

Tobacco, E-cigarettes and Alternative Products: A Product Guide for Pediatric Providers



Although youth use of traditional cigarettes has declined in New York City (NYC), youth have turned to other products, including cigars, smokeless tobacco, electronic cigarettes (e-cigarettes) and cannabis (marijuana). These products are often flavored (such as with menthol), and tobacco products always contain nicotine. Flavors are concerning because they can mask the harshness of tobacco, appeal to kids, and are often directly marketed to teens and preteens.

Nicotine can change the chemistry of the adolescent brain. It may affect learning ability and worsen memory and concentration. Youth are particularly vulnerable to nicotine dependence, which can occur even with occasional use. Nicotine withdrawal symptoms include anxiety, irritability and depressed mood, so nicotine dependence may compound stress and mental health symptoms. Nicotine may also affect the way the adolescent brain processes other drugs, such as alcohol, cannabis and cocaine.

This guide lists selected products and their health effects to help you better counsel your patients and their families.

To learn about retail tobacco laws, including about flavored products, and how to report violations, visit on.nyc.gov/tobacco-action-guide.

To learn more about cannabis, visit nyc.gov/health/cannabis.



Tobacco: Smokeless Tobacco

The Facts

- Smokeless tobacco is not burned or smoked but **always** contains nicotine.*
 - It includes tobacco that can be sucked, chewed, spit or swallowed, depending on the product.

| Product Name | What It Is |
|--|--|
|  <p>Chewing Tobacco Also Known As Chew</p> | <ul style="list-style-type: none">• Comes in loose leaf, plug or twist form<ul style="list-style-type: none">▸ Used by taking a piece and placing it between the cheek and gums, and may require spitting |
|  <p>Snuff Also Known As Dip</p> | <ul style="list-style-type: none">• Comes in moist, dry or packet (snus) form<ul style="list-style-type: none">▸ Moist snuff is used by taking a pinch and placing it between the lip or cheek and gums, and requires spitting.▸ Dry snuff is used by putting a pinch of powder in the mouth or by sniffing into the nose.▸ Snus comes in packets that are placed between the cheek and gums, and does not require spitting. |
|  <p>Dissolvables</p> | <ul style="list-style-type: none">• Comes in lozenge, stick, strip and orb form<ul style="list-style-type: none">▸ All forms dissolve slowly in the mouth. |

Short-term Risks and Exposures From Smokeless Tobacco Use

- Can cause gum disease, tooth decay and tooth loss¹
- Can contain several known cancer-causing chemicals²

Long-term Risks of Smokeless Tobacco Use

- Can increase risk of oral, esophageal and pancreatic cancer^{2,3}

*For health effects of nicotine, see Page 2.

Tobacco: Combustible Tobacco

The Facts

- Combustible tobacco is designed to be smoked and **always** contains nicotine.*
- Cigar use is now as common among NYC high school students as cigarette use.⁴ Youth may mistakenly perceive cigars as a safer alternative to cigarettes.^{5,6,7}
- Little cigars, cigarillos and large cigars can come in flavors and have names that indirectly indicate a flavor, such as purple (grape), golden (vanilla) and tropical (pineapple and banana).
- Menthol cigarettes are just as harmful as nonmenthol cigarettes, but this additive makes the smoke easier to tolerate.^{8,9}

| Product Name | What It Is |
|---|--|
|  <p>Cigarettes Also Known As Cigs, ciggies, loosies, smokes, butts, stokes</p> | <ul style="list-style-type: none"> • Thin cylinder of finely cut tobacco rolled in paper for smoking and usually has a filter • Often contain other preservatives and additives, including menthol <ul style="list-style-type: none"> ▸ Menthol has analgesic and anesthetic properties, which make the cigarette smoke easier to inhale and exhale. |
|  <p>Cigarillos Also Known As Blunts (when hollowed out and filled with cannabis)</p> | <ul style="list-style-type: none"> • Longer, slimmer versions of cigars • Usually have a wooden or plastic tip • Wrapped in brown paper that contains tobacco <ul style="list-style-type: none"> ▸ Often hollowed out and used to smoke cannabis (a cannabis-filled cigarillo is called a blunt) |
|  <p>Little Cigars Also Known As Small cigars, blunts (when hollowed out and filled with cannabis)</p> | <ul style="list-style-type: none"> • Wrapped in brown paper that contains tobacco and usually artificial sweeteners • Have an integrated filter, like cigarettes • Often hollowed out and used to smoke cannabis (a cannabis-filled little cigar is called a blunt) |
|  <p>Cigars Also Known As Large cigars, stogies, blunts (when hollowed out and filled with cannabis)</p> | <ul style="list-style-type: none"> • Any roll of tobacco wrapped in leaf tobacco or another substance that contains tobacco <ul style="list-style-type: none"> ▸ Often hollowed out and used to smoke cannabis (a cannabis-filled cigar is called a blunt) |

*For health effects of nicotine, see Page 2.

Short-term Risks of Smoking

- Bad breath, dry mouth, and decreased ability to taste and smell^{10,11,12}
- Teeth discoloration and gum disease^{3,10}
- Increased respiratory symptoms, such as cough and shortness of breath¹

Long-term Risks of Smoking³

- Impacts nearly every organ in the body, and can cause lung disease (such as asthma, chronic obstructive pulmonary disease and pneumonia), heart disease, stroke, diabetes, vascular disease and more than 10 types of cancer, including lung, oropharynx, esophagus, stomach, liver, pancreas, kidney, cervix and bladder cancer
- Reduced fertility in women and erectile dysfunction in men
- Up to one-half of people who smoke long-term will die from a smoking-related illness.

Secondhand Smoke

- Children exposed to secondhand smoke have higher risks of asthma attacks, sudden infant death syndrome (SIDS), and respiratory and ear infections.³
- Adults who do not smoke and are exposed to secondhand smoke have increased risks of stroke, heart disease and lung cancer.³
- Family smoking is also a strong risk factor for smoking initiation among children and adolescents.¹³

*For health effects of nicotine, see Page 2.

Tobacco: Heated Tobacco Products

The Facts

- Heated tobacco products are designed to heat loose leaf tobacco or a tobacco stick, similar to a cigarette, to produce an aerosol that the user can inhale.
- Heated tobacco products **always** contain tobacco and nicotine.*
- Although the heated tobacco product IQOS (I-Quit-Ordinary-Smoking), a Philip Morris product, was not available in NYC in 2020, many New Yorkers knew about and had used it.¹⁴
- IQOS marketing in other countries has promoted the products as high-tech and modern, with a harm reduction message,¹⁵ which can appeal to youth, including those who have never smoked.^{16,17} In Italy, nearly one-half of people who tried IQOS in 2017 had never previously smoked.¹⁸
- Heated tobacco products must follow all existing regulations for cigarettes, including marketing restrictions and warning label requirements, to be sold in the U.S.¹⁹



*For health effects of nicotine, see Page 2.

| Product Name | What It Is |
|--------------|---|
| IQOS | <ul style="list-style-type: none"> IQOS consists of disposable tobacco sticks (HeatSticks) that are soaked in propylene glycol and heated by an electronic holder, which allows the user to inhale an aerosol. |

Short-term Exposures From Heated Tobacco Use

- Although Philip Morris claims IQOS products are safer than cigarettes, research has shown that IQOS emits lower levels of some toxic chemicals but higher levels of other chemicals. IQOS products also deliver similar levels of nicotine as traditional cigarettes.²⁰
- The aerosol from IQOS contains nicotine and other toxic chemicals, such as formaldehyde and benzene (cancer-causing chemicals), particulate matter (which has been linked to decreased lung function, heart attacks and cancer), and tobacco-specific nitrosamines (cancer-causing chemicals).^{21,22,23}

Long-term Risks of Heated Tobacco Use

- More research is needed to understand any differences in health outcomes from use compared to smoking.

Secondhand Aerosol From Heated Tobacco

- Secondhand tobacco aerosol from IQOS contains many of the same toxic chemicals that are in secondhand cigarette smoke.^{24,25,26}
- People exposed to secondhand IQOS aerosol have reported related symptoms, including sore throat and feeling ill.²⁷

E-cigarettes and Other Nicotine Products

The Facts

- E-cigarettes are devices that heat liquid (e-liquid) into aerosol (mist). When people use e-cigarettes (also called vaping), they inhale this aerosol.
- E-liquids do not contain tobacco but almost always contain flavors, chemicals and nicotine.* Nicotine is addictive and has other health effects for youth.^{28,29}
- E-cigarette devices are used to deliver cannabis and other non-nicotine aerosols.
- E-cigarettes come in many shapes and sizes, and thousands of flavors.³⁰
- As of 2022, the formulation of e-liquids is not closely regulated, so nicotine content, additives and flavorings in each product can vary extensively. The vast majority of e-cigarettes sold currently have very high nicotine content.³¹
- Current New York State (NYS) and NYC laws regulate the sale of e-cigarettes but not other recreational nicotine products (as price and flavor restrictions do not apply to those products).

| Product Name | What It Is |
|--|---|
|  <p>E-cigarettes Also Known As E-cigs, e-hookahs, mods, tanks, vape pens, vapes, electronic nicotine delivery system (ENDS)</p> | <ul style="list-style-type: none">• E-cigarettes can be made to look like regular cigarettes, cigars, pipes and other devices (such as USB flash drives and albuterol inhalers).<ul style="list-style-type: none">▶ There are refillable and rechargeable products as well as disposable and single-use products.▶ E-liquid refills are often called pods or cartridges.▶ A single device or pod can contain the same amount of nicotine as 20 to 30 cigarettes.• Disposable vapes became popular, partly because federal policies focus on pod- and cartridge-based devices.³²<ul style="list-style-type: none">▶ Disposable products may also appeal to youth since they do not require buying separate parts or need to be charged, making them easier to use.• Tank devices are refillable and come in large sizes (tanks or mods) and small sizes (vape pens).<ul style="list-style-type: none">▶ People who use tank devices exhale a cloud of vape aerosol, making them popular products for doing tricks (such as exhaling the aerosol into specific shapes and patterns). |

*For health effects of nicotine, see Page 2.

| Product Name | What It Is |
|--|--|
|  <p>Nicotine Pouches</p> | <ul style="list-style-type: none"> • Nicotine from tobacco or synthetic sources with flavorings and plant-based fibers, packaged in a small pouch and placed inside the lip (similar to snus) • The ingredients and nicotine content are not closely regulated. • Many nicotine pouches are produced and distributed by the same companies that make and profit from tobacco sales. |
|  <p>Other Nicotine Products (Toothpicks, Gum and Lozenges)</p> | <ul style="list-style-type: none"> • Nicotine from tobacco or synthetic sources in lozenge, gum or toothpick forms and sold in numerous flavors <ul style="list-style-type: none"> ▸ The nicotine is absorbed through the mouth. • The ingredients and nicotine content are not closely regulated. • Many of these products are produced and distributed by the same companies that make and profit from tobacco sales. |

Short-term Risks and Exposure From E-cigarette Use

- Short-term nicotine exposure increases youth’s risk of dependence and can cause temporary symptoms, including palpitations, headache, nausea or dizziness.* E-liquids almost always contain nicotine.²⁹
- If swallowed or absorbed in the skin or eyes, e-liquid can poison children and adults.²⁸
- The aerosol from heated e-liquids can contain harmful chemicals, such as formaldehyde and benzene (cancer-causing chemicals), diacetyl from flavoring (which has been linked to lung disease), and heavy metals (nickel, tin and lead).²⁸
- The main ingredient in many e-liquids is propylene glycol or glycerol.²⁸ Glycol and glycol mists can cause airway irritation and cough.^{33,34}

Long-term Risks of E-cigarette Use

- Youth who use e-cigarettes are more likely to try cigarettes.³⁵⁻⁴⁷
- The long-term health consequences of e-cigarette use are unknown, especially given the wide range of additives, flavorings and other chemicals they contain.

*For health effects of nicotine, see Page 2.

E-cigarettes and Other Nicotine Products (continued)

Secondhand Aerosol

- The aerosol from heated e-liquids contains nicotine and may also contain harmful chemicals, such as formaldehyde and benzene (cancer-causing chemicals), diacetyl from flavoring (which has been linked to lung disease), and heavy metals (nickel, tin and lead).²⁸
- The main component of many e-liquids is propylene glycol or glycerol. Glycol and glycol mists can cause airway irritation and cough.^{33,34}

E-cigarette or Vaping Use-associated Lung Injury (EVALI)

- A national outbreak of lung injuries associated with e-cigarette use developed in 2019, including multiple cases in NYC. The majority of patients were hospitalized and some died.
- Although most of the cases seemed to involve vaping cannabis products, such as THC oils, no single substance, chemical or type of product has been linked to every case. There continue to be ongoing cases associated with both cannabis and nicotine vaping products in NYS and the U.S. No reported cases have been associated with vaping NYS-regulated cannabis products, including those from the Medical Cannabis Program.
- Patients report respiratory symptoms (cough, shortness of breath or chest pain). Some also report gastrointestinal symptoms (nausea, vomiting or diarrhea) or nonspecific constitutional symptoms (fatigue, fever or weight loss).
- Many patients require supplemental oxygen. Some may require intubation and assisted ventilation.
- For more information about EVALI, visit nyc.gov/health and search for **e-cigarettes**.

Hookah

The Facts



- A hookah (or water pipe) uses burning charcoal to heat shisha, a flavored blend of herbal substances. Tobacco is common in shisha, but some shisha is tobacco-free. There is no type of shisha — with or without tobacco — that is harmless when smoked.
- A hookah consists of multiple parts:
 - ▶ Bowl: Holds the charcoal and shisha
 - ▶ Ashtray (or plate): Catches ash from the burning charcoal
 - ▶ Shisha: A flavored blend of herbal substances that often includes tobacco.
 - ▶ Charcoal: Heats the shisha when burned
 - ▶ Hose: Draws smoke from the water base to the mouth of the person who is smoking
 - ▶ Water base: Cools the smoke created in the bowl
- Young people ages 18 to 20 in NYC are much more likely to smoke hookah than those older than age 21.⁴⁸ This may be because they underestimate the health risks.^{49,50,51}
- Retail stores and other establishments are banned from selling or serving shisha to people younger than age 21. People younger than age 21 are not permitted to enter hookah-serving establishments.

Short-term Exposures From Hookah Use

- Hookah smoke contains toxic chemicals, such as carbon monoxide, particulate matter (which has been linked to decreased lung function, heart attacks and cancer) and formaldehyde (a cancer-causing chemical), which water does not effectively filter out.⁵²⁻⁵⁵
- One hour of smoking hookah can expose someone to more carbon monoxide and tar than smoking 10 cigarettes.⁵²
- Smoking hookah can cause carbon monoxide poisoning.^{56,57}

Secondhand Hookah Smoke

- There are ongoing cases of carbon monoxide poisoning associated with smoking hookah in NYC. Everyone in a room where hookah is being smoked is exposed to carbon monoxide and toxic chemicals in hookah smoke.^{53,58,59}

Cannabis

The Facts

- Nicknames include weed, pot, Mary Jane, green, ganga, dope, herb, reefer, bud, chronic, skunk and 420.
- THC, or tetrahydrocannabinol (delta-9-THC), is the main intoxicating compound that produces the feeling of being high. Other compounds, such as delta-8-THC and delta-10-THC, can also be intoxicating. When derived from hemp, they are not restricted federally and therefore are more widely available in retail products.
- CBD (or cannabidiol) is another compound often derived from hemp. It is not intoxicating. There is one FDA-approved CBD medication for the treatment of refractory epilepsy.⁶⁰
- In New York, cannabis consumption is legal for people age 21 and older. To learn more, including about the medical program and use in New York, visit nyc.gov/health/cannabis.
- National data suggests that teens, and preteens' perceptions of cannabis harms have declined in recent years.⁶¹

| Product Name | What It Is |
|--|--|
|  <p>Joints Also Known As Spliffs</p> | <ul style="list-style-type: none"> • Thin cylinder of cut cannabis rolled in paper for smoking • Can be mixed with rolling tobacco (soft, moist or sticky) or dry tobacco from deconstructed cigarettes |
|  <p>Blunts</p> | <ul style="list-style-type: none"> • Created by slicing open a cigar or cigarillo and replacing some or all of the tobacco with cannabis |
|  <p>Pipes, Water Pipes Also Known As Pieces, bowls, bongs</p> | <ul style="list-style-type: none"> • Used to smoke cannabis in its dried herb form • Can range from simple, homemade devices, such as water pipes made from used soda bottles, to glass or ceramic bongs |
|  <p>Cannabis-infused Food and Drinks Also Known As Edibles</p> | <ul style="list-style-type: none"> • Many forms of cannabis can be mixed into food (such as gummies and baked goods) and drinks. • May take up to four hours to fully take effect, making it easy to eat too much • Metabolize differently, so many people feel their effects more intensely than other forms of cannabis consumption |

| Product Name | What It Is |
|--|--|
|  <p>Marijuana Oils, Concentrates, Tinctures and Extracts</p> <p>Also Known As Dabs, wax, shatter, oil</p> | <ul style="list-style-type: none"> • Concentrates (more commonly called dabs) are products that look like honey or butter in solid and liquid form. • Concentrates in solid form can be smoked using very high heat or diluted and consumed via e-cigarette devices (often called wax pens or dab pens). • Tinctures, extracts and oils can be mixed into beverages and consumed in drinks. |

Short-term Risks of Cannabis⁶²

- Can impair recall memory and ability to retain information
- Higher risk of motor vehicle crashes due to driving while impaired
- Can cause immediate, temporary reactions, including anxiety, fast heart rate, nausea and vomiting
- See “E-cigarette or Vaping Use-associated Lung Injury (EVALI)” on Page 10 for information about lung injuries associated with e-cigarette use or vaping.

Long-term Risks of Cannabis⁶²

- Cannabis can have serious impacts on young people as their brains are still developing. Negative effects can include difficulty thinking, learning or solving problems; poor memory or focus; or reduced physical coordination.
- Starting cannabis use at a younger age or using it frequently can be associated with earlier onset of psychotic disorders, especially for those already at risk.
- People who smoke or vape cannabis can experience respiratory symptoms, such as cough, and bronchitis.
- Other long-term health risks of cannabis use are still being studied.

Secondhand Smoke and Aerosol

- Cannabis smoke contains toxic chemicals, such as carbon monoxide, particulate matter (which has been linked to decreased lung function, heart attacks and cancer), and formaldehyde and benzene (cancer-causing chemicals).⁶³ Cannabis aerosol has been studied less but can also contain particulate matter and other toxic chemicals.
- Metabolites of THC have been found in children exposed to secondhand cannabis smoke.⁶⁴

References

- ¹U.S. Department of Health and Human Services. *The Health Consequences of Smoking: A Report of the Surgeon General*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004.
- ²World Health Organization. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans (Volume 89): Smokeless Tobacco and Some Tobacco-specific N-Nitrosamines*. International Agency for Research on Cancer; 2007. Accessed June 12, 2019.
- ³U.S. Department of Health and Human Services. *The Consequences of Smoking: 50 Years of Progress: A Report of the Surgeon General*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014. https://ncbi.nlm.nih.gov/books/NBK179276/pdf/Bookshelf_NBK179276.pdf
- ⁴New York City Department of Health and Mental Hygiene. Youth Risk Behavior Survey, 2017. Accessed April 4, 2019. <http://nyc.gov/health/epiquery>
- ⁵Malone RE, Yerger V, Pearson C. Cigar risk perceptions in focus groups of urban African American youth. *J Subst Abuse*. 2001;13(4):549-561. doi:10.1016/s0899-3289(01)00092-x
- ⁶Cornacchione J, Wagoner KG, Wiseman KD, et al. Adolescent and Young Adult Perceptions of Hookah and Little Cigars/Cigarillos: Implications for Risk Messages. *Journal of Health Communication*. 2016;21(7):818-825. doi:10.1080/10810730.2016.1177141
- ⁷Sterling KL, Fryer CS, Fagan, P. The Most Natural Tobacco Used: A Qualitative Investigation of Young Adult Smokers' Risk Perceptions of Flavored Little Cigars and Cigarillos. *Nicotine & Tobacco Research*. 2016;18(5):827-833. doi:10.1093/ntr/ntv151
- ⁸Menthol Cigarettes and Public Health: Review of the Scientific Evidence and Recommendations. Tobacco Products Scientific Advisory Committee; 2011. Accessed April 4, 2019. <https://wayback.archive-it.org/7993/20170405201731/https://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/TobaccoProductsScientificAdvisoryCommittee/UCM269697.pdf>
- ⁹Preliminary scientific evaluation of the possible public health effects of menthol versus nonmenthol cigarettes. U.S. Food and Drug Administration. Accessed April 4, 2019. <http://purl.fdlp.gov/GPO/gpo39032>
- ¹⁰Warnakulasuriya S, Dietrich T, Bornstein MN, et al. Oral health risks of tobacco use and effects of cessation. *Int Dent J*. 2010;60(1):7-30.
- ¹¹Thomson, WM, Lawrence, HP, Broadbent, JM, Poulton, R. The impact of xerostomia on oral-health-related quality of life among younger adults. *Health Qual Life Outcomes*. 2006;4:86. doi:10.1186/1477-7525-4-86
- ¹²Da Ré AF, Gurgel LG, Buffon G, et al. Tobacco Influence on Taste and Smell: Systematic Review of the Literature. *Int Arch Otorhinolaryngol*. 2018;22(1):81-87. doi:10.1055/s-0036-1597921
- ¹³Leonardi-Bee J, Jere ML, Britton J. Exposure to parental and sibling smoking and the risk of smoking uptake in childhood and adolescence: a systematic review and meta-analysis. *Thorax*. 2011;66(10):847-855. doi:10.1136/thx.2010.153379
- ¹⁴New York City Department of Health and Mental Hygiene. New York City Health Opinion Poll (NYC HOP) Topline Reports: Findings From HOP5, 2020. Internal analyses.
- ¹⁵Kirkham C. Exclusive: Philip Morris suspends social media campaign after Reuters exposes young 'influencers.' Reuters. May 10, 2019. Accessed June 12, 2019. <https://reuters.com/article/us-philipmorris-ecigs-instagram-exclusive/idUSKCN1SH02K>
- ¹⁶McKelvey K, Popova L, Kim M, et al. Heated tobacco products likely appeal to adolescents and young adults. *Tobacco Control*. 2018;27(1):s41-s47. doi:10.1136/tobaccocontrol-2018-054596
- ¹⁷Hair EC, Bennett M, Sheen E, et al. Examining perceptions about IQOS heated tobacco product: consumer studies in Japan and Switzerland. *Tobacco Control*. 2018;27(1):s70-s73. doi:10.1136/tobaccocontrol-2018-054322
- ¹⁸Liu X, Lugo A, Spizzichino L, Tabuchi T, Pacific R, Gallus S. Heat-not-burn tobacco products: concerns from the Italian experience. *Tobacco Control*. 2019;28(1):113-114. doi:10.1136/tobaccocontrol-2017-054054
- ¹⁹FDA permits sale of IQOS Tobacco Heating System through premarket tobacco product application pathway. News release. U.S. Food and Drug Administration; April 30, 2019. Accessed June 12, 2019. <https://fda.gov/news-events/press-announcements/fda-permits-sale-iqos-tobacco-heating-system-through-premarket-tobacco-product-application-pathway>
- ²⁰St Helen G, Jacob III P, Nardone N, Benowitz NL. IQOS: examination of Philip Morris International's claim of reduced exposure. *Tobacco Control*. 2018;27(1):s30-s36. doi:10.1136/tobaccocontrol-2018-054321
- ²¹Auer R, Concha-Lozano N, Jacot-Sadowski I, Cornuz J, Berthet A. Heat-Not-Burn Tobacco Cigarettes: Smoke by Any Other Name. *JAMA Intern Med*. 2017;177(7):1050-1052. doi:10.1001/jamainternmed.2017.1419
- ²²Bekki K, Inaba Y, Uchiyama S, Kunugita N. Comparison of Chemicals in Mainstream Smoke in Heat-not-burn Tobacco and Combustion Cigarettes. *J UOEH*. 2017;39(3):201-207. doi:10.7888/juoe.39.201
- ²³Leigh NJ, Palumbo MN, Marino AM, et al. Tobacco-specific nitrosamines (TSNA) in heated tobacco product IQOS. *Tobacco Control*. 2018;27(1):s37-s38. doi:10.1136/tobaccocontrol-2018-054318
- ²⁴O'Connell G, Wilkinson P, Burse K, Stotesbury S, Pritchard J. Heated Tobacco Products Create Side-Stream Emissions: Implications for Regulation. *J Environ Anal Chem*. 2015;2(163):2380-2391. doi:10.4172/2380-2391.1000163
- ²⁵Protano C, Manigrasso M, Avino P, V Matteo. Second-hand smoke generated by combustion and electronic smoking devices used in real scenarios: Ultrafine particle pollution and age-related dose assessment. *Environ Int*. 2017;107:190-195. doi:10.1016/j.envint.2017.07.014
- ²⁶Ruprecht A, De Marco C, Saffari A, et al. Environmental pollution and emission factors of electronic cigarettes, heat-not-burn tobacco products, and conventional cigarettes. *Aerosol Science and Technology*. 2017;51(6):674-684. doi:10.1080/02786826.2017.1300231
- ²⁷Tabuchi T, Gallus S, Shinozaki T, Nakaya T, Kunugita N, Colwell B. Heat-not-burn tobacco product use in Japan: its prevalence, predictors and perceived symptoms from exposure to secondhand heat-not-burn tobacco aerosol. *Tobacco Control*. 2017;27(e1):e25-e33. doi:10.1136/tobaccocontrol-2017-053947
- ²⁸U.S. Department of Health and Human Services. *Surgeon General's Report: E-Cigarette Use Among Youth and Young Adults*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2016.
- ²⁹Marynak KL, Gammon DG, Rogers T, Coats EM, Singh T, King BA. Sales of Nicotine-Containing Electronic Cigarette Products: United States, 2015. *Am J Public Health*. 2017;107(5):702-705. doi:10.2105/AJPH.2017.303660
- ³⁰Hsu G, Sun JY, Zhu SH. Evolution of Electronic Cigarette Brands From 2013-2014 to 2016-2017: Analysis of Brand Websites. *J Med Internet Res*. 2018;20(3):e80. doi:10.2196/jmir.8550
- ³¹Ali FRM, Seaman EL, Crane E, Schillo B, King BA. Trends in US E-cigarette Sales and Prices by Nicotine Strength, Overall and by Product and Flavor Type, 2017-2022. *Nicotine & Tobacco Research*. 2023;25(5):1052-1056. doi:10.1093/ntr/ntac284
- ³²Li D, Ossip DJ, Bansal-Travers M, Xie Z. Impact of the FDA flavour enforcement policy on flavoured electronic cigarette use behaviour changes. *Tobacco Control*. 2022;31:s176-s183. doi:10.1136/tc-2022-057492

- ³³Wieslander G, Norback D, Lindgren T. Experimental exposure to propylene glycol mist in aviation emergency training: acute ocular and respiratory effects. *Occup Environ Med.* 2001;58(10):649-655. doi:10.1136/oem.58.10.649
- ³⁴Offermann FJ. Chemical emissions from e-cigarettes: Direct and indirect (passive) exposures. *Building and Environment.* 2015;93(1):101-105. doi:10.1016/j.buildenv.2015.03.012
- ³⁵Soneji S, Barrington-Trimis JL, Wills TA, et al. Association Between Initial Use of e-Cigarettes and Subsequent Cigarette Smoking Among Adolescents and Young Adults: A Systematic Review and Meta-analysis. *JAMA Pediatr.* 2017;171(8):788-797. doi:10.1001/jamapediatrics.2017.1488
- ³⁶Loukas A, Marti CN, Cooper M, Pasch KE, Perry CL. Exclusive e-cigarette use predicts cigarette initiation among college students. *Addict Behav.* 2018;76:343-347. doi:10.1016/j.addbeh.2017.08.023
- ³⁷Bold KW, Kong G, Camenga DR, et al. Trajectories of E-Cigarette and Conventional Cigarette Use Among Youth. *Pediatrics.* 2018;141(1):e20171832. doi:10.1542/peds.2017-1832
- ³⁸Hammond D, Reid JL, Cole AG, Leatherdale ST. Electronic cigarette use and smoking initiation among youth: a longitudinal cohort study. *CMAJ.* 2017;189(43):E1328-E1336. doi:10.1503/cmaj.161002
- ³⁹Best C, Haseen F, Currie D, et al. Relationship between trying an electronic cigarette and subsequent cigarette experimentation in Scottish adolescents: a cohort study. *Tobacco Control.* 2017;27(4):373-378. doi:10.1136/tobaccocontrol-2017-053691
- ⁴⁰Conner M, Grogan S, Simms-Ellis R, et al. Do electronic cigarettes increase cigarette smoking in UK adolescents? Evidence from a 12-month prospective study. *Tobacco Control.* 2017;27(4):365-372. doi:10.1136/tobaccocontrol-2016-053539
- ⁴¹Spindle TR, Hiler MM, Cooke ME, Eissenberg T, Kendler KS, Dick DM. Electronic cigarette use and uptake of cigarette smoking: A longitudinal examination of U.S. college students. *Addict Behav.* 2017;67:66-72. doi: 10.1016/j.addbeh.2016.12.009
- ⁴²Miech R, Patrick ME, O'Malley PM, Johnston LD. E-cigarette use as a predictor of cigarette smoking: results from a 1-year follow-up of a national sample of 12th grade students. *Tobacco Control.* 2017;26(e2):e106-e111. doi:10.1136/tobaccocontrol-2016-053291
- ⁴³Barrington-Trimis JL, Urman R, Berhane K, et al. E-Cigarettes and Future Cigarette Use. *Pediatrics.* 2016;138(1):e20160379. doi:10.1542/peds.2016-0379
- ⁴⁴Wills TA, Sargent JD, Gibbons FX, Pagano I, Schweitzer R. E-cigarette use is differentially related to smoking onset among lower risk adolescents. *Tobacco Control.* 2016;26(5):534-539. doi:10.1136/tobaccocontrol-2016-053116
- ⁴⁵Leventhal AM, Strong DR, Kirkpatrick MG, et al. Association of Electronic Cigarette Use With Initiation of Combustible Tobacco Product Smoking in Early Adolescence. *JAMA.* 2015;314(7):700-707. doi:10.1001/jama.2015.8950
- ⁴⁶Primack BA, Soneji S, Stoolmiller M, Fine MJ, Sargent JD. Progression to Traditional Cigarette Smoking After Electronic Cigarette Use Among US Adolescents and Young Adults. *JAMA Pediatr.* 2015;169(11):1018-1023. doi:10.1001/jamapediatrics.2015.1742
- ⁴⁷Berry KM, Fetterman JL, Benjamin EJ, et al. Association of electronic cigarette use with subsequent initiation of tobacco cigarettes in US youths. *JAMA Netw Open.* 2019;2(2):e187794. doi:10.1001/jamanetworkopen.2018.7794.
- ⁴⁸New York City Department of Health and Mental Hygiene. NYC Community Health Survey, 2016. Internal analysis of data.
- ⁴⁹Sutfin EL, McCoy TP, Reboussin BA, Wagoner KG, Spangler J, Wolfson M. Prevalence and correlates of waterpipe tobacco smoking by college students in North Carolina. *Drug Alcohol Depend.* 2011;115(1-2):131-136. doi:10.1016/j.drugalcdep.2011.01.018
- ⁵⁰Heinz AJ, Giedgowd GE, Crane NA, et al. A comprehensive examination of hookah smoking in college students: use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addict Behav.* 2013;38(11):2751-2760. doi:10.1016/j.addbeh.2013.07.009
- ⁵¹Knishkowsky B, Amitai Y. Water-pipe (narghile) smoking: an emerging health risk behavior. *Pediatrics.* 2005;116(1):e113-e119. doi:10.1542/peds.2004-2173
- ⁵²Primack BA, Carroll MV, Weiss PM, et al. Systematic Review and Meta-Analysis of Inhaled Toxicants from Waterpipe and Cigarette Smoking. *Public Health Rep.* 2016;131(1):76-85. doi:10.1177/003335491613100114
- ⁵³Hammal F, Chappell A, Wild TC, et al. 'Herbal' but potentially hazardous: an analysis of the constituents and smoke emissions of tobacco-free waterpipe products and the air quality in the cafés where they are served. *Tobacco Control.* 2015;24(3):290-297. doi:10.1136/tobaccocontrol-2013-051169
- ⁵⁴Shihadeh A, Salman R, Jaroudi E, et al. Does switching to a tobacco-free waterpipe product reduce toxicant intake? A crossover study comparing CO, NO, PAH, volatile aldehydes, "tar" and nicotine yields. *Food Chem Toxicol.* 2012;50(5):1494-1498. doi:10.1016/j.fct.2012.02.041
- ⁵⁵Shihadeh A, Schubert J, Klaiany J, El Sabban M, Luch A, Saliba NA. Toxicant content, physical properties and biological activity of waterpipe tobacco smoke and its tobacco-free alternatives. *Tobacco Control.* 2015;24(1):i22-i30. doi:10.1136/tobaccocontrol-2014-051907
- ⁵⁶El-Zaatari ZM, Chami HA, Zaatari, GS. Health effects associated with waterpipe smoking. *Tobacco Control.* 2015;24(1):i31-i43. doi:10.1136/tobaccocontrol-2014-051908
- ⁵⁷Rostron BL, Wang B, Liu ST. Waterpipe or Hookah-Related Poisoning Events Among U.S. Adolescents and Young Adults. *J Adolesc Health.* 2019;64(6):800-803. doi:10.1016/j.jadohealth.2018.12.021
- ⁵⁸Zhou S, Behrooz L, Weitzman M, et al. Secondhand hookah smoke: an occupational hazard for hookah bar employees. *Tobacco Control.* 2017;26(1):40-45. doi:10.1136/tobaccocontrol-2015-052505
- ⁵⁹Zhou S, Weitzman M, Vilcassim R, et al. Air quality in New York City hookah bars. *Tobacco Control.* 2015;24(e3):e193-198. doi:10.1136/tobaccocontrol-2014-051763
- ⁶⁰FDA Approves First Drug Comprised of an Active Ingredient Derived from Marijuana to Treat Rare, Severe Forms of Epilepsy. News release. U.S. Food and Drug Administration; June 25, 2018. <https://fda.gov/news-events/press-announcements/fda-approves-first-drug-comprised-active-ingredient-derived-marijuana-treat-rare-severe-forms>
- ⁶¹Substance Abuse and Mental Health Services Administration. *Results from the 2017 National Survey on Drug Use and Health (NSDUH): Key Substance Use and Mental Health Indicators in the United States*; 2018. HHS Publication No. SMA 18-5068, NSDUH Series H-53. Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration.
- ⁶²National Academies of Sciences, Engineering, and Medicine. *The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research*; 2017. The National Academies Press.
- ⁶³Moir D, Rickert WS, Levasseur G, et al. A Comparison of Mainstream and Sidestream Marijuana and Tobacco Cigarette Smoke Produced under Two Machine Smoking Conditions. *Chem Res Toxicol.* 2008;21(2):494-502. doi:10.1021/tx700275p
- ⁶⁴Wilson KM, Torok MR, Wei B, et al. Detecting biomarkers of secondhand marijuana smoke in young children. *Pediatr Res.* 2017;81(4):589-592. doi:10.1038/pr.2016.261

