

**Centers for Disease Control and Prevention, Office on Smoking and Health**  
**Summary of Scientific Evidence:**  
**Secondhand Smoke Exposure and the Impact of Smokefree Policies**  
**November 2021**

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**The Public Health Burden of Secondhand Exposure to Commercial Tobacco Smoke**

- Secondhand smoke, the combination of smoke from burning commercial tobacco\* products and the smoke breathed out by a person who is smoking, is deadly.
  - Secondhand smoke exposure is estimated to have caused nearly 2.5 million deaths from 1964 to 2014 among Americans who did not smoke.<sup>1</sup>
  - From 2005-2009, an estimated 7,330 lung cancer deaths and 33,950 coronary heart disease deaths annually were attributable to secondhand smoke exposure.<sup>1</sup>
- The scientific evidence on the harmful effects of secondhand smoke exposure is well-documented.
  - The Surgeon General first concluded in 1986 that secondhand smoke causes lung cancer.<sup>2</sup>
  - 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.<sup>3</sup> This conclusion was reaffirmed in 2010.<sup>4</sup>
  - The 2010 Surgeon General's Report on *How Tobacco Smoke Causes Disease* documented how the complex mix of chemicals in tobacco smoke causes disease, including finding that cigarette smoke contains more than 7,000 chemicals.<sup>5</sup> At least 250 of these chemicals are known to be harmful,<sup>6</sup> and at least 69 can cause cancer.<sup>5,6</sup>
  - The 2014 Surgeon General's Report on *The Health Consequences of Smoking—50 Years of Progress* summarized additional evidence on the health effects of secondhand smoke exposure.<sup>7</sup>
    - In adults, secondhand smoke exposure causes stroke, lung cancer, and coronary heart disease, as well as adverse reproductive health effects in women, including low birth weight.<sup>8</sup> Specifically, the report estimated that secondhand smoke exposure increases the risk of stroke by 20% to 30%.<sup>9</sup>
    - 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 frequent and severe asthma, respiratory symptoms, and slowed lung growth.<sup>8</sup>
- The effects of secondhand smoke exposure on the body are immediate.<sup>3,10</sup>
  - A 2011 study reported that secondhand smoke exposure can produce adverse inflammatory and respiratory effects within 60 minutes of exposure and that these

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\* References to tobacco refer to commercial tobacco and not the sacred and traditional use of tobacco by some American Indian communities.



effects persist for at least three hours after the exposure.<sup>11</sup> Therefore, there may be compounded health effects for an employee working an eight-hour shift in a smoke-filled place, such as a restaurant or bar.<sup>12</sup>

- The costs attributable to smoking are borne not just by individuals, but also by society.
  - According to 2014 data, it is estimated that every year in the United States, over \$300 billion in healthcare spending and productivity losses are attributable to cigarette smoking.<sup>1, 13, 14</sup> This estimate includes costs for direct medical care, lost productivity due to premature death, and lost productivity due to secondhand smoke exposure.<sup>1</sup>
  - The 2014 estimate relies on data from 2006 showing lost productivity costs of \$5.6 billion due to secondhand smoke exposure.<sup>1</sup>

### **Who Is Exposed to Secondhand Smoke**

- Everyone deserves a fair and just opportunity to reach their full health potential. Secondhand smoke exposure causes disease and death. Because not all populations are equitably protected by comprehensive smokefree laws intended to address exposure to secondhand smoke, it is not always possible for people to reach their full health potential.
  - As of June 2021, of the ten U.S. states with the highest proportion of Black residents, only three of those states have comprehensive smokefree laws. Of the seven states that do not have comprehensive laws, two also prevent local communities from adopting comprehensive smokefree laws.<sup>15-17</sup>
  - As of July 1, 2021, only 61.2% of the U.S. population was protected by comprehensive smokefree state or community policies.<sup>18</sup>
- Reasons for disparities may include not only inequitable protection by smokefree policies, but also social determinants of health (the conditions in which people are born, grow, live, work, and age) and tobacco industry misstatements about the health effects of secondhand smoke to “deceive the public, distort the scientific record, . . . and forestall indoor air restrictions.”<sup>1, 19-22</sup>
- As a result of the considerable body of evidence documenting the adverse effects of secondhand smoke, substantial progress has been made over the last 50 years toward eliminating exposure to this preventable health hazard among people who do not smoke.<sup>7, 23</sup> For example, between 1999 and 2012, secondhand smoke exposure in the United States was reduced by half, but continued efforts to protect people are needed.<sup>24</sup>
- Cotinine, a metabolite of nicotine, is used as a biomarker of recent secondhand smoke exposure. Using an established serum cotinine range of 0.05 ng/mL to 10 ng/mL, during 2017-2018, nearly one in four Americans aged  $\geq 3$  years who do not smoke were exposed to secondhand smoke.<sup>19, 25</sup>
- From 2011-2012 to 2017-2018, the prevalence of people who do not smoke who were exposed to secondhand smoke remained steady across most population groups. Among Mexican Americans 20 years of age or older, prevalence of secondhand smoke exposure declined significantly.<sup>25</sup>
- However, due to uneven smokefree protections, inequities in secondhand smoke exposure have persisted for some population groups.<sup>25, 26</sup>
  - Groups of people who are more likely than other groups to be exposed to secondhand smoke include: non-Hispanic, Black people; people who live below

the federal poverty level; people with less than a college degree; people who live with someone who smokes inside the home; people who work in traditionally “blue collar” industries, service occupations, or construction; people who live in rental properties; and children 3-11 years of age.<sup>19, 20, 25, 27</sup>

- Almost two of every five children 3-11 years of age, including over half of non-Hispanic Black children, were exposed to secondhand smoke during 2017-2018.<sup>19, 25</sup>
- During 2017-2018, secondhand smoke exposure among non-Hispanic Black individuals and those living below the poverty level continued to be approximately twice as high compared with non-Hispanic White individuals and those living above the poverty level, respectively.<sup>25, 26</sup>
- Many disparities in exposure, illnesses, deaths, and lost productivity could be prevented if comprehensive smokefree laws prohibiting smoking in all indoor areas of worksites, restaurants, and bars were implemented throughout the United States.<sup>19, 28, 29</sup>
- A recent study assessed secondhand smoke exposure using a lowered serum cotinine threshold of 0.015–10 ng/mL instead of the established threshold of 0.05–10 ng/mL, effectively expanding the definition of who is considered to have been exposed to secondhand smoke. The authors found that:
  - Using the expanded range more than doubled the estimated proportion of Americans aged  $\geq 3$  years who do not smoke who were exposed to secondhand smoke.
  - The prevalence of secondhand smoke exposure among Americans who do not smoke declined from 58.3% in 2011-2012 to 52.3% in 2017-2018 based on the expanded range.<sup>25</sup>

### **Preventing Secondhand Exposure to Commercial Tobacco Smoke**

- There are population-level, evidenced-based strategies that work to prevent the harms of secondhand smoke exposure.
  - In 2006, the Surgeon General concluded that using designated smoking areas indoors to separate people who smoke from people who do not smoke, cleaning or filtering the air, or ventilating buildings does not remove the risk of secondhand smoke exposure.<sup>30</sup> Completely eliminating smoking in indoor spaces is the only way to fully protect people who do not smoke from secondhand smoke exposure.<sup>30</sup>
  - 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.<sup>31</sup>
  - Furthermore, the 2014 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 United States.<sup>9</sup>

- Comprehensive smokefree laws are associated with rapid reductions in hospitalizations related to heart attacks and strokes.<sup>32, 33</sup>
  - For instance, in Colorado, following the implementation of a statewide, comprehensive smokefree law in 2006, Gilpin County saw a 23 percent drop in ambulance calls from all places other than casinos.<sup>34</sup> 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 in Gilpin County dropped nearly 20 percent.<sup>34</sup> This experience illustrates that these health impacts are nearly immediate and save lives.
- Smokefree policies in hospitality venues—such as restaurants, bars, and casinos—protect both employees and patrons from the adverse health effects of secondhand smoke exposure. 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 employees who do not smoke.<sup>30, 35, 36</sup>
- As mentioned above, disparities in exposure to secondhand smoke exist among a number of population groups, including individuals who are non-Hispanic Black, those who live below the poverty level, and those who live in multiunit housing.<sup>25</sup> Many of these disparities are due to a lack of comprehensive smokefree laws.<sup>29, 37</sup> Comprehensive smokefree laws that apply to all workplaces and public places, and smokefree policies for homes and vehicles would allow adults and children to be equally protected against the harms of secondhand smoke exposure, as well as to help eliminate tobacco-related health disparities.
  - CDC defines a comprehensive smokefree law as one that prohibits smoking at all times, in all indoor areas of all workplaces, 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.<sup>9, 17</sup>
  - The implementation of smokefree laws also increases the adoption of voluntary smokefree rules in homes.<sup>38</sup> These rules can further protect people who do not smoke—especially those who are disproportionately affected by secondhand smoke exposure in the home, such as children.<sup>29</sup>
- Beyond reducing exposure to secondhand smoke, smokefree laws also lower smoking rates as a whole.<sup>29</sup>
  - Both the Surgeon General and the U.S. Guide to Community Preventive Services have concluded that smokefree laws in workplaces and communities increase smoking cessation and reduce tobacco use.<sup>29, 39, 40</sup>
  - In addition, smokefree workplaces and communities make youth and young adults less likely to start smoking due to a number of factors, including seeing fewer role models smoke, fewer opportunities to smoke alone or with others, and reduced social acceptability for smoking.<sup>29</sup>

## **Evidence Shows that Smokefree Laws Do Not Adversely Impact Business**

- The evidence concerning the economic impact of smokefree laws on businesses is well documented.
- In 2006, the Surgeon General concluded that “evidence from peer-reviewed studies shows that smoke-free policies and regulations do not have an adverse economic impact on the hospitality industry.”<sup>30</sup> These findings have been replicated numerous times at the international, state, and local levels.
  - 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 concluded that studies consistently have found that smokefree policies do not harm business.<sup>31</sup>
  - The largest analysis of the impact of smokefree ordinances, which examined local ordinances in eight states (Alabama, Indiana, Kentucky, Mississippi, Missouri, South Carolina, Texas, and West Virginia) and a state-level law in one state (North Carolina), found that smokefree laws do not have a negative impact on either employment or sales in restaurants and bars.<sup>41</sup>
  - A study of El Paso, Texas’s smokefree law found that it had no effect on restaurant and bar revenue.<sup>42</sup>
  - A 2007 study on the economic impact of a smokefree law in Lexington-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.”<sup>43</sup>
  - A study of 25 years of employment data for all 50 states and the District of Columbia, from 1990-2015, found that smokefree laws do not have an adverse impact on restaurant and bar employment.<sup>44</sup>
- Few studies have examined the economic impact of smokefree policies on casinos.
  - A review of the studies published from January 1998 to March 2011 found that the results of these studies are mixed, although none appeared to have examined the cost savings that could result from adoption of these policies.<sup>45</sup>
  - The reviewers noted that a study published in June 2011 found that implementation of Illinois’ smoke-free law – which applies to casinos – did not result in fewer people going to casinos.<sup>45, 46</sup> A 2018 study of the Illinois law reached a similar conclusion.<sup>47</sup>
  - Another study showed that, in 2017, nearly half of people who smoke and three-quarters of casino visitors favor smokefree casinos.<sup>48</sup>
- Other reviews of the literature have also found that, in some cases, a smokefree policy produces positive effects for local businesses.<sup>49-51</sup>
  - 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.<sup>52</sup>
  - 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.<sup>53</sup>

## **Smokefree Policies and Secondhand Aerosol**

- Electronic cigarettes, or e-cigarettes, are sometimes called “e-cigs,” “vapes,” “mods,” “e-hookahs,” “vape pens,” and “electronic nicotine delivery systems (ENDS).”
- Scientists are still learning about the health effects of e-cigarettes. However, there is sufficient scientific evidence to support the implementation of strategies to protect the public from risks associated with exposure to the emissions from these products.
  - For example, the 2016 Report from the U.S. Surgeon General on e-cigarette use among youth and young adults concluded that e-cigarette aerosol is not harmless.
    - E-cigarette aerosol can contain harmful and potentially harmful constituents, including nicotine, volatile organic compounds, cancer-causing chemicals, and heavy metals such as nickel, tin, and lead.<sup>54</sup>
    - The report notes that exposure to the aerosol from these products can be particularly dangerous for youth; specifically, the report concludes that “[n]icotine exposure during adolescence can cause addiction and can harm the developing adolescent brain.”<sup>54</sup>
    - E-cigarette aerosol also can contain cancer-causing chemicals and tiny particles that reach deep into the lungs.<sup>54</sup>
  - Bystanders, including children and adolescents, pregnant people, and people who do not use e-cigarettes, can also breathe in e-cigarette aerosol when the user exhales into the air.<sup>54</sup>
  - Therefore, clean air—free of both smoke and e-cigarette aerosol—remains the standard to protect health.
- In the 2016 Surgeon General’s Report, the Call to Action states that “State, local, tribal, and territorial governments should implement population-level strategies to reduce e-cigarette use among youth and young adults, such as including e-cigarettes in smokefree indoor air policies.”<sup>55</sup>
  - The report notes that most smokefree indoor air policies were put in place before the rise in e-cigarette use. Because of that, these policies may not cover e-cigarettes or exposure to the aerosol these products produce.<sup>55</sup>
  - Therefore, the Call to Action states that “[s]mokefree indoor air policies should be updated to prohibit the use of both conventional cigarettes and e-cigarettes, thereby preserving standards for clean indoor air. Efforts to include e-cigarettes in smokefree laws should also uphold or strengthen, not weaken, existing protections against exposure to secondhand smoke.”<sup>55</sup>
- Permitting e-cigarette use in public places could perpetuate combusted tobacco use and, therefore, tobacco-related morbidity and mortality.
  - In 2019, 36.9% of adults who currently used e-cigarettes also currently smoked cigarettes.<sup>56</sup> E-cigarette use in public places could make it easier for people who smoke to sustain their nicotine addiction in public places, without switching completely away from combusted tobacco use.<sup>57</sup>
  - In 2020, the U.S. Surgeon General concluded that there is inadequate evidence to conclude that e-cigarettes, in general, increase smoking cessation.<sup>58</sup> Additionally, because some e-cigarettes are designed to mimic smoking,<sup>59</sup> allowing e-cigarette

use in places where smoking is prohibited could complicate enforcement of smokefree policies and renormalize tobacco use.

- As noted in the 2016 Surgeon General’s report, including e-cigarettes in smokefree indoor air policies can eliminate health risks from exposure to secondhand aerosol from e-cigarettes; discourage people from using both combustible and electronic tobacco products (dual use); simplify compliance with and enforcement of existing smokefree laws; help to reduce the use of e-cigarettes among youth and young adults; and maintain tobacco-free norms.<sup>60</sup>

### **What States and Communities Have Done**

- As of October 1, 2021, 28 states, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia have comprehensive smokefree laws in effect that prohibit smoking tobacco in private worksites, restaurants, and bars. Twenty-two states, Puerto Rico, and the U.S. Virgin Islands prohibit smoking in state-regulated gambling venues.<sup>61</sup>
- As of October 1, 2021, 19 states, Puerto Rico, and Washington D.C. prohibit the use of e-cigarettes in private worksites, restaurants, and bars, and 13 of those jurisdictions also prohibit the use of e-cigarettes in gambling venues.<sup>62</sup>
- As of October 1, 2021, 1,149 local U.S. communities have comprehensive smokefree laws in effect that prohibit smoking tobacco in private worksites, restaurants, and bars.<sup>61</sup> There are also 993 local U.S. communities that prohibit the use of e-cigarettes in 100% smokefree venues.<sup>62</sup>
- The most effective tobacco control policies have most often originated at the local level.<sup>63, 64</sup> This is especially true in the area of smokefree policies.<sup>29</sup>

### **Conclusion**

- Evidence shows that secondhand smoke causes considerable death and disease and costs the United States billions of dollars every year in lost productivity. These harms are completely preventable.
- Further, secondhand aerosol is not harmless. The diversification of the tobacco product landscape is important to consider in the development of public health interventions to protect the public from involuntary exposure to known health risks.
- Comprehensive smokefree laws and policies that equitably cover all persons are essential to protecting everyone from the harms of secondhand smoke exposure.
- Clean air—free of both smoke and aerosol—remains the standard to protect health.

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