

E-Cigarette, Vaping, and Anesthesia



Leah Gordon, DNP, APRN, CRNA

Authorship assistance from the Minnesota Physician Advocacy Network

Disclosure

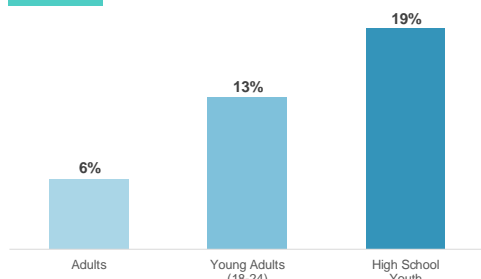
- ▣ I have no actual or potential conflict of interest in relationship to this presentation

Learning Objectives

- ▣ At the conclusion of this session the learner will
 - Discuss the history of the E-cigarette and vaping
 - List negative impacts of vaping and E-cigarette use
 - Illustrate the steps to plan for a patient that uses vaping in the anesthesia setting.

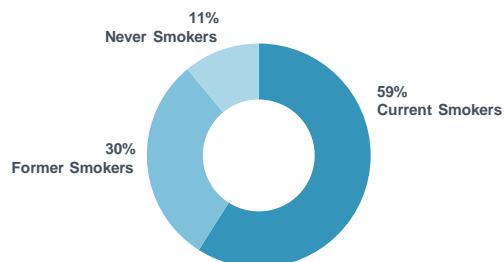
E-cigarettes: Who's Vaping?

More Youth Vape Than Adults



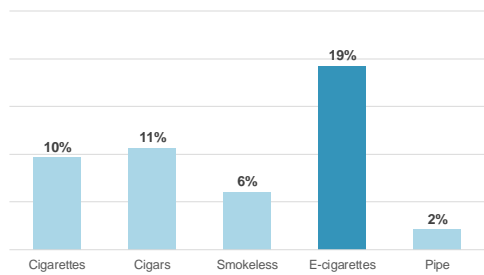
Minnesota Department of Health

Most Adults Both Smoke and Vape



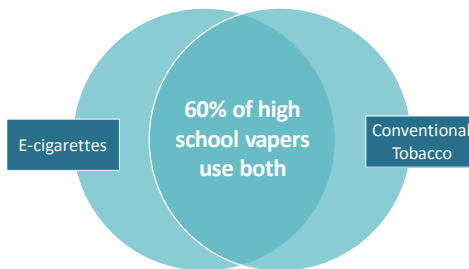
MMWR October 28, 2016

Youth E-cigarette Use



Minnesota Youth Tobacco Survey, 2017

Youth Dual Use, Too



Minnesota Student Survey, 2016



How E-cigarettes Work



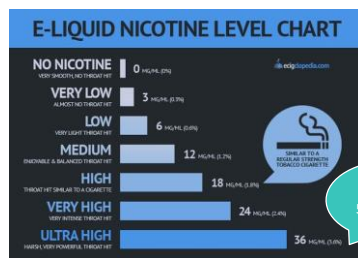
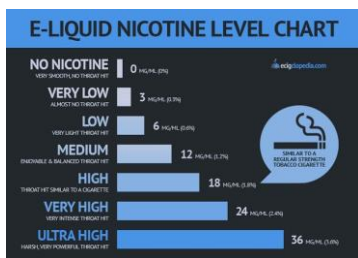
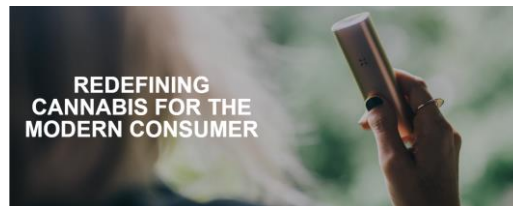
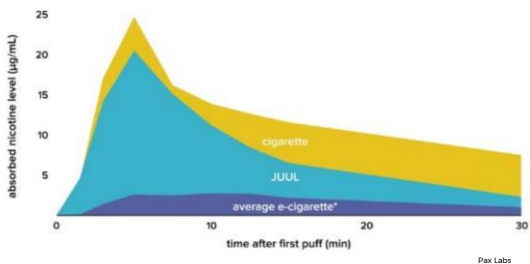
Then and Now



In 2014 there were almost 8,000 unique flavors

Kmietowicz, 2014

JUUL: A New Kind of Nicotine

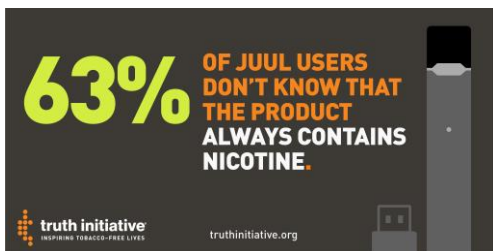


99.6% of e-cigarette products sold contain nicotine.

Marynak et al. 2015

99.6% of e-cigarette products sold contain nicotine.

Marynak et al. 2015



High nicotine vaping



Higher frequency and intensity smoking and vaping

Goldenson et al. 2017

New Tobacco Users



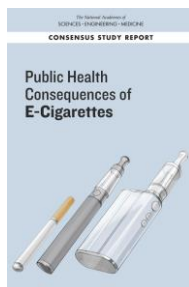
Minnesota Department of Health



- Highly addictive
- Harms brain development during adolescence
- Harmful to fetal health during pregnancy

Health Risks of Vaping: What We Know

Public Health Consequences of E-cigarettes



- National Academies of Sciences, Engineering, and Medicine
- Released January 2018
- Identified and examined over 800 peer-reviewed scientific studies

NASEM

Key Take Aways



- E-cigarettes pose health risks
- Switching completely from combustible tobacco to e-cigarettes reduces short-term adverse health outcomes in adult smokers
- The long-term health effects of vaping are not yet clear

NASEM

Respiratory Impacts of Vaping



- Increased cough in wheeze in adolescents
- Increased asthma exacerbations in adolescents
**Teens with asthma vape at higher rates than those without*
- Boosts the production of inflammatory chemicals and disables key protective cells in the lung

NASEM, Scott et al., 2018

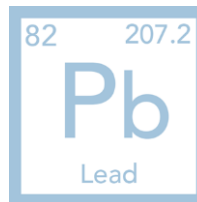
DNA Damage and Mutagenesis



- Chemicals present in e-cigarette aerosol are capable of causing DNA damage and mutagenesis
- Long-term exposure to e-cigarette vapor could increase cancer risk
- Chemicals include formaldehyde, N-nitrosornicotine (NNN) and volatile organic chemicals like benzene
- Exposure is highly variable depending on the type of e-cig and how it is used

[NASEM, UMN, Lee et al., 2017, Salamanca et al., 2018](#)

Metal Exposure



- E-cigarette vapor contains toxic metals including chromium, nickel, lead, manganese, and zinc
- Chronic inhalation of these metals has been linked to lung, liver, immune, cardiovascular and brain damage, and cancers

[NASEM Olmedo et al., 2017](#)

Benefits for Adult Smokers who Switch



- Reduced short-term adverse health outcomes in several organ systems
- Improvement in lung function and respiratory symptoms among adult smokers with asthma
- Reduction of COPD exacerbations
- These benefits are strongest in smokers who switch completely and do not continue to dual use

[NASEM](#)

Vaping & Tobacco Cessation

Vaping & Tobacco Cessation



Limited evidence from randomized controlled trials about the effectiveness of e-cigarettes as cessation aids compared FDA approved smoking cessation treatments

[NASEM](#)

U.S. Preventive Services Task Force

Current evidence is insufficient to recommend e-cigarettes for tobacco cessation in adults, including pregnant women.

[USPSTF, 2015](#)

American Cancer Society

Advise patients to use FDA-approved cessation aids that have been proven to support successful quit attempts.

Support all attempts to quit the use of combustible tobacco. Switching to the exclusive use of e-cigarettes is preferable to continuing to smoke combustible products.

Individuals should be regularly advised to completely quit using all tobacco products and **not to dual use e-cigarettes and combustible cigarettes.**

ACS, 2018



Every Try Counts

11 Quit Attempts

It takes an average of 8 - 11 attempts before someone quitting smoking permanently

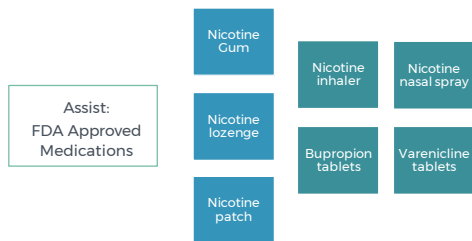
CDC

Addressing Tobacco Use

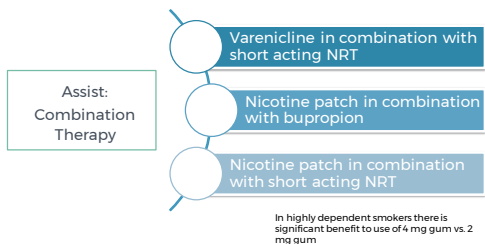
Ask:
Ask about all products, and in multiple ways

Advise:
Use Motivational Interviewing
Advise patients about research & resources

Assist:
Counseling and Nicotine Replacement Therapy



Resources available at e-cigarettes.surgeongeneral.gov and www.panmn.org



Slagy et al. 2000



Free quit help for all Minnesotans.

For Adolescents: **smokefreeteen**



FDA Regulations

FDA Cracks Down On E-Cigarette Sales To Curb Teen Vaping

November 9, 2018 - 5:01 PM ET
Heard on All Things Considered

JOHN DALEY

FDAH



E-cigarettes in Clean Indoor Air

23 counties in Minnesota ban vaping indoors everywhere that smoking is banned



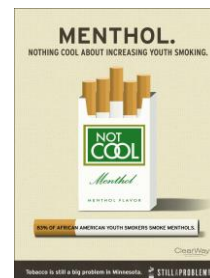
Keep Tobacco Prices High

Cities like New York and Providence have set **minimum prices for tobacco products** to prevent discounts that make smoking more affordable



Flavored Tobacco Restrictions

Minneapolis, St Paul and Duluth have restricted the sale of all flavored tobacco products to adult-only tobacco stores



Tobacco 21

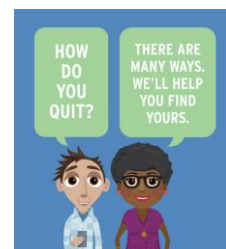
Raising the tobacco sales age to 21 would prevent **30,000 young people** from becoming smokers over the next 15 years



Boyle et al 2017

Fund Tobacco Cessation

Quitplan will end in March of 2020, so we much establish and fund a new tobacco quit line



Take Action



Anesthesia

AANA Journal February 2020

Vaping: Anesthesia Considerations for Patients Using Electronic Cigarettes

Amina Hobson, DMAP, CRNA
 Karri Anst, DNP, CRNA
 Shelby Karsenick, DNP, CRNA

Anesthetists are generally familiar with the perioperative implications of patients' cigarette smoking. Electronic cigarettes are, however, a relatively newly popular phenomenon among adolescents and young adults. There is a generalized lack of knowledge among health-care providers regarding the overall health effects of electronic cigarettes, which often are advertised as a harmless smoking cessation tool. US health promotion agencies have reported that electronic cigarettes contain cytotoxic compounds and harmful byproducts such as nicotine, heavy metals, propylene glycol, diacetyl, and other impurities. The current literature

suggests that components of these devices (the liquid and heating element) produce chemicals that can cause acute and chronic multiorgan toxicities. On a cellular level, the pulmonary, cardiovascular, immunologic, and pharmacologic effects of electronic cigarettes are most noteworthy. The purpose of this article is to inform anesthesia providers regarding the pathophysiologic effects and anesthetic implications of electronic cigarette use.

Keywords: Anesthesia considerations, cytotoxic, electronic cigarettes, health effects, vaping.

Digital being advertised as an effective alternative to traditional cigarettes, electronic cigarettes (EC) contain nicotine and other harmful chemicals that can greatly increase the

heat-induced degradation compounds produced from the liquid in EC, show traces of heavy metals, tobacco-specific N-nitrosamines, and diacetyl.¹ This article identifies the health effects of these compounds and the associated

Pathophysiologic Changes

System	Change
Pulmonary	<ul style="list-style-type: none"> Increased airway hyperreactivity Increased airway resistance Increased mucous production Paraneuronal inflammation Increased closing capacity Interference with lung development Impaired defense against bacterial and viral pathogens Nasal airway irritation Bronchiolitis obliterans

Pathophysiologic Changes

System	Change
Cardiac	<ul style="list-style-type: none"> Hemodynamic instability under GA <ul style="list-style-type: none"> Hypertension Tachycardia Increased myocardial oxygen consumption Impaired coronary blood flow <ul style="list-style-type: none"> Hypertension Atherosclerosis Impaired cardiac development in pediatric patients Insulin resistance

Pathophysiologic Changes

System	Change
Central nervous system	<ul style="list-style-type: none"> Impaired brain development in pediatric patients CNS depression
Immunology	<ul style="list-style-type: none"> Antiproliferation of cells Impaired fibroblast activity Impaired tissue oxygenation Decreased collagen

Pathophysiologic Changes

System	Change
Response to anesthetic agents	<ul style="list-style-type: none"> Increased opioid requirement Decreased sensitivity to NMBDs Decreased MAC secondary to CNS depression

Anesthetic Management

Management stage	Strategy
Education	Recommend cessation of e-cigarette use.
Preparation	<ul style="list-style-type: none"> Consider PFTs, chest radiographs, and blood gas analysis to get baseline PaO₂ and PaCO₂ in long-standing EC users Obtain cardiac function testing Determine amount of EC nicotine use.
Premedication	<ul style="list-style-type: none"> Use an anticholinergic agent such as glycopyrrolate to dry secretions. Use an anxiolytic agent such as midazolam to negate the psychological effects.
Induction and intubation	<ul style="list-style-type: none"> Preoxygenate for 3-5 min. Use intravenous lidocaine to prevent laryngospasm during intubation. If performing inhalation induction with volatile agents, sevoflurane is preferred. Avoid airway manipulation during light anesthesia, which may result in coughing, breath holding, laryngospasm, or bronchospasm. Before intubation, use LTA to anesthetize the larynx and suppress laryngeal hyperreactivity.

Anesthetic Management

Management stage	Strategy
Maintenance	<ul style="list-style-type: none"> • Avoid light anesthesia, which may result in bronchospasm. • Have bronchodilators available for symptomatic smokers. • Avoid desflurane, which is a respiratory irritant and results in higher blood pressure and heart rate. • A higher dose of benzodiazepine, opioid, and muscle relaxants will be required. • Increase minute volume.

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Anesthetic Management

Management stage	Strategy
Monitoring	<ul style="list-style-type: none"> • When using current pulse oximeters, remember that a gross overestimation of oxygenated hemoglobin saturation (SaO₂) occurs. • Monitor for signs and symptoms of acute nicotine intoxication. • Pay special attention to changes in blood pressure, heart rate, and rhythm, especially in patients with history of coronary heart disease. • Use a peripheral nerve stimulator to monitor the neuromuscular block since there are various reports on the increased requirement of muscle relaxants. • In long procedures, perform intermittent blood gas analysis to check the PaCO₂ since PaCO₂ - ETCO₂ gradient is higher than in nonsmoking patients.
Recovery	Do not extubate during light anesthesia because it may result in cough, breath holding, laryngospasm, or bronchospasm.

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