

# **CDL 2015** **92<sup>ND</sup> ANNUAL 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

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## 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)



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## 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



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## 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

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## 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



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## 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



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## 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)



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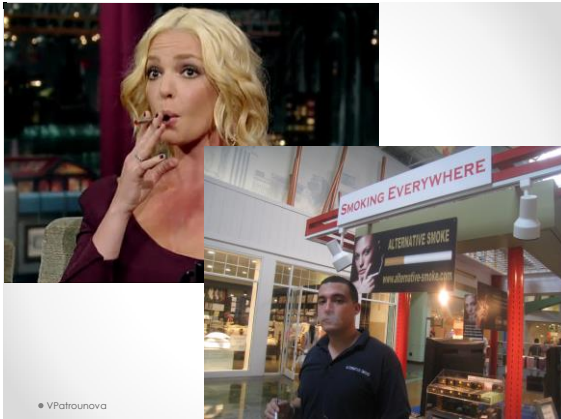
## Electronic Cigarettes

- 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



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## 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)

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## 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



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## Disposable E-cigarettes



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## Rechargeable E-cigarettes



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## 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)



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## 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 Review	1-3 Days	★★★★★ Read Review	Visit Site
2	Green smoke	\$69.97	SAVE 10% Check Review	1-3 Days	★★★★★ Read Review	Visit Site
3	WHITE CLOUD	\$49.95	SAVE 10% Check Review	1-3 Days	★★★★★ Read Review	Visit Site
4	Revlon e-smoker	\$59.99	SAVE 10% Check Review	1-3 Days	★★★★★ Read Review	Visit Site
5	SMOKE	\$59.99	SAVE 10% Check Review	1-3 Days	★★★★★ Read Review	Visit Site
6	Vapor FUTURE	\$79.95	SAVE 10% Check Review	1-3 Days	★★★★★ Read Review	Visit Site
7	blu	\$69.95	SAVE 10% Check Review	4-7 Days	★★★★★ Read Review	Visit Site

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## 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



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## 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

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## 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



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## 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



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## 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

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## 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



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## 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

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## 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 TSNA



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## 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.

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## 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

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## 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



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## 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



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## 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



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## 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



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## 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)



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## 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

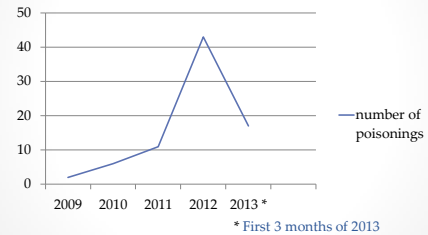


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## Poisonings from E-cigs

CDC—Increased number of poisonings (2009-13)



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## 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



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## 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)



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## "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?

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## Recent Headlines

**Will F**  
**The E**  
**US city health officials want tighter**  
**restrictions on e-cigarettes**

Comment Now

Published May 02, 2014 - Readers

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## 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/TobaccoProducts/Labeling/ucm388395.htm>

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## 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



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## FDA Proposed Rules on ENDD

- Public comments till **July 2nd, 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

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## 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



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## 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



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## 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!



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## 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

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## Questions???



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