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TESTIMONY ON THE SCIENTIFIC EVIDENCE ON THE PUBLIC HEALTH EFFECTS OF SECONDHAND SMOKE AND ELECTRONIC NICOTINE DELIVERY SYSTEMS AEROSOL

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Thank you for the opportunity to submit testimony today about the health impact of secondhand smoke exposure and aerosol from electronic nicotine delivery systems, including e-cigarettes. I am Dr. Brian King with the Office on Smoking and Health, Centers for Disease Control and Prevention (CDC), the lead Federal agency for comprehensive tobacco prevention and control. I am the author of over 50 peer-reviewed scientific articles on tobacco prevention and control. I am also a contributing author to the 50th anniversary Surgeon General's report, *The Health Consequences of Smoking—50 Years of Progress*, as well as the lead author of CDC's 2014 evidence-based state guide, *Best Practices for Comprehensive Tobacco Control Programs*. I am an international subject matter expert on the issue of secondhand smoke, and have worked for nearly a decade to provide sound scientific evidence to inform tobacco control policy and practice, as well as to effectively communicate this information to key stakeholders at the national, state, and local levels. I am also an international subject matter expert on electronic nicotine delivery systems and have authored multiple peer-reviewed publications on the issues of electronic nicotine delivery system use among adults and youth, susceptibility among youth, and public health policy related to these products.

For the record, I am submitting expert written testimony today at the request of Alison Kulas, Program Manager of the state of Alaska's Tobacco Prevention and Control Program, to discuss the scientific evidence for eliminating exposure to secondhand smoke, as well as the public health effects of electronic nicotine delivery systems, including exposure to the aerosol emitted from these products.

Also for the record, this testimony is not for or against any specific legislative proposal.

The Health Effects of Secondhand Smoke Exposure

I will begin by discussing the harms of secondhand smoke exposure, which has a robust scientific evidence base reflecting decades of research.

Secondhand smoke from burning tobacco products is deadly. In adults, secondhand smoke exposure causes stroke, lung cancer, and coronary heart disease, as well as nasal irritation and reproductive effects in women, such as low birth weight.[1] Children who are exposed to secondhand smoke are at an increased risk for sudden infant death syndrome (SIDS), acute respiratory infections such as pneumonia and bronchitis, middle ear disease, more severe asthma, respiratory symptoms, and slowed lung growth.[1]

The scientific evidence on the harmful effects of secondhand smoke exposure is well-documented. The Surgeon General first concluded that secondhand smoke causes lung cancer in 1986.[2] In 2006, the Surgeon General's Report on *The Health Consequences of Involuntary Exposure to Tobacco Smoke* concluded that there is no risk-free level of secondhand smoke exposure.[3] Separating smokers and nonsmokers, using designated smoking areas, cleaning or filtering the air, and using separately ventilated areas do not work.[3]

In 2010, the Surgeon General's Report on *How Tobacco Smoke Causes Disease* reaffirmed the conclusion that there is no risk-free level of exposure to tobacco smoke.[4] The report and subsequent findings also documented how the complex mix of chemicals in tobacco smoke causes disease, including finding that cigarette smoke contains 7,000 chemicals, 250 of which are toxic and nearly 70 of which cause cancer.[1,4]

In 2014, the 50th Anniversary Surgeon General's Report on *The Health Consequences of Smoking* further affirmed these findings.[1] The report estimates that secondhand smoke exposure increases the risk of stroke by 20 to 30%.[1]

The effects of secondhand smoke exposure on the body are immediate.[3] A 2011 study reported that secondhand smoke exposure can produce adverse inflammatory and respiratory effects within 60 minutes of exposure and that these effects persist for at least three hours after the exposure.[5] These findings are significant; the concern is not just secondhand smoke exposure for guests during a meal at a restaurant, but also the compounded health effects for an employee working an eight-hour shift in a smoke-filled restaurant or bar.[3]

The Burden of Secondhand Smoke Exposure

Secondhand smoke exposure costs nonsmokers—especially vulnerable populations, such as children—their health and wellbeing. These costs are born not just by individuals, but by society: exposure to secondhand smoke costs the United States billions of dollars in lost productivity and medical expenses every year.[1]

As a result of the considerable body of evidence documenting the adverse effects of secondhand smoke, substantial progress has been made toward eliminating nonsmokers' exposure to this preventable health hazard over the last 50 years.[1] Recent assessments of cotinine, a metabolite of nicotine and biomarker of recent secondhand smoke exposure, indicates that about 1 in 4 Americans continue to be exposed to secondhand smoke.[6]

In the past 50 years, secondhand smoke exposure is estimated to have caused nearly 2.5 million deaths in nonsmoking Americans.[1] Each year, an estimated 7,330 lung cancer deaths and 33,950 coronary heart disease deaths are attributable to secondhand smoke exposure.[1] The smoking-attributable economic costs in the United States also include about $5.6 billion in lost productivity every year due to secondhand smoke exposure.[1] Many of these deaths and this lost productivity could be prevented if comprehensive smokefree laws prohibiting smoking in all indoor areas of worksites, restaurants, and bars were implemented nationwide.[1]

Preventing Secondhand Smoke Exposure

We know what works to prevent these harms. In 2006, the Surgeon General concluded that eliminating smoking in indoor spaces is the only way to fully protect nonsmokers from secondhand smoke exposure.[3] In 2009, the World Health Organization's International Agency for Research on Cancer reiterated these findings, concluding that smokefree policies lead to substantial declines in secondhand smoke exposure, citing air quality improvements of up to 90% in high-risk settings, such as bars.[7]

The latest Surgeon General's report delved deeper into the science behind the success of smokefree laws in protecting people's health. Specifically, the report concluded that smokefree laws directly cause reductions in coronary events (especially heart attacks), making comprehensive smokefree laws one of the most effective and cost-effective approaches for reducing heart disease—the leading cause of death—in the country.[1]

Finally, beyond reducing exposure to secondhand smoke, smokefree laws also lower smoking rates as a whole, especially among vulnerable youth and young adults.[1] Both the Surgeon General and the U.S. Guide to Community Preventive Services conclude that smokefree laws in workplaces and communities help smokers quit and reduce tobacco use.[1,8] In addition, smokefree workplaces and communities make youth and young adults less likely to start smoking due to a number of factors, including lower visibility of people who smoke, fewer opportunities to smoke alone or with others, and reduced social acceptability for smoking.[1] The implementation of smokefree laws also increase the adoption of voluntary smokefree rules in homes, which can further protect nonsmokers—especially the most vulnerable that are exposed to secondhand smoke in the home, such as children.[1]

CDC defines a comprehensive smokefree law as one that prohibits smoking at all times, in all indoor areas of all workplaces and public places, including restaurants and bars. If a law allows exemptions for designated or ventilated smoking areas in workplaces, restaurants or bars, the state or community is not considered to have a comprehensive smokefree law. As of January 2015, CDC has determined that 26 states, Puerto Rico, the District of Columbia, and over 697 other communities in the United States have comprehensive smokefree laws in effect.[9,10]

Smokefree policies in hospitality venues such as restaurants, bars, and casinos protect employees and patrons from the health effects of secondhand smoke. These policies are associated with improved indoor air quality and with reduced secondhand smoke exposure, reduced sensory and respiratory symptoms, and improved lung function in nonsmoking employees, which translates into improved productivity.[2] Comprehensive smokefree laws

are also associated with rapid reductions in hospitalizations due to heart attacks and strokes.[11] These improvements occur within months after implementation.[12,13] For instance, in Colorado, following the implementation of a comprehensive smokefree law in 2006, the state saw a 23 percent drop in ambulance calls from these venues.[14] However, there was no change in ambulance calls from casinos until the law was expanded in 2008 to include casinos—after which, ambulance calls from casinos dropped nearly 20 percent.[14] Again, this illustrates that these health improvements are lifesaving and nearly immediate.

The Business Case for Smokefree Laws

The evidence concerning the economic impact of smokefree laws is also well-documented. In 2006, the Surgeon General concluded that "evidence from peer-reviewed studies shows that smokefree policies and regulations do not have an adverse economic impact on the hospitality industry."[3]

These findings have been replicated numerous times at the international, state, and local levels.[1,3,7] In 2009, the International Agency for Research on Cancer conducted a comprehensive review of 97 studies from eight countries on the economic impact of smokefree policies and found that studies consistently conclude that smokefree policies do not harm business.[7]

At the state and local level, studies consistently reiterate these conclusions. The largest analysis of the impact of local smokefree ordinances, which examined nine states (Alabama, Indiana, Kentucky, Mississippi, Missouri, South Carolina, Texas, and West Virginia), found that smokefree laws do not have a negative impact on either employment or sales in restaurants and bars.[15] A study of El Paso, Texas's smokefree policy found that the law had no effect on restaurant and bar revenue.[16] Furthermore, a 2007 study on the economic impact of a smokefree law in Lexingon-Fayette County, Kentucky found that "no important economic harm stemmed from the smoke-free legislation…despite the fact that Lexington is located in a tobacco-producing state with higher-than-average smoking rates."[17]

Further reviews of the literature have also found that, in some cases, a smokefree policy produces positive effects for local businesses.[18,19,20] A number of cities and localities have experienced these positive effects. For instance, an in-depth analysis of tax revenue data in California after the state implemented their smokefree restaurant law (in 1995) and bar law (in 1998) found that the smokefree restaurant law was associated with an increase in restaurant revenues, and the smokefree bar law was associated with an increase in bar revenues.[21] Additionally, just one year after implementation of the New York City smokefree law, an evaluation found that restaurant and bar revenues in New York City increased by 8.7% from April 2003 through January 2004.[22]

These economic impact studies highlight one of the key benefits to implementing a comprehensive smokefree law, rather than relying on voluntary policies: an equal playing field for businesses. Businesses can compete fully on their merits, while protecting the health of their workers and patrons and promoting healthy communities.

Electronic Nicotine Delivery Systems

I will now summarize the current market and regulation of electronic nicotine delivery systems, or ENDS, as well as the current scientific literature on these products, including the effect of ENDS aerosol on nonusers.

The Current Regulation of Electronic Nicotine Delivery Systems

E-cigarettes are part of a class of products often referred to as electronic nicotine delivery systems (ENDS), which are battery-powered devices that provide doses of nicotine and other additives to the user in an aerosol.[23] There are currently multiple types of ENDS on the U.S. market, including e-cigarettes, e-hookahs, hookah pens, vape pens, e-cigars, and others. Some of these products are disposable varieties, while others can be refilled or recharged for repeated use.

ENDS, including e-cigarettes, are currently not regulated by the U.S. Food and Drug Administration (FDA) under the Family Smoking Prevention and Tobacco Control Act (FSPTCA), although FDA issued a proposed rule in April 2014 to regulate them under its tobacco product authorities.[24] FDA's authority, however, does not extend to certain key policy interventions related to ENDS, such as use in public places.[24]

Absent federal regulation, the current landscape of ENDS—including product design and availability, sales, marketing, use, and related legislation—is one of rapid change and high variability. Furthermore, given that ENDS have only recently entered the U.S. market, significant questions remain regarding ENDS' safety.

Scientific Evidence of the Health Effects of Electronic Nicotine Delivery Systems

We have very little information about the ingredients of ENDS liquids, or the exposure to harmful and potentially harmful constituents when using electronic cigarettes over the short-term or long-term. To date, manufacturers are not required to publish what chemicals are in the ENDS solution, or to perform or reveal results from systematic testing. Studies have demonstrated wide variability in design, operation, and contents and emissions of carcinogens, other toxicants, and nicotine from ENDS.[1] Depending on the brand, ENDS cartridges typically contain nicotine, a component to produce the aerosol (e.g., propylene glycol or glycerol), and flavorings (e.g., fruit, mint, or chocolate).[25] Harmful or potentially harmful constituents have also been documented in some ENDS, including tobacco-specific nitrosamines, aldehydes, metals, volatile organic compounds, phenolic compounds, polycyclic aromatic hydrocarbons, and tobacco alkaloids, but at lower levels than in conventional cigarettes.[26] However, because there are hundreds of manufacturers and no manufacturing standards, there is no way to ensure that all ENDS have acceptably low levels of toxicants.

Smokefree Laws and ENDS

ENDS aerosol is not "water vapor." It contains nicotine and can contain additional toxins, and thus, it is not as safe as clean air.[27]

Although nicotine exposure in the absence of combustion is less hazardous than exposure to combusted conventional tobacco products, nicotine itself is not without risk.[1,28] Nicotine is addictive.[1] Pregnant women can transfer nicotine to their developing fetus, which can be toxic.[1] The evidence is also suggestive that nicotine exposure during adolescence may have lasting adverse consequences for brain development.[1] And for non-smokers, nicotine is an acute irritant, potentially causing headache, nausea, and discomfort; for former smokers, nicotine exposure can trigger cravings jeopardizing their abstinence.[29,30]

Furthermore, beyond the concerns of nonuser exposure to nicotine, there are also reports in the news media about the potential for e-cigarettes to be altered to deliver other psychoactive substances such THC, the active ingredient in marijuana.[31,32] Like nicotine, in an aerosolized form, THC is largely odorless, making it very difficult for the public to discern if they have been exposed.

Air containing ENDS aerosol is less safe than clean air, and ENDS use has the potential to involuntarily expose children and adolescents, pregnant women, and non-users to aerosolized nicotine and, if the products are altered, to other psychoactive substances. In fact, research has documented the presence of secondhand nicotine exposure using environmental monitoring and the measurement of biomarkers among exposed nonusers.[33] Therefore, clean air—free of both smoke and ENDS aerosol—remains the standard to protect health.

As of November 2014, three states and over 200 localities nationwide have incorporated ENDS into their smokefree laws.[34] In fact, North Dakota, the most recent state to pass a comprehensive statewide smokefree law, included the prohibition of ENDS use in indoor public places, including restaurants and bars.[34]

Conclusion

ENDS have a range of potential impacts on individual and population health, and significant questions remain regarding their safety However, given that these products emit nicotine—a psychoactive drug that can harm those involuntarily exposed—and other toxins, ENDS use should be prohibited in all places where smoking is prohibited in order to: protect children and adolescents, pregnant women, and non-smokers from involuntary exposure to aerosolized nicotine and potentially to other psychoactive substances, support enforcement of clean indoor air policies, and prevent renormalization of tobacco use.[1,34]

While we continue to learn more about the specific health effects of ENDS, the evidence shows that secondhand smoke causes considerable death and disease, costing the United States billions every year in direct health care costs and lost productivity. And unlike many other health hazards, these harms are completely preventable.

Thank you.

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