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FIVE THINGS ABOUT

VAPING AND E-CIGARETTES

Electronic cigarettes (e-cigarettes) have rapidly expanded in popularity since first entering the U.S. market in 2006. E-cigarettes convert a liquid solution into an aerosol that users inhale — a process known as vaping. Inhaling the heated, condensed aerosol allows the drug to rapidly absorb into the blood system and penetrate the deep lung tissue. Vaping has emerged as a serious public health issue that has dramatically changed the substance use landscape. Here is what vaping research has taught us so far:

1. Personal vaporizers are being used to inhale drugs other than nicotine.

Pod-based e-cigarettes facilitate discreet vaping, helping users to easily consume nicotine and other drugs in public spaces, such as schools, while making their detection difficult. Personal vaping devices can also be modified to deliver THC (the most prevalent intoxicating compound in cannabis), methamphetamine, fentanyl, and synthetic cannabinoids.[1] In fact, a third of youths who use personal vaping devices vape cannabis.[2]

2. E-cigarettes can deliver most drugs of abuse effectively and with increased potency.

Vaping allows people to absorb more of a drug into the body than smoking because less of the drug is lost through sidestream smoke (the smoke that escapes from traditional smoking materials as the product continues to burn when the user is not actively inhaling).[3] The compounds are only released when the user actively inhales. Vaping also reduces the amount of drug that is destroyed or changed into something else via the combustion process found in traditional smoking.

Researchers have found that vaping devices can be modified to increase the dosage, increase the volume of "puff," and vaporize solids such as plant materials and drug-containing waxes.[4] Though often thought of as less harmful than smoking, modified vaping devices can create even greater risk.[5]

3. Users often unknowingly consume unlabeled solvents and other chemicals through vaping.

The e-liquids used to fill e-cigarettes (called e-juice or vape juice) can contain unknown compounds, such as an industrial solvent that may cause serious health effects like acute lung injury.[6] E-liquids may also contain vitamin E, which can lead to severe lung tissue damage when vaped. Other illicit or uncontrolled substances, such as synthetic cannabinoids, are present in some e-liquids and can be difficult to detect. In addition, concentration claims on labels are often inaccurate.[7] Finally, e-liquids often contain ethanol as an unlisted ingredient, and the health and safety implications of this are not yet well understood.[8]

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4. E-cigarette technology has evolved, and consumer demand has expanded faster than regulatory action, leaving significant gaps in consumer knowledge and awareness.

The rapid increase in vaping, particularly among youths, has been attributed to aggressive marketing, easy-to-use devices, youth-friendly designs and flavors, and the perception that vaping is safer than smoking.[9] Because the market has expanded so rapidly in recent years, it has been difficult for regulatory agencies to keep up. As a result, consumers may not be aware of all the potential risks associated with e-cigarettes, particularly as new products and technologies emerge. The Food and Drug Administration has established regulations for e-cigarettes and e-liquids, but not all e-liquids on the market adhere to these guidelines or are subject to regulatory oversight. Loopholes in regulatory language, particularly those that restricted flavoring chemicals, have created confusion for consumers. Also, a lack of enforcement has allowed manufacturers to include unlabeled compounds in their products with no transparency to the consumer.

5. For effective prevention and treatment purposes, public health and public safety stakeholders must understand the impact of vaping in their communities.

Pediatricians, substance use treatment counselors, school personnel, and law enforcement should work together to address the impact of vaping. Health professionals should ask patients about their vaping habits to assess negative health outcomes. School personnel and substance use treatment counselors need to understand discreet vaping, especially when it's used to consume drugs other than nicotine. Law enforcement officers need to understand the value of collecting e-cigarette and vaping paraphernalia as evidence.

Looking for Help?

Helping Teens Quit — lung.org/quit-smoking/helping-teens-quit

Law enforcement agencies should also be aware that e-liquids can contain ethanol, which may impact the results of drug tests that evaluate ethanol consumption. Research is currently underway to evaluate the production of ethanol biomarkers from vaping compared to drinking.

Related NIJ Awards

Michelle Peace et al., "Through the Looking Glass: Abuse of the Evolving Electronic Cigarette and the Impact of Vaping Ethanol in the Evaluation of Impairment," Final report to the National Institute of Justice, award number 2018-75-CX-0036, February 2023, NCJ 305954, ojp.gov/sites/g/files/xyckuh241/files/media/document/305954.pdf.

Michelle Peace, Justin L. Poklis, and Joseph Turner "Chasing the Electronic Cigarette Dragon: Characterizing the Evolution and Impact of Design and Content," Final Report to the National Institute of Justice, award number 2016-DN-BX-0150, May 2019, NCJ 25921, ojp.gov/pdffiles1/nij/grants/252921.pdf.

Michelle Peace and Joseph Turner, "Characterization and Abuse of Electronic Cigarettes: The Efficacy of 'Personal Vaporizers' as an Illicit Drug Delivery System," Final report to the National Institute of Justice, award number 2014-R2-CX-K010, June 2018, NCJ 251788, ojp.gov/pdffiles1/nij/grants/251788.pdf.

Notes

1. Rose Krakowiak, Justin Poklis, and Michelle Peace, "The Analysis of Aerosolized Methamphetamine From E-Cigarettes Using High Resolution Mass Spectrometry and Gas Chromatography Mass Spectrometry," *Analytical Toxicology* 43 no. 8 (2019): 592-599, doi.org/10.1093/jat/bkz067; and Alaina K. Holt et al., "Cannabinoid-Based Vaping Products and Supplement Formulations Reported by Consumers To Precipitate Adverse Effects," *Drug Testing and Analysis* (2022): 1-10, doi.org/10.1002/dta.3253.

2. Nicholas Chadi, Claudia Minato, and Richard Stanwick, "Cannabis Vaping: Understanding the Health Risks of a Rapidly Emerging Trend," *Pediatric Child Health* 25 suppl. 1 (2020): S16-S20, doi.org/10.1093/pch/pxaa016.

3. Laerissa Reveil et al., "A Determination of the Aerosolization Efficiency of Drugs of Abuse in a Eutectic Mixture With Nicotine in Electronic Cigarettes," *Drug Testing and Analysis* (2022): 1-8, doi.org/10.1002/dta.3343.

4. Michelle R. Peace et al., "Evaluation of Nicotine and the Components of E-Liquids Generated From E-Cigarette Aerosols" *Journal of Analytical Toxicology* 42 no. 8 (2018): 537-543, doi.org/10.1093/jat/bky056.

5. Michelle Peace and Joseph Turner, "Characterization and Abuse of Electronic Cigarettes: The Efficacy of 'Personal Vaporizers' as an Illicit Drug Delivery System," Final report to the National Institute of Justice,

award number 2014-R2-CX_K010, June 2018, NCJ 251788, ojp.gov/pdffiles1/nij/grants/251788.pdf.

6. Haley A. Mulder et al., "Characterization of E-Cigarette Coil Temperature and Toxic Metal Analysis by Infrared Temperature Sensing and Scanning Electron Microscopy – Energy-Dispersive X-Ray," *Inhalation Toxicology* 32 no. 13-14 (2020): 447-455, doi.org/10.1080/08958378.2020.1840678; and Alaina K. Holt et al., "Identification of Gamma Butyrolactone in JUUL Liquids," *Journal of Analytical Toxicology* 45 no. 8 (2021): 892-900, doi.org/10.1093/jat/bkab067.

7. Michelle Peace et al., "Concentration of Nicotine and Glycols in 27 Electronic Cigarette Formulations," *Journal of Analytical Toxicology* 40 no. 6 (2016): 403-407, doi.org/10.1093/jat/bkw037.

8. Justin Poklis, Carl Wolf II, and Michelle Peace, "Ethanol Concentration in 56 Refillable Electronic Cigarettes Liquid Formulations Determined by Headspace Gas Chromatography With Flame Ionization Detector (HS-GC-FID)," *Drug Testing and Analysis* 9 no. 10 (2017): 1637-1640, doi.org/10.1002/dta.2193.

9. U.S. Food and Drug Administration, "E-Cigarettes, Vapes, and Other Electronic Nicotine Delivery Systems (ENDS)," fda.gov/tobacco-products/products-ingredients-components/e-cigarettes-vapes-and-other-electronic-nicotine-delivery-systems-ends, accessed March 2023.

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