

January 22, 2020

No. 262

Federal Health Agencies' Misleading Messaging on E-Cigarettes Threatens Public Health

Misinformation about Effective Harm Reduction Products Will Prevent Smokers from Quitting

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The scientific community is increasingly unified in the assessment that e-cigarettes are vastly safer than smoking, help smokers quit, and are a net positive for public health.¹ However, the general perception of e-cigarettes is increasingly at odds with that fact. This divergence between reality and public opinion is largely due to attempts by the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) to scare and misinform the public about e-cigarettes' relative risks and benefits. This disinformation campaign has put peoples' lives in acute danger by failing to warn them of products that are actually linked to a recent spate of hospitalizations and deaths.

Even though CDC eventually admitted that illegal cannabis products—not nicotine e-cigarettes—appeared to be the main, if not only, culprit, it was too little too late.² The CDC's reversal has done little to abate the calls for prohibitionist policies, such as the FDA's recent ban on flavored e-cigarettes, which was promoted by misinformation about the outbreak.³ Furthermore, as a result of their efforts to stoke unwarranted fears about the risks of e-cigarettes, these agencies, which are supposedly responsible for protecting the health and well-being of Americans, are scaring adult smokers away from products that could help them quit smoking and may even be driving some back to smoking combustible cigarettes, which contribute to nearly half a million deaths in the U.S. every year.⁴

Despite the harm reduction potential of e-cigarettes, the FDA, CDC, and anti-smoking advocacy groups have been relentless in their attempts to raise doubts about the safety of e-cigarettes and suppress their use. While they claim their campaign is targeted at preventing never-smokers and minors from initiating e-cigarette use, it has also deceived adult smokers. In April 2019, a survey found that 87.5 percent of adult smokers in the U.S. incorrectly believed that e-cigarettes are no less harmful than combustible cigarettes.⁵

That is simply not true. The dangers associated with smoking come mainly from burning tobacco and inhaling tar and other products of combustion.⁶ Nicotine, divorced from this combustible delivery method, is relatively harmless with effects and risks similar to those associated with caffeine.⁷ E-cigarettes, on the other hand, heat a solution of nicotine, propylene glycol, vegetable glycerin, and flavoring agents into an aerosol without any combustion. As a result, the best studies to date estimate that e-cigarettes are at least 95

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percent less harmful than smoking and, based on long-term studies, appear to have a similar impact as nicotine replacement therapy.⁸

Yet, despite this evidence, a growing number of people fail to understand the relative safety and potential benefits of e-cigarettes compared to smoking. That makes it less likely that these smokers will even consider trying e-cigarettes, though clinical trials show they are twice as effective in helping smokers quit than traditional nicotine replacement therapies, such as patches.⁹ But, instead of recognizing this confusion among the general public as evidence of health authorities' failure to properly communicate the relative risks of e-cigarettes, agencies in the U.S., including the CDC and FDA, have only doubled down on their campaigns to spread unjustified fear about these products and drum up support for restrictive new rules or even bans on e-cigarettes. Their willingness to prioritize a political agenda above public safety was made painfully clear during an outbreak of “vaping linked” lung injuries that swept the country over this past summer.

For the last two years, at least, officials at the FDA and CDC have dedicated much energy and millions of dollars to combating what they have described as an “epidemic” of adolescent e-cigarette use. This terminology is based on a misleading interpretation of survey data that found an increase in experimental use of e-cigarettes—once a month or more—among middle and high school students since 2017. However, they ignore that the percentage of teenagers who have never smoked but use e-cigarettes habitually—20 or more times a month—is approximately 0.5.¹⁰ That is not an epidemic. Moreover, while e-cigarette experimentation is up, teen use of combustible cigarettes is at the lowest rate ever.¹¹

Nevertheless, when news headlines began reporting a growing number of mostly young people being hospitalized after reportedly vaping, government and non-governmental health organizations seized the opportunity to link the outbreak to e-cigarettes and foment public panic and support for policies they have been proposing for years.

It started in the Midwest around late June, after several news stories reported that a number of teenagers had been hospitalized with severe lung ailments after using vaping devices. However, what the headlines failed to convey was that it was clear from the start that most—if not all—of those falling ill were not just vaping over-the-counter nicotine e-cigarettes. They were consistently reporting vaping cartridges containing tetrahydrocannabinol (THC), the psychoactive ingredient in cannabis. More specifically, patients reported using THC vapes purchased from unlicensed street dealers.¹²

One cannot entirely blame journalists for this oversight because the CDC—the agency responsible for communicating about and containing exactly this sort of outbreak—consistently refused to acknowledge the role of black market THC in the outbreak. By September, numerous states had been reporting that THC was linked to most of the cases, based on self-reporting by the patients. For example, Utah reported that 94 percent of patients admitted to using THC cartridges while only 6 percent said they used only nicotine vapes. In that state, testing of the products used by the patients found that none of the nicotine vaping devices were contaminated, but 89 percent of the THC vapes were found to have been adulterated with ingredients that may explain the illnesses.¹³ Still, CDC's warning

to the public focused on e-cigarettes and stated that “no single product or substance has been linked to all lung injury cases.”¹⁴

By late September, the CDC finally admitted that black market THC vaping cartridges appeared to be playing a major role in the outbreak. And, it was not until that tepid admission that news outlets began to clarify that the crucial element involved in the outbreak was *what* people had vaped, tainted THC in particular. By then, however, it was far too late. The governors of Michigan, New York, Massachusetts, Rhode Island, and Washington had already enacted emergency bans on the sale of flavored e-cigarettes, with other states set to follow suit.¹⁵

Since the onset of the outbreak, federal lawmakers have held a number of hearings, supposedly aimed at exploring the causes of the illness and potential solutions. However, these hearings served only to further conflate the outbreak with the separate issue of teen e-cigarette use, while downplaying the role of illicit products in the reported illnesses. For example, at the House Appropriations Committee hearing, CDC Deputy Director Anne Schuchat testified that only 13 percent of patients reported using only nicotine vapes, that some may be reluctant to admit using marijuana, and that the agency could not exclude the possibility that nicotine-containing vapes played some role in the outbreak.¹⁶

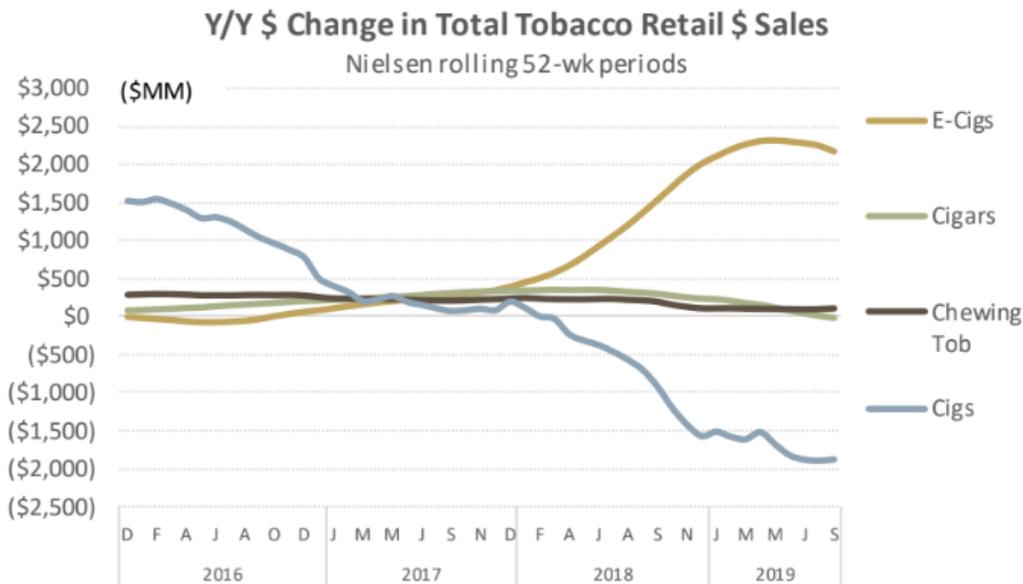
The problem extends beyond the federal level. State health departments helped spread the misinformation by carefully wording press releases to emphasize that the cases of the lung-illness linked to “e-cigarette use,” strategically omitting patients’ use of THC even when that information was available. For example, on October 17, 2019 the Tennessee Department of Health issued a press release about the “cluster of illnesses ... linked to e-cigarette use” and the state’s first death—a person described as “a patient with serious respiratory disease associated with use of electronic cigarettes or other vaping devices.”¹⁷ However, subsequent reports indicate that the patient had only ever used THC and CBD cartridges, making the Tennessee Health Department’s choice to describe his product use as “e-cigarettes or other vaping devices” somewhat curious.¹⁸

As Dr. Michael Siegel, a public health professor at Boston University and former CDC employee, wrote, this is akin to attributing a death related to salmonella from eating lettuce to “the consumption of artichokes or other vegetables,” something no one would do, “unless you were intentionally trying to deceive the public into thinking that artichokes were responsible for the death.”¹⁹ Tennessee is not alone. According to Siegel’s analysis, of the 25 state health departments that issued warnings, nearly half failed to accurately communicate the role of THC in the outbreak, and three did not mention THC at all.²⁰

Unfortunately, this fear-mongering messaging has achieved its goal, based on polling of the public’s understanding of the outbreak. In a September 2019 Morning Consult poll, 58 percent of respondents said they believed the lung illness deaths were caused by “ecigs, such as Juul,” while only 34 percent said the cases involved “marijuana or THC e-cigs.” The poll also found that the percentage of those who believed e-cigarettes were less harmful than combustible cigarettes dropped to 22 percent—a 14 percent decline since June.²¹

The consequences of this misinformation about the likely cause of the lung illness outbreak are twofold. First, people will continue to use black market THC cartridges and some will become sick or die as a result. Second, the growing belief that e-cigarettes are no safer and possibly more harmful than cigarettes will cause people to either forgo trying e-cigarettes as a smoking cessation or prompt a return to smoking. Anecdotal evidence suggests that the latter is already happening. Many former smokers report throwing out their e-cigarettes and going back to smoking cigarettes.²² Nielsen data also shows that beginning around July, as e-cigarette sales suddenly began to decline, sales of traditional cigarettes—which had been in a practical free fall the last few years—suddenly began to level off.

E-Cigs Contribution to Total Tobacco Retail \$ Sales Continues to Grow Nielsen rolling 52-wk periods



Youth use of e-cigarettes is a problem that should be addressed, but not by spreading false information to support a political agenda. Certainly, efforts to address youth use should not come at the expense of scaring adult smokers away from a potentially life-saving products or at the cost of misinforming the public amid an outbreak of tainted vaping products.²³

The government’s biased messaging about the lung illness outbreak is only the latest and, perhaps, most egregious example of their bias against e-cigarettes. For many years, CDC and the FDA simply refused to acknowledge the growing scientific consensus that e-cigarettes, even if not risk-free, are far less harmful than smoking, more effective at helping smokers quit than most other options, and, as such, a huge win for public health.²⁴

One reason the FDA has been so reluctant to embrace the evidence about e-cigarettes’ benefits is the agency’s overriding need to build public support for new regulations on that industry. The rules, which require manufacturers to submit every product for a pre-market

FDA review, will functionally eliminate the e-cigarette industry as it exists today. The prohibitive cost in both time and money of these applications, without any certainty about gaining approval, ensures that only the largest tobacco companies would be capable of attempting to navigate the process. For the handful of products that might eventually be approved, these will be more expensive, harder to obtain, and less effective for consumers, thus limiting who might benefit from e-cigarettes. Furthermore, the process all but guarantees that innovation will grind to a halt, preventing future technological advances that might make the products safer and more effective.²⁵ It would be difficult for the FDA to justify implementing such industry-destroying rules if it admitted that e-cigarettes were safer than cigarettes and could save millions of lives.

E-Cigarettes' Effectiveness at Harm Reduction. Recent studies suggest that e-cigarettes are less harmful than combustible cigarettes. In fact, Public Health England has stated that e-cigarettes are 95 percent less dangerous than traditional cigarettes.²⁶ They are less dangerous for three related reasons: 1) e-cigarettes are non-combustible sources of nicotine, 2) they contain fewer harmful and potentially harmful chemicals, and 3) they do not expose people around e-cigarette users to secondhand smoke.

Unlike traditional cigarettes, e-cigarettes do not burn tobacco. Instead, they vaporize a nicotine-based liquid. Contrary to a commonly held misconception, it is not the nicotine in cigarettes that causes cancer, but rather inhalation of the tar and other chemicals created by burning tobacco and paper. The fact that e-cigarettes do not burn anything makes them less dangerous than combustible tobacco products.²⁷ The vapor from an e-cigarette not only avoids combustion, it also contains fewer harmful chemicals than combustible cigarettes.

While e-cigarettes do contain some toxic chemicals, they are present in far lower concentrations than in combustible cigarettes.²⁸ A 2018 report from the National Academies of Sciences, Engineering, and Medicine found that “overall, e-cigarette aerosol contains fewer numbers and lower levels of toxicants than smoke from combustible tobacco cigarettes.”²⁹ While the study notes that e-cigarettes do have biological effects in humans, those effects are less severe than those of combustible cigarettes.³⁰ Thus, even if smokers do not fully quit, replacing some of their cigarette use with e-cigarettes may still reduce their health risks. Furthermore, a 2017 study by researchers at the University of North Carolina (UNC) at Chapel Hill found that toxic chemicals in e-cigarettes are present in concentrations nine to 450 times lower than those in combustible cigarettes.³¹

E-cigarettes may also reduce the risks to nonsmokers who come into proximity of those using the products. While the evidence is surprisingly unclear about the risks of secondhand smoking, studies have found that e-cigarettes emit far fewer toxins than combustible cigarettes.³² Whatever the degree of risk to nearby non-users, e-cigarettes are comparatively less harmful than cigarettes.³³ Not only could switching to e-cigarettes increase the lifespan of the smoker, it also decreases risks to others by limiting passive exposure to chemicals. Steam from vaporizer products might not smell great, but it is not dangerous, and most nonsmokers would likely prefer it to cigarette smoke.³⁴

E-cigarettes can also help smokers of combustible cigarettes quit smoking. In a recent study conducted in England of 18,929 adult smokers who wanted to quit smoking, e-cigarettes were one of two products that were effective at increasing the chances of continued smoking cessation after a quitting attempt. The other effective smoking cessation product is the prescription medication varenicline, better known by its commercial name, Chantix.³⁵

E-cigarettes are more effective than other over-the-counter smoking cessation products. In a test between the effectiveness of e-cigarettes and nicotine patches, 57 percent of e-cigarette users were able to cut their smoking of traditional cigarettes by at least half. Only 41 percent of nicotine patch users were able to do the same.³⁶ Furthermore, a 2019 study published in the *New England Journal of Medicine* found that e-cigarette users were nearly twice as successful at quitting combustible cigarettes as smokers who used other smoking cessation aids. The study found that “users of e-cigarettes were ... significantly more likely to be abstinent than those that did not use cessation aids.”³⁷

Other studies have shown that e-cigarettes are useful smoking cessation aids. The UNC study cited above, which observed 1,374 U.S. smokers, found that “regular e-cigarette users were six times more likely to quit smoking” than non-e-cigarette users.³⁸ Interestingly, it found that for every percentage point rise in e-cigarette use, quit attempts of traditional cigarettes rose by 0.98 percent and successful quit attempts rose by 0.58 percent.³⁹

Finally, a comparison study between English and American smokers found that over 50 percent of those who tried e-cigarettes were able to limit their intake of combustible cigarettes.⁴⁰ In both the English and American studies, there has been a significant amount of evidence that many people are using e-cigarettes to successfully quit smoking traditional cigarettes or significantly reduce their consumption of traditional cigarettes.

While the aforementioned studies are not conclusive, they do point to significant harm reduction benefits from e-cigarettes. Moreover, while the long-term side effects of e-cigarettes are not entirely clear, it appears they do not have the negative side effects of some other smoking cessation aids. Chantix and Zyban, another prescription smoking cessation aide, have both been associated with depression and suicide (even though Zyban is also prescribed for treating depression).⁴¹

Public Policy Matters. The United Kingdom offers an illustrative counterexample to the United States in terms of public policy, in that British public health agencies have been much more receptive than their American counterparts to e-cigarettes and their potential harm reduction benefits.⁴² British smokers have been more willing to try e-cigarettes, in part because they have not been fed misinformation about them. The result is that there has been far more harm reduction in Britain than in America. Combustible tobacco smoking and the related secondhand smoke has decreased as UK smokers have switched to e-cigarettes.

Unfortunately, the same has not occurred in America. Misleading messaging and misplaced hysteria has scared American smokers away from a potentially lifesaving product, as surveys of smokers suggest. Only 21 percent of U.S. smokers have tried e-cigarettes, far below the 36 percent of U.K. smokers who have tried the product, according to a recent

transnational study. Additionally, 87.5 percent of those surveyed in the U.S. said that they had not tried e-cigarettes because they thought they were just as dangerous as combustible cigarettes. Comparatively, only 23.4 percent of British smokers said the same thing.⁴³

Conclusion. The CDC’s recent announcement is welcome, but the agency should have made it clear from the start of the vaping-linked lung injury outbreak that the main culprit was not “vaping,” but vaping illicit THC cartridges. Every message from the CDC and the FDA that drums up fear and turns Americans away from e-cigarettes should be measured in the lives it could cost. Adult smokers should be allowed to smoke combustible cigarettes if they choose. However, they should also be informed that there are less harmful alternatives on the market, like e-cigarettes, and that those alternatives can help them quit combustible cigarettes. While these two agencies are not the only organizations that have contributed to the anti-e-cigarette hysteria, they have a responsibility as government organizations to provide citizens the best and most up to date information available, without political agendas. That information is that e-cigarettes are safer than smoking, can help smokers quit, and are likely a net positive for public health.

Notes

¹ Michelle Minton, “Fear Profiteers: How E-cigarette Panic Benefits Health Activists,” *Issue Analysis* 2018 No. 1, Competitive Enterprise Institute, January 24, 2019, <https://cei.org/content/fear-profiteers>.

² U.S. Centers for Disease Control and Prevention, “Outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products,” updated January 17, 2020, 1:00 PM EST, https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html.

³ Abby Goodnough, Maggie Haberman, and Sheila Kaplan, “With Partial Flavor Ban, Trump Splits the Difference on Vaping,” *New York Times*, January 2, 2020, <https://www.nytimes.com/2020/01/02/health/flavor-ban-e-cigarettes.html>.

⁴ U.S. Centers for Disease Control and Prevention, “Smoking & Tobacco Use,” accessed January 17, 2020, https://www.cdc.gov/tobacco/data_statistics/fact_sheets/fast_facts/index.htm.

⁵ Roger Bate and Aparna Mathur, “To Vape or Not to Vape? Preliminary Results from a Qualitative Survey of Smokers,” *RealClearPublicAffairs*, June 4, 2019, https://www.realclearpublicaffairs.com/public_affairs/2019/06/04/to_vape_or_not_to_vape_preliminary_results_from_a_qualitative_survey_of_smokers.html.

⁶ *Ibid.*

⁷ Royal Society for Public Health, “Nicotine ‘no more harmful than caffeine,’” August 13, 2015, <https://www.rsph.org.uk/about-us/news/nicotine--no-more-harmful-to-health-than-caffeine-.html>.

⁸ Lion Shahab, Marciej L. Goniewicz, Benjamin C. Blount, Jamie Brown, Ann McNeill, K. Udeni Alwis, June Feng, Lanqing Wang, and Robert West, “Nicotine, Carcinogen, and Toxin Exposure in Long-Term E-Cigarette and Nicotine Replacement Therapy Users: A Cross-sectional Study,” *Annals of Internal Medicine*, Vol. 166, Issue 6 (March 21, 2017), <https://annals.org/aim/article-abstract/2599869/nicotine-carcinogen-toxin-exposure-long-term-e-cigarette-nicotine-replacement>.

⁹ Peter Hajek, Anna Phillips-Waller, Dunja Przulj, Francesca Pesola, Katie Myers Smith, Natalie Bisal, Jinshuo Li, Steve Parrott, Peter Sasieni, Lynne Dawkins, Louise Ross, Maciej Goniewicz, et al., “A Randomized Trial of E-Cigarettes versus Nicotine-Replacement Therapy,” *New England Journal of Medicine*, Vol. 380, No. 7 (February 2019), <https://www.nejm.org/doi/full/10.1056/NEJMoa1808779>.

¹⁰ Brad Rodu, “The 2018 American Teen Vaping Epidemic, Recalculated,” *Tobacco Truth*, May 16, 2019, <https://rodutobaccotruth.blogspot.com/2019/05/the-2018-american-teen-vaping-epidemic.html>.

¹¹ *Ibid.*

¹² Michelle Minton “If You Vape (Illicit Street Drugs), It May Kill You (Duh),” *OpenMarket* blog, Competitive Enterprise Institute, July 30, 2019, <https://cei.org/blog/if-you-vape-illicit-street-drugs-it-may-kill-you-duh>.

¹³ Utah Department of Health, “Vaping-related Lung Injury, Utah, 2019: Investigation to Date,” September 30, 2019, <https://health.utah.gov/wp-content/uploads/Vaping-Report-for-Public-9-30-Final.pdf>.

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- ¹⁴ Centers for Disease Control and Prevention, “Outbreak of Lung Injury Associated with E-Cigarette Use, or Vaping,” updated October 3, 2019, www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html.
- ¹⁵ Jaime Ducharme, “As the Number of Vaping-Related Deaths Climbs, These States Have Implemented E-Cigarette Bans,” *Time*, September 25, 2019, <https://time.com/5685936/state-vaping-bans>.
- ¹⁶ <https://appropriations.house.gov/events/hearings/e-cigarettes-an-emerging-threat-to-public-health>.
- ¹⁷ Tennessee Department of Health, “TDH Reports First Death from Vaping-associated Respiratory Disease,” October 17, 2019, <https://www.tn.gov/health/news/2019/10/17/tdh-reports-first-death-from-vaping-associated-respiratory-disease.html>.
- ¹⁸ “Minnesota man dies from vaping in Tennessee,” ABC 5 Eyewitness News, October 18, 2019, <https://kstp.com/news/minnesota-man-dies-from-vaping-in-tennessee-october-17-2019-/5527542/>.
- ¹⁹ Michael B. Siegel, “Tennessee Department of Health Appears to Have Deliberately Blamed E-Cigarettes for a Death It Knew Was Caused by THC Carts,” *The Rest of the Story*, October 18, 2019, <http://tobaccoanalysis.blogspot.com/2019/10/tennessee-department-of-health-appears.html>.
- ²⁰ Michael B. Siegel, “Analysis Reveals that 44% of State Health Departments are Not Explicitly Warning Youth Not to Vape THC and Three States are Committing Public Health Malpractice,” *The Rest of the Story*, October 24, 2019, <http://tobaccoanalysis.blogspot.com/2019/10/analysis-reveals-that-44-of-state.html>.
- ²¹ Yusra Murad, “As Vaping-Related Lung Illnesses Worsen, Public Holds E-Cigarettes Like Juul Culpable,” *Morning Consult*, September 19, 2019, <https://morningconsult.com/2019/09/19/as-vaping-related-lung-illnesses-worsen-public-holds-e-cigarettes-like-juul-culpable>.
- ²² Joshua Rhett Miller, “Some vapers return to cigarettes amid growing e-cig health crisis,” *New York Post*, September 16, 2019, <https://nypost.com/2019/09/16/some-vapers-return-to-cigarettes-amid-growing-e-cig-health-crisis>.
- ²³ Daren Bakst, “Government’s War on E-Cigarettes Ignores Their Benefits,” *The Daily Signal*, June 06, 2019, <https://www.dailysignal.com/2019/06/05/governments-war-on-e-cigarettes-ignores-their-benefits/>.
- ²⁴ *Ibid.*
- ²⁵ *Ibid.*
- ²⁶ Sohini Ghosh, M.D., and Bradley Drummond, M.D., “Electronic Cigarettes as Smoking Cessation Tool: Are We There?” *Current Opinion in Pulmonary Medicine*, Vol. 23, No. 2 (March 2017), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5480094/>.
- ²⁷ Bakst.
- ²⁸ *Ibid.*
- ²⁹ Kathleen Stratton, Leslie Y. Kwan, and David L. Eaton, eds. *Public Health Consequences of E-Cigarettes*, Health and Medicine Division, National Academy of Sciences, Engineering, and Medicine, January 23, 2018, Accessed June 17, 2019. <https://www.nap.edu/read/24952/chapter/1>.
- ³⁰ *Ibid.*
- ³¹ Ghosh and Drummond.
- ³² Judy Peres, “No Clear Link between Passive Smoking and Lung Cancer,” *Journal of the National Cancer Institute*, Vol. 105, Issue 24 (December 18, 2013), pp. 1844–1846, <https://academic.oup.com/jnci/article/105/24/1844/2517805>.
- Jacob Grier, “We Used Terrible Science to Justify Smoking Bans,” *Slate*, February 13, 2017, <https://slate.com/technology/2017/02/secondhand-smoke-isnt-as-bad-as-we-thought.html>.
- ³³ Ashley Turner, “Juul-sponsored study shows secondhand vaping emissions are much less toxic than cigarette smoke,” *CNBC*, June 14, 2019, <https://www.cnbc.com/2019/06/13/juul-study-shows-secondhand-vaping-emissions-are-less-toxic-than-cigarette-smoke.html>.
- ³⁴ Faye Flam, “Are E-Cigs a Crisis? It’s Risky to Call Them ‘Unsafe.’” *Bloomberg*, June 3, 2019, <https://www.bloomberg.com/opinion/articles/2019-06-04/are-e-cigs-a-public-health-crisis-it-s-risky-to-call-them-unsafe>.
- ³⁵ Sarah Jackson, Daniel Kotz, Robert West, and Jamie Brown, “Moderators of Real-World Effectiveness of Smoking Cessation Aids: A Population Study,” *RealClearPublicAffairs*, June 4, 2019, https://www.realclearpublicaffairs.com/public_affairs/2019/06/04/moderators_of_real-world_effectiveness_of_smoking_cessation_aids_a_population_study.html.
- ³⁶ *Ibid.*

³⁷ Belinda Borrelli, Ph.D., and George T. O'Connor, M.D., "E-Cigarettes to Assist with Smoking Cessation," *New England Journal of Medicine*, Vol. 380 (February 14, 2019), <https://www.nejm.org/doi/full/10.1056/NEJMe1816406>.

³⁸ Ghosh and Drummond.

³⁹ Ibid.

⁴⁰ Roger Bate and Aparna Mathur, "To Vape or Not To Vape? Preliminary Results from a Qualitative Survey of Smokers," RealClearPublicAffairs, June 4, 2019, https://www.realclearpublicaffairs.com/public_affairs/2019/06/04/to_vape_or_not_to_vape_preliminary_results_from_a_qualitative_survey_of_smokers.html.

⁴¹ Sharon Cannistra, Jackie Britz, Sarah Pedersen, Natalie Rosseau, Kristine Chin, and Simon E. Aberg, "Drugs to Quit Smoking Can Affect Mental and Physical Health: The Truth about Chantix and Zyban," National Center for Health Research, February 21, 2018, <http://www.center4research.org/drugs-quit-smoking-can-affect-mental-physical-health-truth-chantix-zyban/>.

⁴² Ghosh and Drummond.

⁴³ Bate and Mathur.