerging use of vaping devices for other substances, such as cannabis, further highlights the need for regulating minors' access to ENDS and exposure to secondhand vapor.

#### Conflict of interest

The authors declare there is no conflict of interest.

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