E-CIGARETTES: PROS AND CONS

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Disclosure Information

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- I have the following financial relationships to disclose: Royalties from: UpToDate, Inc. for a chapter on e-cigarettes Spouse is stockholder in: Merck, Eli Lilly and Company, Boston Scientific
- I will not discuss off label use or investigational use in my presentation.



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Electronic cigarettes

- Type of electronic nicotine delivery system
- Battery-powered devices that heat a solution of humectants, nicotine, flavorings, which is then inhaled
- Hundreds of brands, thousands of flavors



Disposable e-cigarette



Rechargeable e-cigarette



Pen-style, medium-sized rechargeable e-cigarette



Tank-style, large-sized rechargeable e-cigarette



- Consists of a battery, atomizer, and cartridge containing solution
- Not rechargeable or refillable
- Often contain element allowing regulation of puff frequency and duration
- Can hold larger amounts of solution

 Often contain manual switches and battery casing to customize battery capacity





Altria Group/ AP











E-CIGARETTE MARKETING



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E-CIGARETTE USE PATTERNS

Use of e-cigarettes (U.S. adults)



Schoenborn CA and Gindi RM. 2015. NCHS Data Brief.

Prevalence of Use

- Ever use higher in
 - Men
 - Younger age
 - Non-Hispanic white/AIAN race/ethnicity
- Current use higher in
 - Younger age
 - Non-Hispanic white/AIAN race/ethnicity

Reasons for Use



POPULATION HEALTH EFFECTS OF E-CIGARETTES

Debate among public health and research communities

VIEWPOINT

Promise and Peril of e-Cigarettes Can Disruptive Technology Make Cigarettes Obsolete?

Commentary Electronic cigarettes: The road ahead

Electronic Cigarettes: Smoke-Free Laws, Sale Restrictions, and the Public Health

Harm Reduction at the Crossroads The Case of E-Cigarettes

The Case in Favor of E-Cigarettes for Tobacco Harm Reduction

A fresh look at tobacco harm reduction: the case for the electronic cigarette

Electronic cigarettes: achieving a balanced perspective









E-CIGARETTES: COMPONENTS AND SAFETY

Nicotine concentration of e-cigarettes

- Some are nicotine-free
- Nicotine delivery variable
 - Differences in devices and individual use patterns
 - Experienced users may receive nicotine in comparable amounts to combustible cigarettes

Risks of nicotine

- May alter brain development (fetal, youth)
- Liquid nicotine toxicity
 - Increase in monthly poison control center calls from 2010 to 2014
 - Liquid refills now required to have child-resistant packaging



Toxin and carcinogen content of e-cigarettes

Toxins	E-cigarette (15 puffs)	Conventional cigarette	Nicotine inhaler
Formaldehyde (µg)	0.20 - 5.61	1.6 - 52.0	0.20
Acetaldehyde (µg)	0.11 - 1.36	52.0 - 140.0	0.11
Acrolein (µg)	0.07 - 4.19	2.4 - 62.0	ND
o-methylbenzaldehyde (µg)	0.13 - 0.71		0.07
Toluene (µg)	ND - 0.63	8.3 – 70.0	ND
p,m-xylene (µg)	ND - 0.2		ND
NNN (ng)	ND - 0.00043	0.0005 - 0.19	ND
NNK (ng)	ND - 0.00283	0.012 - 0.11	ND
Cadmium (µg)	ND - 0.022		0.003
Nickel (µg)	0.01 - 0.03		0.019
Lead (µg)	0.003 - 0.057		0.004

ND = Not Detected; -- = not reported

Data from Goniewicz et al. 2013 Tobacco Control using lowest and highest values reported

Particulate matter

- Fine and ultrafine particles found in e-cigarette aerosol
 - Actual particle number affected by:
 - Nicotine content
 - Puffing time
- Similar particle number and size distribution to cigarettes in a few studies
 - Toxicity of these particles unknown

Risks of flavors

- Diacetyl, found in sweetflavored e-cigarettes at levels, associated with respiratory disease
- Benzaldehyde, found in cherry-flavored ecigarettes, associated with respiratory irritation



Farsalinos et al. Nicotine and Tobacco Research. 2015; 17(2): 168-74 Kosmider L et al. Thorax. 2016. 71(4):376-7

E-CIGARETTES: SMOKING CESSATION

E-cigarettes for smoking cessation: clinical trials

- One randomized control trial of e-cigarettes vs NRT (New Zealand)
 - 6-month cigarette abstinence: 7.3% in nicotine e-cigarette group, 5.8% in nicotine patch group, 4.1% in no-nicotine e-cigarette group (p=NS)
 - Higher drop-out rate in the NRT group
- Randomized trial of different e-cigarette nicotine doses for cessation (Italy)
 - 1-year cigarette abstinence: 13% in group using constant e-cigarette dose, 9% in group using tapering e-cigarette dose, 4% in group using nonnicotine e-cigarettes (p=NS for reduction and cessation)

Smoking cessation in observational studies

- Many observational studies of e-cigarette use in the "real world" show less quitting among those who use e-cigarettes
 - Methodological weaknesses
- One cross-sectional study (UK) found that smokers who made at least one quit attempt in the past year and used e-cigarettes as part of a quit attempt had higher smoking abstinence
 - OR 2.2 (95% CI 1.7-2.9) for e-cigarettes vs NRT
 - OR 1.4 (95% CI 1.1-1.8) for e-cigarettes vs no aid

Meta-analysis of all studies



Kalkhoran S and Glantz SA. Lancet Respir Med. 2016. 4(2): 116-28

E-cigarettes for smoking cessation

- To date, no clinical trials have found a significant difference between quitting smoking in those using e-cigarettes vs NRT
- Population-based longitudinal studies suggest less quitting in those using e-cigarettes, but have methodological weaknesses
- May be differences in how e-cigarettes are used in the real world versus in a clinical setting
 - E-cigarettes are mass-marketed consumer products, not prescriptions
- May be differences in e-cigarettes for smoking cessation among different users
 - Daily vs nondaily users
 - Tank device users vs disposable e-cigarette users

E-cigarettes for Tobacco Harm Reduction

- Harm reduction: substitution of cigarettes with lower-risk nicotine- or tobacco-containing products
- Reduction in cigarette consumption
 - Cardiopulmonary risk with even a few cigarettes/day
 - No reduction in overall mortality
 - Some who reduce later quit

Risks of different amounts of cigarette smoking



Pope C A et al. Circulation. 2009;120:941-948

E-CIGARETTES: YOUTH UPTAKE

Current (past 30-day) e-cigarette use - youth



Current Cigarette and E-cigarette Use among HS Students, 2011-2015



Substance Last Vaped Among 12th Graders with Past-30 Day E-cigarette Use



Miech R et al. Tob Control. 2016. doi: 10.1136/tobaccocontrol-2016-053014.

E-cigarette Advertising

- In 2014, 69% of US middle and HS students exposed to ecigarette advertising (Singh T et al, MMWR 2016)
 - Sources: retail stores, Internet, TV/movies, print
- Exposure to e-cigarette advertisements among US youth associated with e-cigarette use (Singh T et al, Pediatrics 2016)

E-cigarette use among youth and future smoking

- 3X increase in e-cigarette use among never smoking youth
 - 79,000 in 2011 to 263,000 in 2013
 - Ever e-cigarette users had higher odds of smoking intentions (OR 1.7, 95% CI 1.2-2.3)
- 7.9% of never smoking young adults ever tried e-cigarettes in 2012-2013
 - Ever use associated with openness to cigarette smoking (OR 2.4, 95% CI 1.7-3.3)

NYTS 2011-2013 Bunnell R et al. Nicotine Tob Res. 2015. 17(2): 228-35. Coleman BN et al. Nicotine Tob Res. 2015. 17(2): 212-18.

From: 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

	Combustible Tobacco Use During Past 6 mo			
	Total (N = 2530) ^b	Never Use of e-Cigarettes (n = 2308)	Ever Use of e-Cigarettes (n = 222)	– Difference in Prevalence Rates, % (95% CI)
6-mo Follow-up				
Any combustible tobacco product (n = 2473) ^c	249 (10.1)	182 (8.1)	67 (30.7)	22.7 (16.4-28.9)
Combustible cigarettes (n = 2468) ^c	89 (3.6)	68 (3.0)	21 (9.7)	6.7 (2.7-10.7)
Cigars (n = 2443) ^c	107 (4.4)	70 (3.1)	37 (17.3)	14.2 (9.0-19.3)
Hookah (n = 2434) ^c	160 (6.6)	122 (5.5)	38 (17.8)	12.3 (7.1-17.5)
No. of different combustible tobacco products (n = 2472) ^c				
0	2223 (89.9)	2072 (91.9)	151 (69.3)	
1	166 (6.7)	122 (5.4)	44 (20.2)	
2	59 (2.4)	42 (1.9)	17 (7.8)	
3	24 (1.0)	18 (0.8)	6 (2.8)	
12-mo Follow-up				
Any combustible tobacco product (n = 2463) ^c	264 (10.7)	210 (9.3)	54 (25.2)	15.9 (10.0-21.8)
Combustible cigarettes (n = 2462) ^c	91 (3.7)	74 (3.3)	17 (7.9)	4.7 (1.0-8.4)
Cigars (n = 2374) ^c	126 (5.3)	93 (4.3)	33 (16.2)	11.9 (6.8-17.0)
Hookah (n = 2371) ^c	152 (6.4)	127 (5.9)	25 (12.3)	6.4 (1.8-11.0)
No. of different combustible tobacco products (n = 2462) ^c				
0	2198 (89.3)	2038 (90.7)	160 (74.8)	
1	181 (7.4)	143 (6.4)	38 (17.8)	
2	61 (2.5)	50 (2.2)	11 (5.1)	
3	22 (0.9)	17 (0.8)	5 (2.3)	

 a Data are expressed as No. (%) unless otherwise indicated. All P value comparisons yielded values <.001 and were calculated using the χ^{2} test.

^b Indicates No. of students who completed follow-up assessments at 6 or 12 months.

^c The denominator is for the data in column 2 and is provided due to missing data for this variable in each column in this row (or rows; the denominators for columns 3 and 4 are not provided).

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Table 3. Multivariable Associations Between e-Cigarette Use at Baseline and Progression Along the Cigarette Smoking Trajectory by Follow-up

		Adjusted Odds Ratio (95% CI) ^a		
	Characteristic	NSNS to SNS	NSNS to Cigarette Smoking Initiator	
\Rightarrow	e-Cigarette use at baseline (yes vs no)	8.5 (1.3-57.2)	8.3 (1.2-58.6)	
,	Age, y ^b	0.8 (0.7-0.96)	0.9 (0.8-1.04)	
	Sex (male vs female)	1.0 (0.6-1.9)	0.8 (0.4-1.5)	
	Race/ethnicity			
	Non-Hispanic black (vs non-Hispanic white)	0.4 (0.1-2.9)	2.2 (0.7-7.0)	
	Hispanic (vs non-Hispanic white)	0.7 (0.2-3.0)	1.4 (0.5-4.3)	
	Other (vs non-Hispanic white)	1.1 (0.4-2.8)	0.5 (0.1-1.9)	
	Maternal educational level ^c	1.0 (0.8-1.1)	1.0 (0.8-1.1)	
	Sensation-seeking tendency ^d	1.9 (0.96-3.6)	2.6 (1.3-5.2)	
	Smoking			
	Parent ^e	0.9 (0.6-1.4)	1.0 (0.6-1.6)	
	Friend ^f	0.9 (0.6-1.4)	1.8 (1.2-2.9)	

Abbreviations: NSNS, nonsusceptible nonsmoker; SNS, susceptible nonsmoker.

^a Adjusted for all variables in the table.

^b Adusted odds ratios represent increases in odds for each additional year.

^c Scores ranged from 1 to 10, with higher scores representing more advanced education.

^d Scores ranged from 1 to 4, with higher scores representing greater sensation-seeking tendency.

^e Scores ranged from 0 to 3, with 0 representing never a smoker, 1 representing a former smoker, 2 representing a nondaily smoker, and 3 representing a daily smoker.

^f Scores ranged from 0 to 3, with higher numbers representing a greater proportion of friends who smoke.

Primack BA et al. Progression to Traditional Cigarette Smoking After Electronic Cigarette Use Among US Adolescents and Young Adults. JAMA Pediatrics 2015 Sep 8: 1-7. doi: 10.1001/jamapediatrics.2015.1742.

E-CIGARETTES: TALKING TO OUR PATIENTS

Patient-Provider Communication

- Recent study of 561 US physicians:
 - At least 70% report being asked about e-cigarettes sometimes
 - 58% report asking about e-cigarettes sometimes
 - 38% have ever recommended an e-cigarette
- Attitudes:
 - 72% believe can help smokers reduce cigarettes smoked
 - 45% believe they are safer, can lower risk of disease
 - 55% believe they can help with cessation
 - 63% believe they have adverse health effects

Common questions about e-cigarettes

- Side effects/harmfulness
 - Comparison to cigarettes
- Safety
- Use as a quit aid
- Use in certain medical conditions

Brown-Johnson CG et al. Am J Prev Med. 2016.

Annals of Internal Medicine



www.USPreventiveServicesTaskForce.org

Behavioral and Pharmacotherapy Interventions for Tobacco Smoking Cessation in Adults, Including Pregnant Women: Clinical Summary

	-			
Population	Nonpregnant adults aged ≥18 y	Pregnant adults aged ≥18 y	Pregnant adults aged ≥18 y	All adults aged ≥18 y
Recommendation	Provide pharmacotherapy and behavioral interventions for cessation. Grade: A	Provide behavioral interventions for cessation. Grade: A	Pharmacotherapy interventions: No recommendation. Grade: I statement	ENDS: No recommendation. Grade: I statement
Assessment	The 5 A's framework is a useful str patient about tobacco use, advising quit assisti	5 A's include asking every users to make an attempt to up.		
Behavioral Counseling Interventions	Behavioral interventions alone (in- person behavioral support and counseling, telephone counseling, and self-help materials) or combined with pharmacotherapy substantially improve achievement of tobacco cessation.	Behavioral interventions substantially improve achievement of tobacco smoking abstinence, improve infant birthweight, and reduce risk for preterm birth.		
Pharmacotherapy Interventions	Pharmacotherapy interventions, including NRT, bupropion SR, and varenicline–with or without behavioral counseling interventions–substantially improve achievement of tobacco cessation.		There is inadequate or no evidence on the benefits of NRT, bupropion SR, or varenicline to achieve tobacco cessation or improve perinatal outcomes in infants.	There is inadequate evidence on the benefit of ENDS to achieve tobacco cessation or improve perinatal outcomes in infants.
Balance of Benefits and Harms	The USPSTF concludes with high certainty that the net benefit of behavioral interventions and FDA-approved pharmacotherapy for tobacco cessation, alone or in combination, is substantial.	The USPSTF concludes with high certainty that the net benefit of behavioral interventions for tobacco cessation on perinatal outcomes and smoking abstinence is substantial.	The USPSTF concludes that the evidence on pharmacotherapy interventions for tobacco cessation is insufficient because of a lack of studies, and the balance of benefits and harms cannot be determined.	The USPSTF concludes that the evidence on the use of ENDS for tobacco cessation is insufficient, and the balance of benefits and harms cannot be determined.
Other Relevant USPSTF Recommendations	The USPSTF recommends that primary care clinicians provide interventions, including education or brief counseling, to prevent the initiation of tobacco use in school-aged children and adolescents. This recommendation is available on the USPSTF Web site (www.uspreventiveservicestaskforce.org).			

For a summary of the evidence systematically reviewed in making this recommendation, the full recommendation statement, and supporting documents, please go to www.uspreventiveservicestaskforce.org.





Table 2. Summary of Current Recommendations for Clinical Guidance

E-cigarette use should be included in tobacco screening questions that are part of every health examination.

Clinicians should be educated about e-cigarettes and should be prepared to counsel their patients regarding comprehensive tobacco cessation strategies.

Patients should be separated into 3 treatment categories based on their tobacco/e-cigarette use status133:

- 1. Tobacco product users who are willing to quit should receive intervention to help them quit
- 2. Tobacco product users unwilling to quit at the time should receive interventions to increase their motivation to quit
- 3. Those who recently guit using tobacco products should be provided relanse prevention treatment.

There is not yet enough evidence for clinicians to counsel their patients who are using tobacco products to use e-cigarettes as a primary cessation aid.

- If a patient has failed initial treatment, has been intolerant to or refuses to use conventional smoking cessation medication, and wishes to use e-cigarettes to aid quitting, it is reasonable to support the attempt. However, patients should be informed that although e-cigarette aerosol is likely to be much less toxic than cigarette smoking, the products are unregulated, may contain low levels of toxic chemicals, and have not been proven to be effective as cessation devices. In the absence of long-term safety studies of e-cigarette use, it may be appropriate to advise the patient to consider setting a quit date for their e-cigarette use and not to plan to use it indefinitely (unless needed to prevent relapse to cigarettes).
- It is also important to stress that patients should quit smoking cigarettes entirely as soon as possible, because continued cigarette smoking, even at reduced levels, continues to impose tobacco-induced health risks.

For patients with existing CVD or stroke, or at risk of a CVD event, intensive cessation counseling and pharmacotherapy should be offered as soon as possible.

CVD indicates cardiovascular disease; e-cigarette, electronic cigarette.

Bhatnagar A et al. Electronic Cigarettes: A Policy Statement from the American Heart Association. Circulation. 2014;1524-4539.

How to advise smokers interested in using e-cigarettes to quit

- Be supportive of quit attempts
- Advise them on the unknown long-term health effects of e-cigarettes (single product or dual use)
- Explore what they have tried in the past to quit (counseling, NRT, pharmacotherapy) and try alternative options

What to discuss with patients using e-cigarettes

- Reasons for use
- Extent of use
 - Important to consider all sources of nicotine
- Openness to switching to FDA-approved cessation medications
- Setting a quit date for e-cigarettes in addition to cigarettes

EXAMPLE CASES

Case

- Mr. S, a 46 y/o long term smoker, comes in for a regular followup visit
- You address his smoking at every visit, however he has never been ready to quit
- He is excited to tell you that he wants to try quitting with ecigarettes, which "worked wonders" for his neighbor
- How would you counsel Mr. S?

- Congratulate him on wanting to quit smoking and take a positive step toward improving his health
- E-cigarettes are just undergoing regulation and long-term health effects remain unknown
- While some people find success with e-cigarettes, efficacy as a quit aid is unknown
- Explore interest in nicotine replacement therapy, bupropion, varenicline

Case

- Ms. T, a 30 y/o patient who has been smoking for the past 15 years is here for follow-up
- When you ask about her smoking, she says that she has been using e-cigarettes to help her quit for the past month
- She has gone from 1 pack a day to ½ pack per day in that time
- What else would you talk to Ms. T about?

- She says that the patch gave her a rash and didn't help
- She says "she hates the taste" of the gum
- She is not interested in varenicline or bupropion because of concerns about side effects
- She says that she spent a lot of money on the e-cigarette kit and flavored refills and is unwilling to try anything else
- Next steps?

- Advise about unknown health effects long-term
- Set a quit date for cigarettes, followed by one for e-cigarettes as well
- Ensure close follow-up to monitor success with cessation plan

E-CIGARETTES: POLICY CONSIDERATIONS

New FDA Regulations

- No sales to those <18 years old
- No vending machine sales except in adult-only venues
- No free samples
- Manufacturers cannot make unsubstantiated health/risk claims
- As of 2018, need warning on products/advertisements:
 - "WARNING: This product contains nicotine. Nicotine is an addictive chemical."

New FDA Regulations

- Application as "new" tobacco products
- Submit list of ingredients in products and quantities of harmful and potentially harmful constituents

State Regulations



E-CIGARETTES: CONCLUSIONS

Evolution of products, health risks, and use patterns



Population health effects will depend on (currently unknown) long-term e-cigarette health risks and use patterns

Conclusions

- E-cigarette awareness and use is rising among adults and youth
- Will likely be years until long-term health effects of e-cigarettes are discovered
- Further research is needed to determine the efficacy of ecigarettes for smoking cessation

THANK YOU! QUESTIONS?

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