

E-Cigarettes: The Vapor This Time?

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From Whence E-cigarettes

- 2003: Chinese pharmacist, Hon Lik, is credited with conceptualizing and producing the first modern Electronic Cigarette



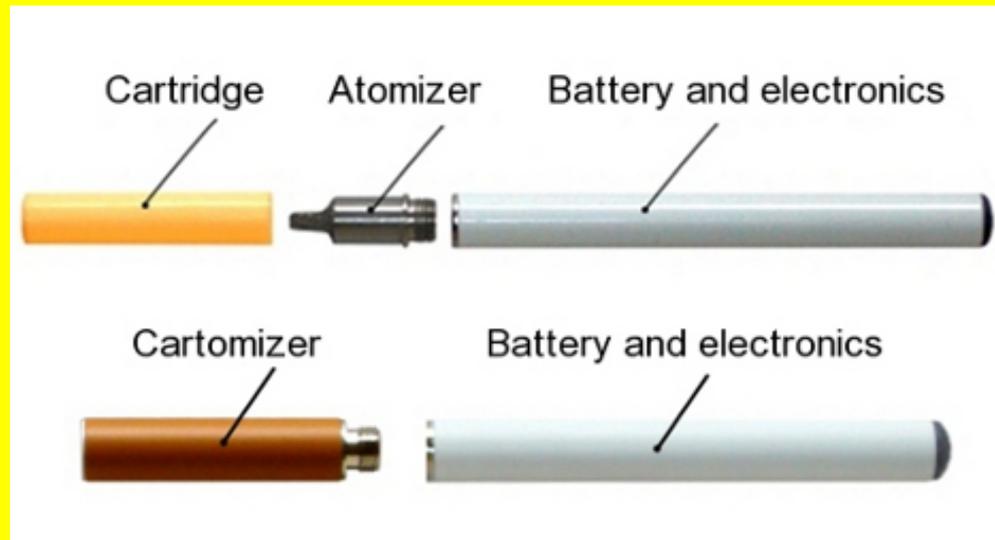
E-Cigarettes

- **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
- 7700+ Flavorings
 - Menthol
 - All Banned FDA flavors
- Tax the Liquid; the Nicotine; the Device

Component Parts E-Cig-a-Likes



E-Cig Tank Systems; Mods



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)

E-Cigarette Advertising Triples, 2011 to 2012

- “Overall, e-cigarette advertising expenditures across media channels **tripled** from \$6.4 million in 2011 to **\$18.3 million in 2012**
 - 80 unique brands
 - blu eCigs dominated ad spending, comprising 76.7% of all e-cigarette advertising
 - Highest in Magazines and TV; Lowest in Newspapers
 - (Kim et al., 2014)

E-Cigarette Advertising Doubles, 2012 to 2013

- E-cigarette manufacturers have significantly increased marketing spending, more than doubling expenditures between 2012 and 2013.

In total, six e-cigarette companies spent **\$59.3 million in 2013** to market e-cigarettes

(Durbin 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)

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)

Enter the tobacco industry

- **Lorillard (LO)**
 - Acquired the Blu E-Cigs in April 2012 for \$135M.
- **Reynolds American (RAI)**
 - Vuse: Microprocessor Controlled
- **Altria Group (MO)**
 - MarkTen; Rolled out 2014
- **NJOY (privately held)**
 - Ex Surgeon General Carmona; other personnel includes Several Ex-Altria Execs.
- **Logic (privately held)**



LOGIC

PREMIUM ELECTRONIC CIGARETTES



THE MOST TRUSTED BRAND.



Tobacco Industry Taking Over the E-Cigarette Industry

- **Convenience Store Sales Volume**

– Reynolds	Vuse	30.1%
– Lorillard	blu	21.6%
– Logic*	Logic	14.5%
– Altria	Mark Ten	10.9%
– NJOY*	NJOY	4.4%

– (Herzog, March, 2015) * Privately held

Vape Shops on the Rise

- The "**Starbucks of e-vapor**"
 - It is estimated that there are somewhere between 5,000-10,000 vape shops in the U.S.
 - Tank systems; Refills; Mix-your-Own
 - Vapers can hang out, work, socialize and vape
 - Purchase products; sample new ones
 - Eating and Drinking
 - (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
 - 7000+ 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

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)

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 40 – 65c
- **2nd Generation**
 - Tank Systems; refillables
 - Some Toxins Emitted Approaching Levels found in Regular Cigarettes
 - Aerosolizing Temperatures >65c

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)

Combustion; Heating; Aerosolizing

- Cigarettes burn tobacco at $\sim 900^\circ$ Celsius
- Heated Tobacco Products
- E-Cigarettes aerosolize nicotine laced propylene glycol at $40 - 65^\circ$ Celsius *
- * 1st Generation

E-Cigarettes are Sooo Last Year Heat not Burn



© Associated Press Photo

Marlboro Heatstick Heat not Burn



Reynolds Revo Heat not Burn



Heat not Burn

- 8 major studies conducted by PMI in 2012
- **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

Secondhand Exposure to Vapors From Electronic Cigarettes

(Czogala et al, 2013)

- The average concentration of nicotine resulting from smoking tobacco cigarettes was 10 times higher than from e-cigarettes (31.60 ± 6.91 vs. 3.32 ± 2.49 $\mu\text{g}/\text{m}^3$)
- 7xs more Particulate matter
- Still, in a room of 5 to or more e-cigarette users, nicotine and particulate matter levels are above healthy levels

Secondhand Vaping and Nicotine

- Similar nicotinergetic impact as tobacco cigarettes
- E-cigarettes and tobacco cigarettes generated similar ($p > 0.001$) effects on serum cotinine levels
 - (Flouris et al., 2013)

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**
- Rhubidium

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

Second Hand 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).

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)

Health Effects of E-Cigarettes

- **Long Term Health Effects are unknown**
- **Short-term Health Effects include:**
 - Decreased Fractional exhaled Nitric Oxide (FeNO) [a measure of lung function retardation]
 - Increased respiratory resistance
 - Decreases in the eye's tear film stability
 - Acute nicotine poisoning
 - (Vardavas, 2012; Norback and Lindfren, 2001)

Health Effects of E-Cigarette

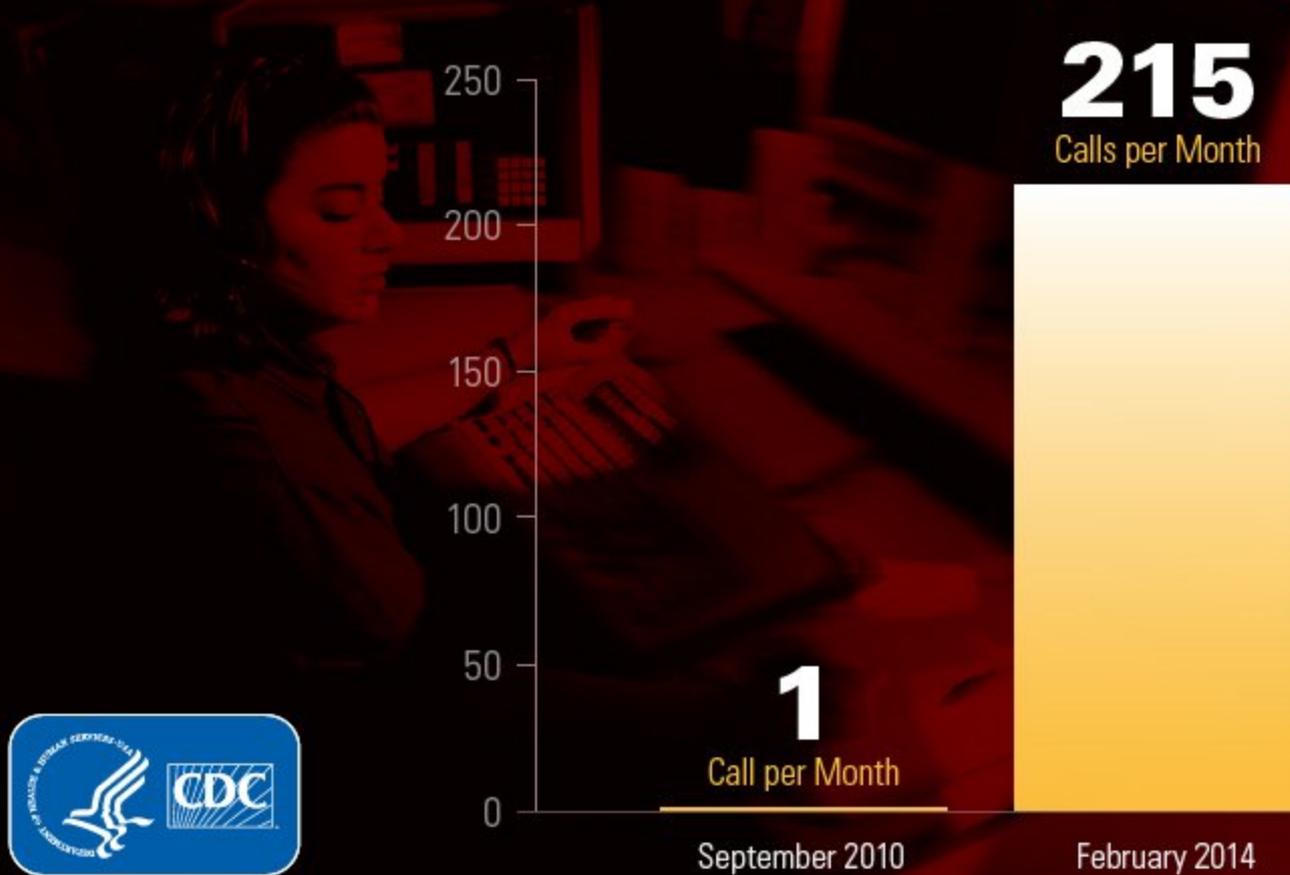
- **Constricts peripheral airways**, possibly as a result of the irritant effects of propylene glycol, which could be of particular concern in people with chronic lung disease such as asthma, emphysema, or chronic bronchitis.

– (Vardavas, 2012)

Health Effects of E-Cigarette

- Adversely effects epithelial functions of young people.
- Even nicotine-free e-liquid promotes pro-inflammatory response and HRV infection.
- Both e-liquid without nicotine and with nicotine inhibits lung innate immunity (e.g., SPLUNC1) that is involved in lung defense against HRV infection.
- “These findings strongly suggest the deleterious health effects of e-cigarettes in the airways of young people.” (Wu, et al., 2014)

Poison center calls involving e-cigarettes



Calls to California Poison Control Centers Concerning E-Cigs

2010	4
2011	12
2012	19
2013 thru Feb 2014	155

(F. Lee Cantrell California Poison Control System, 2014)

Renormalization



Renormalization

I'M SENDING CHESTERFIELDS to all my friends.
That's the merriest Christmas any smoker can have —
Chesterfield mildness plus no unpleasant after-taste
Ronald Reagan

the RONALD REAGAN
starring in "HONG KONG" a Film
Thomas Paramount Production
Color by Technicolor

CHESTERFIELD Buy the beautiful
Christmas-card carton

WHY QUIT? SWITCH TO BLU

blu is the smart choice for smokers wanting a change. Take back your freedom to smoke when and where you want without ash or smell. blu is everything you enjoy about smoking and nothing else. Nobody likes a quitter, so make the switch today.

Visit blucigs.com

* New blu Smart Pack

PREMIUM ELECTRONIC CIGARETTE

18+ only. CALIFORNIA PROPOSITION 65 - Warning: This product contains nicotine, a chemical known to the state of California to cause birth defects or other reproductive harm.

Renormalization



Need We Say More



The collage features three distinct images. On the left is a magazine cover for '50th Anniversary 2014 SWIMSUIT ISSUE' with three women in bikinis. In the center is a close-up of a woman's midsection wearing a black bikini bottom with the 'blu ELECTRONIC CIGARETTES' logo. On the right is a pack of 'blu CLASSIC TOBACCO' e-cigarettes next to a black carrying case with the 'blu' logo.

50th ANNIVERSARY
2014 SWIMSUIT ISSUE

blu ELECTRONIC CIGARETTES

SLIM. CHARGED. READY TO GO.

AVAILABLE NATIONWIDE!
Visit us at blucigs.com/store-locator

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European Union E-Cigarettes Regulation

Starting in 2016

- Advertising Banned
- Graphic Health Warning Labels
- Child-Proof
- Nicotine Limited to 20mgs
- Outlawing Menthol Cigarettes (4-year delay)
- **Indoor and Outdoor use NOT Regulated**

The Road to FDA Regulation (or lack thereof)

- **No FDA Regulation**

- Blocked imports in 2008
- Launch toxicological studies 2009
- Seized NJOY/Sottera shipments 2009
- Sottera sued the FDA, claiming the e-cigarettes should be regulated like cigarettes, not a medicine
- 2010, both the lower and appellate court agreed with Sottera
- 2014, FDA posted limited deeming regulations

FDA Deeming Regulations

- Register with FDA and report product and ingredient listings
- Only market new tobacco products after FDA review
- Only make claims of reduced risk if FDA confirms that scientific evidence supports the claim and that marketing the product will benefit public health as a whole
- Not distribute free samples

FDA Deeming Regulations

- Minimum age and identification restrictions to prevent sales to underage youth
- Requirements to include health warnings
- Prohibition of vending machine sales, unless in a facility that never admits youth

FDA Deeming Regulations: A Cautionary Tale

- TV, Radio and Social Media Advertising Remain
- 7000 + Candy Flavorings, including Menthol Remain
- Internet and Mail Order Sales Continue with **No Age Restrictions**
- WSJ, Wells Fargo, the tobacco industry and E-Cigarette Manufacturers Like the Regulations (or lack thereof)

FDA Deeming Regulations: A Cautionary Tale

- No Child-Proofing Requirements
- No Warning Labels
- A Minimum of 2 years to Enact, by then the E-Cigarette horse will be even further out of the Barn, Down the Road and Coming to a Clinic, Office and or Home Near You.

California Laws on E-Cig Laws

- 60 California Cities Regulate E-cigarettes
<http://www.no-smoke.org/pdf/ecigslaws.pdf>
- UC Prohibits the use of E-Cigarettes
http://www.ucop.edu/risk-services/_files/UC-RK-13-0221_SmokeandTobaccoFreeEnvironment%20Issuance%20Ltr.pdf
- California State HEALTH AND SAFETY CODE
SECTION 119405 Prohibits the Sale to Minors
<http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=119001-120000&file=119405>

The Aerosol This Time? Precaution Advised

- **E-Cigarette Vapor**

- Concentrations of pollutants and carcinogens less than in cigarettes
- Great variation within and between products; no product standards
- Renormalization; youth uptake on the rise
- Intermediate and long term health effects unknown
- ***Maybe* safer, but this doesn't mean safe**

Thank You!

TRDRP

Research for a Healthier California

www.trdrp.org

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Grant Funding

Cutting Edge Research

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Dissemination of Research Findings