

**adha** **CELL 2015**  
**92<sup>ND</sup> ANNUAL SESSION** **JUNE 17-23\*2015**  
**SESSION** **NASHVILLE, TN**

**CE Course Handout**

**E-cigarette-A Friend or A Foe?**

**Saturday, June 20, 2015**  
**2:00pm-4:00pm**



American  
Dental  
Hygienists'  
Association

## Objectives

Upon completion of this course the participants will be able to:

- Discuss nicotine addiction and harm reduction in tobacco control
- Recognize limitations of nicotine replacement therapies
- Recognize different types and parts of e-cigarettes
- Discuss role e-cigarettes in harm reduction and cessation
- Evaluate safety, benefits and disadvantages of e-cigarettes
- Describe the current status and future directions of e-cigarettes regulations in US

• VPatrounova

• 2

## Smoking by Age Groups

- 17.3% of adults aged 18–24 years
- 21.6% of adults aged 25–44 years
- 19.5% of adults aged 45–64 years
- 8.9% of adults aged 65 years and older

- 2013—**18.1%** of American adults smoked
  - 42.1 million
  - 20.5% men and 15.8% women

- 70% of adult smokers want to quit

Source:  
[http://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/adult\\_data/cig\\_smoking/index.htm](http://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm)



• VPatrounova

• 3

## Nicotine Addiction

- Nicotine enters the brain faster than IV drugs and trigger chemical reactions
  - Acetylcholine—increased HR and alertness
  - Dopamine and endorphins—pleasure and increased working memory
- Physical dependence
- Emotional and mental dependence make it hard to stay away from nicotine after you quit
- To quit and stay quit smokers must deal with both the physical and mental dependence



• VPatrounova

## Harm Reduction

- A strategy to reduce harm to an individual or society by modifying hazardous behavior that is difficult to prevent
  - Seat belts
  - Promotion of safe sex
  - Needle exchange for drug addicts
- Harm reduction in tobacco control—cutting down, modified cigarettes, smokeless product, nicotine replacement therapies (NRTs) and electronic cigarettes
- Can contribute to significant reductions in smoking prevalence

• VPatrounova

• 6

## Harm Reduction in EU

- Snus in Sweden and inhaler in UK
- National Institute for Health & Care Excellence, UK
- Royal College of Physicians report "Harm Reduction in Nicotine Addiction" (2007)
- Some smokeless tobacco products are 90% less harmful than cigarettes
- Promoting ST can reduce smoking by 1-3%
- Switch of 1% could save 60,000 lives in 10 years in UK



• VPatrounova

## Harm Reduction in US

- National Cancer Institute— "all tobacco products should be strongly discouraged"
- FDA can evaluate and approve safer tobacco products
- CDC doesn't consider smokeless tobacco safe
- Tobacco companies cannot market smokeless products as less risky



• VPatrounova

• 8

## Limitations of NRTs

- Do not deliver nicotine in the same way
- Lack of behavioral characteristics
- Lack of social acceptability
- Lower level of nicotine
- Expensive
- Modest impact
  - Quit rate 50-70%
  - Cigarette-free at 52 weeks 7-10% (without behavioral support)
- Many smokers would like a safer alternative (similar to smoking ritual)



© VPatrounova

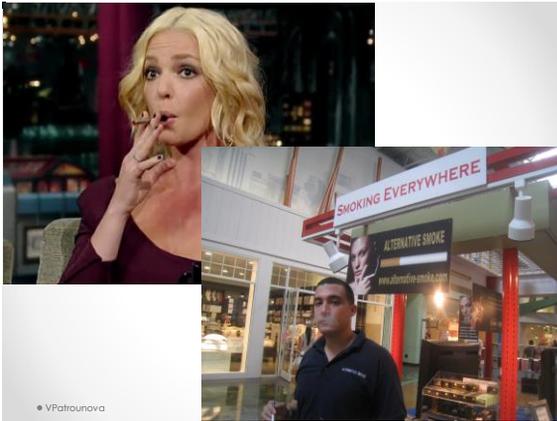
## Electronic Cigarettes

- Mimic smoking
- Relatively inexpensive
- Consumer support (>5 mln e-cigarettes blogs)
- Market position—lifestyle rather than a medical product
- If nicotine delivery can be improved they have a potential to reduce prevalence of smoking



© VPatrounova Welcome to ECF, the largest e-cigarette website in the world.

© 10



© VPatrounova

## History of Electronic Cigarettes

- 1963—patented by Herbert Gilbert
- 2003—marketed in China
- 2004—introduced in US
- 2008—used by 4 million in US
- 2009—FDA sampled e-cigs
- 2012—\$2 billion industry
- 2014—FDA proposed the regulations
- 2016—will require a license and compliance with quality standards (UK)

© VPatrounova

© 12

## Many Names Same Product?

- Look like cigarettes, cigars, and pipes
- Electronic Nicotine Delivery Device (ENDD) or System (ENDS)
- Steam cigarettes
- Vaper cigarettes
- Hookah vapor pen
- Pen vaporizer



© VPatrounova

© 13

## Disposable E-cigarettes



© VPatrounova

© 14

## Rechargeable E-cigarettes



• VPatrounova

• 15

## E-Cigarettes Structure

1. Battery-operated heating element
2. Atomizer—converts the contents of the cartridge into a vapor
3. Replaceable cartridge (nicotine and flavorings in propylene glycol)



Battery operated heating element

Atomizer

Replaceable cartridge with liquid

• VPatrounova

• 16

## Top Brands

**TOP** e-cigarette reviewed.com  
This table is based on 201 user reviews

Rank	Name	Price	Discount Coupon	Arrival	Rating	Info
1	V2 CIGS	\$49.95	SAVE 10% CHECK OUT NOW	1-3 Days	★★★★★ Read Review	Visit Site
2	Green smoke	\$69.97	SAVE 10% CHECK OUT NOW	1-3 Days	★★★★★ Read Review	Visit Site
3	WHITE CLOUD	\$49.95	SAVE 10% CHECK OUT NOW	1-3 Days	★★★★★ Read Review	Visit Site
4	POWER PUFFERS	\$59.99	SAVE 10% CHECK OUT NOW	1-3 Days	★★★★★ Read Review	Visit Site
5	SMOKE	\$59.99	SAVE 10% CHECK OUT NOW	1-3 Days	★★★★★ Read Review	Visit Site
6	Vapor OUTURE	\$79.95	SAVE 10% CHECK OUT NOW	1-3 Days	★★★★★ Read Review	Visit Site
7	blu	\$69.95	SAVE 10% CHECK OUT NOW	4-7 Days	★★★★★ Read Review	Visit Site

• VPatrounova

• 17

## E-cigarette Liquid

- E-cigarette liquid (water, propylene glycol, glycerin, nicotine and flavorings)
  - Glycol and glycerol—upper airway irritants
  - Glycol mist—dry out mucous membranes and eyes
  - Various level of flavorings
  - Low levels of tobacco-specific nitrosamines (TSNA) and diethylene glycol (= similar to levels in a nicotine patch)
  - Glycerin, propylene glycol—no cytotoxic effects



• VPatrounova

• 17

## Nicotine in ENDD

- Deliver a spray of nicotine
- Standard dose—8-24 mg/ml per cartridge (up 100!)
- Variable level of nicotine exposure (14.8-87.2 mg/mL)
- High nicotine concentration in cartridges
- Inconsistent product labeling
- Travers, M. (2014) analyzed nicotine content
  - 32 e-cigs
  - 1 out of 4 differed by more than 20%
  - Nicotine was found in "nicotine-free" e-cigs
- Vapers can exceed nicotine blood level of traditional smokers

• VPatrounova

• 20

## Carcinogens in E-Cigarettes

- FDA detected diethylene glycol and formaldehyde (2009)
- FDA issued warning letters for various violations (unsubstantiated claims and poor manufacturing practices) of the Federal Food, Drug, and Cosmetic Act (FDCA)
- Study from France (2013)
  - Formaldehyde—carcinogen
  - Acrolein—carcinogen, chemical weapon
  - Nickel and chromium



• VPatrounova

• 21

## Electronic Cigarette Use

- Majority of users—former smokers
- Higher in younger than in older smokers
- Attractive, affordable and available
- To cut down, to reduce harm or to quit smoking
- Using instead of NRTs



• VPatrounova

• 23

## E-cigs Survey

- 1,347 people from 33 countries
- Average age—43 years, 70% were male and 96% were of white ethnic origin
- Used for smoking cessation for longer duration than NRTs
- Users believe them to be safer
- 75% didn't smoke for several weeks or months
- 91% reported 'substantially decreased' craving for tobacco cigarettes
- 70% didn't have as much of an urge to smoke

• VPatrounova

•

## Inhalation Effects

- Climate conditions
- Air flow
- Room size
- Number of users in the vicinity
- Type(s) and age of systems being used
- Battery voltage
- Puff length and interval between puffs
- User characteristics
  - Age
  - Gender
  - Experience
  - Health status



• VPatrounova

• 25

## ENDD and Heart

- Farsalinos (2012) Greece
- 42 healthy volunteers (age 25-45 years)
  - 20 regular cigarette smokers
  - 22 ex-smokers using e-cigarettes
- Baseline echocardiogram and hemodynamic measurements
- Exposure
  - 1 cigarette (1mg nicotine, 10mg tar, 10mg CO)
  - E-cig for 7 min ( 11mg/ml nicotine)
- Repeat echocardiogram and hemodynamic measurements
- No acute adverse effects on cardiac function

• VPatrounova

• 26

## ENDD and Airways

- Gratzou (2012), Greece.
- Instant increase in airway resistance that lasted 10 min
- American Lung Association—secondhand vapor emissions from e-cigs -formaldehyde, benzene and TSNAs



• VPatrounova

• 27

## Physiological Effects of Acute Exposure

- Mouth and throat irritation and dry cough
- No change in heart rate, carbon monoxide level, or plasma nicotine level
- Decrease in respiratory flow resistance similar to cigarette use
- No change in complete blood count (CBC) indices
- No change in lung function
- No change in cardiac function
- No increase in inflammatory markers
- Menthol—negative impact on periodontal ligament fibroblasts

Source: Callahan-Lyon P. Electronic cigarettes: human health effects.

• VPatrounova

• 28

## ENDD and Desire to Smoke

- Bullen, C. (2013) New Zealand
- 657 participants—adult cigarettes smokers wanting to quit
  - 289—16 mg ENDD
  - 73—0 mg ENDD
  - 295—patch
- Modestly effective, similar to patch, few adverse events
- Further studies—longer-term safety, potential for long-term use and efficacy as a cessation product

• VPatrounova

• 30

## ENDD and Smoking Reduction

- Polosa et al. (2011)
- 6 month study
- 40 participants unwilling to quit
- Side effects—sore throat, irritation and dry cough
- Results:
  - 50% reduction in cigarette smoking
  - 22.5% overall quit rate
  - EC is proved to be helpful in tobacco cessation



• VPatrounova

• 31

## Benefits of E-Cigarettes

- Less nicotine absorbed (200°C vs 800°C)
- Fewer toxic chemicals
- Deal with chemical and behavioral aspects
- Smoking reduction, relapse prevention and cessation
- No serious adverse effects reported



• VPatrounova

• 32

## Hazards of E-Cigarettes

- Side effects: sore throat, irritation and dry cough
- Sub-standard manufacturing process (diethylene glycol, and other toxins)
- Allow "smoking" in smoke-free areas => increase nicotine exposure
- Delay cessation/dual use



• VPatrounova

• 34

## E-Cigarettes & Youth

- Novelty of the technology
- Price and advertisement sensitive
- Fruit and candy flavors (cotton candy, bubble gum, Atomic fireball, orange cream soda)
- Can be refilled with other substances



• VPatrounova

• 35

## E-Cigarettes & Youth

- Cross sectional analyses of data of 2011 and 2012 National Youth Tobacco Survey
- 2012—6.8% in 6-12th grades report ever using (2011-3.3%)
  - 2012—2.1% in 6-12th grades current users (2011-1.1%)
  - Among ever users—20% middle school and 7.2% high school users never smoked (overall 9.3%)
  - 2013—4.5% of high school students (660,000)
  - 2014—13.4% (2 million)



• VPatrounova

## Public Health Issues

- Waste
- Second- and third- hand vapor
- Nicotine toxicity due to high % (1 g of nicotine in refill bottle)
- Attempted and completed suicide

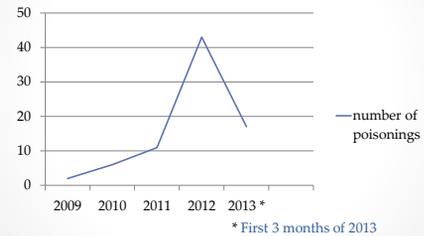


• VPatrounova

• 37

## Poisonings from E-cigs

CDC—Increased number of poisonings (2009-13)



• VPatrounova

• 38

## Poisonings

- Ingestion, inhalation or absorption through the skin or eyes
- Nausea, vomiting and eye irritation
- Sept 2010—1 call per month
- Feb 2014—215 calls per month
- 51% calls—children under age 5
- 42% calls—age 20 and older
- Suicides —IV and ingestions of liquid nicotine



• VPatrounova

• 39

## Exposure Risks for Non-Users

- Depends on nicotine concentration
- Nicotine from aerosol remains on the surfaces React with nitrous acid (gas appliances)
- Produces TSNAs
- Inhale, ingest or dermal exposure to TSNAs

Note: Exhaled aerosol shows traces of TSNAs—  
9 to 450 times less than smoke (=nicotine inhaler)



• VPatrounova

## “Second-hand” Vapor

- Pellegrino, R. (2012) evaluated emissions from e-cigarettes and conventional cigarettes
  - 15 times lower than emissions after use of traditional cigarettes
  - Less danger for second-hand and third-hand exposure
- Goniewicz, M. (2013) analyzed “second-hand” smoke
  - Exposure to nicotine- 10 times less
  - Future research needed on emission of formaldehyde, acetaldehyde and acrolein
  - Found nicotine residue on indoor surfaces after ENDD use
  - Can a second-hand exposure reinforce addiction?

• VPatrounova

• 42

## Recent Headlines

Will FUS city health officials want tighter restrictions on e-cigarettes

Comment Now

The first time cigarettes, it ultimately decides to lifesaving al



But the agency will stop short of steps that many public health advocates and some members of Congress have called for.

But the agency will stop short of steps that many public health advocates and some members of Congress have called for.

Flights from H to ANC

CheapClear.com

Call Toll Fr 1-888-516-

Health Connect

• VPatrounova

## Tobacco Products Regulated by FDA

- Cigarettes and cigarette tobacco
- Roll-your-own tobacco
- Smokeless tobacco
- Cigars - **NO**
- Pipe tobacco- **NO**
- Dissolvable products - **NO**
- Waterpipe tobacco - **NO**
- E-cigarettes - **NO**

Source: <http://www.fda.gov/Tobacco/Products/Labeling/ucm388395.htm>

• VPatrounova

• 44

## FDA Proposed Rules on ENDD (2014)

- The age limit to buy products—18
- Health warnings about the potential for addiction to nicotine
- The sale of products in vending machines would be prohibited
- Manufacturers would be required to register all their products and ingredients
- Provide scientific evidence before any claims
- No free samples



• VPatrounova

## FDA Proposed Rules on ENDD

- Public comments till **July 2<sup>nd</sup>, 2015**
- 135,000 public comments
- 31 health and medical groups (the American Academy of Pediatrics, the American Academy of Family Physicians and the American Heart Association ) wrote a letter to President Obama
- Gateway to other tobacco products?
- 42 states and 1 territory currently prohibit the sale of e-cigarettes or vaping/alternative tobacco products to minors

• VPatrounova

• 45

## Future of Tobacco Control

- Goal to eliminate cigarette smoking and tobacco in 50 years
- Provide full access to cessation programs
- Only 50% of population is covered by smoke-free laws
- Warnings on e-cigarettes and other products
- Strict regulations to prevent teens from smoking
- Increase taxation and make tobacco more expensive



•

## Concerns

- Not childproof
- Advertising and promotion of e-cigarettes
- Unregulated
- Uncertainty about quality standards and performance
- Risk of sustained dual use
- Involvement of tobacco industry



• VPatrounova

## Future Research

- Differences in product engineering, components and toxicity of ENDD
- Content and emission characteristics
- Absorption characteristics
- Potential for addiction
- Long-term effects of use
- 53 scientists believe it can be part of the solution!



• VPatrounova

## Conclusion

- Fewer toxicants but no adequate data on long-term effects
- Respiratory effects
- Increasing number of users
- Second and third hand aerosol exposure need further evaluation
- With proper regulations and manufacturing oversight may facilitate smoking cessation

## Questions???



Save the Date!

**adha CLL2016**  
**93RD ANNUAL SESSION**  
**JUNE 8-14, 2016 / PITTSBURGH, PA**

## References

1. Brown, Beard, Katz, Michie & West. Real-world effectiveness of e-cigarettes when used to aid smoking cessation: a cross-sectional population study. *Addiction*, May 2014
2. Bullen C., & others. Electronic cigarettes for smoking cessation: a randomised controlled trial. *Lancet*, November 2013. [http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(13\)61842-5/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)61842-5/abstract)
3. Callahan-Lyon P. Electronic cigarettes: human health effects. *Tobacco Control*, 2014 May; 23(Suppl 2): ii36-ii40.
4. [www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/adult\\_data/cig\\_smoking/index.htm](http://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm)
5. Czogala, J. & others. Secondhand Exposure to Vapors From Electronic Cigarettes. *Nicotine & Tobacco Research*, 2013
6. Dawkins L, Turner J, Roberts A, and Soar K. "Vaping" profiles and preferences: an online survey of electronic cigarette users. *Addiction*, Volume 108, Issue 6, pages 1115-1125, June 2013
7. Fagerstrom K., Bridgman K. Tobacco Harm Reduction: The Need for New Products that Can Compete with Cigarettes. *Addictive Behavior* (2013)
8. Farsalinos K. & others. Acute effects of using an electronic nicotine-delivery device (e-cigarette) on myocardial function: comparison with the effects of regular cigarettes. *European Heart Journal* (2012) 33 | Abstract Supplement 1, 203
9. *FDA Warns of Health Risks Posed by E-Cigarettes*. [www.fda.gov/downloads/forconsumers/consumerupdates/](http://www.fda.gov/downloads/forconsumers/consumerupdates/) Extracted on May 23rd 2014.

## References

10. Gennimata, A & others. Acute effect of e-cigarette on pulmonary function in healthy subjects and smokers.
11. Goniewicz M., & others. Nicotine Levels in Electronic Cigarettes. *Nicotine and Tobacco Research*, April 22, 2012.
12. King B, et al. Awareness and Ever Use of Electronic Cigarettes Among U.S. Adults, 2010-2011. <http://ntr.oxfordjournals.org/> Extracted May 22nd, 2014.
13. New CDC study finds dramatic increase in e-cigarette-related calls to poison centers. <http://www.cdc.gov/media/releases/2014/p0403-e-cigarette-poison.htm> Extracted on May 2nd 2015.
14. Notes from the Field: Electronic Cigarette Use Among Middle and High School Students — United States, 2011-2012. *September 6, 2013 / 62(35):729-730*. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6235a6.htm>
15. Notes from the Field: Calls to Poison Centers for Exposures to Electronic. April 4, 2014 / *63(13):292-293*. [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6313a4.htm?s\\_cid=mm6313a4\\_w](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6313a4.htm?s_cid=mm6313a4_w)
16. Polosa R. & others. Effect of an electronic nicotine delivery device (e-Cigarette) on smoking reduction and cessation: a prospective 6-month pilot study. *BMC Public Health*, 2011.
17. Robehmed N. E-cigarette Sales Surpass 1 Billion as Big Tobacco Moves in. <http://www.tobes.com/> Extracted on May 22nd 2014
18. <http://www.cigbuyer.com/disposable-vs-rechargeable-e-cigarettes/>
19. <http://store.blucigs.com/disposables/>