The Adolescent Vaping Epidemic

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May 1, 2021

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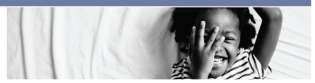

Disclosures

- None

Objectives

- Identify the scope of the adolescent vaping epidemic
- Recognize the clinical presentation of e-cigarette, or vaping, product-use-associated lung injury (EVALI)
- Discuss the treatment approach for adolescents with vaping related lung injury

Outline

- Case
- Vaping in Adolescents
- What are E-Cigarettes?
- Presenting Symptoms
- Associated Problems
- Workup and Treatment
- What can you do?

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Case

HPI

- 17-year-old boy presenting with productive cough, chest pain, dyspnea, fever, nausea, vomiting, diarrhea
  - Chest pain: "knives are stabbing my lungs"
  - Unintentional 10-pound weight loss
- Completed course of azithromycin (concern for atypical pneumonia) without improvement in symptoms

Case

Vitals & Exam

- Vitals
  - T 102.6, HR 120, BP 114/60, RR 30, SpO2 86% in room air.
- Exam
  - General: pale, tired appearing
  - Eyes: right inferior conjunctival hemorrhage
  - HEENT: Dry and cracked lips
  - Lungs: Tachypneic, but non-labored. Crackles and decreased aeration at bases

Case

Additional History

- **PMH:**
  - Depression, anxiety, prior inpatient hospitalizations x2
- **Medications:**
  - Sertraline and clonidine
- **Social History:**
  - Lives with adoptive parents (maternal grandfather and his fiancé).
  - History of physical abuse and neglect when previously living with biologic parents
  - Attends farming vocational school

Dozens of Young People Hospitalized for Breathing and Lung Problems After Vaping

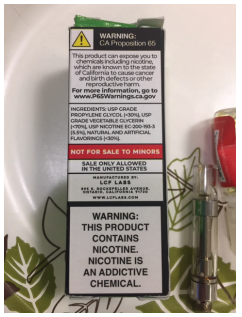
Vaping from a cannabis cartridge in Madison, Wis.
Emily Hamer/Wisconsin Watch, via Associated Press

By Sheila Kaplan

Aug. 14, 2019

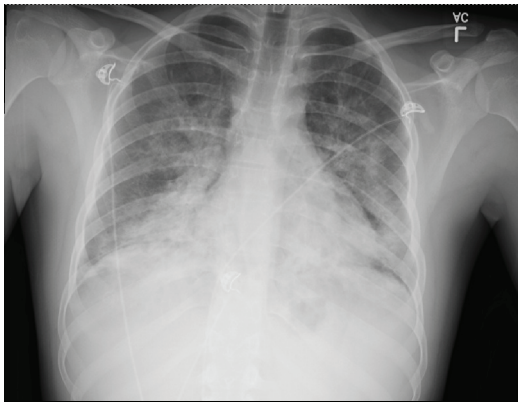
Case

Additional Social History



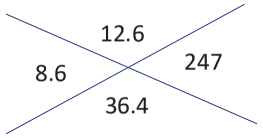
Case

CXR



Case

Labs



Absolute neutrophil count 8.01
Absolute lymphocyte count 0.26
Absolute eosinophil count 0.11
Absolute basophil count 0.03
Absolute monocyte count 0.14

CRP 25.4

Case

Hospital Course

- Admitted to the Step-Down Unit
- Switched from vancomycin/zosyn to ceftriaxone and ultimately levofloxacin
- Persistent fevers and hypoxia
  - Maximal respiratory support: HFNC 25L, FIO2 40%

Case

Additional Infectious Workup

- Respiratory culture and gram stain with normal upper respiratory flora
- Blood culture negative
- Influenza A/B negative
- Aspergillus galactomannan negative
- 1, 3-B-D-glucan negative
- Fungus culture negative
- KOH Fungal stain negative
- Cryptococcus antigen negative
- Pneumocystis carinii stain negative
- HIV non-reactive
- T-SPOT TB test negative

Case

PFTs

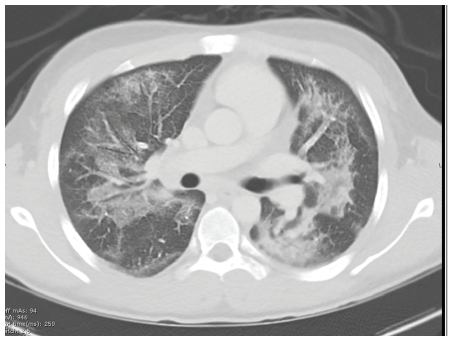
Spirometry (BTPS)		Predicted	Pre Bronchodilator	
Parameter		Value	Actual	% Pred
FVC	L	4.48	**2.85**	64
FEV_1	L	3.88	**2.36**	61
FEV_1 / FVC	%	87	**83**	95
PEFR	L/s	7.79	**6.03**	77
FIF_{50}	L/s	----	**4.82**	----
FEF_{75}	L/s	2.19	**1.12**	51
FEF_{25-75}	L/s	4.39	**3.27**	74
FIVC	L	4.48	**2.15**	48
FIF_{50}	L/s	----	**2.44**	----
SVC	L	4.48	**2.90**	65
MVV	L/m	136.8	**----**	----

Lung Volumes (Box)		Predicted	Pre Bronchodilator	
Parameter		Value	Actual	% Pred
TLC	L	5.36	**4.74**	88
VC	L	4.48	**2.90**	65
FRC	L	2.85	**2.49**	87
RV	L	1.26	**1.84**	146
RV/TLC	%	24	**39**	----

Diffusion (Corrected for Hb)		Predicted	Pre Bronchodilator	
Parameter		Value	Actual	% Pred
DLCO [Hb]	mL/min/mmHg	29.57	**15.08**	51
VA [BTPS]	L	5.36	**3.76**	70
KCO [DL/VA]	mL/min/mmHg/L	6.28	**4.01**	64
Hb	g/dl	14.6	**12.8**	----
VI [BTPS]	L	----	**2.80**	----

Case

Chest CT



Case

Bronchoscopy

- Notable for airway hyperemia
- Cytology with 56-60% neutrophils, 15-19% eosinophils, 15% macrophages, 10% respiratory epithelial cells. Abundant mucus. Moderate increase in fat-laden macrophages. No iron-laden macrophages.
- BAL negative for adenovirus, chlamydia pneumonia, enterovirus, human bocavirus, human coronavirus, human metapneumovirus, influenza, mycoplasma, parainfluenza, respiratory syncytial virus, AFB culture, aspergillus, fungus, legionella, nocardia

Case

- Overall, case thought to be consistent with eosinophilic pneumonia
- The patient was treated with steroids and followed closely as an outpatient with normalization of PFTs
- Started on nicotine replacement therapy (NRT)
- He resumed vaping while still on steroids

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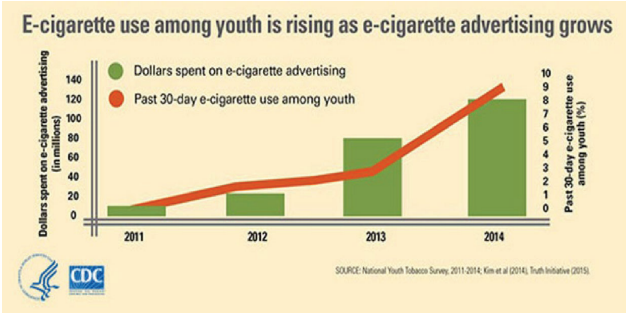
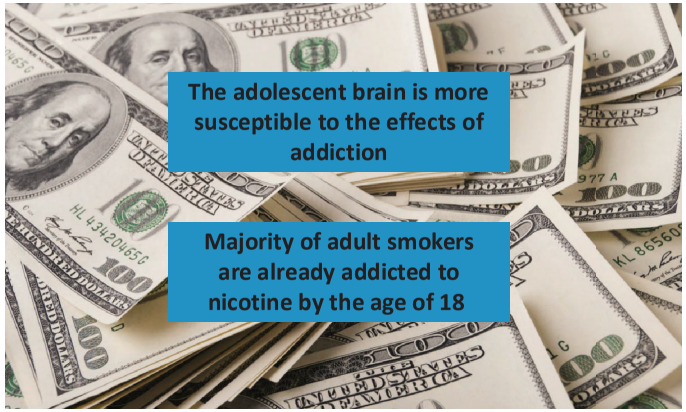
Marketing is Influencing Adolescents



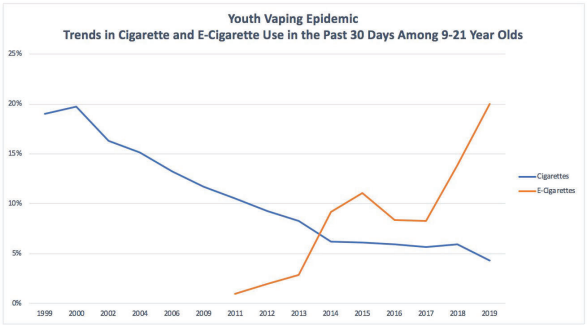
Center for disease control (2020, July 8) E-cigarette Ads and Youth. Retrieved from: https://www.cdc.gov/vitalsigns/ecigarette-ads/index.html

Marketing Toward Adolescents

Why Adolescents?



Scope of the Youth Vaping Epidemic

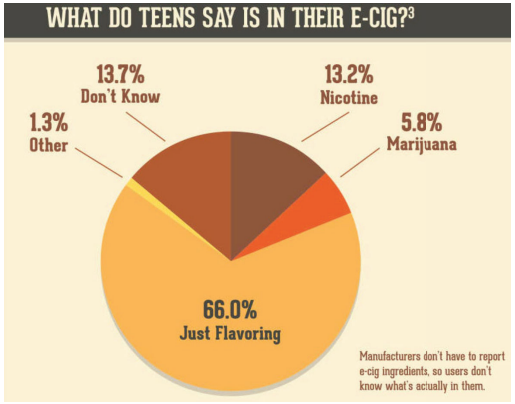


Data obtained from: Center for disease control (2020, July 8) National Youth Tobacco Survey – Historical NYTS Data and Documentation Retrieved from: https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/index.htm

Why Adolescents are Using E-Cigarettes

	Use e-cigarettes only[†]		Use e-cigarettes and other tobacco products[§]	
Reason	% (95% CI)	Estimated no.[¶]	% (95% CI)	Estimated no.
I was curious about them	56.1 (53.4–58.7)	1,900,000	38.4 (35.1–41.7)	730,000
Friend or family member used them	23.9 (21.7–26.3)	810,000	22.2 (19.6–25.1)	420,000
They are available in flavors, such as mint, candy, fruit, or chocolate	22.3 (20.3–24.5)	760,000	26.6 (23.8–29.6)	500,000
I can use them to do tricks	22.0 (20.0–24.2)	740,000	29.0 (25.6–32.7)	550,000
They are less harmful than other forms of tobacco, such as cigarettes	17.2 (15.3–19.3)	580,000	19.1 (16.7–21.9)	360,000
I can use them unnoticed at home or at school	14.5 (12.9–16.3)	490,000	22.9 (19.4–26.8)	430,000
I was peer pressured into using them	8.9 (7.7–10.3)	300,000	7.5 (5.8–9.8)	140,000
They are easier to get than other tobacco products, such as cigarettes	3.9 (3.0–5.0)	130,000	9.7 (7.9–11.8)	180,000
I've seen people on TV, online, or in movies use them	3.8 (3.1–4.6)	120,000	5.4 (3.9–7.4)	100,000
To try to quit using other tobacco products, such as cigarettes	2.8 (1.8–4.2)	90,000	17.0 (14.0–20.5)	320,000
They cost less than other tobacco products, such as cigarettes	2.5 (1.9–3.3)	80,000	11.6 (9.4–14.3)	220,000
I used them for some other reason**	15.9 (14.0–18.0)	540,000	22.2 (17.9–27.3)	420,000

Wang TW, et al. *MMWR Surveill Summ.* 2019;68(No. SS-12):1–22.



National Institute on Drug Abuse (2020, July 8). Teens and E-cigarettes. Retrieved from: https://www.drugabuse.gov/drug-topics/trends-statistics/infographics/teens-e-cigarettes

Outline

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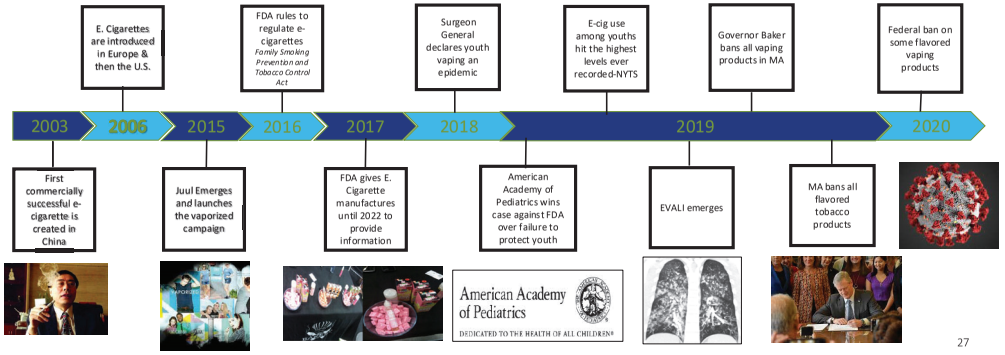
Timeline



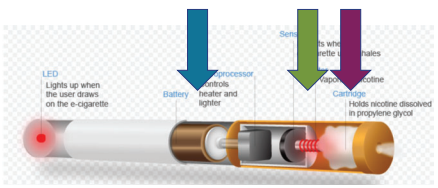
Slide courtesy of Alicia Casey

E-Cigarettes Today

E-Cigarettes Today

Devices that use HEAT to aerosolize e-liquids, flavoring, and nicotine or THC

- Components:
  - Power source
  - Electronic heating element
  - Liquid cartridge
    - Stabilizing agent
      - e.g. propylene glycol
    - Nicotine or THC
    - Flavoring additives



Nicotine Content in E-Cigarettes

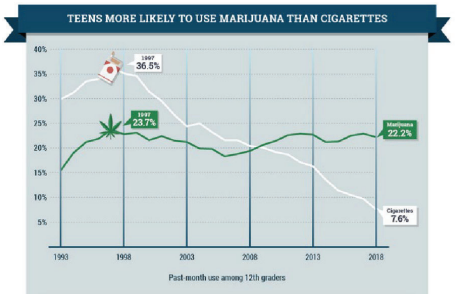
- Significant variation in nicotine concentration depending on device, e-liquid, and user characteristics
  - A study of 16 different e-cigarettes showed nicotine level in 300 puffs of vapor varied from 0.5mg to 15.4mg (vs. 1.54mg to 2.6mg in one conventional cigarette)
- One Juul 5% pod = 1 pack of conventional cigarettes
- Many of cartridges labeled as "no nicotine" still delivered some nicotine
  - Teens often unaware of this

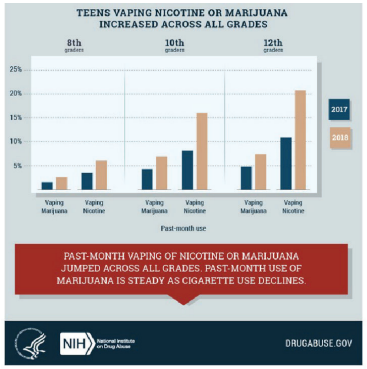
Goniewicz, M et al. *Nicotine Tob Res* 2013;15(1):158-66.
Djordjevic, M et al. JNCI 2000; 92(2):106-111.
Willett et al. *Tob Control* 2019; 28(1):115-116
Hadwiger, M. et al. *J Chromatogr A* 2010; 1217(48):7547-55.

Nicotine Salt

Vaping360 (2020, February 12). Best Nicotine Salt E-Juices 2020. Retrieved from: https://vaping360.com/best-e-liquids/nicotine-salts/

Vaping Marijuana

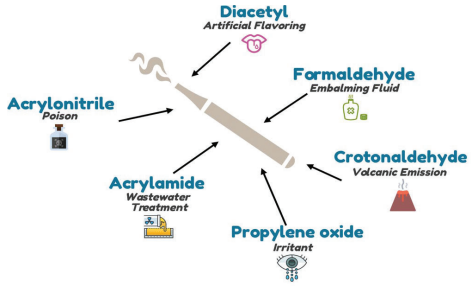




National Institute on Drug Abuse (2020, July 8). Monitoring the Future 2018 Survey Results. Retrieved from: https://www.drugabuse.gov/drug-topics/trends-statistics/infographics/monitoring-future-2018-survey-results

Flavoring

- FDA "generally recognized as safe" (GRAS) - *for ingestion*
  - Inhalant safety not tested and not known
- Thermal decomposition of propylene glycol, glycerol & flavorings produce toxic aldehydes with flavorings at levels that exceed occupational safety standards in most popular brands



Khlystov et al. *Environ Sci Technol.* 2016;50(23):13080-13085

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When to Consider E-Cigarette Use

Symptoms

- Respiratory
  - Cough in absence of cold or allergy symptoms
  - SOB, wheezing, worsening asthma
  - Decreased exercise tolerance
  - Hemoptysis
- Gastroenterological
  - Abdominal pain
  - Nausea
  - Vomiting
  - Diarrhea
- Constitutional
  - Weight loss
  - Fever
  - Night sweats

Nicotine toxicity

- Stomach pain
- Headache
- Dizziness
- Difficulty Concentrating

EVALI Presenting Symptoms

From Initial Wisconsin & Illinois Cases – 53 cases (median age 19 years)

Symptoms reported at presentation	
Median duration of symptoms before presentation (range) — days	6 (0–61)
Any respiratory symptom — no./total no. (%)§	52/53 (98)
Shortness of breath	46/53 (87)
Any chest pain	29/53 (55)
Pleuritic chest pain	20/53 (38)
Cough	44/53 (83)
Hemoptysis	6/53 (11)
Any gastrointestinal symptom — no./total no. (%)§	43/53 (81)
Nausea	37/53 (70)
Vomiting	35/53 (66)
Diarrhea	23/53 (43)
Abdominal pain	23/53 (43)
Any constitutional symptom – no./total no. (%)§	53/53 (100)
Subjective fever	43/53 (81)
Chills	31/53 (58)
Weight loss	14/53 (26)
Fatigue or malaise	24/53 (45)
Headache — no./total no. (%)	21/53 (40)

Vital signs at presentation	
Temperature ≥38°C — no./total no. (%)	15/51 (29)
Heart rate >100 beats/min — no./total no. (%)	34/53 (64)
Respiratory rate >20 breaths/min — no./total no. (%)	22/51 (43)
Oxygen saturation while breathing ambient air — no./total no. (%)	
≥95%	16/52 (31)
89–94%	20/52 (38)
≤88%	16/52 (31)
Initial laboratory results	
White-cell count >11,000/mm³ — no./total no. (%)	45/52 (87)
White-cell count with >80% neutrophils — no./total no. (%)	34/36 (94)
Erythrocyte sedimentation rate >30 mm/hr — no./total no. (%)	14/15 (93)
Sodium <135 mmol/liter — no./total no. (%)	15/49 (31)
Potassium <3.5 mmol/liter — no./total no. (%)	16/46 (35)
Aspartate aminotransferase, alanine aminotransferase, or both — no./total no. (%)	
>35 U/liter¶	20/40 (50)
>105 U/liter‖	2/40 (5)
Median procalcitonin (IQR) — μg/liter **	0.58 (0.35–1.00)
Median creatinine (IQR) — mg/dl††	0.87 (0.76–0.99)
Initial radiographic findings	
Abnormal chest radiograph — no./total no. (%)	48/53 (91)
Abnormal chest CT — no./total no. (%)	48/48 (100)
Bilateral infiltrates identified on chest radiograph or CT — no./total no. (%)	53/53 (100)

Layden JE et al., *N Engl J Med* 2020; 382:903-916.

EVALI - Definition

Confirmed Case

Using an e-cigarette in 90 days prior to symptom onset

AND

Pulmonary infiltrate, such as opacities, on plain film chest radiograph or ground-glass opacities on chest CT

Probable Case: Infection identified BUT clinical team believes it is not sole cause of underlying lung injury OR minimum criteria to rule out pulmonary infection is not met and clinical team believes infection is not sole cause of underlying lung injury

AND

All other clinically-indicated respiratory infectious disease testing are negative

AND

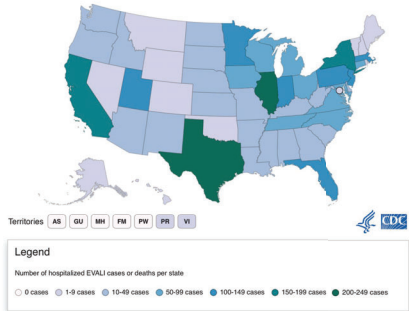
No evidence of alternative plausible diagnosis (e.g. cardiac, rheumatologic)

Center for Disease Control (2020, July 10). For State, Local, Territorial, and Tribe Health Departments. Retrieved from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease/health-departments/index.html

Where the world comes for answers Boston Children's

Emergence of EVALI

Number of Hospitalized EVALI Cases or Deaths Reported to CDC as of February 18, 2020



- As of February 18, 2020:
  - 2,807 cases of patients hospitalized with EVALI in USA
  - 68 deaths confirmed

Center for Disease Control (2020, July 10). Outbreak of Lung Injury Associated with the Use of E-Cigarettes, or Vaping, Products. Retrieved from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#map-cases

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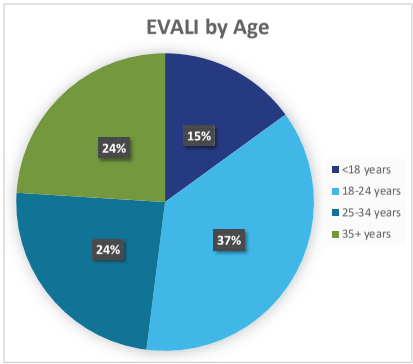
EVALI by Age

- Among the 2,668 hospitalized EVALI cases or deaths (as of 1/14/20):
  - Median age: 24 years
  - Age range: 13-85 years



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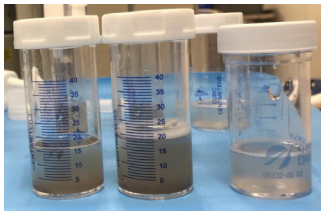
EVALI – Products Used

- Among those with information on substances used in the 3 months prior to symptom onset (as of 1/14/20):
  - 82% reported using THC-containing products; 33% reported exclusive use, 16% from commercial sources
  - About half report nicotine-containing products; **14% reported exclusive use**
  - Some reporting CBD use or just vapor use

Center for Disease Control. (2020, January 22) Outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products. Retrieved from https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html. 1

EVALI Pathology: What is the Cause?

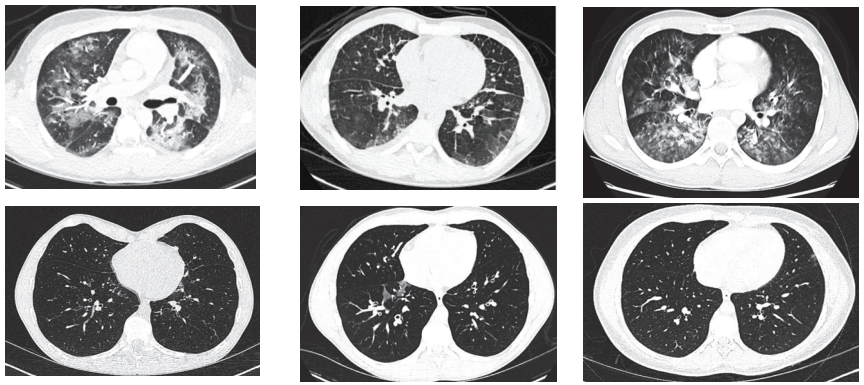
- Thermal burn injury
- Allergic reaction/eosinophilic pneumonia
- Hypersensitivity pneumonia
- Organizing pneumonia
- Toxic lung injury



BAL Fluid from a BCH patient with suspected EVALI

- Patterns are non-specific & there is likely more than one component contributing

EVALI Imaging



Henry TS, et al. *NEJM* 2019;381:1486-1487
Kass AP, et al. *Pediat Pulmonol*; 55(5):1224-1236 3

EVALI – Vitamin E Acetate

Table 3. Frequency of Detection of Priority Toxicants in EVALI Case Patients and in Healthy Comparators.*

Toxicant	EVALI Case Patients (N=51)	Healthy Comparators			
		Nonusers (N=52)	E-Cigarette Users (N=18)	Cigarette Smokers (N=29)	All Comparators (N=99)
		number/total number (percent)			
Vitamin E acetate	48/51 (94)	0/52	0/18	0/29	0/99
Medium-chain triglyceride oil	0/49	0/34	0/11	0/18	0/63
Coconut oil	1/48 (2)	0/34	0/11	0/18	0/63
Plant oil	0/49	0/34	0/11	0/17	0/62
Squalane	0/38	0/52	0/17	0/29	0/98
Squalene	0/38	0/52	0/17	0/29	0/98
α-Pinene	0/39	0/52	0/17	0/28	0/97
β-Pinene	0/39	0/52	0/17	0/28	0/97
3-Carene	0/39	0/52	0/17	0/28	0/97
Limonene	1/39 (3)	0/52	0/17	0/28	0/97
Petroleum distillates	0/12	0/52	0/17	0/29	0/98

Blount BC, et al. *NEJM.* 2020;382:697-705 4

Vaping and Asthma

- Vaping is more popular among asthmatic teenagers vs. non-asthmatic peers
- EVALI cases occur at a higher than expected rate in asthmatics
- 33% of 11-17 year old with asthma had secondhand e-cigarette exposure which was associated with increased risk of exacerbation
  (Florida Youth Tobacco Survey)
- Case report of two adolescent asthmatics with history of e-cigarette use who presented with life threatening status asthmaticus requiring V-V ECMO

Schweitzer RJ et al., *Prev Med* 2017;105:226-231
Layden JE et al., *N Engl J Med* 2020; 382:903-916.
Kalininskiy A et al., *Lancet Respir Med* 2019;7(12):1017-1026
Bayly JE et al., *Chest* 2019;155(1):88-93
Bradford LE et al., *J Asthma* 2019 (epub)

Vaping Leads to Chronic Respiratory Symptoms

- 45,000 adolescents in Hong Kong, vaping in the previous month was associated with increased odds of reporting chronic cough or phlegm
- 2000 HS students in Southern California, past and current vaping was associated with a nearly twofold increase in the risk of chronic bronchitis symptoms
- Vaping was found to be an independent risk factor for respiratory illnesses in adults, and dual use of combustible cigarettes and e-cigarettes is riskier

Wang, M. et al *JAMA Pediatrics* 2016;170:89-91.
McConnell R, et al. *AJRCCM* 2017;195:1043-9.
Bhatta D. et al *AJPM* 2020;58(2):182-190.

Vaping and COVID-19

- Important to still consider vaping related lung injury in COVID-19 era
- Compared to non-users, adolescents & young adults who use e-cigarettes:
  - Have more symptoms of COVID-19
  - Get tested more frequently for COVID-19
  - More commonly test positive for COVID-19
- COVID-19 diagnosis 5 times more likely among ever-users of e-cigarettes
  - Even more common in dual users

Gaiha, S.M. et al. *Journal of Adolescent Health* 2020;67:519-523

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Slide courtesy of Sharon Levy

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E-Cigarettes are NOT approved NRT

- Marketed as safer alternative to cigarettes
- May perpetuate nicotine dependence
- Inconsistent labeling & poor regulation
- Major tobacco companies now own e-cigarette companies

-Cancer Research UK (2020, July 8). New study comes the closest yet to proving that e-cigarettes aren't as dangerous as smoking. Retrieved from: https://scienceblog.cancerresearchuk.org/2017/02/06/new-study-comes-the-closest-yet-to-proving-that-e-cigarettes-arent-as-dangerous-as-smoking/
-SmokeFree60+ (2020, July 10). Quitting Tools and Medications. Retrieved from: https://60plus.smokefree.gov/quit/tools
-Chiel L et al., *Pediatr Pulmonol* 2020;55(2):272-275

E-Cigarettes vs. NRT in Smoking Cessation

Table 2. Abstinence Rates at Different Time Points and Smoking Reduction at 52 Weeks.*

Outcome	E-Cigarettes (N=438)	Nicotine Replacement (N=446)	Primary Analysis: Relative Risk (95% CI)†	Sensitivity Analysis: Adjusted Relative Risk (95% CI)
Primary outcome: abstinence at 52 wk — no. (%)	79 (18.0)	44 (9.9)	1.83 (1.30–2.58)	1.75 (1.24–2.46)‡
Secondary outcomes				
Abstinence between wk 26 and wk 52 — no. (%)	93 (21.2)	53 (11.9)	1.79 (1.32–2.44)	1.82 (1.34–2.47)§
Abstinence at 4 wk after target quit date — no. (%)	192 (43.8)	134 (30.0)	1.45 (1.22–1.74)	1.43 (1.20–1.71)¶
Abstinence at 26 wk after target quit date — no. (%)	155 (35.4)	112 (25.1)	1.40 (1.14–1.72)	1.36 (1.15–1.67)‡
Carbon monoxide–validated reduction in smoking of ≥50% in participants without abstinence between wk 26 and wk 52 — no./total no. (%)	44/345 (12.8)	29/393 (7.4)	1.75 (1.12–2.72)	1.73 (1.11–2.69)‖

- At one year, 18% of those in the e-cigarette group & 9% of the NRT group were abstinent from smoking cigarettes
- In those abstinent, 80% of those in the e-cigarette group were still using e. cigarettes & only 9% of those in the NRT group were still using NRT

Hajek P et al., *NEJM* 2019;380:629-637

Slide courtesy of Sharon Levy

Slide courtesy of Sharon Levy

Slide courtesy of Sharon Levy

Slide courtesy of Sharon Levy

Increased Risk of Substance Use in Teens Who Vape

5.8X

6.5X

3.0X

Curran KA, et al. *Clin Pediatr* 2015;57(10):1191-1198

Health and Wellness Vapes

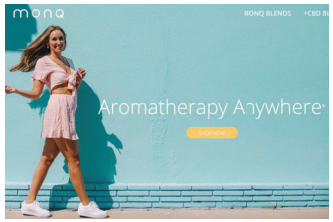
MONQ Cares About Your Safety

Enjoy MONQ personal aromatherapy diffusers knowing they are free from nicotine, artificial ingredients, and tobacco. Simply breathe pure therapeutic air®.

What is MONQ Therapeutic Air®?

MONQ Therapeutic Air® is the product you breathe from MONQ's personal aromatherapy diffusers. These diffusers are filled with custom blends of essential oils, emulsified in coconut-derived vegetable glycerin. When heated, these blends leave the diffuser as aromatherapy-rich water vapor.

MONQ is 100% pure Therapeutic Air. MONQ does not contain nicotine, artificial flavors or ingredients, tobacco, Vitamin E acetate, THC, or synthetic cannabinoids. So, everything that goes into MONQ diffusers is healthy, and everything that comes out ofMONQ diffusers is healthy. This is by design.



INHALE HEALTH

Sleep on demand™

Melatonin is a hormone that helps regulate sleep timing. Take control of your circadian rhythm with a nighttime routine conditioned for good sleep.

https://monq.com
https://www.inhalehealth.com/products/melatonin-inhaler-lavender-dream

Outline

- Case
- Vaping in Adolescents
- What are E-Cigarettes?
- Presenting Symptoms
- Associated Problems
- Workup and Treatment
- What can you do?

Recommended Evaluation

Imaging	Diagnostic Testing	Infectious w/u
❑Chest X-ray (PA and Lateral)	❑PFT ❑Spirometry (pre & post) ❑TLC ❑DLCO ❑6 Minute Walk Test	❑Influenza PCR or rapid test ❑ SARS-CoV-2 PCR ❑ Viral Panel ❑ Sputum sample if productive cough ❑Send for gram stain/culture, AFB, fungal ❑Mycoplasma ❑PJP if risk factors
❑Chest CT (If symptoms persist and persistent abnormal PFTs and/or CXR)	❑ LABS: ❑CBC, CRP, ESR and liver function tests ❑Urine Cotinine/Drug Screen	

Slide courtesy of Jillian King

Where the world comes for answers
Boston Children's

Admission and Follow-Up Criteria

- "Strongly consider admitting patients with potential lung injury, especially if respiratory distress present, have comorbidities that compromise pulmonary reserve, or decreased (**<95%**) oxygen saturation"
  - Post-discharge follow-up ideally within 48 hours
- Patient not admitted to hospital
  - Recommended follow-up within 24-48 hours

Center for Disease Control (2020, July 10). Update: Interim Guidance for Health Care Providers Evaluating and Caring for Patients with Suspected E-cigarette, or Vaping Product Use Associated Lung Injury – United States, October 2019. Retrieved from: https://www.cdc.gov/mmwr/volumes/68/wr/mm6841e3.htm#B2_down

Where the world comes for answers
Boston Children's

Management and Follow-Up

Prevention	Treatment
❑ Flu Shot ❑ Consider PPSV23	❑ Vaping Cessation/Referral to Pulmonary & Addiction Medicine ❑ Consider steroids ❑ Consider antimicrobial treatment ❑ Nicotine Replacement Therapy (NRT)

Indication	Recommend Follow Up
Systemic steroids/Severe Presentation	1-2 weeks
Mildly hypoxia 6mwt or decreased DLCO	2-3 months
New ICS or ICS/LABA and vaping	2-3 months
Still vaping, mildly abnormal or normal studies	3 months
Quit vaping, mildly abnormal	6 months

Slide courtesy of Jillian King

Where the world comes for answers
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Vaping Clinic at BCH

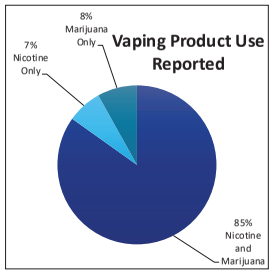
- Comprehensive pulmonary evaluation for patients who are vaping with concerning symptoms
  - Over 130 referrals, 103 patients seen to date
  - 39% distant asthma history & 66% mental health history
  - Half of referred patients met criteria for confirmed EVALI or probable EVALI with signs of infection
  - Many have obstructive spirometry, Low DLCO, and/or hypoxia on 6 min walk
  - Referred 70% patients to the Adolescent Substance Abuse Program (ASAP)

Vaping Clinic Goals

- Improve identification of youths & young adults who are vaping and have pulmonary symptoms
- Update tobacco screening to include vaping specific language to uncover patients at risk for EVALI
- Develop a vaping product use questionnaire
- Establish a comprehensive pulmonary evaluation
- Expand treatment resources in partnership with the Adolescent Substance Abuse Program (ASAP)
- Create a Pulmonary Vaping Program Biobank
- Provide advocacy and education

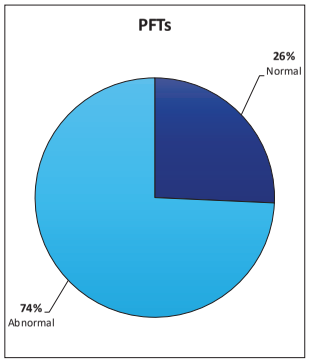
Vaping Clinic Demographics

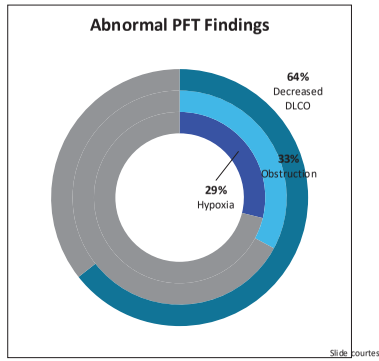
Patients Evaluated in Vaping Clinic		n=103
Sex, Male		74 (72%)
Median Age, years		17 (13-28)
Past Medical History	Healthy (No PMH)	15 (15%)
	Asthma	41 (39%)
	Pneumonia	28 (27%)
	Chronic Respiratory Illness	13 (13%)
	Chronic Gastrointestinal Condition	29 (28%)
	Chronic Neurologic Condition	20 (19%)
	Concussion	12 (12%)
Past Mental Health History		68 (66%)
	Anxiety	48 (47%)
	Depression	40 (39%)
	Attention Deficit Hyperactivity Disorder	31 (30%)



Slide courtesy of Eleanor Muise

Vaping Clinic Demographics





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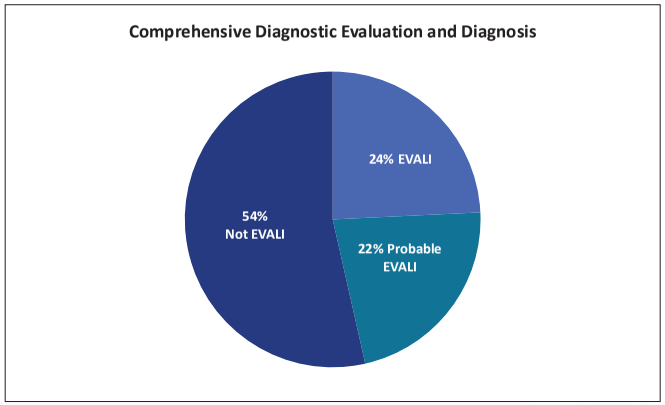
Vaping Clinic Demographics



Slide courtesy of Eleanor Muise

Resources for Quitting

Refer to https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease/resources/index.html

- AAP Toolkit
- Truth Initiative
- Ditch JUUL
- Family Education Sheet
- SmokeFree.gov
- Smokefree Teen
- How to Quit Smoking
  This CDC web page provides free resources, including the quitSTART app and how to build a quit plan.

Outline

- Case
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Is Vaping Worse than Cigarettes?

"For years we've known that tobacco cigarettes were dangerous, but short-term use does not send people to the hospital. Now, there is increasing evidence that short-term use of e-cigarettes can send children to the emergency room. The public must be alerted to the dangers of vaping e-cigarette products, and healthcare professionals educated on what to look for in patients suffering from vaping-related respiratory distress."

- Frank Leone, MD, member of the ATS Tobacco Action Committee

Lack of Federal Regulation in Vaping

- None of these products are regulated by the FDA
- In 2016, the FDA expanded its authority to regulate tobacco products to include e-cigarettes and cigars
  - FDA later announced manufacturers do not have to provide information about e-cigarettes until 2022
- In May 2019, federal judge rules in favor of the American Academy of Pediatrics and others in lawsuit against the FDA for allowing manufacturers to keep products on the market
- At end of 2019, Federal officials said they would forbid the sale of most flavored e-cigarette cartridges, but would exempt menthol and tobacco flavors, as well as flavored liquid nicotine sold in open tank systems at vape shops
  - 4/28/21: Biden administration planning to propose a ban on menthol cigarettes
  - 4/29/21: FDA announces that it will ban menthol cigarettes and all flavored cigars by 2022

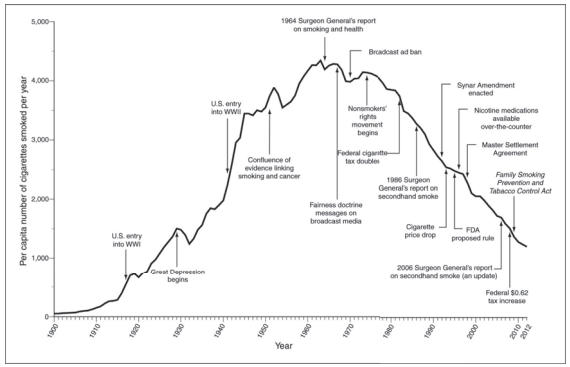
Balmes, J. AJRCCM 2019; 200(11):1342-1344.
American Academy of Pediatrics, (2019, May 16). Retrieved From: https://www.aappublications.org/news/2019/05/16/ecigarettelawsuit051619

Advocacy by the AAP

- Advocacy priorities:
  - Prohibit all flavored tobacco products, including menthol and mint
  - Regulate all tobacco products in the interest of public health
- AAP wins a lawsuit that was filed against the FDA for failure to protect children from the dangers of e-cigarettes in 2019.
- Vaping, JUUL and E-Cigarette Presentation Toolkit
  - https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Richmond-Center/Pages/vaping-juul-e-cigarettes-toolkit.aspx

https://services.aap.org/en/advocacy/tobacco-e-cigarettes/

Importance of Science & Public Policy in Reducing Cigarette Use



U.S. Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress.* A Report of the Surgeon General. Atlanta (GA): 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.

State Advocacy Results in Change

Policies passed in MA

- Sale/distribution of e-cigarette is prohibited under age 21 including mail-order & internet sales
- Use of e-cigarettes prohibited in the same spaces where smoking prohibited
- In September 2019, due to EVALI, sale of all vaping products prohibited for 4 months
- November 2019, ban on the sale of flavored vaping and tobacco products including mint and menthol cigarettes
- AG Maura Healey files suit against Juul in February 2020

What Can you do to Limit the Scope of the Vaping Epidemic?

- **Ask** patients and families about vaping
- **Educate** patients and families
- **Don't tolerate** vaping in our communities
- **Report cases** of pulmonary complications of vaping
- **Report violations** of state and federal laws
- **Participate** in anti vaping efforts/**advocacy**
- **Support legislation** to limit youth access to e-cigarette devices

Take Home Points

- E-cigarettes contain a power source, an electronic heating element, and liquid cartridge
  - Liquid cartridge contains stabilizing agent, psychoactive compound, and flavoring additives
- EVALI is diagnosed with e-cigarette use with respiratory/GI/constitutional symptoms, changes on imaging, no infectious etiology, and no evidence of alternative diagnosis
  - The most important treatment is e-cigarette cessation
  - Steroids and antibiotics can be considered
- Adolescents comprise a significant portion of EVALI cases
- Much is still unknown about EVALI, including underlying cause and best treatment
  - Referral to Pulmonary and Addiction Medicine is important
- Advocacy efforts by AAP and ATS, among others, are underway
  - We must continue these efforts to prevent widespread pulmonary complications

Thank You

- Alicia Casey, MD
- Vaping Team
  - Laura Chiel, MD
  - Eleanor Muise, MD
  - Jacky Steiding, RN
  - Jillian King, NP
  - Keri Sullivan, NP
  - Edward Boyer, MD
  - Daniel Overbeek, MD
- AAP