Reducing the harm from combustible tobacco use

switching from smoking to vaping

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Declaration of Competing Interests

- In the past 5 years have received honoraria for speaking at smoking cessation meetings that have been organized by J&J and Pfizer
- I have no links with any tobacco or e-cigarette manufacturers
- **I believe that vaping can make an overall positive contribution to public health**

My views and practice

- The best thing smokers can do to improve their health is to quit smoking.
  - I discuss what I can offer to help people quit.
- For those smokers who won't or can't quit, the next best thing would be to switch to vaping.
  - I provide information about what we currently know about about vaping.
- For those who choose to switch from smoking to vaping
  - I support them to do so.

E-CIGARETTES (VAPOURISERS)

What are they?
Who's using them?
Why?

Vapourisers

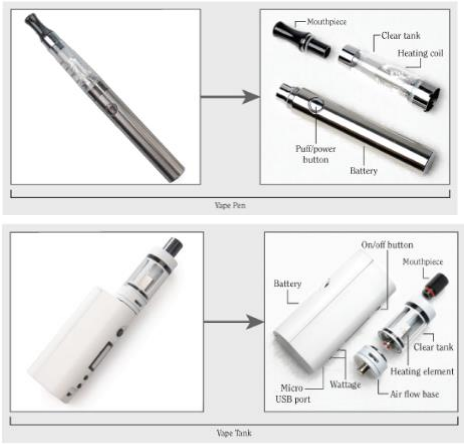
Figure 1.1 Diversity of e-cigarette products

Source: Photo by Mandie Mills, CDC.

Components

Three main components

1. Battery
2. Tank or cartridge to hold e-liquid
3. Heating coil (atomiser)



Source: Photo by Mandie Mills, CDC.

Vaping Liquid

VG/PG: 30%/70%

Nicotine: 12mg/ml

Volume: 10ml

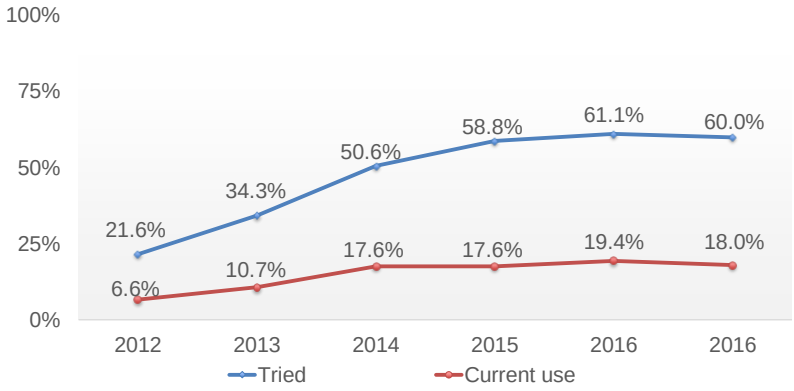
Cost?

30ml = NZ$25

VG=vegetable glycerin
(smoothness, cloud chasing)
PG=propylene glycol
(throat-hit, stealth vaping)

Source: Photo by Mandie Mills, CDC.

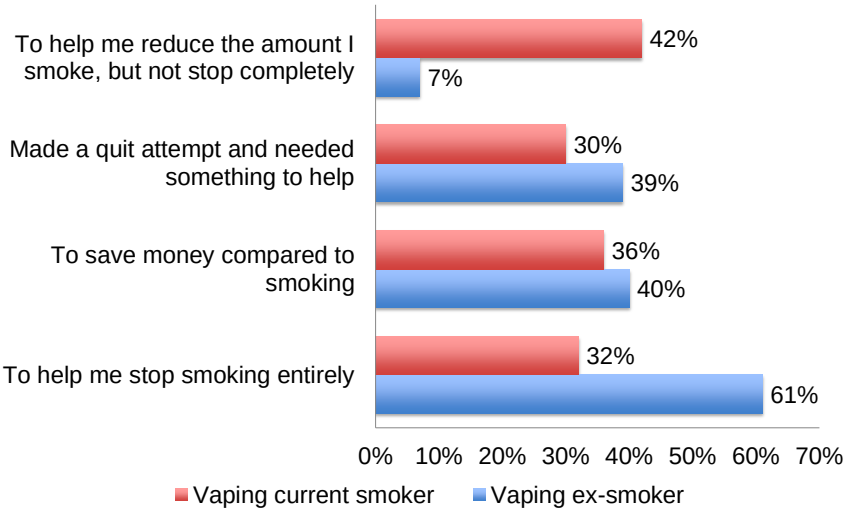
Current vaping in adult smokers (UK data)



Unweighted base: GB adult smokers (2010, n=2297; 2012, n=2093; 2013, n=1895; 2014, n=1776; 2015 n=2037; 2016 n=1704 2017 n=1840)

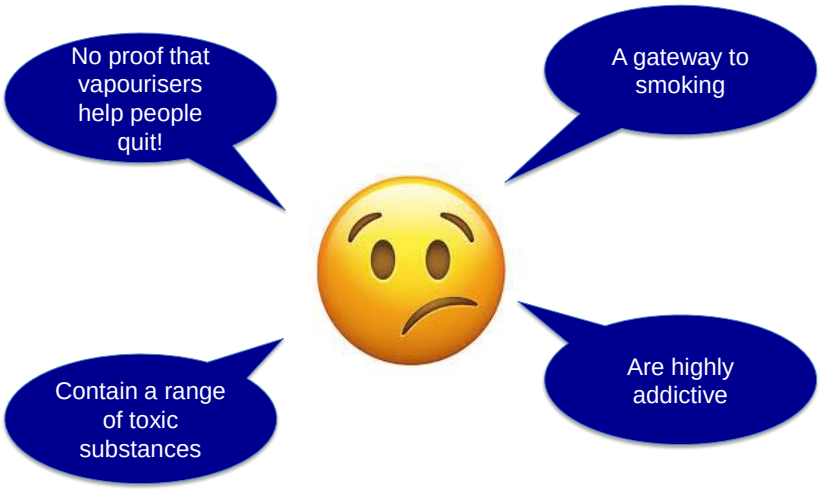
ASH Factsheet: Use of electronic cigarettes (vapourisers) among adults in Great Britain. May 2017

Reasons for vaping (UK data)



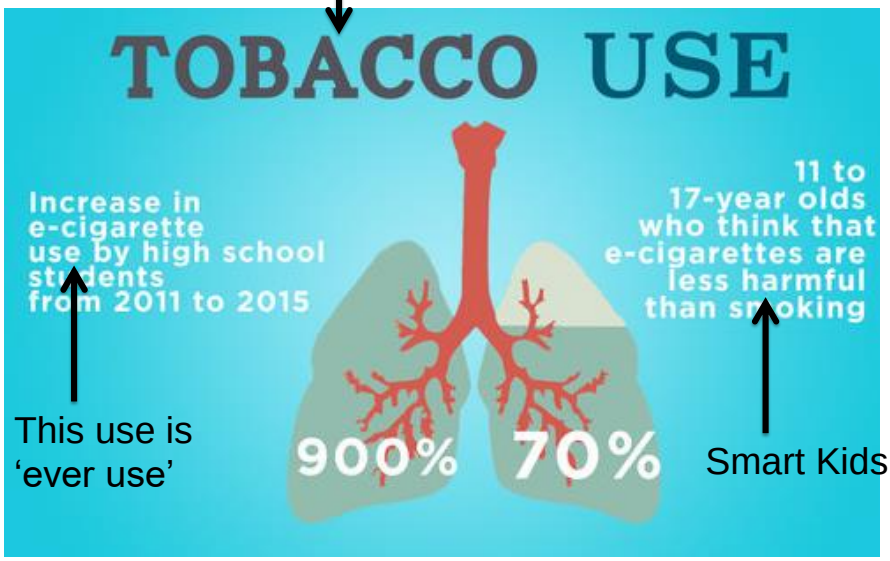
Adapted from: ASH Factsheet: Use of electronic cigarettes (vapourisers) among adults in Great Britain. May 2017

Concerns about vaping



CONCERN: UPTAKE IN CHILDREN AND NON-SMOKERS

Vaping is not tobacco use

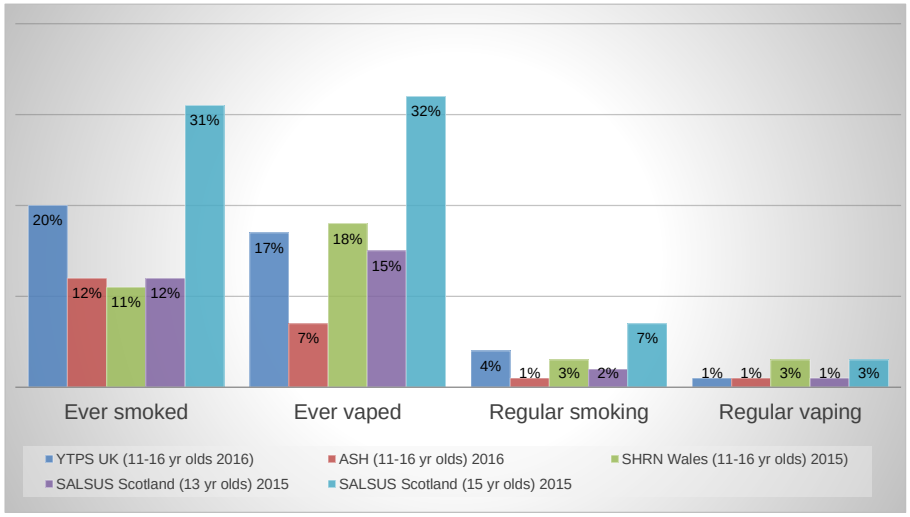


This use is 'ever use'

Smart Kids!

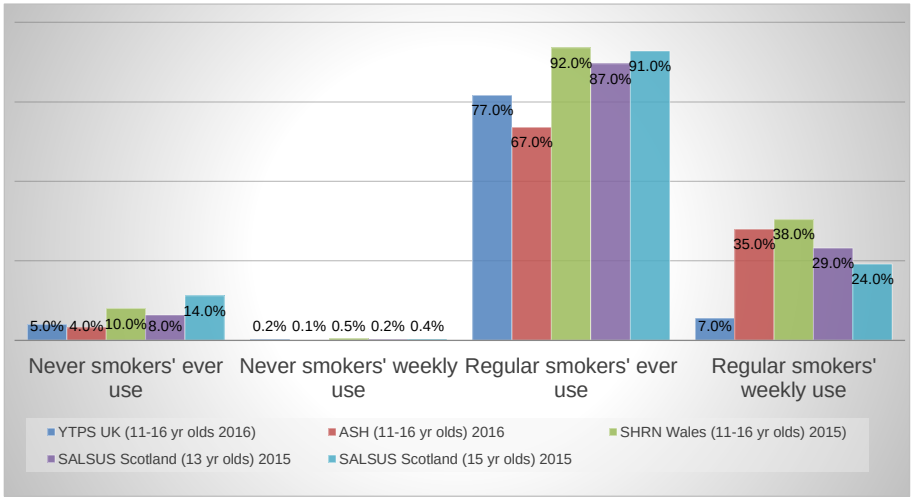
http://www.livewellnwfl.org/breathe-well/

Smoking vs. vaping in young people



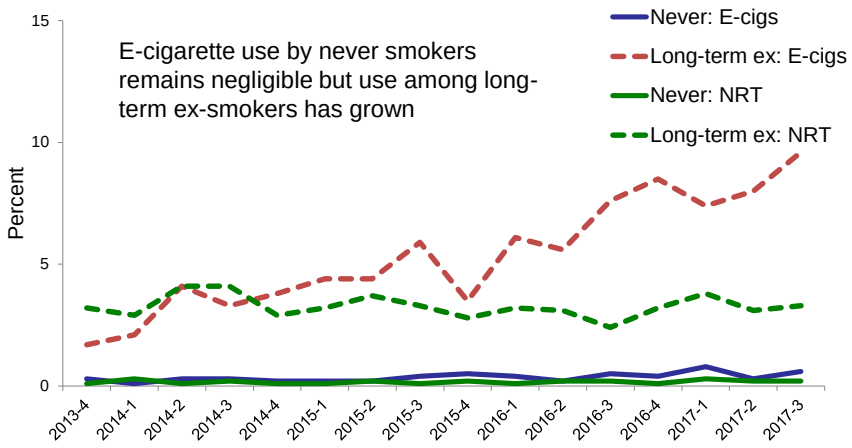
Bauld et al. Int J Environ Res Public Health 2017, 14, 973

Vaping by smoking status in young people



Bauld et al. Int J Environ Res Public Health 2017, 14, 973

Nicotine use by never smokers and long-term ex-smokers



N=63376 never and long-term ex-smokers from Nov 2013

Electronic cigarettes in England – Latest Trends – Smoking Toolkit Study (STS 140122) http://www.smokinginengland.info/latest-statistics/

Is vaping a gateway to smoking?

Figure 2. Meta-analysis of Adjusted Odds of Cigarette Smoking Initiation Among Never Cigarette Smokers at Baseline and Ever e-Cigarette Users at Baseline Compared With Never e-Cigarette Users at Baseline

☑ Association

☒ Causation

The odds ratios (OR) for the studies[5-10,22] are adjusted for a study-specific set of demographic, psychosocial, and behavioral risk factors. The size of the point estimate (black square) is proportional to the weight of the study in the random-effects meta-analysis model. The weights add to 99.9% and not 100% because of rounding. Q indicates Cochrane Q.

Soneji et al. JAMA Pediatr. 2017;171(8):788-797

Recent longitudinal studies

Do electronic cigarettes increase cigarette smoking in UK adolescents? Evidence from a 12-month prospective study

Mark Conner,[1] Sarah Grogan,[2] Ruth Simms-Ellis,[1] Keira Flett,[3] Bianca Sykes-Muskett,[1] Lisa Cowap,[3] Rebecca Lawton,[1] Christopher J Armitage,[4] David Meads,[5] Carole Torgerson,[6] Robert West,[5] Kamran Siddiqi[7]

"…while acknowledging that a causal relationship may be plausible, we cannot confirm this based on our findings and the trends observed over the same time period in the UK; rates of e-cigarette use have increased, but the rates of cigarette use have continued to decline."

Conner M, et al. Tob Control 2017;0:1–8.

Relationship between trying an electronic cigarette and subsequent cigarette experimentation in Scottish adolescents: a cohort study

Catherine Best,[1] Farhana Haseen,[2] Dorothy Currie,[2] Gozde Ozakinci,[3] Anne Marie MacKintosh,[4] Martine Stead,[4] Douglas Eadie,[4] Andy MacGregor,[5] Jamie Pearce,[6] Amanda Amos,[7] John Frank,[7] Sally Haw[1]

"It is possible that the relationship between e-cigarettes and tobacco experimentation may not be causal if young never-smokers who try an e-cigarette would have gone on to initiate smoking anyway due to being already favourably disposed towards tobacco use."

Best C, et al. Tob Control 2017;0:1–6.

CONCERN: VAPING MIGHT UNDERMINE QUITTING?

www,trinketsandtrash.org

Meta-analysis

Limitations

"There are several serious problems with the analysis, but the most glaring is its reliance on studies that enrolled people who smoke, then asked if they had used e-cigarettes"

"Smokers helped by e-cigarettes have left this population (because they gave up smoking) and only those not helped have remained."

Hajek, McRobbie, Bullen Lancet Respir Med 2016

Data from randomised controlled trials

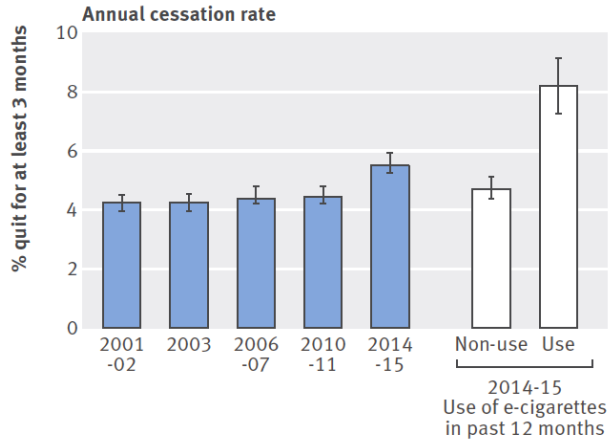
- Vaping with nicotine containing liquid, vs. placebo, significantly increases long-term quit rates

Study	Nicotine vape	Placebo vape	RR (95% CI)
Bullen 2013	7% (21/289)	4% (3/73)	1.77 (0.54 – 5.77)
Caponnetto 2013	11% (22/200)	4% (4/100)	2.75 (0.97 – 7.76)
Total	9% (43/489)	4% (7/173)	2.29 (1.05 – 4.96)

Study	Nicotine vape	Nicotine Patch	RR (95% CI)
Bullen 2013	7% (21/289)	6% (17/295)	1.26 (0.68 – 2.34)

Hartmann-Boyce J, McRobbie H, Bullen C,, Hajek P. Electronic cigarettes for smoking cessation and reduction. Cochrane Database Syst Rev 2016

Cessation rate by vaping



Data on e-cigarette use were obtained from the total sample of the 2014-15 CPS-TUS (n=161 054).

Smoking cessation rates were obtained from those who reported smoking cigarettes 12 months before the survey (n=23 270).

Rates from 2014-15 CPS-TUS were then compared with those from 2010-11 CPSTUS (n=27 280) and those from three other previous surveys.

Vaping has appeared to increase smoking cessation at the population level

Zhu et al BMJ 2017;358:j3262

Regulatory Environment

- The effectiveness of vaping may depend on the regulatory environment
- Compared to unassisted quitting, smokers who used a vapouriser to quit between 2010 and 2014
  - from UK or USA were more likely to have stopped smoking for at least 30 days (OR=1.95; 95%CI: 1.19-3.20)
  - from Australia or Canada were less likely to have stopped smoking for at least 30 days (OR=0.36; 95%CI:0.18-0.72)

Yong et al Nicotine & Tobacco Research 2017, 1-9

CONCERN: NICOTINE IS HIGHLY ADDICTIVE

Is vaping addictive?

This may change in the future as EC technology evolves

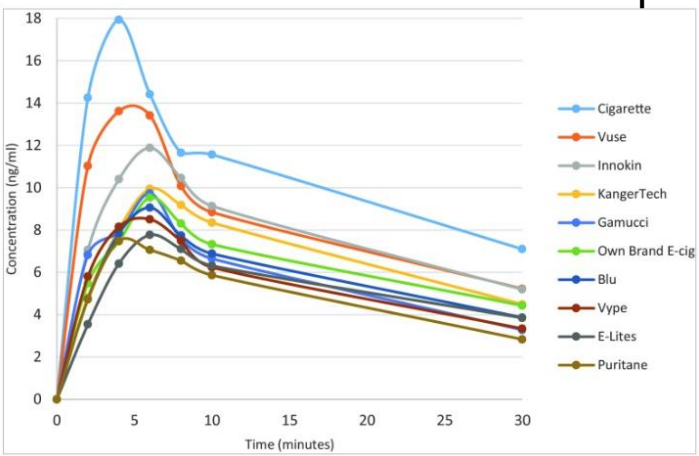
- Very few never smokers who try EC become regular users
- EC users report that they feel less dependent on them than on cigarettes
- Possible reasons for this include:
  - Pulmonary absorption from currently available EC is likely to be low, especially with first time use
  - **The addictiveness of cigarettes is likely to also be related to other substances in tobacco smoke**

Nicotine delivery

- The amount of nicotine delivered to the user depends on various factors
  - the **concentration of nicotine** in the liquid
  - **other constituents** of the liquid (such as the ratio of propylene glycol to vegetable glycerin)
  - **heating** of the liquid
  - **technique** of the user

Nicotine delivery

N=12 vapers



Hajek et al Pyschopharmacology (2017) 234: 773-779

CONCERN: SAFETY

Concerns about nicotine

http://www.health.state.mn.us/nicotine

- Adverse effects in pregnancy
- Effects on adolescent brain developement
- Addictiveness
- Toxicty in high doses
- Possible adverse effects of inhaled nicotine (concerns regarding potential association with lung cancer & COPD)

Toxicants

Given that there is very little uptake of regular vaping in never-smokers

Exposure to toxicants and health risks associated with vaping should be

COMPARED WITH SMOKING

In general these are at much lower levels than in cigarette smoke

Comparison of nicotine, carcinogens & toxicants

Compared to toxicants found in urine/saliva in group of cigarette smokers

Parent Compound	Biomarker/ Metabolite	Cigarettes + NRT (n=36) % (95% CI)	Cigarettes + vaping (n=36) % (95% CI)	NRT only (n=36) % (95% CI)	Vaping only (n=36) % (95% CI)
Nicotine	Nicotine	64.2 (39.2-104.9)	152.2 (90.7-255.1)	135.1 (68.1-268.0)	60.4 (35.8-101.8)
NNK	NNAL	**57.1** (33.1-98.4)	81.2 (49.7-132.8)	**11.6** (6.3-21.3)	**2.5** (1.5-4.2)
Acrolein	3HPMA	107.1 (71.8-159.7)	91.2 (60.2-138.2)	**35.3** (23.5-53.0)	**33.3** (20.9-53.1)
Acrylamide	AAMA	80.2 (57.9-111.1)	115.9 (80.8-166.1)	**45.4** (32.4-63.5)	**42.9** (31.1-59.2)
1,3-Butadiene	MHBMA3	101.9 (64.6-160.7)	115.0 (73.2-180.6)	**19.9** (12.8-30.7)	**11.0** (7.5-16.1)

Shahab et al. Ann Intern Med 2017. 166(6): 390-400

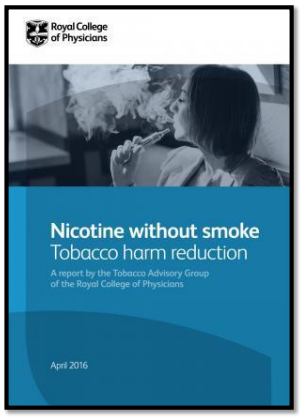
Cancer risk

Table 1 Unit risks and average concentrations for IARC type 1 and 2 carcinogens measured in tobacco smoke and other forms of nicotine delivery

Carcinogens			Tobacco smoke (n=309)	Heat-not-burn emission (n=44)	E-cigarette vapour (n=44)	Nicotine inhaler (n=1)
Compound	IARC type	OEHHA unit risk U_i $(\mu g/m^3)^{-1}$	Mean concentration E_i (μg/mL)	Mean concentration E_i (μg/mL)	Mean concentration in first-generation and second-generation e-cigarettes C_i (μg/mL)	Mean concentration C_i (μg/mL)
Acetaldehyde	2B	2.7×10^{-6}	$\mathbf{2.55\times10^{-0}}$	$\mathbf{3.33\times10^{-1}}$	4.41×10^{-3}	1.05×10^{-4}
Formaldehyde	1	6.0×10^{-6}	1.54×10^{-1}	$\mathbf{1.06\times10^{-2}}$	$\mathbf{8.07\times10^{-3}}$	$\mathbf{1.90\times10^{-4}}$
Acrylonitrile	2B	2.9×10^{-4}	$\mathbf{4.59\times10^{-2}}$	$\mathbf{2.96\times10^{-4}}$	NR	NR
Benzene	1	2.9×10^{-5}	$\mathbf{1.57\times10^{-1}}$	9.32×10^{-4}	NR	NR
1,3-Butadiene	1	1.7×10^{-4}	$\mathbf{1.83\times10^{-1}}$	$\mathbf{3.94\times10^{-4}}$	NR	NR
2-Amino-naphthalene	1	5.14×10^{-4}	4.13×10^{-5}	4.82×10^{-8}	NR	NR
4-Amino-biphenyl	1	6.0×10^{-3}	8.68×10^{-6}	1.80×10^{-8}	NR	NR
Benzo[a]pyrene	1	1.1×10^{-3}	3.67×10^{-5}	2.12×10^{-6}	NR	NR
NNN	1	4.0×10^{-4}	4.63×10^{-4}	2.57×10^{-5}	1.94×10^{-7}	BDL
NNK	1	4.0×10^{-4}	2.88×10^{-4}	1.64×10^{-5}	8.39×10^{-7}	BDL
Cadmium	1	4.2×10^{-3}	1.99×10^{-4}	BDL	$\mathbf{1.01\times10^{-5}}$	$\mathbf{9.52\times10^{-7}}$
Lead	2B	1.2×10^{-5}	7.52×10^{-5}	4.09×10^{-6}	7.06×10^{-6}	1.90×10^{-6}
Chromium	1	1.5×10^{-1}	BDL	BDL	NR	NR
Nickel	2B	2.6×10^{-4}	BDL	BDL	6.98×10^{-6}	1.90×10^{-6}
Arsenic	1	3.3×10^{-3}	2.20×10^{-5}	2.14×10^{-6}	NR	NR
Mean cancer potency ratio (equation 5)			1.0	2.01×10^{-2}	1.81×10^{-3}	1.02×10^{-4}
Mean lifetime cancer risk (equations 6 and 7)		Consumption	15 cigarettes/day	15 sticks/day	30 L vapour/day	30 L vapour/day
		Risk	2.1×10^{-2}	5.7×10^{-4}	3.3×10^{-5}	3.3×10^{-5}
		Ratio to tobacco smoke	1.0	0.024	0.004	0.0004
		Ratio to nicotine inhaler	2697	64	10.7	1.0

Stephens WE. Tob Control 2017;0:1–8. doi:10.1136/tobaccocontrol-2017-053808

Level of risk

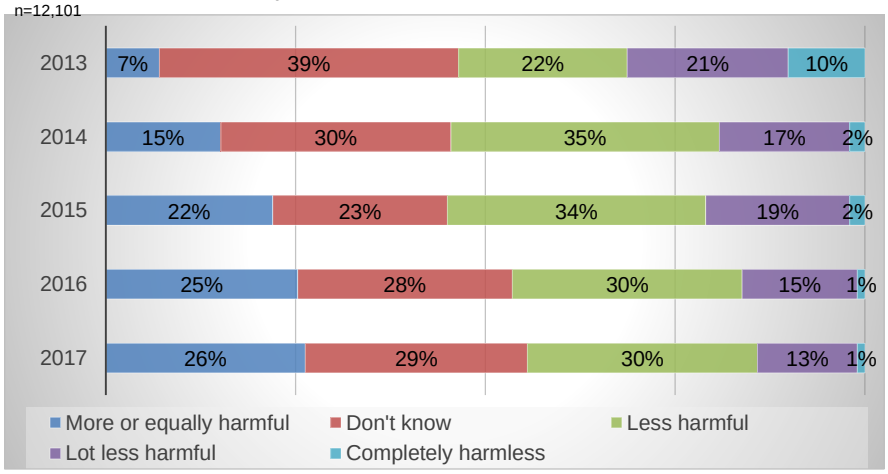


- We cannot be certain on the exact degree of risk
- However, an estimate can be based on the facts that the constituents of cigarette smoke that harm health are either
  - absent in e-cigarette vapour, or
  - if present, are mostly at levels significantly below 5% of doses from smoking (mostly below 1%)

Nutt et al. Estimating the harms of nicotine-containing products using the MCDA approach. Eur Addict Res 2014;20:218–25.
McNeill et al. E-cigarettes: an evidence update. A report commissioned by Public Health England. London: PHE, 2015.

Perception of harm from vaping relative to smoking

All GB adults who have heard of e-cigarettes - 2013, n=8936; 2014, n=11,307; 2015 n=11,340; 2016 n=11,489; 2017 n=12,101



ASH Factsheet: Use of electronic cigarettes (vapourisers) among adults in Great Britain. May 2017

Harm Reduction

- Important option for people who find quitting difficult
- Acknowledges the role that vapourisers and other novel nicotine delivery systems can play
- New Zealand's changing legislation will incorporate a harm reduction approach

New Zealand Legislation

Currently

- The sale and supply of nicotine containing vapourisers/liquid is unlawful
- People can obtain nicotine vaping products for via personal online overseas sales (or illegal local sales)

2018

- Change to legalise the sale and supply of nicotine containing vapourisers with appropriate controls

Changes in 2018

- Legalise the sale and supply of nicotine containing vapourisers and liquid as consumer products
- Prohibit sale and supply in a public place to under 18s
- Allow point of sale displays
- R18 retail settings will be allowed to promote products
- Prohibit broader advertising
- Prohibit vaping in where smoking is not allowed under the SFEA 1990
- Set requirements for product safety
- Develop a regulatory framework

NCSCT Films - Switch
https://www.youtube.com/watch?v=qljBzXmTqjE

Conclusions

- There is growing evidence that electronic cigarettes can help people stop smoking
- Long-term health effects are unknown, however any risks are likely to be many times less than risks associated with smoking tobacco
- Proportional risk analysis needs to be considered when regulating vaping
- The current evidence shows that allowing smokers better access to vaping is associated with net public health benefit
- Ongoing monitoring is needed to assess emerging problems and benefits

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THE END