

Emerging Trends: E-Cigarettes, Hookah & Beyond

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The Truth about Vaping & Electronic Cigarettes
California School Based Health Alliance

Webinar

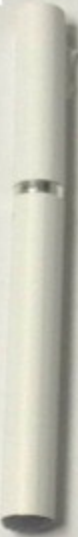
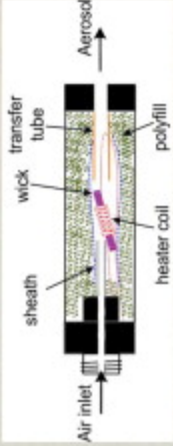
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E-Cigarettes

- **Nicotine Addiction: The Next Generation**
 - Aerosolizes Nicotine Laced Propylene Glycol, Glycerin, and Flavorings
 - Long Term Health Impact Unknown
 - Cessation Aid or Promoter of Nicotine Addiction and Continued Tobacco Use
 - Explosion in Popularity especially among youth; Emergence of a New Vaping Subculture
 - Little Regulation

E-Cigarettes: A Moving Target

- 400+ makes and models
 - Closed systems; cig-a-likes
 - Open systems; tanks
 - Hookah Pens, Vape Pens
- 8000+ Flavorings
 - Menthol
 - All Banned FDA flavors
- Tax the Liquid; the Nicotine; the Device



A



B



C

E-Pens; E-Hookah Pens

- Cherry, Chocolate,
- Vanilla, Bubblegum



E-Cigars

- Swisher Sweets E-cigars (Swisher International)



The E-Cigarette Explosion

- **Market Size Continues to Increase**
 - retail sales are over \$2B currently;
 - **\$10B by 2017.**
- **E-cigs could surpass consumption of conventional cigs within the next decade (by 2023).**

(Herzog, 2014)

Youth Using E-Cigarettes More than Regular Cigarettes

- **8th Grade:** 9% e-cigarette; 4% regular cigarettes
- **10th Grade:** 16% e-cigarette; 7% regular cigarettes
- **12th-Grade:** 17% e-cigarette; 14% regular cigarettes (MTF, 2014)

Adult E-Cig Use 2014

- Overall
 - Lifetime 14.1%
 - Past-month 4.8%
- Smoking Status
 - Current Smokers 49.5%
 - Former 14.7%
 - Never 4.1%

(Caraballo et al., 2014)

Kids Exposed to E-Cig Ads

- Between 2011 and 2013 exposure to e-cigarette TV ads increased by:
 - 256% among adolescents ages 12 to 17
 - 321% among young adults, ages 18 to 24.
- Approximately 76% of the ads seen by each of the two age groups occurred while watching cable networks

– (Duke et al., 2014)

Youth E-Cig Use Continues to Rise

- **Youth Smoking Rates Fall; E-Cigarette Use Rises**
 - Tobacco Use 22.9% in 2013 - -24.3% in 2011.
 - E-Cigarettes Use Tripled to 4.5% in 2013 from 1.5% in 2011.
 - 13% of High School Students
 - (CDC, 2014; CDC 2015)

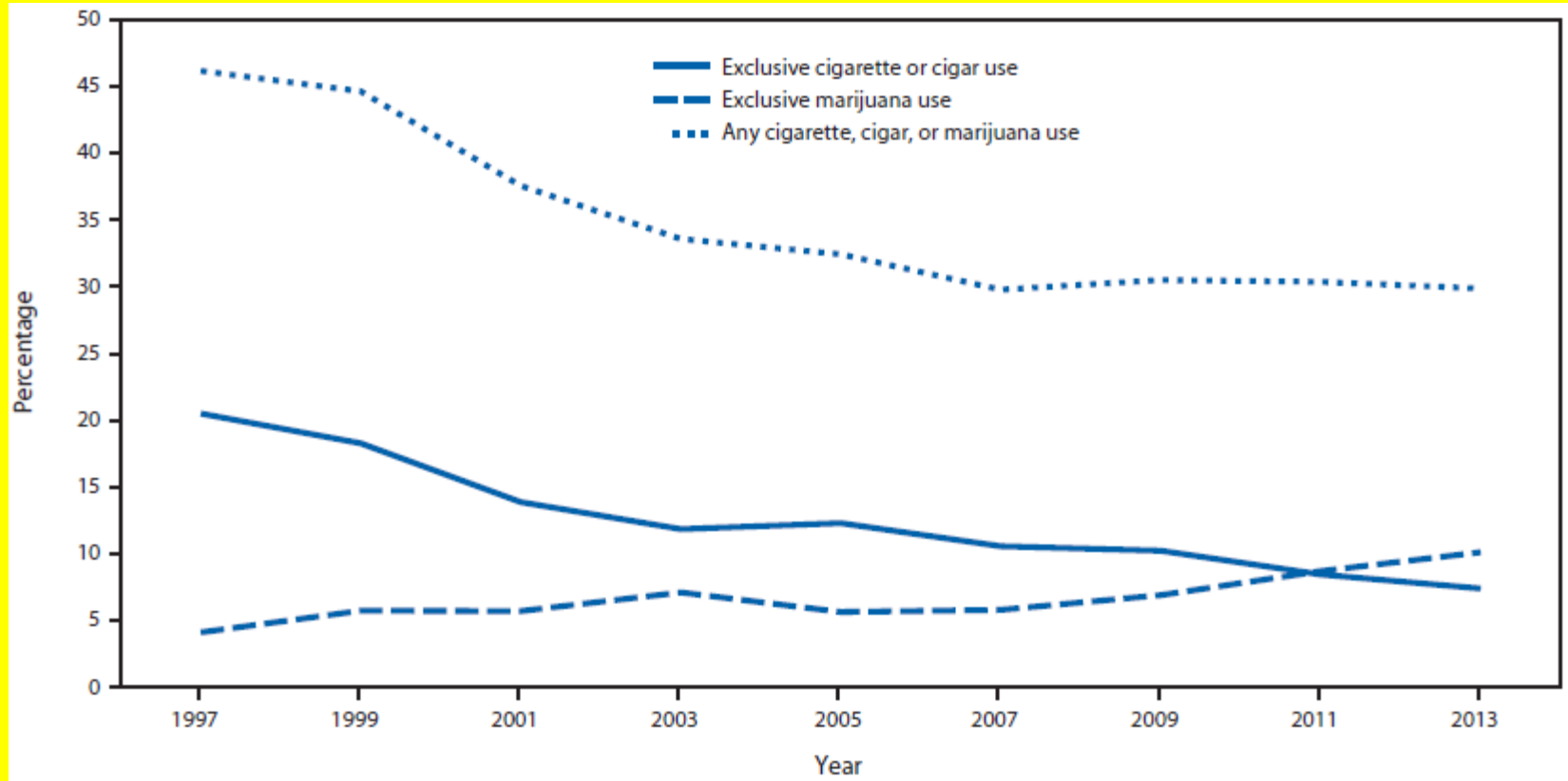
Association of Electronic Cigarette Use With Initiation of Combustible Tobacco Product Smoking in Early Adolescence

- In Los Angeles over 2500 9th graders filled out baseline and follow-up surveys including questions about cigarette and e-cigarette use
 - **Those who had ever used e-cigarettes at baseline compared with nonusers were more likely to report initiation of combustible tobacco use over the next year.** (Leventhal et al., 2015)

High School Students' Use of Electronic Cigarettes to Vaporize Cannabis

- Nearly 4000 High School Students in Connecticut completed an anonymous survey
 - **27% who have used both marijuana and e-cigarettes reported using e-cigarette aerosolizers to vaporize cannabis including hash oil, and wax THC.** (Morean et al., 2015)

Prevalence of exclusive cigarette or cigar use, exclusive marijuana use, and any cigarette, cigar, or marijuana use (MMWR, 2015)



Dabbing

- Dabbing: Inhaling the vapors from a concentrated form of marijuana made by an extracting THC using butane gas.
- Dabs, also known as butane hash oil (BHO) — "budder," "honeycomb" or "earwax"

THC Concentrate (BHO)



Dabbing



3 in 1: Herb, Liquid or Wax



E-Cig Tank Systems & Dabbing



Vape Shops on the Rise

- It is estimated that there are somewhere between 6,000-7,000 Vape Shops in the U.S.
 - Smoke Shops
 - Convenience Stores
 - Liquor stores
 - Drug Stores
 - Markets

(Bour, Vape Mews Magazine, 2015)

Vape Shops on the Rise

- **The "Starbucks of E-vapor"**
 - Tank systems; Refills; Mix-your-Own
 - Vapers can hang out, work, socialize and vape
 - Purchase products; sample new ones
 - Eating and Drinking
 - The 21st Century Bar / Head Shop
- (Herzog, 2014)

New Bluetooth E-Cigarette Lets You Vape AND Receive Calls, Listen to Music



Cloud Contests



E-Cigarette Liquid: The “Juice”



E-Cigarette Liquid Ingredients

Distilled Water

Propylene Glycol

Vegetable Glycerin

Nicotine Concentrate

Artificial Flavoring



E-Cigarette Liquid: The “Juice”

- E-Cigarette Liquid contains:
 - **Nicotine**, extracted from tobacco leaves
 - Large variation in content between and within brands (Cheah et al 2012; Trtchounian et al 2011; Goniewicz et al 2013)
 - Lethal if ingested; 60 mg Adult; 6 mg Children
 - Detrimental to fetuses (Martz, 2009)
 - Tobacco specific nitrosamines (TSNAs) (Laugesen, 2008; Westenberger, 2009; Goniewicz et al 2013)
 - 1.2mg of nicotine in each cigarette, or 24mg of nicotine per pack (1.2mg x 20 cigarettes)= ~ 1 e-cigarette

Nicotine Is Not Benign

- Nicotine can be acutely toxic; Poisonous and addictive
- Nicotine activates multiple biological pathways through which smoking increases risk for disease.
- Nicotine exposure during fetal development has a lasting adverse consequences on brain development and contributes to multiple problematic birth outcomes including low birth weight and still birth

E-Cigarette Liquid: The “Juice”

- E-Cigarette Liquid contains:
 - **Propylene Glycol** - the vapor; the fog
 - FDA approved food additive (humectant, solvent for colors and flavors), cosmetics, and medicines.
 - Short term exposure causes eye, throat, and airway irritation (Wieslander et al 2001; Vardavas et al 2012,)
 - Long term exposure can result in children developing asthma. (Choi et al 2010)
 - Chemical composition changes when heated (Henderson et al, 1981)

E-Cigarette Liquid: The “Juice”

- E-Cigarette Liquid contains:
 - **Glycerin:** A humectant used instead of or in combination with propylene glycol in EC fluids for aerosol production.
 - FDA Approved for ingestion.
 - Slightly hazardous in case of skin and eye contact, ingestion, and inhalation; prolonged exposure may cause organ damage.
 - **Metals**
 - Tin particles found in E-liquid (Williams et al., 2013)

E-Cigarette Liquid: The “Juice”

- E-Cigarette Liquid contains:
 - **Flavorants. Key one Menthol; Candy flavoring**
 - Anesthetic effects,,; promotes deeper inhalation; greater cell permeability
 - Allows the poison to go down easier!
 - Not GRAS! Ingestion vs. Inhalation
 - 8000+ flavors; appeals to kids (bubblegum, strawberry, gummy bears, etc.)
 - Exotic for adults (Sex on the Beach, Aces and 8’s)
- Mix your Own (ala roll your own)

The Aerosol: Its Not Just Water Vapor

- **E-Cigarette Aerosol Contains:**
 - Propylene glycol, glycerol, flavorings, and nicotine, which are found in the e-liquid, are also found in the e-vapor
 - Propylene oxide
 - Volatile Organic Compounds: Benzene and Toluene
 - **Menthol**

The Aerosol: Its Not Just Water Vapor

- **E-Cigarette Aerosol Contains:**
 - **Carbonyl Compounds:** Formaldehyde, acetaldehyde, and acrolein
 - **Metals:** tin, silver, iron, nickel aluminum, sodium, chromium, copper, magnesium, manganese, lead, potassium and silicate nanoparticles
 - **Tobacco specific nitrosamines (TSNAs)** carcinogenic compounds found in tobacco and tobacco smoke.
 - (Schripp et al, 2012; Westenberger 2009; Goniewicz et al, 2013; Williams et al, 2013; Henderson, 1981)

Flavorings GRAS? Not For Inhalation

- GRAS certification by the Flavor Extracts Manufacturers Association (FEMA) pertains only to ingestion, not inhalation.
 - “E-cigarette manufacturers should not represent or suggest that the flavor ingredients used in their products are safe because they have FEMA GRAS™ status for use in food because such statements are false and misleading.”
 - (FEMA, 2015)

Flavorings GRAS? Not For Inhalation

- Aldehydes toxicologically are primary irritants of the mucosa of the respiratory tract
- The lungs have a different spectrum of toxicity than the intestinal tract, substances known to be safe when swallowed can still be dangerous when inhaled

– (Williams, James, and Robert, 2015)

Evaluation of Electronic Cigarette Liquids and Aerosol for the Presence of Selected Inhalation Toxins

- diacetyl (DA) and acetyl propionyl (AP) are chemicals approved for food use but are associated with respiratory disease when inhaled.
- 159 distinct liquids and aerosols were analyzed
 - **DA and AP were found in 74.2% of the samples** (Farsalinos, et al 2014)

Diacetyl: Popcorn Lung

- “Popcorn lung” comes from inhaling diacetyl, a chemical widely used in the flavor industry to simulate dairy (e.g. butter, cheese, yogurt), fruit flavors (e.g. strawberry, bananas), and so-called brown flavors (e.g. coffee, butterscotch)
- In flavoring-induced lung disease, the tiny bronchial passages located near the air exchanging alveoli become gradually scarred shut. One can become progressively shorter of breath due to poor oxygen absorption
- Diacetyl has been found in many e-cigarette vapors, especially sweet flavors.
 - (Tierney et al., 2015; Farsalinos, 2014)

E-Cigarette Emit Metals used in Their Manufacturing

- Zinc and Nickel concentrations were found to be higher in e-cigarette emissions compared to conventional Cigarette emissions, originating from the cartridges holding the e-liquids.
- “Considering the potential adverse health effects associated with the inhalation of these metals (particularly Ni and Zn, and the emission observed both in our analysis as well as the study by Williams et al.13), attention should be directed toward eliminating the use of these metals in the cartridges during the manufacturing process of e-cigarettes.”
 - (Saffari et al., 2014)

E-Cigarettes: The Second Generation

- **1st Generation:**
 - Cig-a-likes; Most Toxins Emitted in the Aerosol Lower than Regular Cigarettes (Goniewicz et al., 2013)
 - Aerosolizing Temperature 100 – 250c
- **2nd Generation**
 - Tank Systems; refillables
 - Some Toxins Emitted Approaching Levels found in Regular Cigarettes
 - Aerosolizing Temperatures Sometimes >250c

As Battery Voltage Increase, Toxins Increase

- On Average, Toxins were 13 – 807 Fold Lower than Tobacco Cigarettes
- **However**, when voltage was increased from 3.2 to 4.8V:
 - 4 to over 200 times increase in formaldehyde, acetaldehyde, and acetone levels
 - The levels of formaldehyde were in the range of levels reported in tobacco smoke

(Kosmider et al., 2014)

Secondhand Vaping and Nicotine

- The levels of airborne nicotine and cotinine concentrations in the homes with e-cigarette users were significantly higher than control homes. **“Our results show that non-smokers passively exposed to e-cigarettes absorb nicotine.”**

– (Fernandez et al., 2014)

E-Cig Aerosol Composition

- Propylene glycol
- glycerin
- Flavorings (many)
- **Nicotine**
- **NNN**
- **NNK**
- NAB
- NAT
- **Ethylbenzene**
- **Benzene**
- P,m, xylene
- **Toluene**
- **Acetaldehyde**
- **Formaldehyde**
- **Naphthalene**
- **Styrene**
- **Benzo(b)fluoranthene**
- Chlorobenzene
- **Crotonaldehyde**
- **Propionaldehyde**
- Benzaldehyde
- Valeric acid
- Hexanal
- Fluorine
- Anthracene
- Pyrene
- Acenaphthylene
- Acenaphthene
- Fluoranthene
- **Benz(a)anthracene**
- **Chrysene**
- Retene
- **Benzo(a)pyrene**
- **Indeno(1,2,3-cd)pyrene**
- Benzo(ghi)perylene
- **Acetone**
- **Acrolein**
- Silver
- **Nickel**
- Tin
- Sodium
- Strontium
- Barium
- Aluminum
- **Chromium**
- Boron
- Copper
- **Selenium**
- **Arsenic**
- **Cadmium**
- Silicon
- Lithium
- **Lead**
- Magnesium
- Manganese
- Potassium
- Titanium
- Zinc
- Zirconium
- Calcium
- Iron
- Sulfur
- Vanadium
- **Cobalt**
- Rbhidium

Compounds in **yellow** are from FDA 2012,
**Harmful and Potentially Harmful
Substances – Established List**

E-Cigarettes Source of Thirdhand Smoke Exposure

- **Conclusions:** This study indicates that there is a risk of thirdhand exposure to nicotine from e-cigarettes. Thirdhand exposure levels differ depending on the surface and e-cigarette brand.
- Future research should explore the potential risks of thirdhand exposure to carcinogens formed from nicotine released from e-cigarettes (Goniewicz and Lee, 2014)

Vaping: The Take Home Message

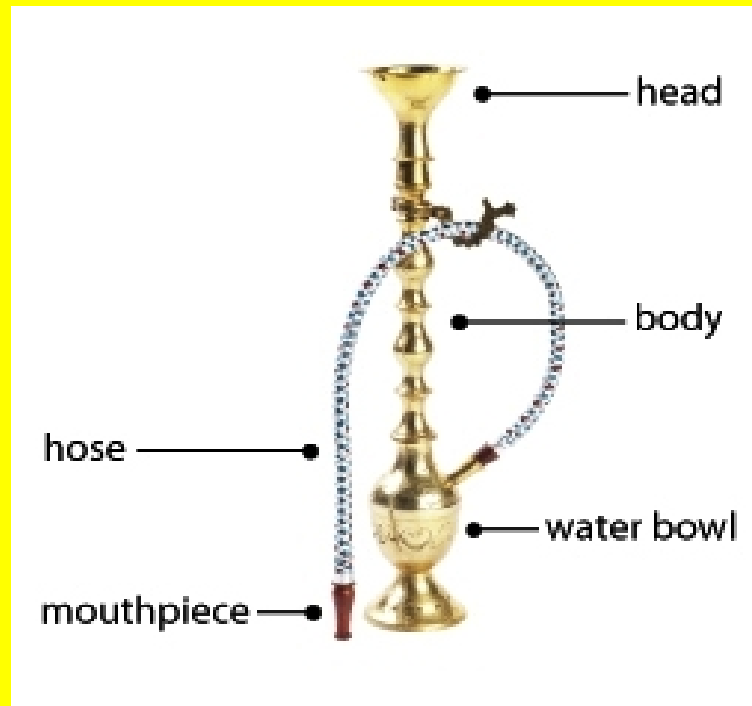
“Overall, the e-cigarette is a new source of VOCs and ultrafine/fine particles in the indoor environment. Therefore, the question of “passive vaping” can be answered in the affirmative. However, with regard to a health-related evaluation of e-cigarette consumption, the impact of vapor inhalation into the human lung should be of primary concern” (Schripp, et al., 2012).

Hookah and E-Hookah

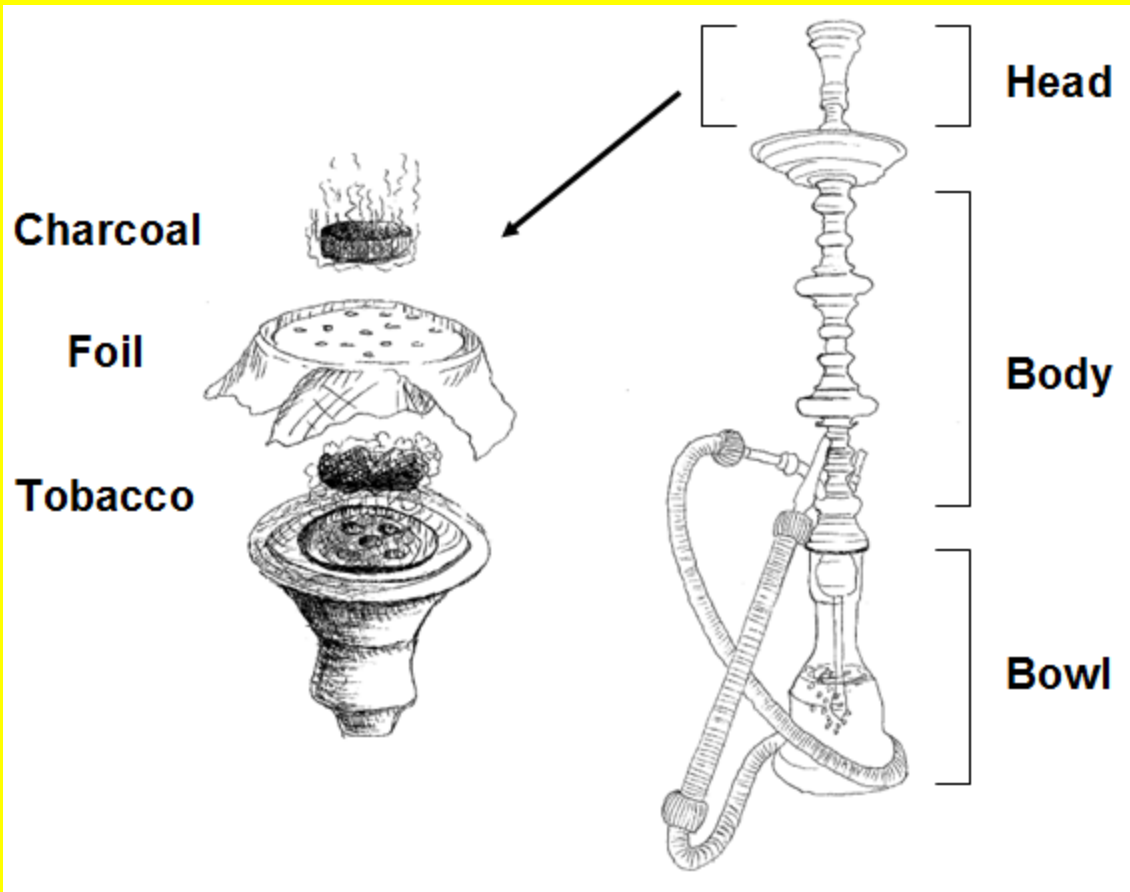
- Hookah and E-Hookah



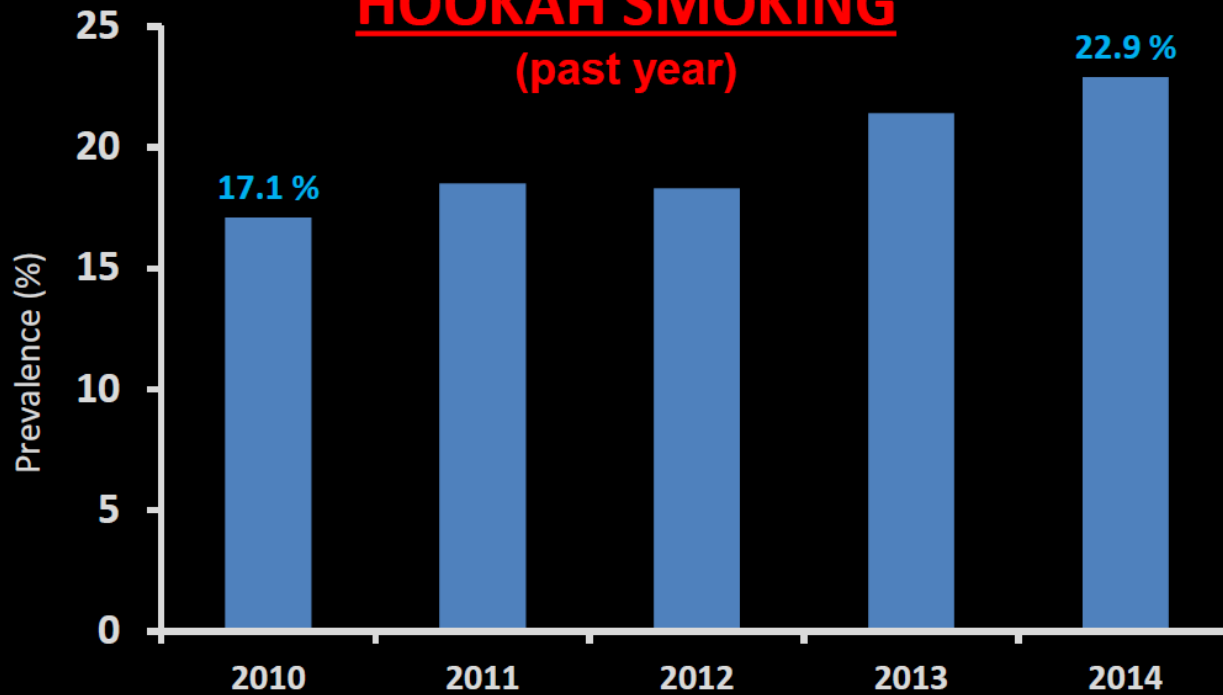
Narghile, Shisha, Hubble-Bubble, Goza and More



Schematic Showing The Major Components of a Hookah



HIGH SCHOOL STUDENTS REPORTING HOOKAH SMOKING (past year)



Data Source: University of Michigan, Monitoring the Future Study

In Comparison

- Waterpipe use may increase exposure to carcinogens because smokers use a waterpipe over a much longer period of time, often 40 to 45 minutes, rather than the 5 to 10 minutes it takes to smoke a cigarette.
- Due to the longer, more sustained period of inhalation and exposure, a waterpipe smoker may inhale as much smoke as consuming 100 or more cigarettes during a single session.

(WHO 2005)

In Comparison

- A single hookah tobacco smoking session (40 to 45 minutes) exposes its users to:
 - 25 times the tar
 - 125 times the smoke
 - 2.5 times the nicotine
 - 10 times the carbon monoxide
- as a single cigarette!

(Primack et al., 2016)

Chemical Footprint

- High levels
 - Arsenic
 - Chromium
 - Lead
 - Carbon Monoxide
 - Array of other Toxins

(Shihadeh, 2003)

Hookah Health Effects

- Lung Cancer
- Respiratory Diseases
- Periodontal Diseases
- Low Birth Weight Babies

– (Akl et al., 2010)

Attitudes and Beliefs

- More than 90% beginning waterpipe smokers believe cigarette smoking is more addictive than waterpipe smoking.
–(Asfar et al., 2005)

Reduced Exposure Products

Camel Dissolvables deliver between 0.0 to 3.1 milligrams of nicotine, while cigarette smokers typically inhale about 1 mg per cigarette.

Emerging Products by R.J. Reynolds

Camel Dissolvable Sticks:

Camel Orbs:

Strips:



Camel Snus

- Spit-less pouch
- The juice can be swallowed



Nicotine Water

Each 8-ounce bottle contains 4mg of nicotine; All you will taste is the water.

From <http://www.nicoworldwide.com/>

“**NICLite**® contains a purified organic nicotine molecule in a Complex Homeopathic Formula, which will go into equal suspension in 8 ounces of pharmaceutical grade water.”





Nicogel 50ml, 50 dose pack

Our diminutive 50ml Nicogel pack has 50 servings of Nicogel that will fit in the palm of your hand & into your handbag. Its available for only £10.99, including post and packaging to anywhere in the world.



To use Nicogel one must take a single press of gel and rub it into their skin.

<http://www.nicogel-uk.com/index.php>

E-Cigarettes are Sooo Last Year! Enter: Heat not Burn



© Associated Press Photo

Marlboro Heatstick Heat not Burn



Platform 2

- Platform 2



Reynolds Revo Heat not Burn



Heat not Burn

- Major studies conducted by PMI in 2012, 2015
- **Findings:**
 - Heat not burn had significantly lower emissions of key toxins compared to regular cigarettes
- Philip Morris' *Marlboro HeatStick*; Test Marketing Nagoya Japan and Milan Italy, November 2014
- Reynolds ' *Revo*; Test Marketing Wisconsin, 2015

The Triangulum

**The Triangulum: Tobacco, Marijuana, and
E-Cigarettes**

Thursday, May 26, 2015

9:00am – 12:00pm PDT

TRDRP Live Webcast

Presenters

- **Kelvin Choi, Ph.D.**, National Institute of Minority Health and Health Disparities
- **Susan Weiss, Ph.D.**, National Institute of Drug Abuse
- **Suzaynn Schick, Ph.D.**, University of California San Francisco
- **Mary Rezk-Hanna, N.P.**, University of California Los Angeles
- **Discussant: Kenneth Warner, Ph.D.**, University of Michigan

Nicotine in the 21st Century

- Combustible Tobacco Products
 - Aerosolized Nicotine
 - Heat Not Burn
 - Dabbing
 - Hookah
- Sticks, Gums, Chews, Patches, Gels, et al.
 - Did I mention Marijuana?

We are only 15 years into the Century!

Thank You!

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