Smoking vs Vaping

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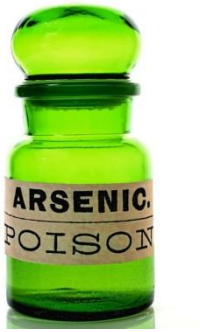
WHAT IS EL-SCIENCE?

- Expert Scientific Team
- State-of-the-art automated instrumentation
- Dedicated to rapid, quality controlled e-liquid manufacture and analysis

WHAT IS IN A CIGARETTE?

- When a cigarette burns it releases a dangerous cocktail of over 5,000 chemicals:
  - **Nicotine**
  - **Carcinogens & poisons**
  - **Additives designed to make cigarettes taste nicer & keep smokers hooked**

- Tar
- Arsenic
- Benzene
- Cadmium
- Formaldehyde
- Polonium-210
- Chromium
- 1,3-Butanediene
- Polycyclic aromatic hydrocarbons (PAHs)
- Tobacco-specific nitrosamines
- Acrolein
- Hydrogen cyanide
- Carbon monoxide
- Nitrogen oxides
- Ammonia



THE DANGERS OF SMOKING

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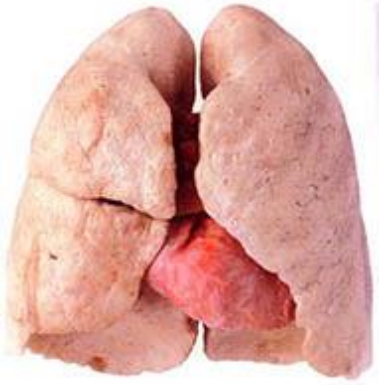
- Smoking causes over a quarter of all cancer deaths in the UK & nearly one in five cancer cases
  - **At least 14 different types of cancer**
  - **Heart disease**
  - **Various lung diseases**

- Chemicals in cigarette smoke enter the blood stream

- DNA damage
  - **Some damage DNA directly**
  - **Others make poisons in cigarette smoke stick more strongly to DNA, increasing the chances of serious damage**
  - **Others interfere with pathways for repairing damaged DNA**



- Weakening of the body's defences
  - **Smokers can't handle toxic chemicals as well as those with healthy lungs & blood**
  - **Major impact to the immune system**

- Concentration of chemicals in body
  - **E.g. heavy smokers can be exposed to up to 150 times the background level of radioactive polonium-210**

WHAT ARE E-CIGS?

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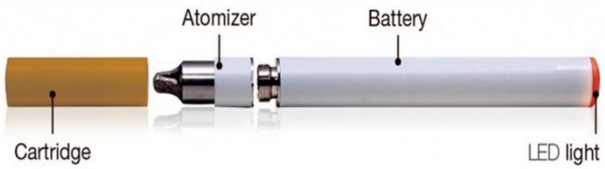
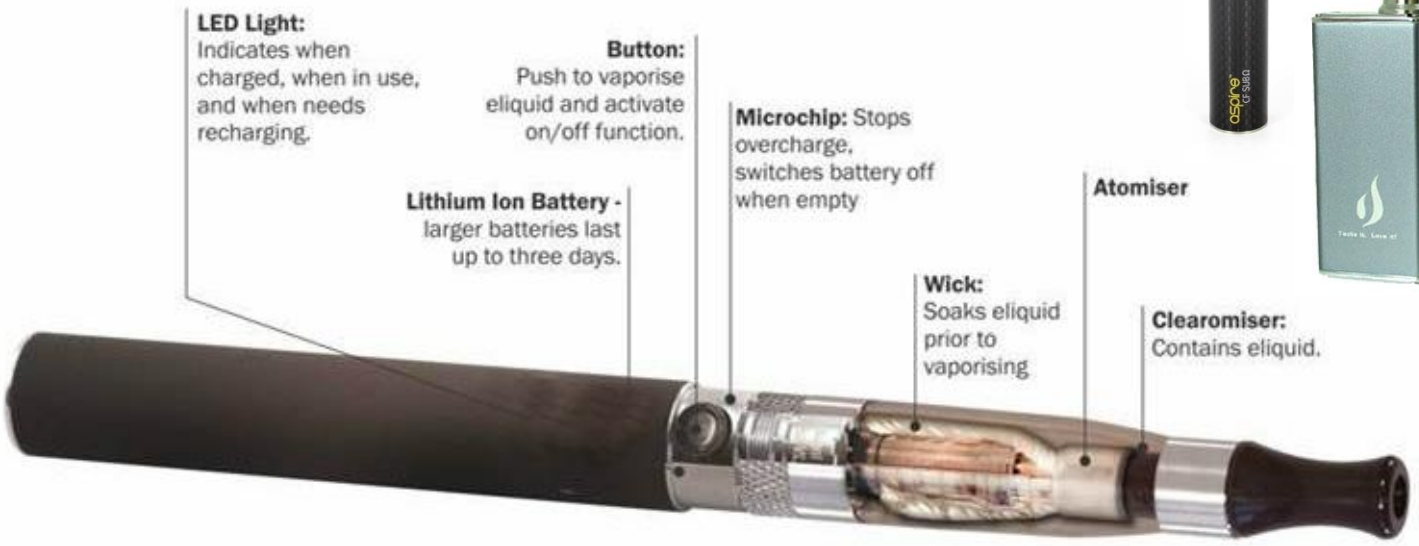
- Battery-powered devices that have cartridges or refillable tanks containing a liquid mixture primarily composed of:
  - **Propylene glycol**
  - **Vegetable glycerin**
  - **Nicotine**
  - **Flavourings**





WHAT ARE E-CIGS?

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- The exhaled aerosol does NOT contain smoke, tar or carbon monoxide.
- Studies have shown that compared with conventional cigarettes, the by-products from e-cig aerosols produce very low levels of air toxins.

PROPYLENE GLYCOL

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- Major e-liquid ingredient
- A clear, colourless, syrupy liquid
- Odourless & tasteless
- Approved by the FDA as a solubilizing agent for different types of medications
- Used in the food, cosmetic, pharmaceutical & chemical industries
- Wide use means much is known about the safety of this material
- Used to generate theatre fog.

VEGETABLE GLYCERIN

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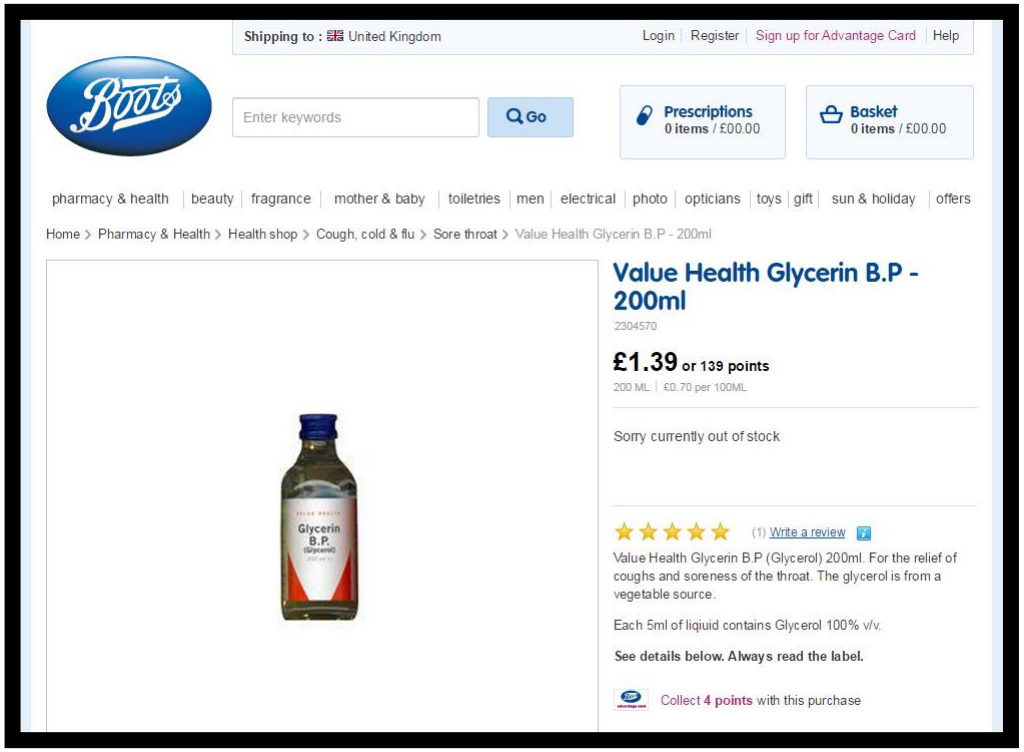
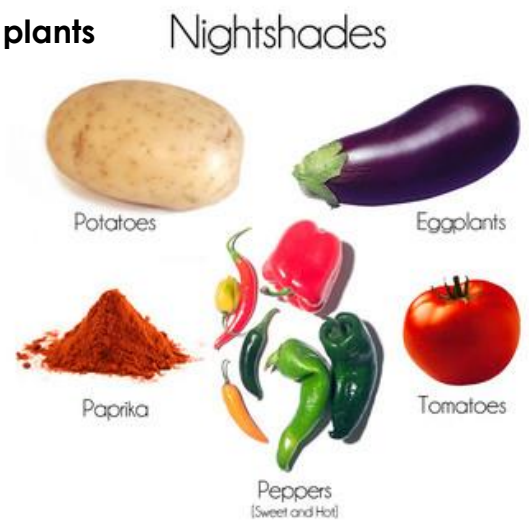
- Also known as glycerol
- Made from vegetable oil
- Widely used in foods, as a sweetener, medications & cosmetic products
- It is a common ingredient in cough mixtures due to its soothing properties
- Used to treat gum disease, as it inactivates the associated bacterial colonies



- Both PG & VG found safe in cells & animal toxicology studies **(Robertson et al. 1947; Wertley et al, 2011; Renne et al, 1992)**

NICOTINE

- Derived naturally from tobacco, which is a member of the nightshade family of flowering plants
  - **Includes potatoes, tomatoes, aubergine & capsicum pepper plants**
- Can also be manufactured synthetically
- Nicotine is absorbed through the skin & mucosal linings in the nose, mouth & lungs
- Travels through the bloodstream to the brain
- Stimulates adrenal glands to produce adrenaline
  - **This increases heart rate & blood pressure while constricting blood vessels**
  - **Also stimulates the production of dopamine – a neurotransmitter that controls the brain's pleasure centre**



Paracelsus

1493 - 1541

Founded the discipline of **Toxicology**

"The dose makes the poison"

NICOTINE

- Most e-liquids contain:
  - **6 mg/mL**
  - **12 mg/mL**
  - **18 mg/mL**
  - **24 mg/mL**

10 mL/week = ± 1.5 mL/day
@ 6 mg/mL = ± 9 mg/day
@ 24 mg/mL = ± 36 mg/day

20 cigarettes/day = ± 20 mg/day
40 cigarettes/day = ± 40 mg/day

- 1 regular cigarette contains approx. 10-15 mg of nicotine & delivers a systemic dose of approx. 1 mg of nicotine

- Blood levels of nicotine are generally lower from electronic cigarette use than conventional cigarettes

- E-Cigs also deliver nicotine much more slowly over a period of time

FLAVOURINGS

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- Widely used to improve or modify odour &/or taste
- Can be extracted from natural sources or manufactured synthetically

FRUITS

MINTS & MENTHOLS

SWEETS & PUDDINGS

TOBACCO

THE PROS OF E-CIGS

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- No serious side effects have ever been reported
  - **Worst effects include cough (26%), dry mouth (22%), shortness of breath (20%), throat irritation (17%), headache (17%)**
  - **Frequency of adverse effects decrease over time (Caponnetto et al., 2013)**
- Study showed an increase in white blood cell count when an individual smoked a cigarette but no significant change with e-cig use **(Flouris et al., Inhalation Toxicology, 2013)**

THE PROS OF E-CIGS

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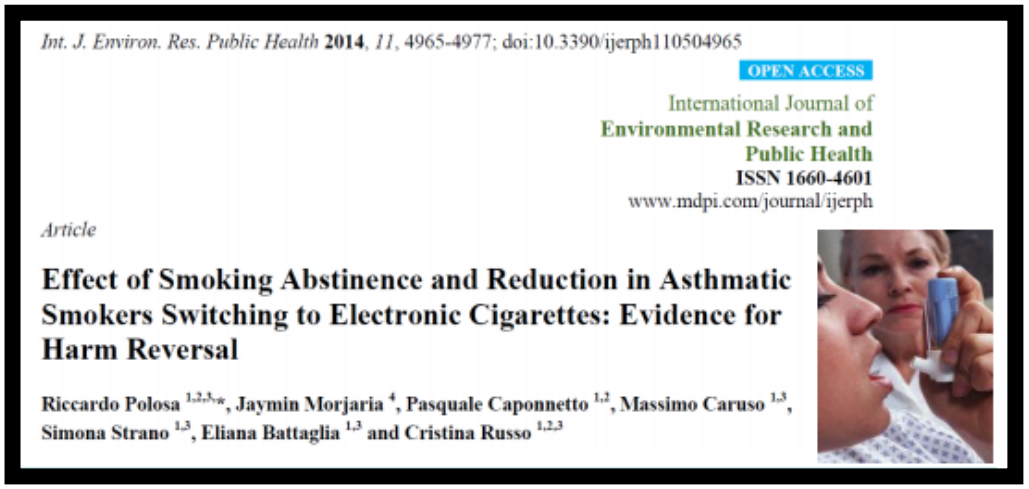
- Study of pulmonary function & symptoms in smokers with asthma who switched to e-cigs – found no adverse effects but rather the e-cig users had improved pulmonary function & reduced severity of asthma symptoms

  - **18 heavy smokers with mild to moderate asthma had pulmonary function tests at 0, 6 & 12 months after beginning to use e-cigs**
  - **10 of these (56%) quit smoking entirely**
  - **8 (44%) continued as dual users**



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Article

Effect of Smoking Abstinence and Reduction in Asthmatic Smokers Switching to Electronic Cigarettes: Evidence for Harm Reversal

Riccardo Polosa [1,2,3,*], Jaymin Morjaria [4], Pasquale Caponnetto [1,2], Massimo Caruso [1,3], Simona Strano [1,3], Eliana Battaglia [1,3] and Cristina Russo [1,2,3]

- **Dual users decreased their number of cigarettes smoked per day from an average of 22.4 at baseline to 3.9 per day at 12 months**

WHAT ABOUT PASSIVE VAPING?

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- Passive cigarette smoke exposure is hazardous
  - **Associated with respiratory diseases**
  - **Asthma**
  - **Lung cancer**
  - **Acute coronary events**
  - **Stroke**

- These effects result from exposure to the combustion products of tobacco

- Most of the second hand smoke generated from conventional cigarettes results from **sidestream smoke**
  - **Accounts for 75% of the burning cigarette mass**

WHAT ABOUT PASSIVE VAPING?

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- E-cigs **do not** generate sidestream aerosol
- Second hand emissions from e-cigs consist entirely of what is exhaled after inhalation by the user
- E-cig emissions of harmful chemicals are significantly **lower** than those generated by combusted cigarettes
- Even the ambient level of nicotine is approx. **10% lower**

WHAT TO BE AWARE OF

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- Be aware of who you purchase your electronic cigarettes & e-liquids from!
- The nicotine content noted on the packaging of some e-liquids has been found to be incorrect
- Has the manufacturer used pharmaceutical grade ingredients?
- Acute nicotine toxicity is a concern if e-liquids are ingested

Keep e-cigs & e-liquids out of reach of children & pets!

WHAT TO BE AWARE OF

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- Heavy heating of e-liquids can result in thermal degradation & the formation of hazardous compounds

Table 4 Comparison of toxins levels between conventional and electronic cigarettes

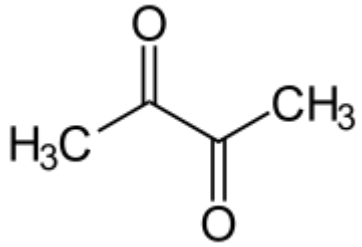
Toxic compound	Conventional cigarette (µg in mainstream smoke) [35]	Electronic cigarette (µg per 15 puffs)	Average ratio (conventional vs electronic cigarette)
Formaldehyde	1.6–52	0.20–5.61	9
Acetaldehyde	52–140	0.11–1.36	450
Acrolein	2.4–62	0.07–4.19	15
Toluene	8.3–70	0.02–0.63	120
NNN	0.005–0.19	0.00008–0.00043	380
NNK	0.012–0.11	0.00011–0.00283	40

Goniewicz et al., Tobacco Control, 2013

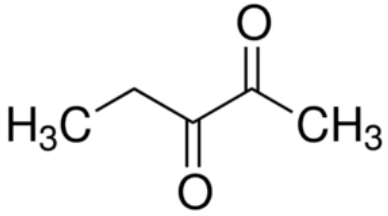
WHAT TO BE AWARE OF

- Many substances are used in the manufacture of flavourings
- Common food flavouring chemicals include:

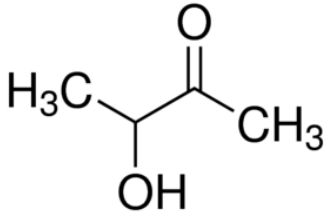
Diacetyl
(2, 3-butanedione)



Acetyl Propionyl
(2,3-pentanedione)



Acetoin
(3-hydroxybutanone)



- Prominent in the following flavours:
  - **Custard**
  - **Caramel**
  - **Butterscotch**
  - **Maple syrup**
  - **Brown sugar**
  - **Coffee**






  - **Some fruit flavours**

WHAT TO BE AWARE OF

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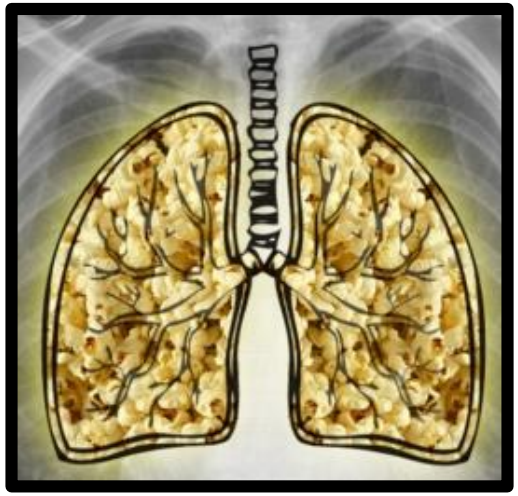
- Occurrence of severe lung disease among workers in workplaces where diacetyl is manufactured and used
  - **Used in artificial butter flavouring**
  - **Workers in several US factories manufacturing microwave popcorn developed**

Bronchiolitis Obliterans

"Popcorn Worker's Lung"



- Flavour manufacturers have substituted diacetyl for acetyl propionyl and acetoin
  - **Very structurally similar**
  - **Not well-studied**
  - **Growing concern that they also pose a health risk upon inhalation**

TIME TO QUIT SMOKING

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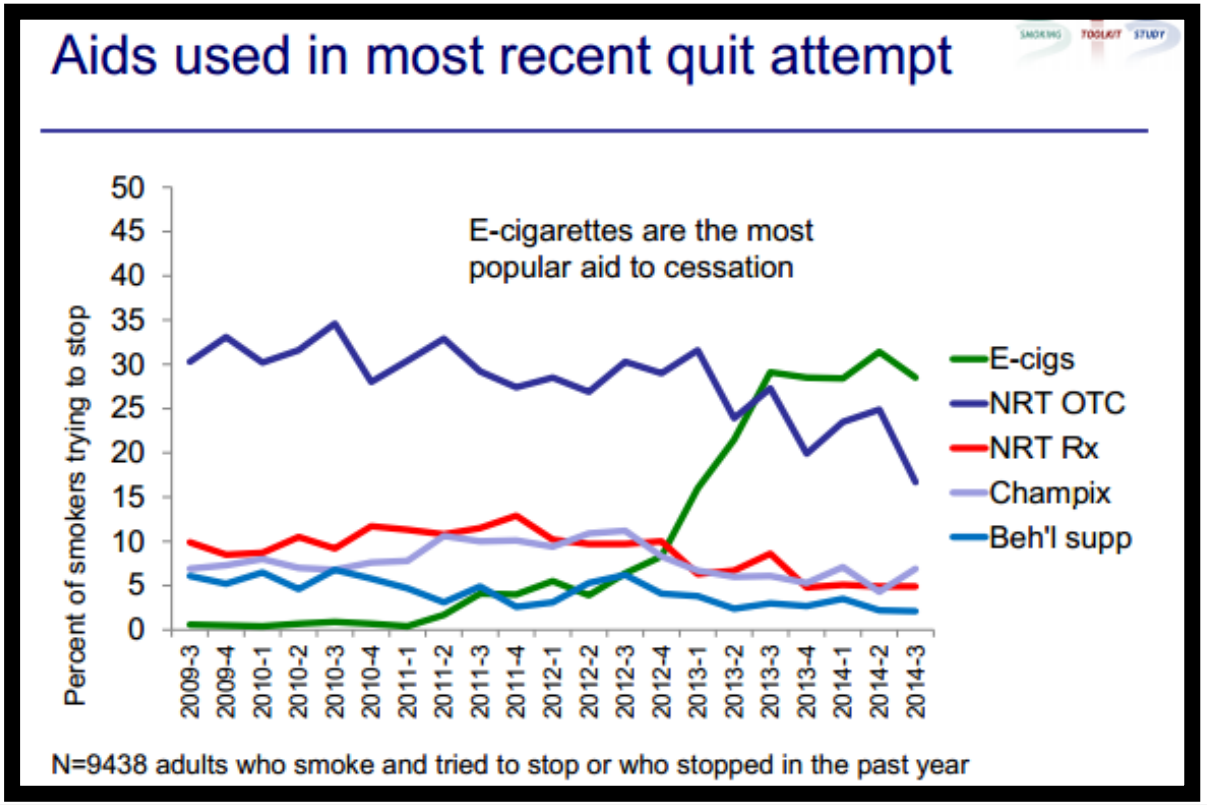
- Prof. Robert West (Professor of Health Psychology & Director of Tobacco Studies at Cancer Research UK
- Currently e-cigarettes are the most popular aid to smoking cessation in the UK
- 30% of quit attempts involve use of e-cigarettes making them the most popular method of stopping smoking
- 20% of smokers & 30% of recent ex-smokers use e-cigarettes



TIME TO QUIT SMOKING

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- Study by Brown et al., Addiction, 2014
  - **Showed that smokers who tried to quit without professional help were significantly more likely to report abstinence using e-cigarettes than with traditional cessation aids or going "cold turkey"**

- UK Survey published by Dawkins et al., Addiction, 2013
  - **Showed that 67.8% of e-cigarette users "completely replaced tobacco cigarettes with electronic cigarettes".**

SPREAD THE WORD

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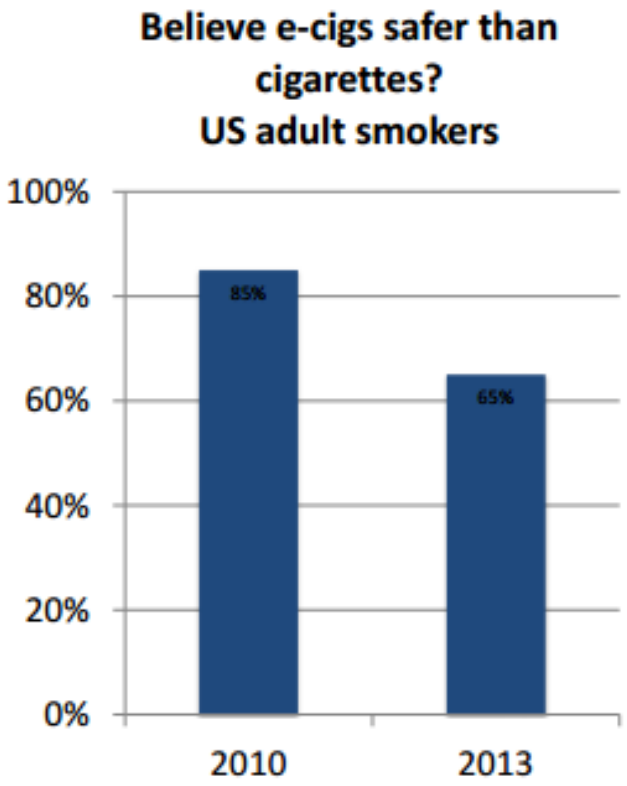
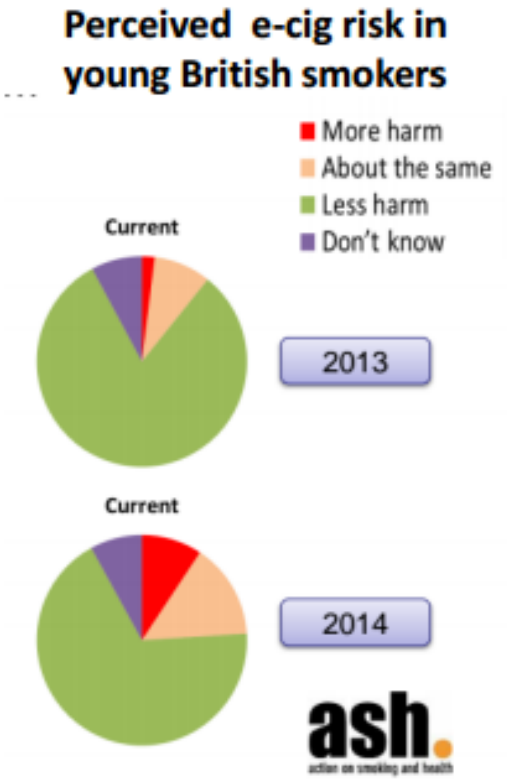


Tan ASL, Bigman CA. E-cigarette awareness and perceived harmfulness: prevalence and associations with smoking-cessation outcomes. Am J Prev Med 2014; 47: 141–9.



Trends in electronic cigarette use in young people in Great Britain over 2013-2014 Arnott, Britton, Cheeseman, Dockrell, Eastwood, Jarvis, & McNeill ASH, CR-UK, PHE 2014

SAVING LIVES

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How much safer are e-cigarettes in comparison to conventional cigarettes?

> 95%

- US Population:
  - **40 million smokers**
  - **480,000 smoking-attributable deaths**
  - **0.8% annual quit rate from 2002 to 2012**

- Cessation leads to a gradual reduction in risk (almost equal to never-smokers in 15-20 years)

- What would happen if the use of e-cigarettes replaced conventional smoking (considering a 5% residual risk from e-cig use)?

How any deaths would be averted in 10 & 20 years?

SAVING LIVES