Electronic cigarette – risks to adolescents

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1.1 What is e-cig

- **Electronic cigarettes** are devices that **do not burn** or use tobacco leaves but instead **vapourise a solution** to generate the aerosol that the user inhales
- The **most common prototype of Electronic Nicotine Delivery Systems** (ENDS)

Adapted from the WHO Statement on ENDS/ENNDS - vhttp://www.who.int/tobacco/communications/statements/eletronic-cigarettes-january-2017/en/

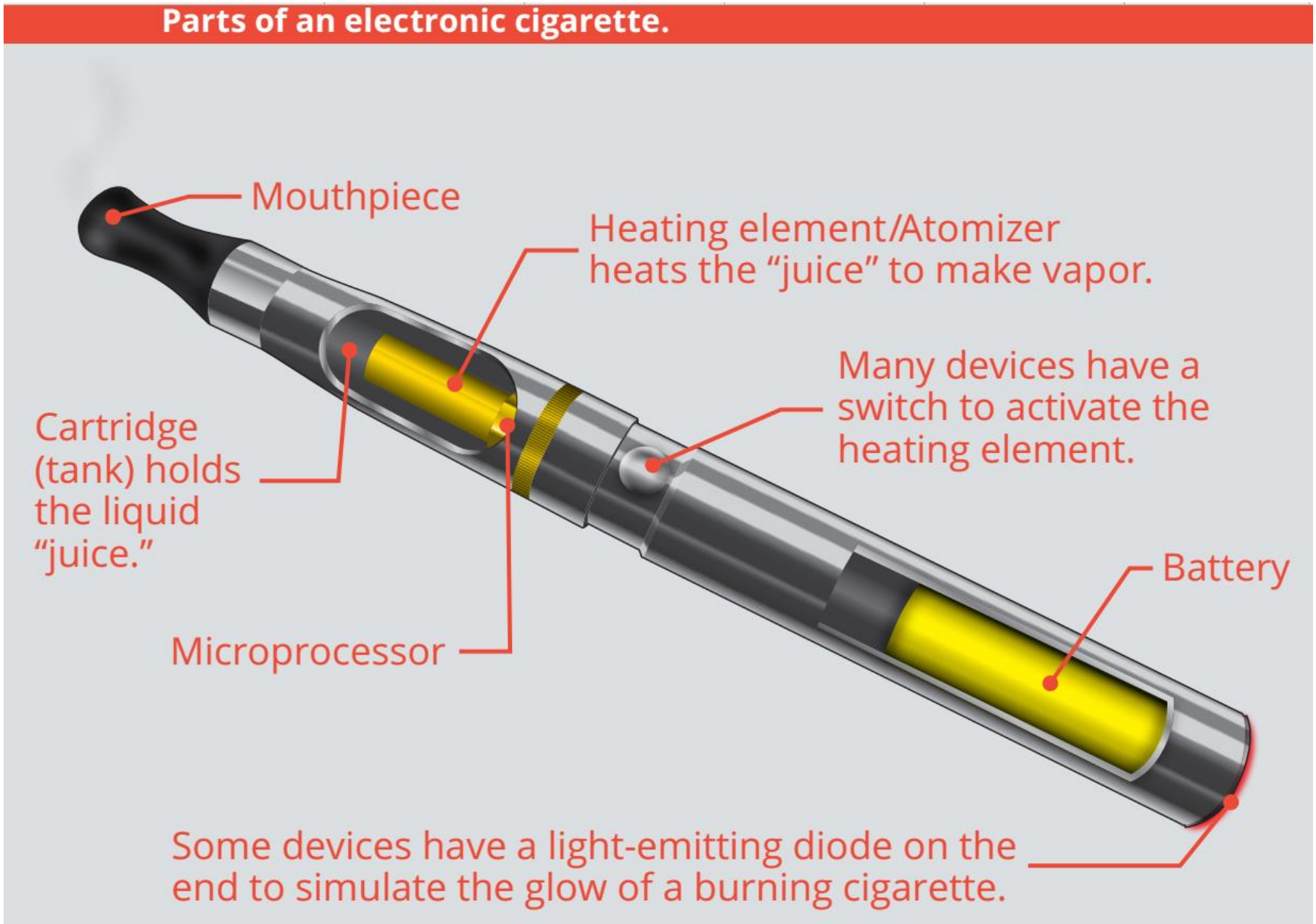
1.1 What is e-cig

- JUUL become extremely popular over the last 3 years

Sources: https://vaporsandthings.com/products/juulpod-4-pack?variant=5057950253092/

Juul's advertising in 2015

Source: https://www.nytimes.com/2018/08/27/science/juul-vaping-teen-marketing.html



Electronic Cigarette Fires and Explosions in the United States 2009 - 2016. U.S. Fire Administration;2017.

Are e-cigs safe?

Harmful chemicals found in e-liquids and aerosol	
Additives and flavourings	Numerous types, not fully disclosed, unknown health effects
Solvent: glycerin (甘油), propylene glycol (丙二醇), or both	Converted to **formaldehyde**-releasing agents while heated
Formaldehyde (甲醛)	Carcinogen, result in respiratory symptoms, and eye, nose, and throat irritation
Polycyclic Aromatic Hydrocarbons (PAHs) (多環芳烴)	Carcinogen
Poly-brominated Diphenyl Ethers (PBDEs) (聚溴二苯醚)	Affect thyroid secretion, reproductive system and fetal development
Heavy metal (eg. tin, nickel, copper, lead)	Metal nanoparticles enter deep into air sacs of lungs
Cartridges and e-liquids	Unintended exposure (ingestion / dermal /inhalation) in children can lead to vomiting, drowsiness, eye irritation, cough/choke or death

American Journal of
Preventive Medicine

RESEARCH ARTICLE

Association Between Electronic Cigarette Use and Myocardial Infarction

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Introduction: Electronic cigarettes (e-cigarettes) are promoted as a less risky alternative to conventional cigarettes and have grown in popularity. Experimental and clinical evidence suggests that they could increase the risk of myocardial infarction.

Methods: The National Health Interview Surveys of 2014 (n=36,697) and 2016 (n=33,028) were used to examine the cross-sectional association between e-cigarette use (never, former, some days, daily) and cigarette smoking (same categories) and myocardial infarction in a single logistic regression model that also included demographics (age, gender, BMI) and health characteristics (hypertension, diabetes, and hypercholesterolemia) using logistic regression. Data were collected in 2014 and 2016 and analyzed in 2017 and 2018.

Results: Daily e-cigarette use was independently associated with increased odds of having had a myocardial infarction (OR=1.79, 95% CI=1.20, 2.66, p=0.004) as was daily conventional cigarette smoking (OR=2.72, 95% CI=2.29, 3.24, p<0.001). Former and some day e-cigarette use were not significantly associated with having had a myocardial infarction (p=0.608 and p=0.392) whereas former (OR=1.70, p<0.001) and some day cigarette smoking (OR=2.36, p<0.001) were. Odds of a myocardial infarction were also increased with history of hypertension (OR=2.32, p<0.001); high cholesterol (OR=2.36, p<0.001); and diabetes (OR=1.77, p<0.001); and age (OR=1.65 per 10 years, p<0.001). Women (OR=0.47, p<0.001) had lower odds of myocardial infarction.

E-cigarette smoke damages DNA and reduces repair activity in mouse lung, heart, and bladder as well as in human lung and bladder cells

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Edited by Bert Vogelstein, Johns Hopkins University, Baltimore, MD, and approved December 20, 2017 (received for review October 17, 2017)

E-cigarette smoke delivers stimulant nicotine as aerosol without tobacco or the burning process. It contains neither carcinogenic incomplete combustion byproducts nor tobacco nitrosamines, the nicotine nitrosation products. E-cigarettes are promoted as safe and have gained significant popularity. In this study, instead of detecting nitrosamines, we directly measured DNA damage induced by nitrosamines in different organs of E-cigarette smoke-exposed mice. We found mutagenic O^6-methyldeoxyguanosines and γ-hydroxy-1,N^2-propano-deoxyguanosines in the lung, bladder, and heart. DNA-repair activity and repair proteins XPC and OGG1/2 are significantly reduced in the lung. We found that nicotine and its metabolite, nicotine-derived nitrosamine ketone, can induce the same effects and enhance mutational susceptibility and tumorigenic transformation of cultured human bronchial epithelial and urothelial cells. These results indicate that nicotine nitrosation occurs in vivo in mice and that E-cigarette smoke is carcinogenic to the murine lung and bladder and harmful to the murine heart. It is therefore possible that E-cigarette smoke may contribute to lung and bladder cancer, as well as heart disease, in humans.

carcinogenicity of ECS, we determined whether ECS can induce DNA damage in different organs of a mouse model and whether ECS can affect DNA-repair activity. We then characterized the chemical nature of ECS-induced DNA damage and how ECS affects DNA repair. Last, we determined the effect of ECS metabolites on the susceptibility to mutations and tumorigenic transformation of cultured human cells.

Results

ECS Induces O^6-Methyl-Deoxuguanosine in the Lung, Bladder, and Heart. Nicotine is the major component of ECS (3). The majority (80%) of inhaled nicotine in smoke is quickly metabolized into cotinine, which is excreted into the bloodstream and subsequently into urine (14). Cotinine is generally believed to be nontoxic and noncarcinogenic (15); however, a small portion (<10%) of inhaled nicotine is believed to be metabolized into nitrosamines in vivo (16–18). Nitrosamines induce tumors in different organs in animal models (6, 19). Inhaled nitrosamines are metabolized into *N*-nitrosonornicotine (NNN) and nicotine-

Teen vaped equivalent of 80 cigarettes and had a seizure. Now, he's sharing his cautionary tale.

16-year-old and his mom were in Newton this week

By Kristen Hart khart@hickoryrecord.com Apr 12, 2019

Kelly and Luka Kinard spoke at Newton-Conover Middle School this week to warn teens and parents about the dangers of vaping.

KRISTEN HART/HICKORY DAILY RECORD

https://www.hickoryrecord.com/news/teen-vaped-equivalent-of-cigarettes-and-had-a-seizure-now/article_00bcdf6e-5c8f-11e9-abf7-b7f803ccdc8b.html

Electronic cigarette explosion and burn injuries

US Emergency Departments (2015 – 2017):

- There were an estimated **2035** case presenting to US hospital emergency departments (95% CI 1107 to 2964)

University of Washington Medical Center:

- Explosion injuries: flame burns (80% of patients), chemical burns (33%), and blast injuries (27%)
- **face (20%), hands (33%), and thigh or groin (53%)**

Rossheim ME , et al. Tobacco control. 2018;0:1–3.
Brownson EG, et al. New England journal of medicine. 2016, 6;375(14):1400-2.

1.2 Heated Tobacco Products

- Heated tobacco products are a new tobacco heating system, which heat a tobacco stick or a tobacco capsule with high temperature
- Also called ‘heat-not-burn’ by tobacco industry
- Examples include ‘iQOS’, ‘glo’, and ‘revo’

iQOS by PMI

Glo by BAT

Ploom by JT

Parts of an iQOS

Pieper, Elke, et al. Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz 2018, 61.11: 1422-1428.

Health risks of HTP

- A kind of tobacco products

- Tobacco is the main ingredient
- Containing **nicotine** and is **addictive**
- Tobacco is inherently **toxic** and contains **carcinogens** (even in its natural form) - **no safety level**

Health risks of HTP

Aerosol of HTP contains chemicals commonly found in traditional cigarettes (cigs)

- **volatile organic compound (VOC)**
- **carbon monoxide (CO)**
- carcinogenic **polycyclic aromatic hydrocarbons (PAHs**)
- **Formaldehyde**

- The Ministry of Food and Drug Safety of South Korea found that some HTP contain similar or even higher amount of **nicotine** and **tar** when compared with conventional cigs.

Source: http://www.hani.co.kr/arti/english_edition/e_business/848291.html

New evidence - iQOS

BMJ Journals

Tobacco Control

Research paper

iQOS: evidence of pyrolysis and release of a toxicant from plastic

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13 March 2018

Abstract

Objective To evaluate performance of the I quit original smoking (iQOS) heat-not-burn system as a function of cleaning and puffing topography, investigate the validity of manufacturer's claims that this device does not burn tobacco and determine if the polymer-film filter is potentially harmful.

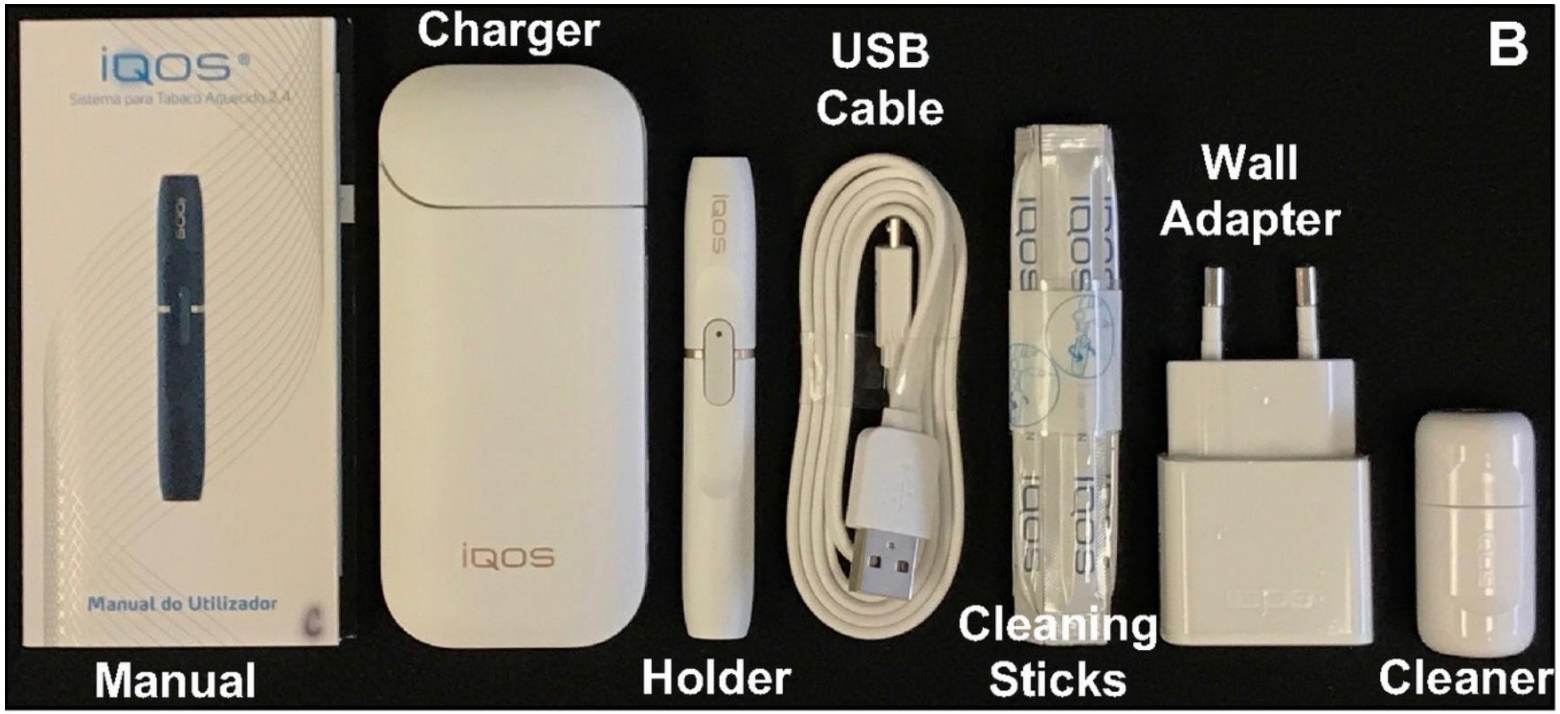
Methods iQOS performance was evaluated using five running conditions incorporating two different cleaning protocols. Heatsticks were visually and stereomicroscopically inspected preuse and postuse to determine the extent of tobacco plug charring (from pyrolysis) and polymer-film filter melting, and to elucidate the effects of cleaning on charring. Gas chromatography–mass spectrometry headspace analysis was conducted on unused polymer-film filters to determine if potentially toxic chemicals are emitted from the filter during heating.

Results For all testing protocols, pressure drop decreased as puff number increased. Changes in testing protocols did not affect aerosol density. Charring due to pyrolysis (a form of organic matter thermochemical decomposition) was observed in the tobacco plug after use. When the manufacturer's cleaning instructions were followed, both charring of the tobacco plug and melting of the polymer-film filter increased. Headspace analysis of the polymer-film filter revealed the release of formaldehyde cyanohydrin at 90°C, which is well below the maximum temperature reached during normal usage.

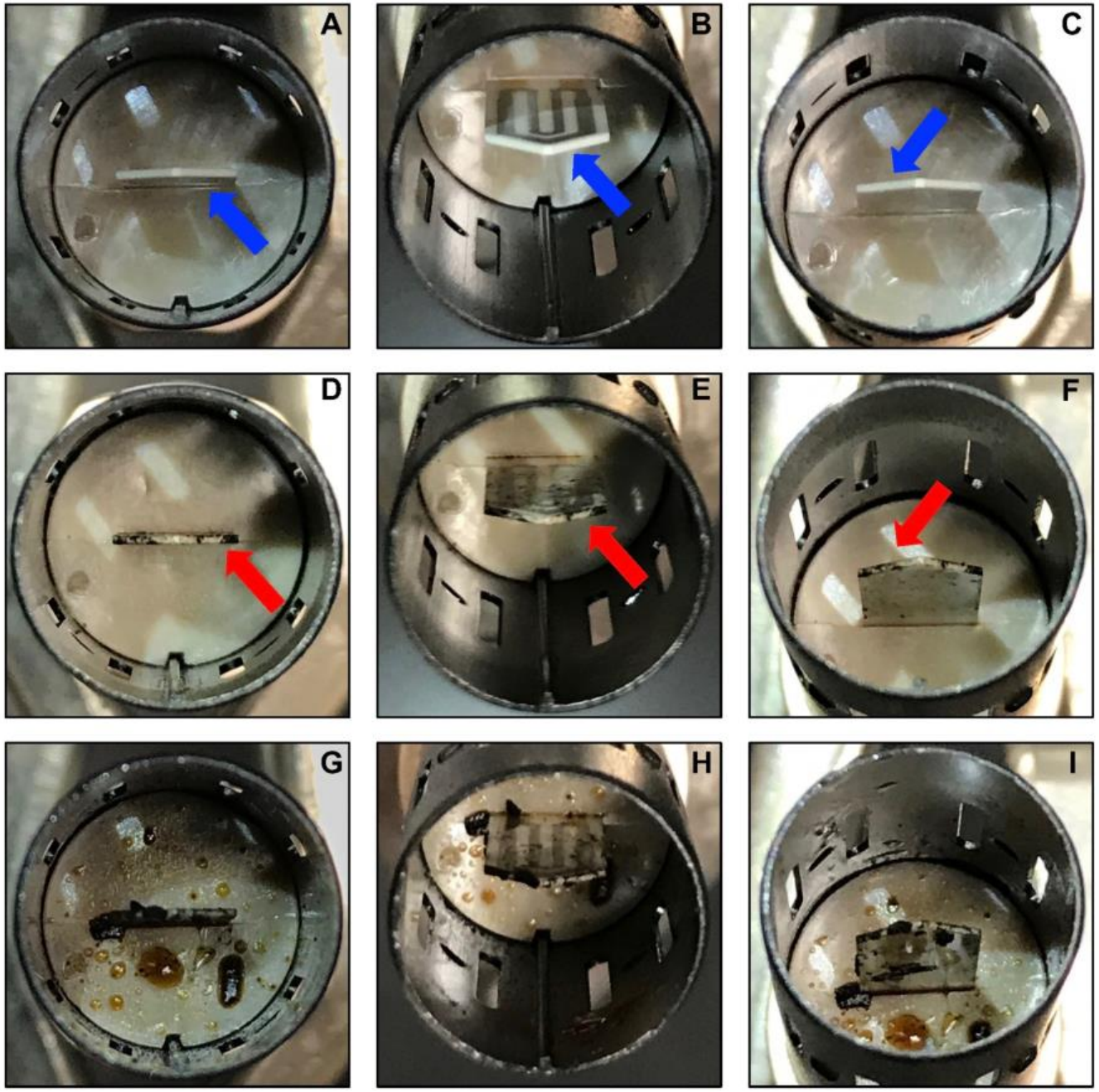
Discussion Device usage limitations may contribute to decreases in interpuff intervals, potentially increasing user's intake of nicotine and other harmful chemicals. This study found that the tobacco plug does char and that charring increases when the device is not cleaned between heatsticks. Release of formaldehyde cyanohydrin is a concern as it is highly toxic at very low concentrations.

New evidence - iQOS

- The iQOS system uses a flange, called the ‘heater’, which is composed of a silver, gold, platinum, ceramic coating, to heat a rolled, castleaf sheet of tobacco impregnated with glycerin.



Davis B, et al. Tob Control 2019;28:34–41.

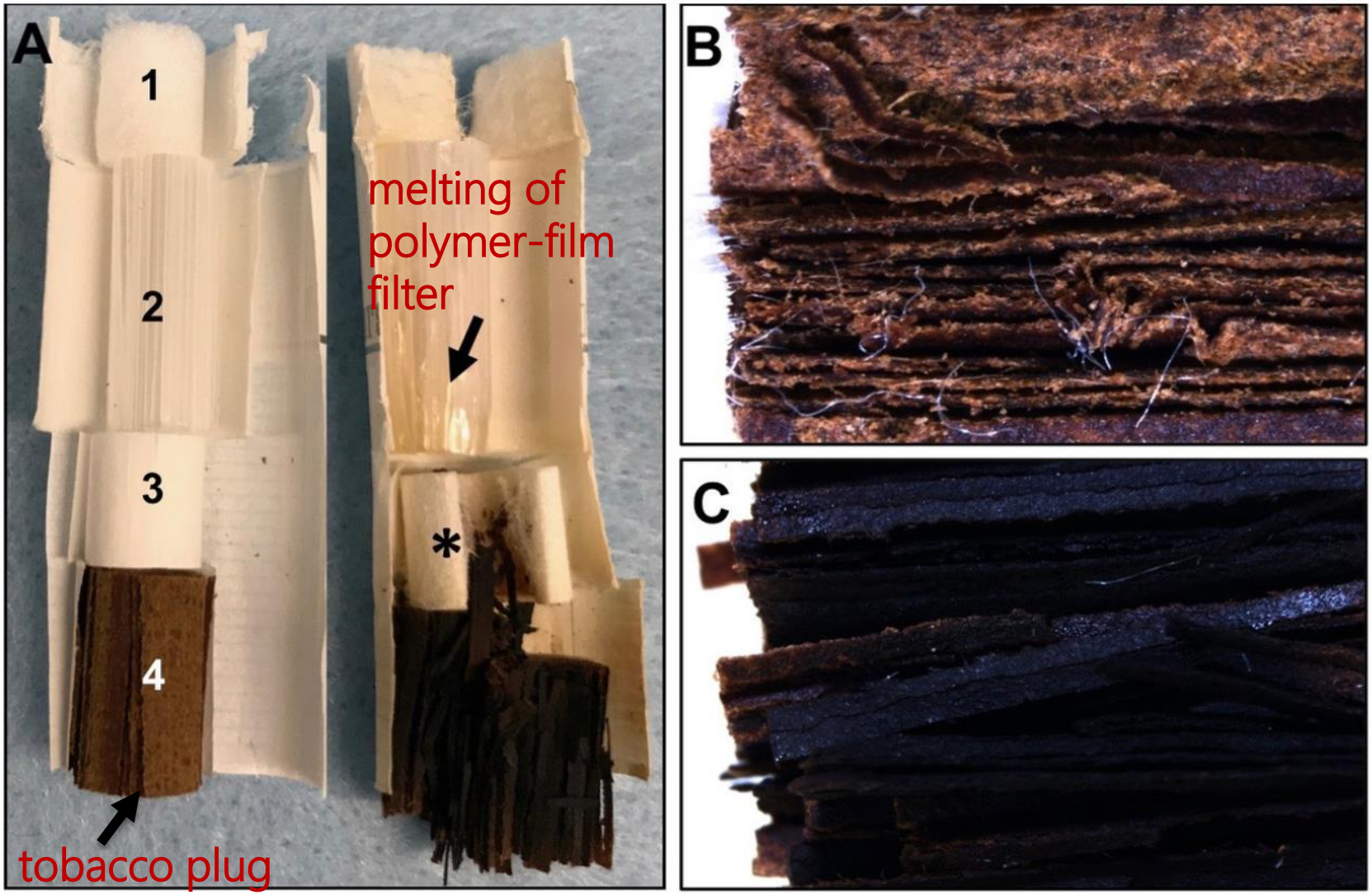


Clean, unused holder showing heater

Used holder that was cleaned after every use; black residue remains on heater

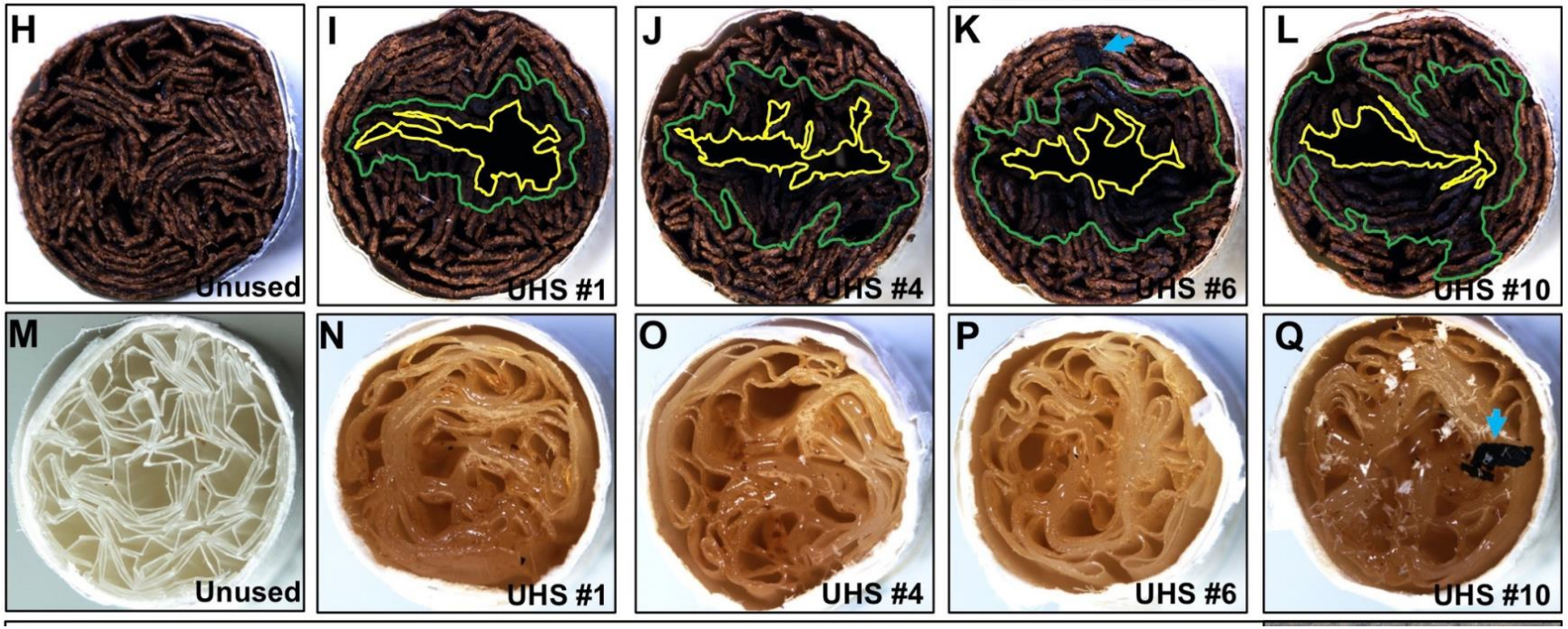
Used holder that was not cleaned between uses (10 uses).

Davis B, et al. Tob Control 2019;28:34–41.



(A) Dissected heatsticks
(B) An unused tobacco plug.
(C) Used tobacco plug showing charring/darkening with use.

Davis B, et al. Tob Control 2019;28:34–41.



(H–L) : Cross sections of **tobacco plugs** before use (H) and after use from the first, fourth, sixth and 10th heatstick of the uncleaned experiment (I–L)

(M–Q): Cross sections of **polymer-film filter** before (M) and after use (N–Q)

Davis B, et al. Tob Control 2019;28:34–41.

New evidence - iQOS

- Device limitations may decrease users' interpuff intervals, **increasing possible toxic exposures**.
- iQOS holders heat hot enough to **cause charring** of the tobacco plug via pyrolysis and **melting of the polymer-film filter**.
- iQOS **holder cleanliness** affects and contributes to increased charring of the tobacco plug and melting of the polymer-film filter.
- **Formaldehyde cyanohydrin**, a toxicant, was released from the polymer-film filter at 90°C — much lower than the regular use temperature (around 350℃).
  - 羥基乙腈(乙醇腈)，是甲醛的衍生物，很容易分解為甲醛及氰化氫，是一種極危險的有機化合物。

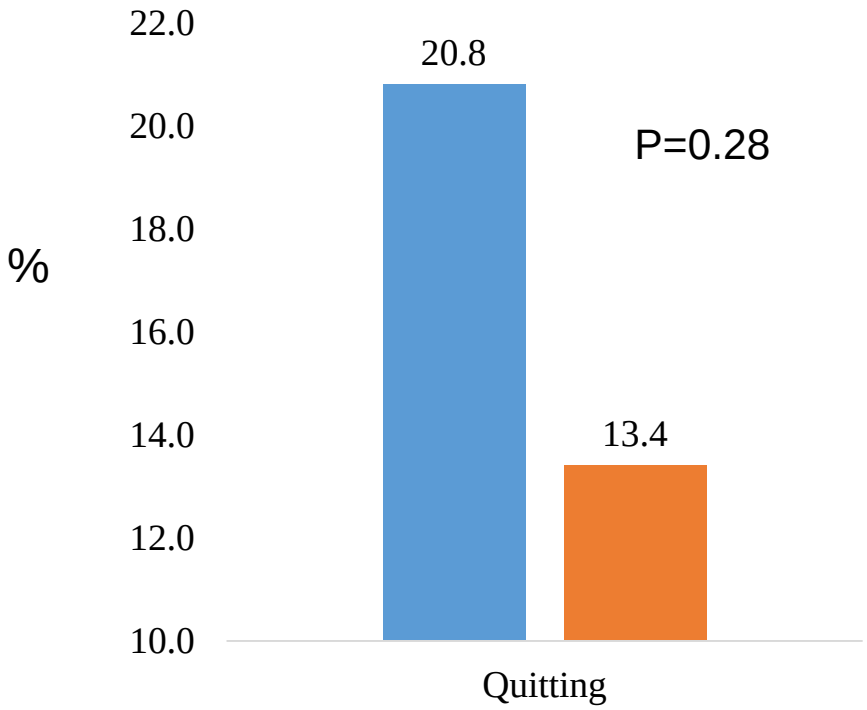
Davis B, et al. Tob Control 2019;28:34–41.

2. E-cigs help quit?

Study – Youth Quitline in Hong Kong (2014-15)

- 224 youth smokers (mean age: 18.1 years)
- 189 completed 6-month follow-up

E-cig use did not help quit smoking at 6-month follow-up



Overall quit rate at 6-month: 16.4% (31/189)

Non-users

Ever e-cig users

Adjusted odds ratio [a]: 0.56 (95% CI 0.24-1.35)

[a] Adjusting for age, sex, smoking friends, smoking family members, baseline quit attempts and Fagerström score.

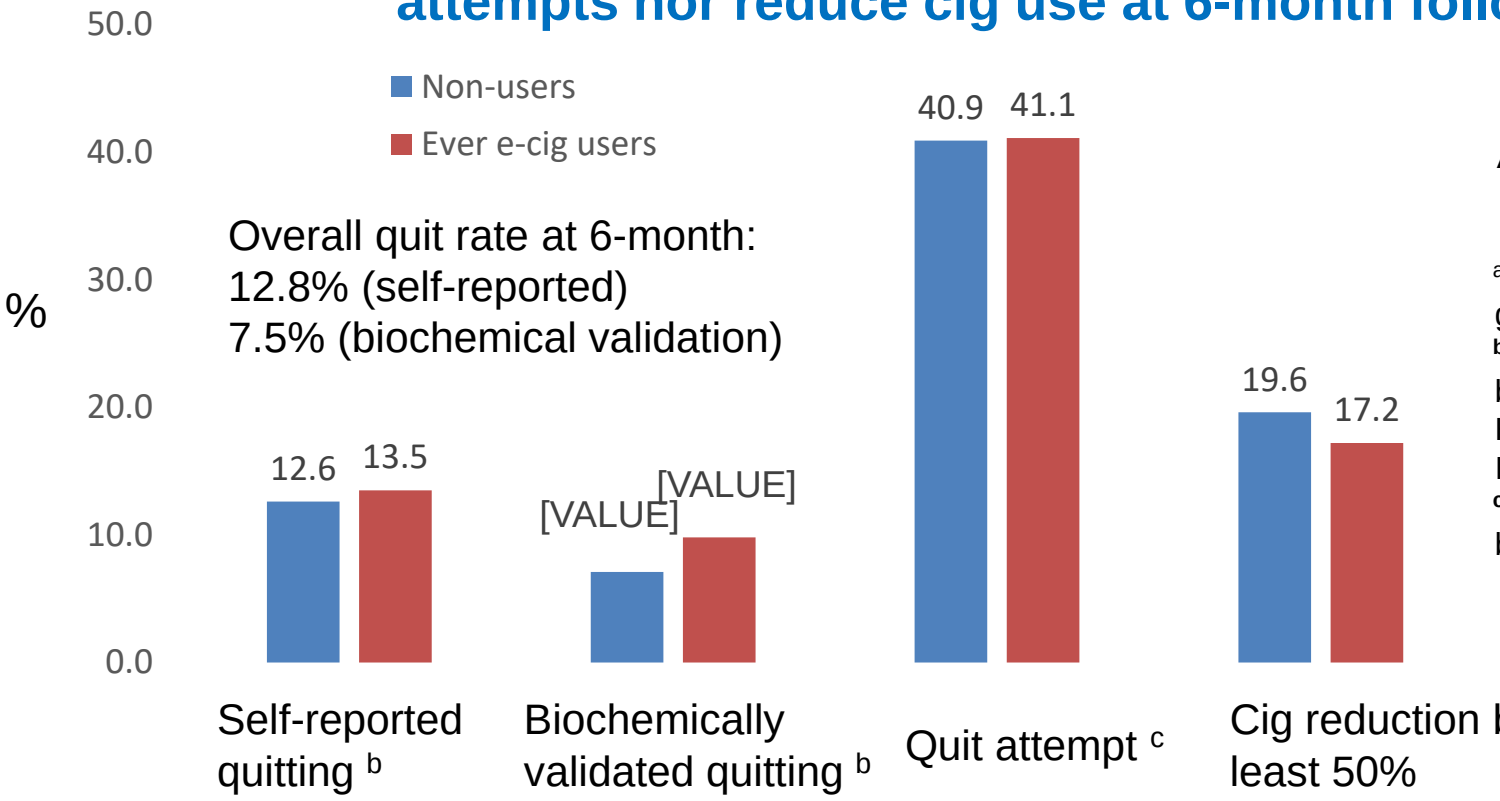
Pediatric RESEARCH

Wang MP, et al. Pediatric Research. 2017;82:14.

Study – Adult prospective study in Hong Kong (2014-15)

- **956** (median age: 41 years) "Quit to Win" Contest participants included at baseline
- Measurement: Self-reported and biomarker (salivary cotinine)

E-cig use did not help quit smoking, make quit attempts nor reduce cig use at 6-month follow-up



All P >0.05

[a] Adjusting for intervention group, age and sex.
[b] Additionally adjust for baseline quit attempts and Heaviness of Smoking Index.
[c] Additionally adjust for baseline quit attempts.

Wu SY, et al. Int J Environ Res Public Health. 2018;15(3).

European study

A Cross-sectional Survey

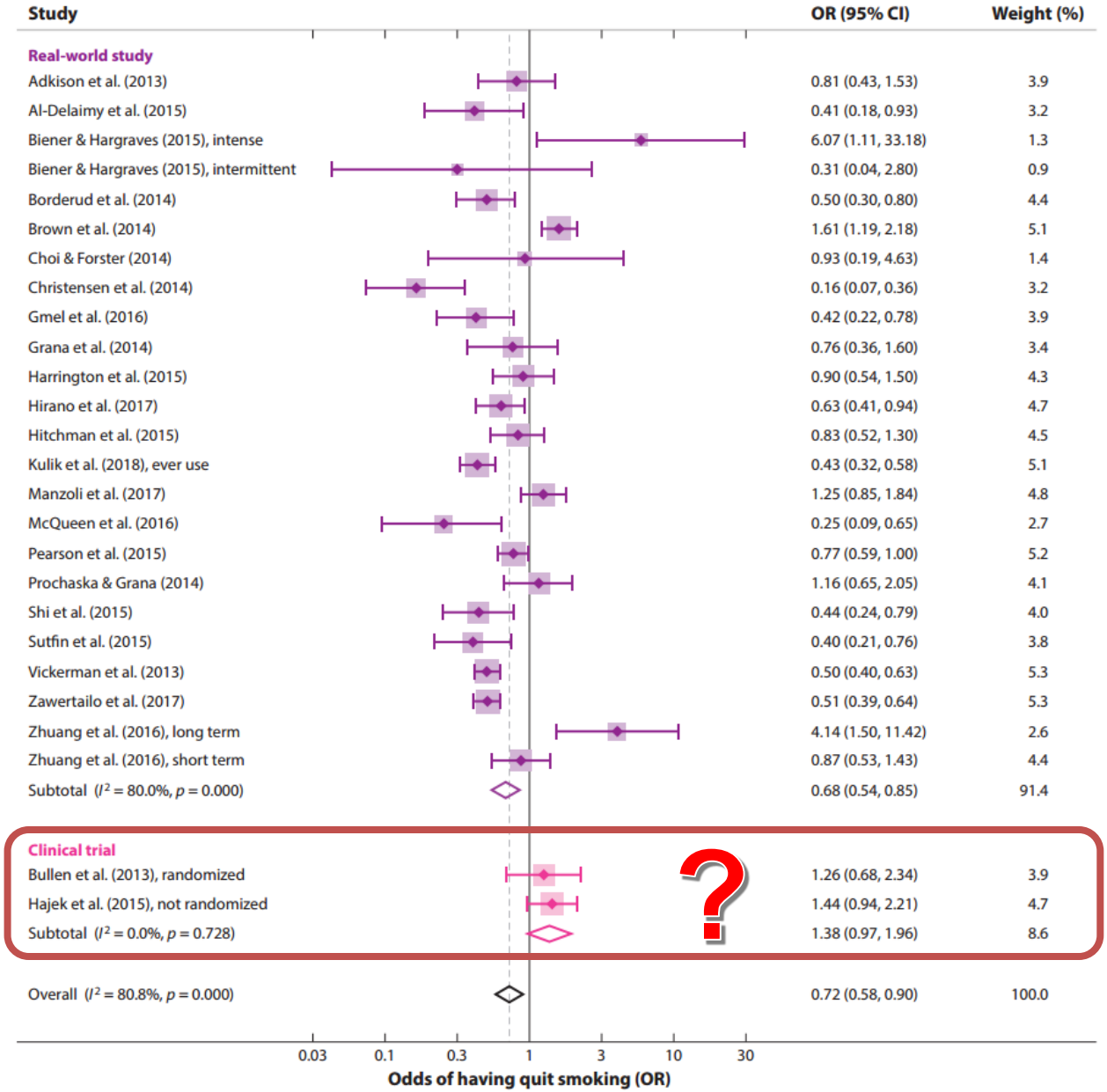
- Self reported: life-time ever use of tobacco cigs and nicotine e-cigs
- Findings:
  - **Among all ever smokers, ever regular use of nicotine e-cigs was associated with lower odds of quitting cig smoking (AOR=0.43, 95% CI 0.32-0.58) compared with never e-cig users.**
  - **Among current smokers, daily cig consumption was more among those who also used e-cigs (15.6 cigs/day) than those who did not use e-cigs (14.4 cigs/day).**

AJPM American Journal of Preventive Medicine
A Journal of the American College of Preventive Medicine and Association for Prevention Teaching and Research

Kulik M C, et al. American Journal of Preventive Medicine, 2018, 54(4):603-609

Overseas studies

- Smokers who use e-cigs are significantly less likely to have stopped smoking than smokers who do not use e-cigs, with the odds of quitting smoking depressed by 27%.



ANNUAL REVIEWS

Glantz S A, et al. Annual Review of Public Health 2018;39:215-235.

The NEW ENGLAND JOURNAL of MEDICINE

A Randomized Trial of E-Cigarettes versus Nicotine-Replacement Therapy

Peter Hajek, Ph.D., Anna Phillips-Waller, B.Sc., Dunja Przulj, Ph.D., Francesca Pesola, Ph.D., Katie Myers Smith, D.Psych., Natalie Bisal, M.Sc., Jinshuo Li, M.Phil., Steve Parrott, M.Sc., Peter Sasieni, Ph.D., Lynne Dawkins, Ph.D., Louise Ross, Maciej Goniewicz, Ph.D., Pharm.D., et al.

February 14, 2019

METHODS

We randomly assigned adults attending U.K. National Health Service stop-smoking services to either nicotine-replacement products of their choice, including product combinations, provided for up to 3 months, or an e-cigarette starter pack (a second-generation refillable e-cigarette with one bottle of nicotine e-liquid [18 mg per milliliter]), with a recommendation to purchase further e-liquids of the flavor and strength of their choice. Treatment included weekly behavioral support for at least 4 weeks. The primary outcome was sustained abstinence for 1 year, which was validated biochemically at the final visit. Participants who were lost to follow-up or did not provide biochemical validation were considered to not be abstinent. Secondary outcomes included participant-reported treatment usage and respiratory symptoms.

- **Background: Public Health England of the UK supports using e-cigs by smokers, saying that e-cigs are 95% less harmful than cigs.**

Hajek P, et al. New England Journal of Medicine. 2019,14;380(7):629-37.

The NEW ENGLAND JOURNAL of MEDICINE

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February 14, 2019

A total of 886 participants underwent randomization. The 1-year abstinence rate was 18.0% in the e-cigarette group, as compared with 9.9% in the nicotine-replacement group (relative risk, 1.83; 95% confidence interval [CI], 1.30 to 2.58; P<0.001). Among participants with 1-year abstinence, those in the e-cigarette group were more likely than those in the nicotine-replacement group to use their assigned product at 52 weeks (80% [63 of 79 participants] vs. 9% [4 of 44 participants]). Overall, throat or mouth

- **Primary outcome: abstinence (from cigs) rather than quitting all smoking products and nicotine.**
- **If the primary outcome was abstinence from both cigs and nicotine, the new results are:**

  E-cig group: 16/438 (3.7%)
  NRT group: 40/446 (9.0%)
  Estimated relative risk = (16/438) / (40/446) = 0.41

Hajek P, et al. New England Journal of Medicine. 2019,14;380(7):629-37.

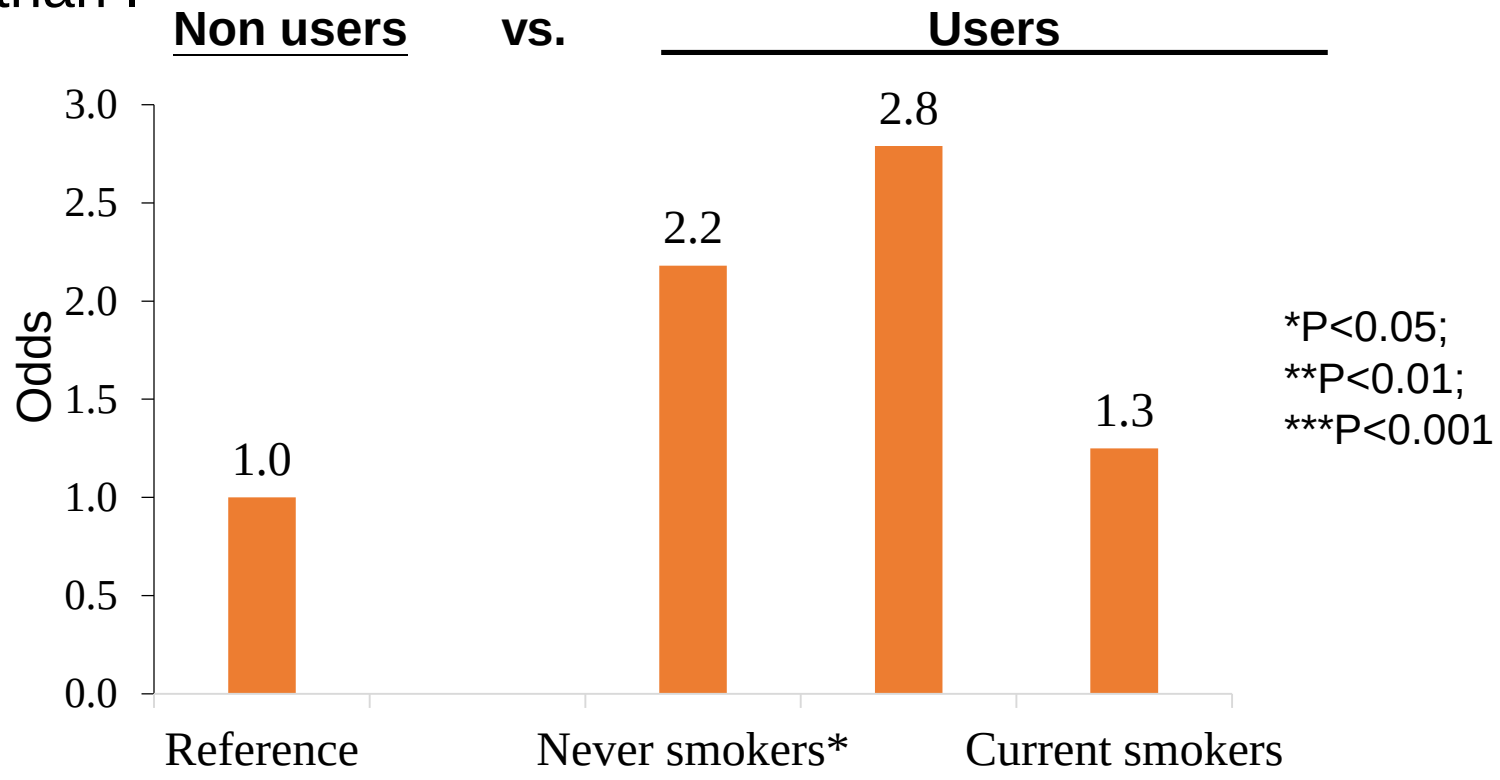
3. E-cig use and smoking

Student smoking survey in Hong Kong

- Biennial since 2010-11, the latest is 2016-17
- Among primary and secondary school students
  - School-based
  - Stratified by districts
- Representative, sample size:
  - Around 30,000 secondary school students
  - Around 15,000 primary school students

E-cig use and smoking (2012/13)

- Past 30-day e-cig use was positively associated with intention to smoke cigs and nicotine addiction.
- Current dual users smoked **2-3** cigs **more** per day than .

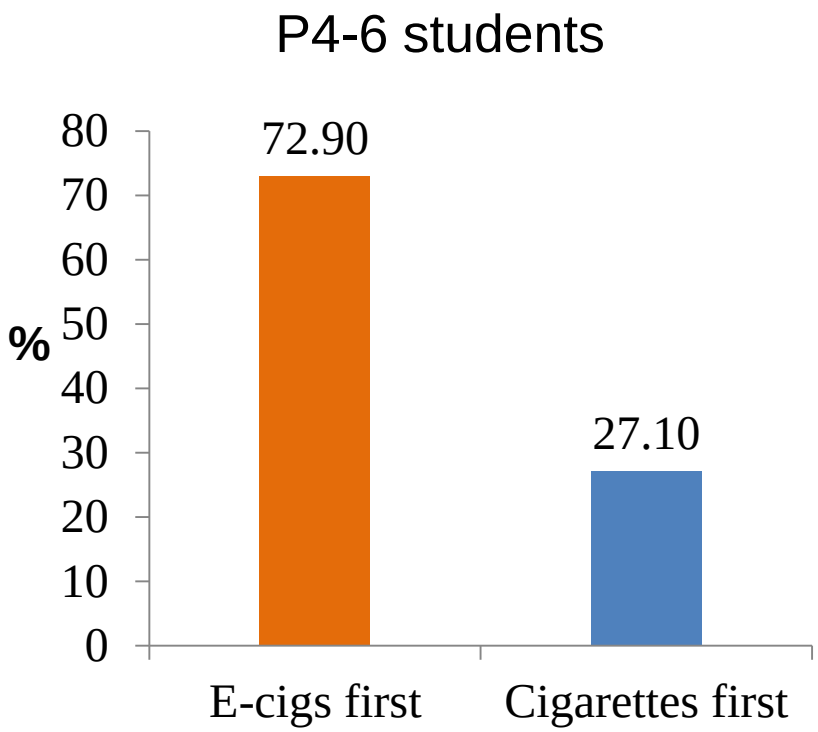


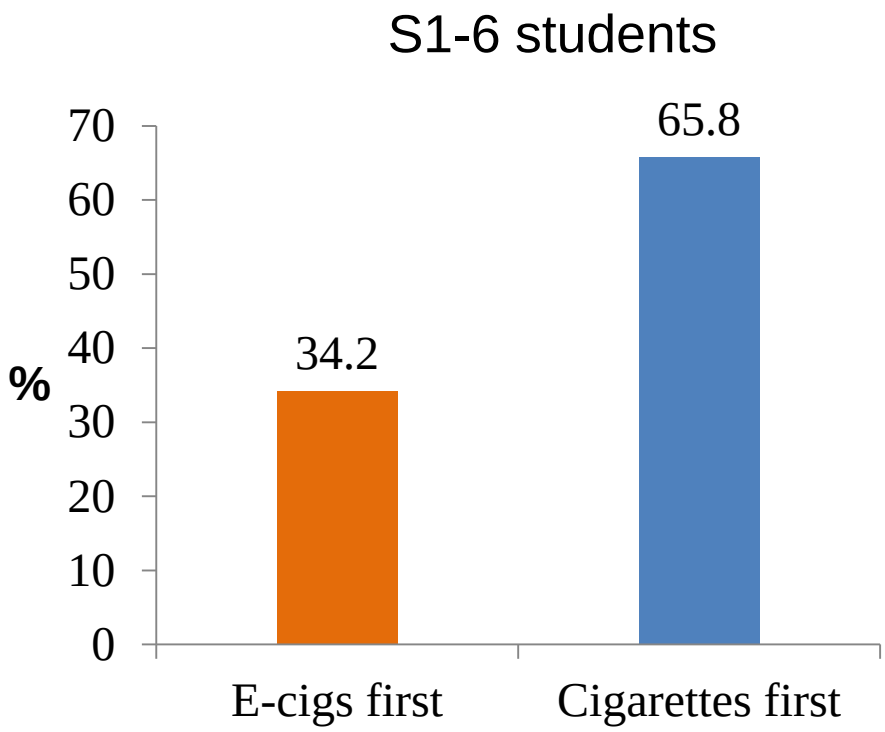
School-based Survey on Smoking among Students 2012/13
(75 secondary schools – 45128 S1-6 students)

Wang M P, et al. Addictive Behaviors, 2015, 50:124-127.

E-cig use as a gateway to cig smoking (2016/17)

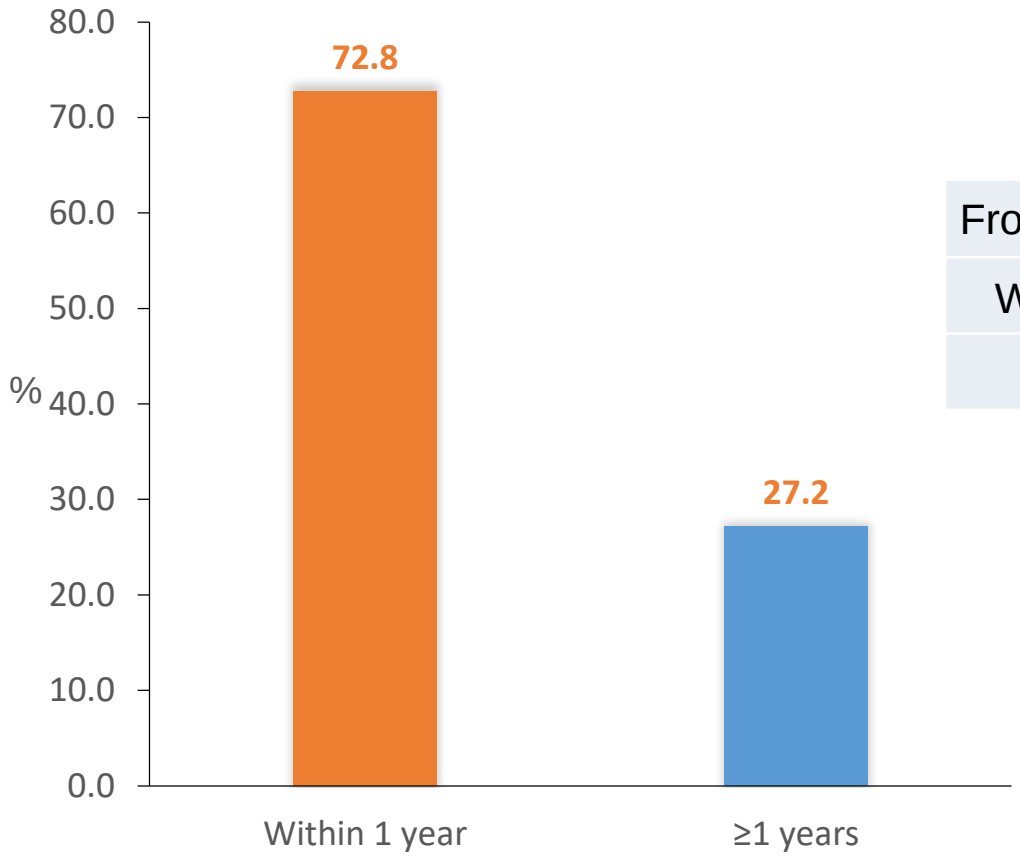
- **>70%** ever users (P4-6) of both cigs and e-cigs used e-cigs first





School-based Survey on Smoking among Students 2016/17
(75 primary schools – 16512 P4-6 students; 84 secondary schools – 27159 S1-6 students)

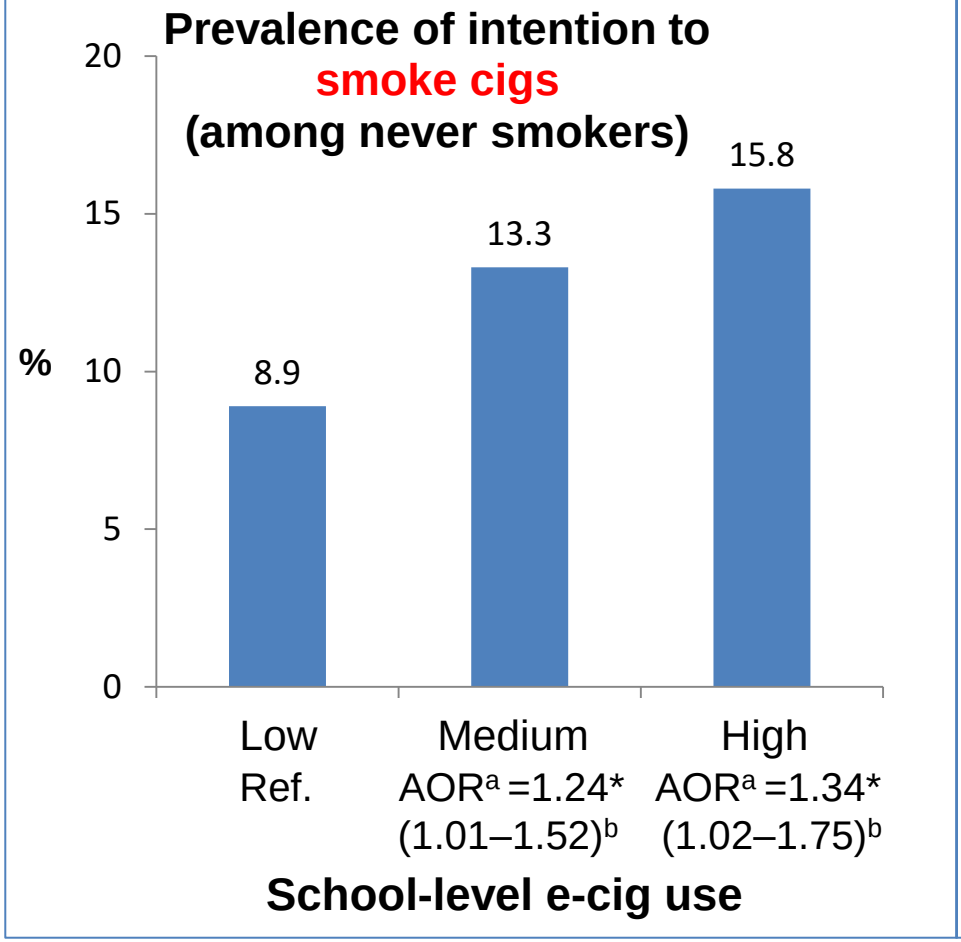
Time interval between the first puff of EC and monthly cig smoking (2016/17)

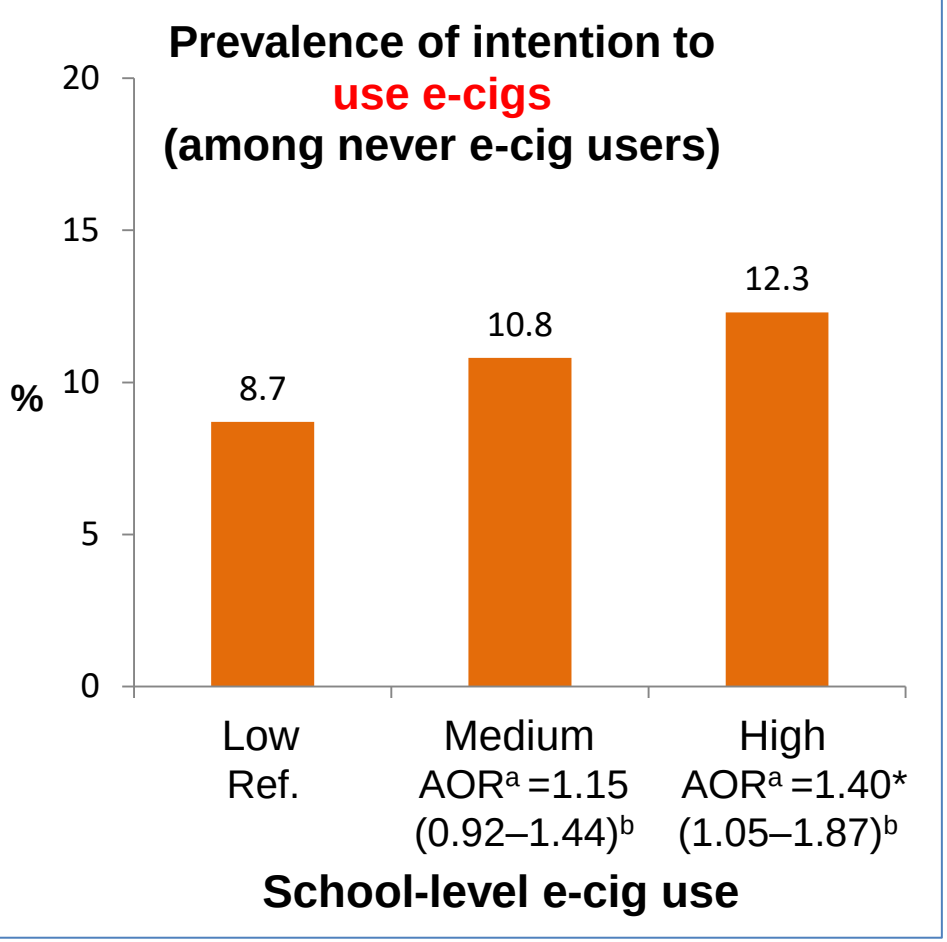


From e-cig to cig	%	N
Within 1 year	72.8	198
≥1 years	27.2	74

School-based Survey on Smoking among Students 2016/17
(84 secondary schools – 10087 S1-6 students)

Students in schools with higher e-cig use prevalence were more likely to have intention to use e-cigs and smoke cigs (2014/15)





SCIENTIFIC REPORTS

School-based Survey on Smoking among Students 2014/15 (92 secondary schools – 40202 S1-6 students)

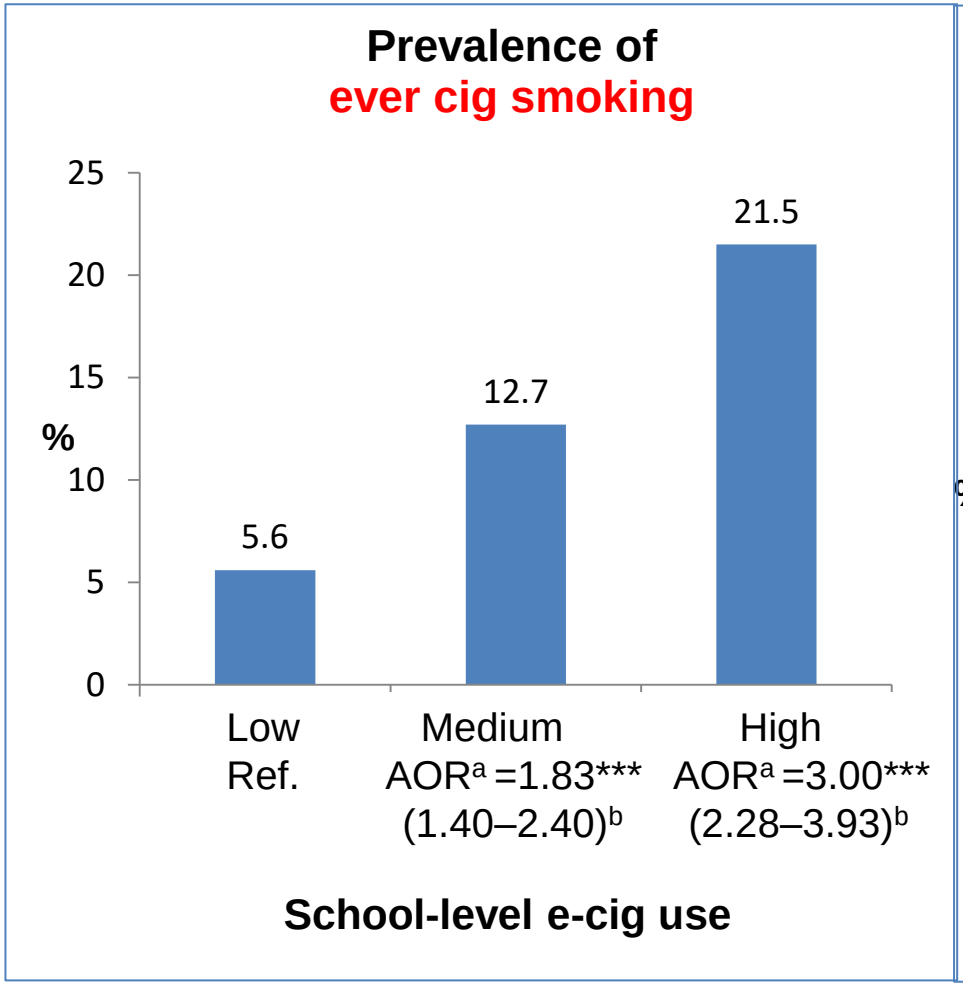
Chen J, et al. Scientific Reports, 2019 ; 9(1):1690.

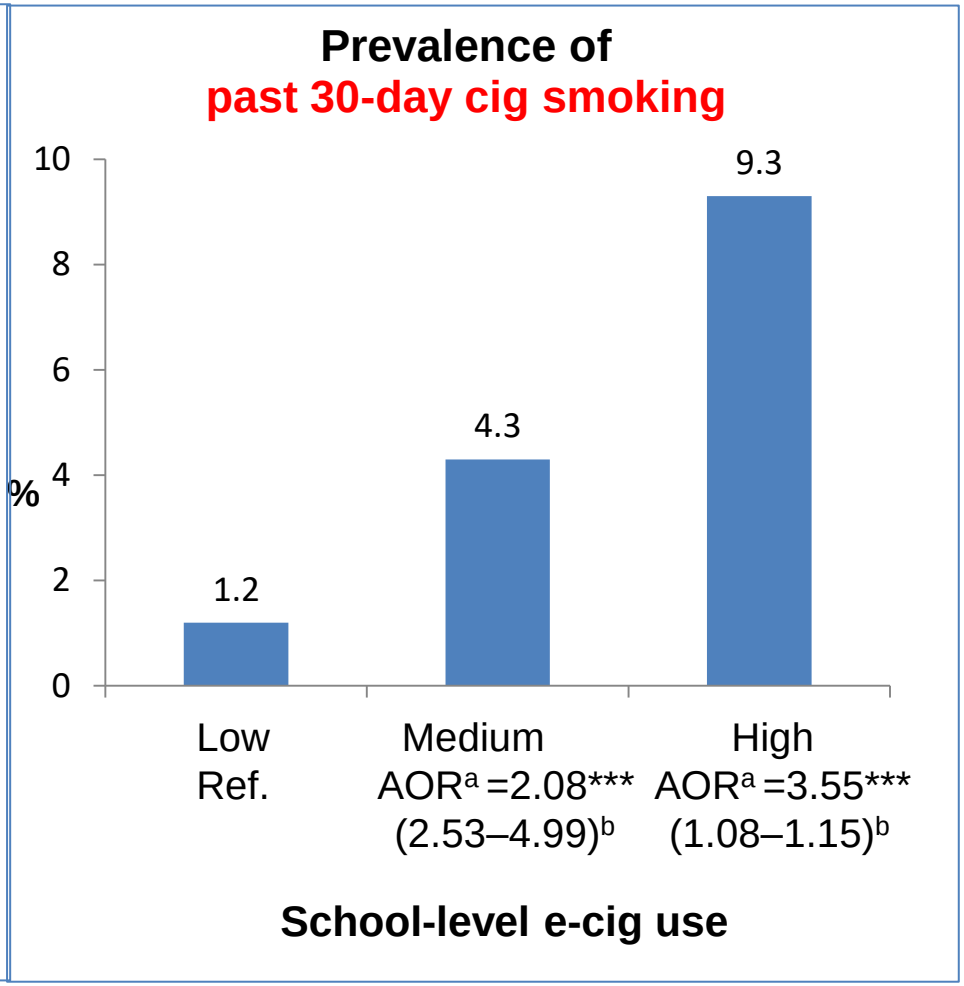
* P< 0.05

[a] Adjusted odds ratio, adjusted for age, sex, perceived family affluence, school-level past 30-day cig smoking prevalence (continuous), and cig smoking/e-cig use status.

[b] 95% confidence interval.

Students in schools with higher e-cig use prevalence were more likely to be cig smokers (2014/15)





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[b] 95% confidence interval.

UK study – gateway effect

A Longitudinal Study in England

- 2836 adolescents (aged 13–14 years) at baseline in 20 schools
- 1726 completed 12-month follow-up
- Findings:

  Initiation of cig use was quadruple in adolescents who at baseline were ever e-cig users (OR= 4.06, 95% CI 2.94-5.60).

	E-cig users	Non users
Baseline non smokers	343	1383
Follow-up smokers	118 (34.4%)	124 (9.0%)

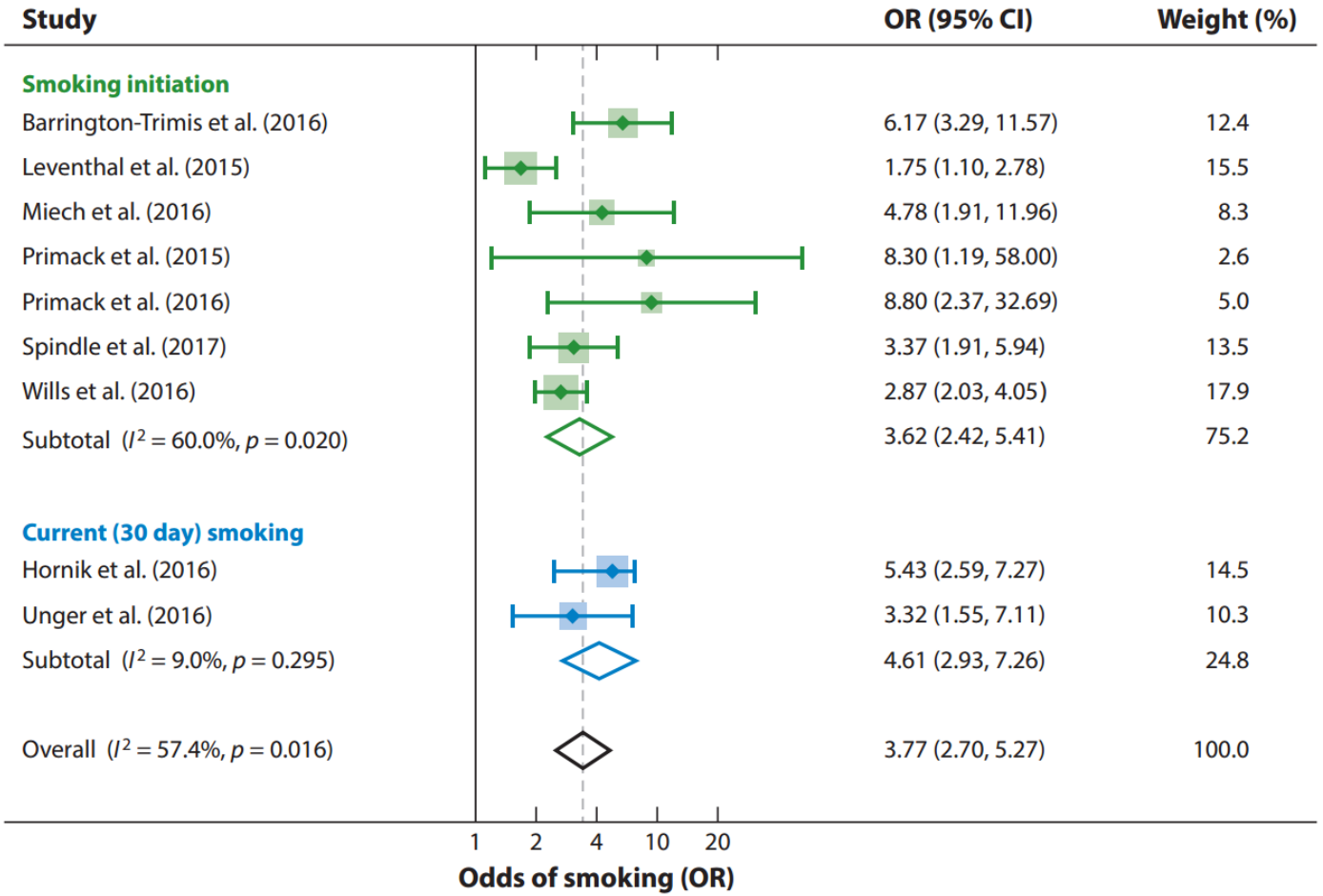
BMJ Journals

Tobacco Control

Conner M, et al. Tobacco Control, 2018, 27(4):365-372.

Overseas longitudinal studies – gateway effect

Ever e-cig use among never smokers at baseline quadruples the odds of being a smoker at follow-up (among adolescents and young a



ANNUAL REVIEWS

Glantz S A, et al. Annual Review of Public Health 2018;39:215-235.

4. Role of tobacco industry

Role of tobacco industry

Promoting e-cigs and HTP intensely, especially in smaller countries where tobacco control communities are weaker.

- Novel designs and flavours which appealing to youth and non-smokers
- Portraying e-cig and HTP as a means of harm reduction
- Sponsorship of sports, charity, school education and scientific research.

Source: https://www.flavorshookkids.org/

THIS IS A TEST

Can you pick out which are tobacco products and which are innocent kid things? Click to play.

Source: https://www.flavorshookkids.org/

THIS IS A TEST

Can you pick out which are tobacco products and which are innocent kid things? Click to play.

ICE CREAM ERASER.
This is an eraser. It's exactly this kind of innocence the tobacco industry tries to co-opt.

NOT A HIGHLIGHTER.
It's a Suorin Drop, a flavored tobacco device that gets past parents and teachers.

REGULAR SPRINKLES. NBD.
But make no mistake, this is one of the flavors the tobacco industry uses to hook kids.

NOT HOT SAUCE.
But it can burn. Skin exposure to e-juice like this one can cause seizures and burns.*

USB FLASH DRIVES.
These are flash drives. Actual flash drives, not vapes designed to look like flash drives.

NOT GAME PIECES.
These are Juul pods. Each contains the nicotine of a pack of cigarettes. Available in six flavors.*

NOT COOKIES.
It looks like an after school snack, but it's e-juice, often containing toxic traces of nickel and lead.*

NOT A SLUSHIE.
It's e-juice. A study found that 75% of tested e-juices use a flavor agent called Diacetyl, known to cause lung disease.*

Source: https://www.flavorshookkids.org/

“Best Colored Vape Tricks”—
Promoted in social media targeted youth

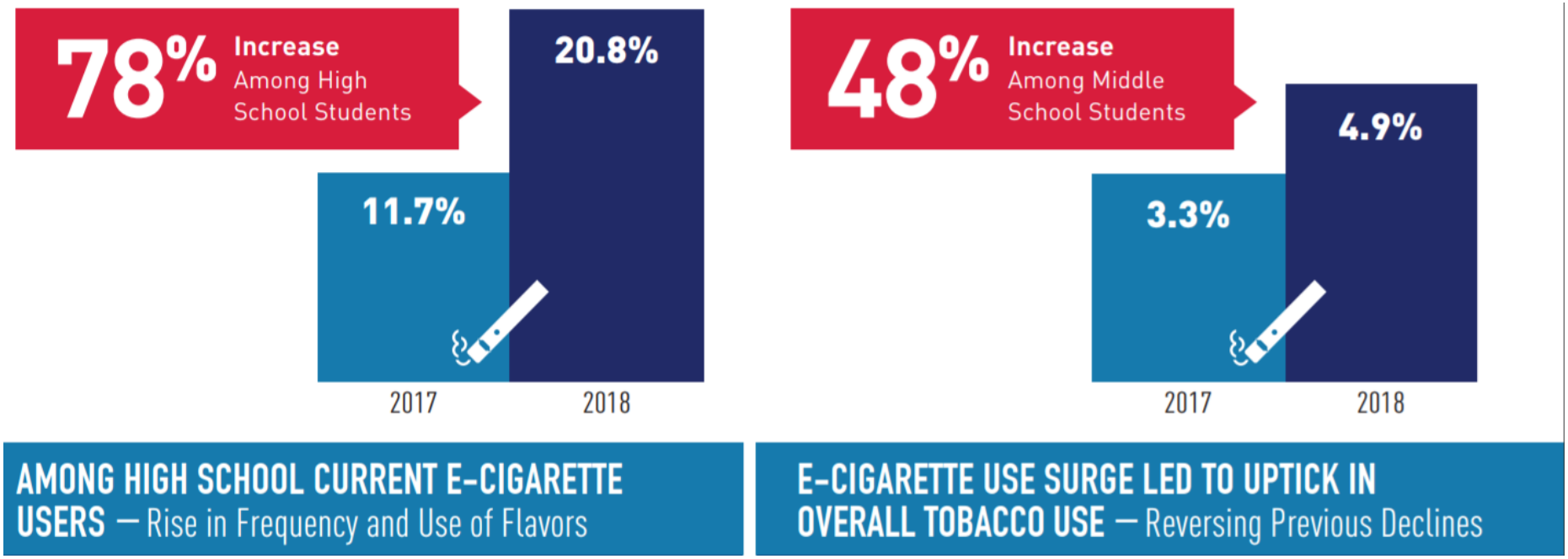
Source: https://www.youtube.com/watch?v=EwhN7EsVNSo Published on Mar 10, 2019

2018 NYTS Data: A Startling Rise in Youth E-cig Use

U.S. FOOD & DRUG ADMINISTRATION

National Youth Tobacco Survey (NYTS) in the US:

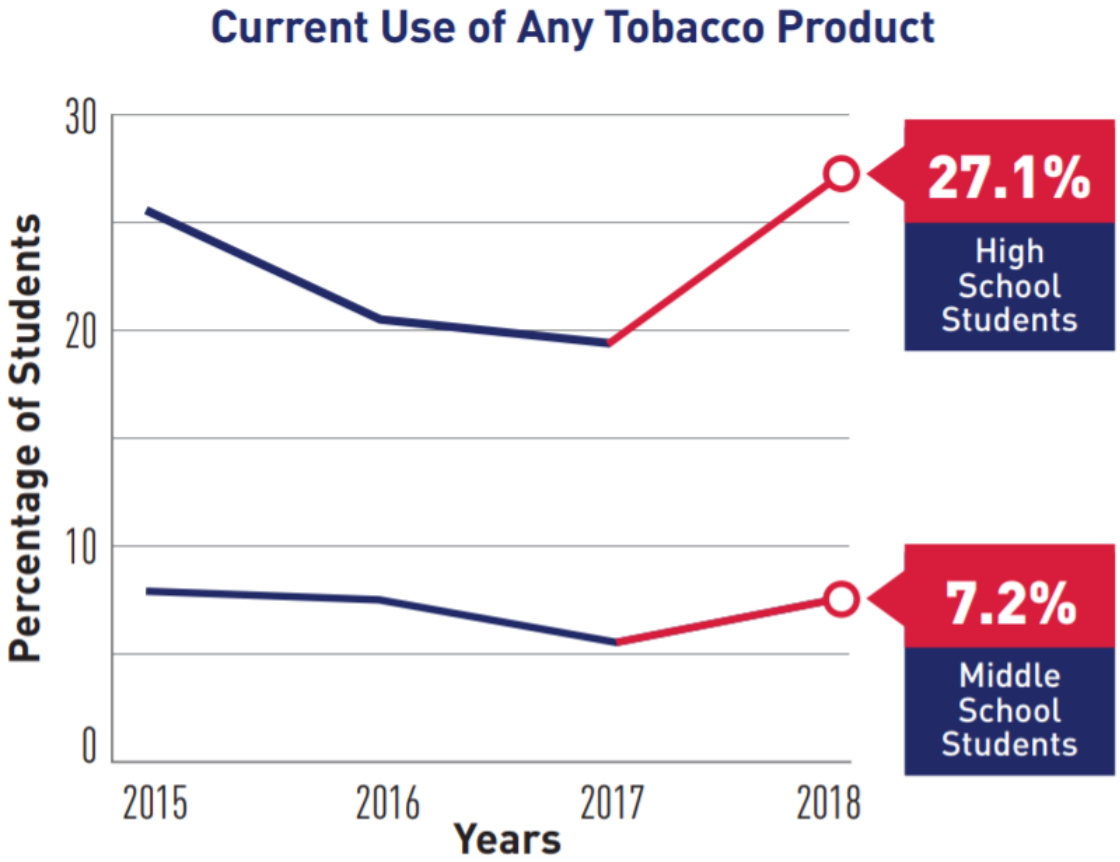
- Current use (past 30-day use) increased alarmingly - the most commonly used tobacco product by U.S. teens



Source: https://www.fda.gov/TobaccoProducts/PublicHealthEducation/ProtectingKidsfromTobacco/ucm625887.htm
Cullen KA, et al. Morbidity and Mortality Weekly Report. 2018; 67(45): 1276.

National Youth Tobacco Survey (NYTS) in the US:

- The significant rise in e-cig use has resulted in **overall tobacco product use increases of 38%** among high school students and **29%** among middle school students between 2017 and 2018, negating declines seen in the previous few years.



Source: https://www.fda.gov/TobaccoProducts/PublicHealthEducation/ProtectingKidsfromTobacco/ucm625887.htm

Cullen KA, et al. Morbidity and Mortality Weekly Report. 2018; 67(45): 1276.

Role of tobacco industry

Promoting e-cigs and HTP intensely, especially in smaller countries where tobacco control communities are weaker.

- Novel designs and flavours which appealing to youth and non-smokers
- Portraying e-cig and HTP as a means of harm reduction
  - Tobacco industry research claims a 90-95% reduction in harms: cannot be trusted
  - Position as trendy and high-tech products to raise self-image
- Sponsorship of sports, charity, school education and scientific research.

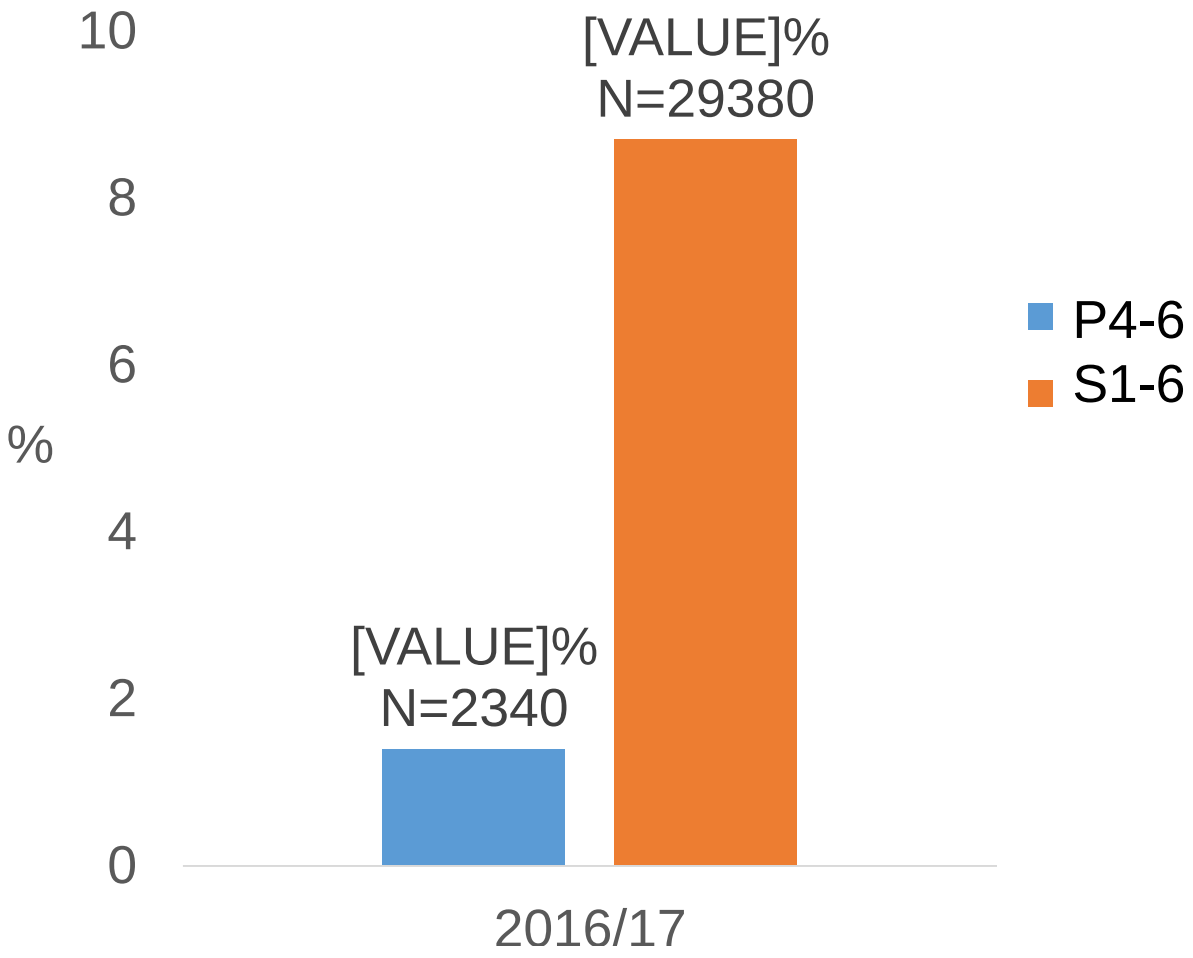
Role of tobacco industry

Promoting e-cigs and HTP intensely, especially in smaller countries where tobacco control communities are weaker.

- Novel designs and flavours which appealing to youth and non-smokers
- Portraying e-cig and HTP as a means of harm reduction
- Sponsorship of charity, sports, school education and scientific research.
  - *Another type of advertisements*
  - *Violate the WHO Framework Convention on Tobacco Control*

5. Situation in Hong Kong

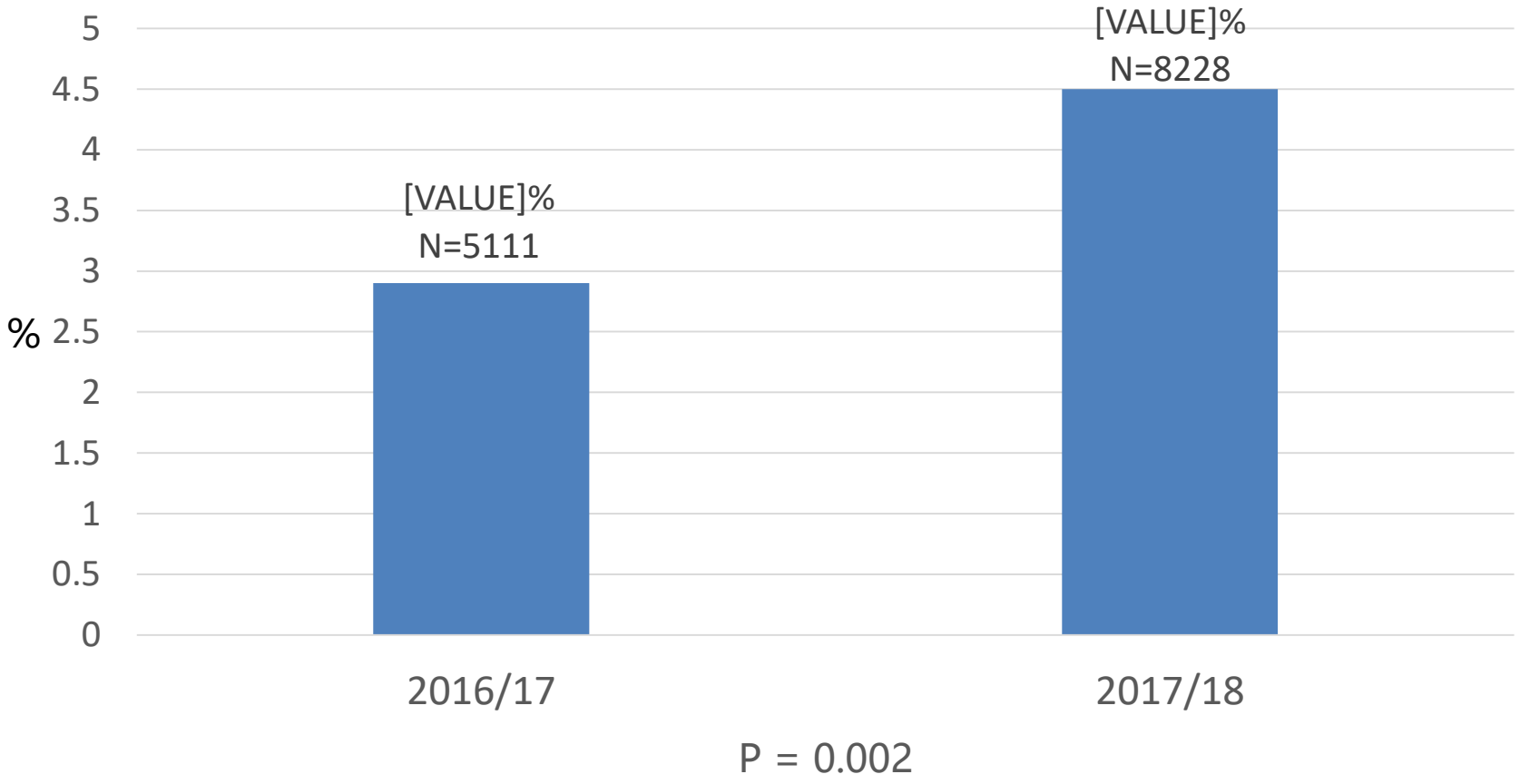
Prevalence of ever e-cig use



School-based Survey on Smoking among Students 2016/17
(2016/17: 75 primary schools – 16512 P4-6 students; 84 secondary schools – 27159 S1-6 students)

Rates of ever e-cig users increased by 55%, indicating that 8.5 P2-4 students started e-cig use each day

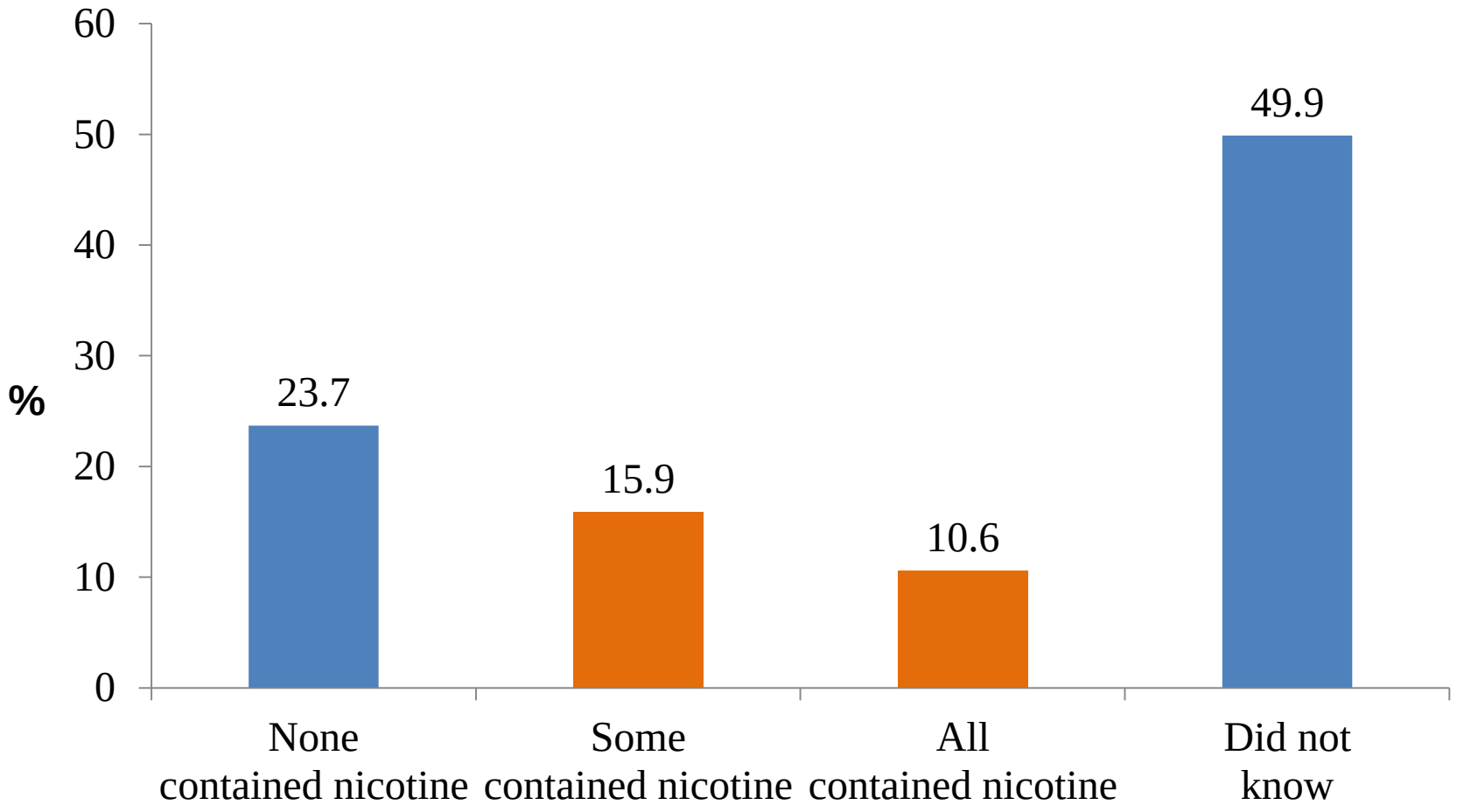
(between School Year 2016/17 - 2017/18)



Hong Kong Council on Smoking and Health Interactive Education Theatre

- 2016/17 (16 primary schools，2076 P2-4 students)
- 2017/18 (26 primary schools，4599 P2-4 students)

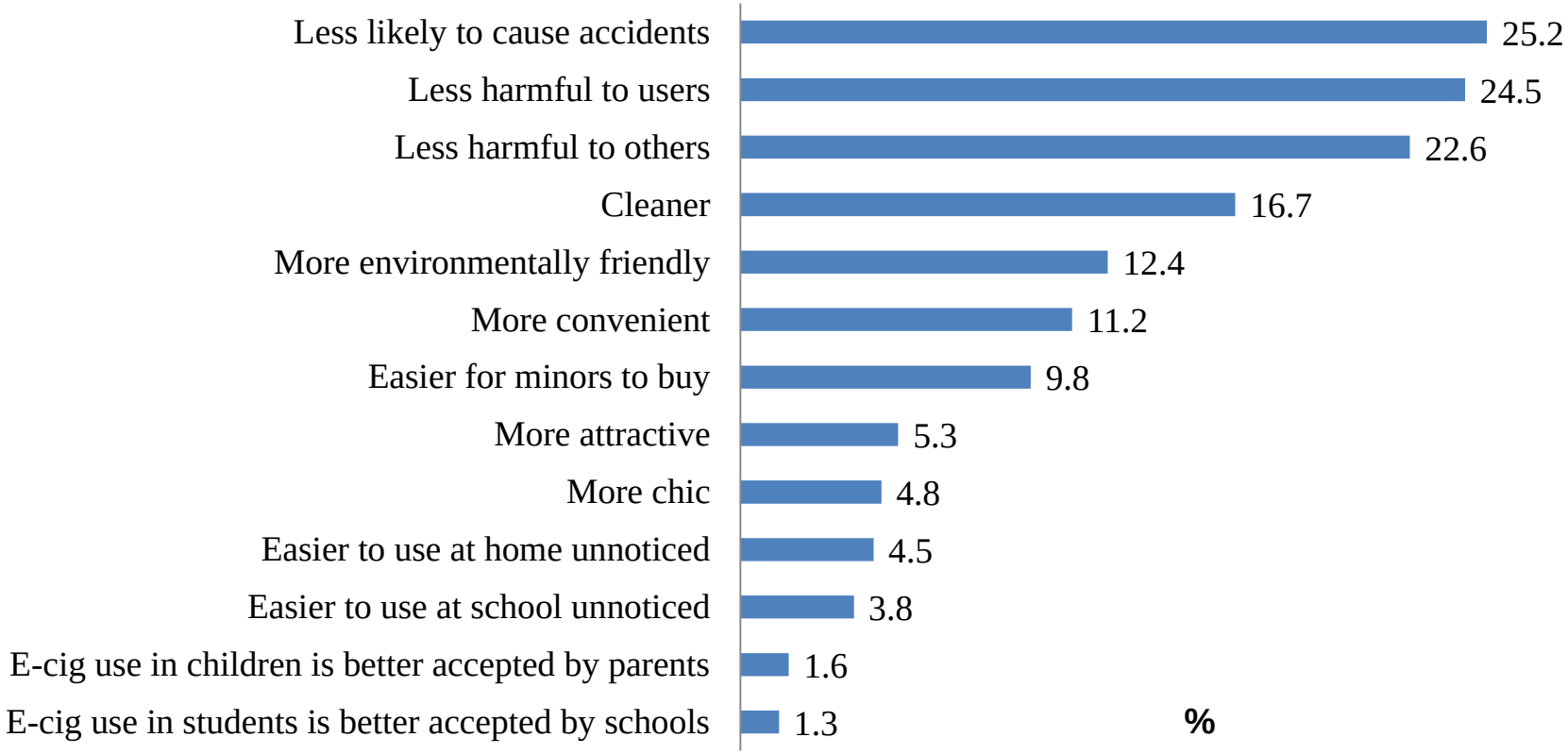
About 1/4 of ever e-cig using adolescents used nicotine-containing e-cigs (2016/17)



School-based Survey on Smoking among Students 2016/17
(84 secondary schools – 27159 S1-6 students)

Adolescent favourable perceptions of e-cig (2014/15)

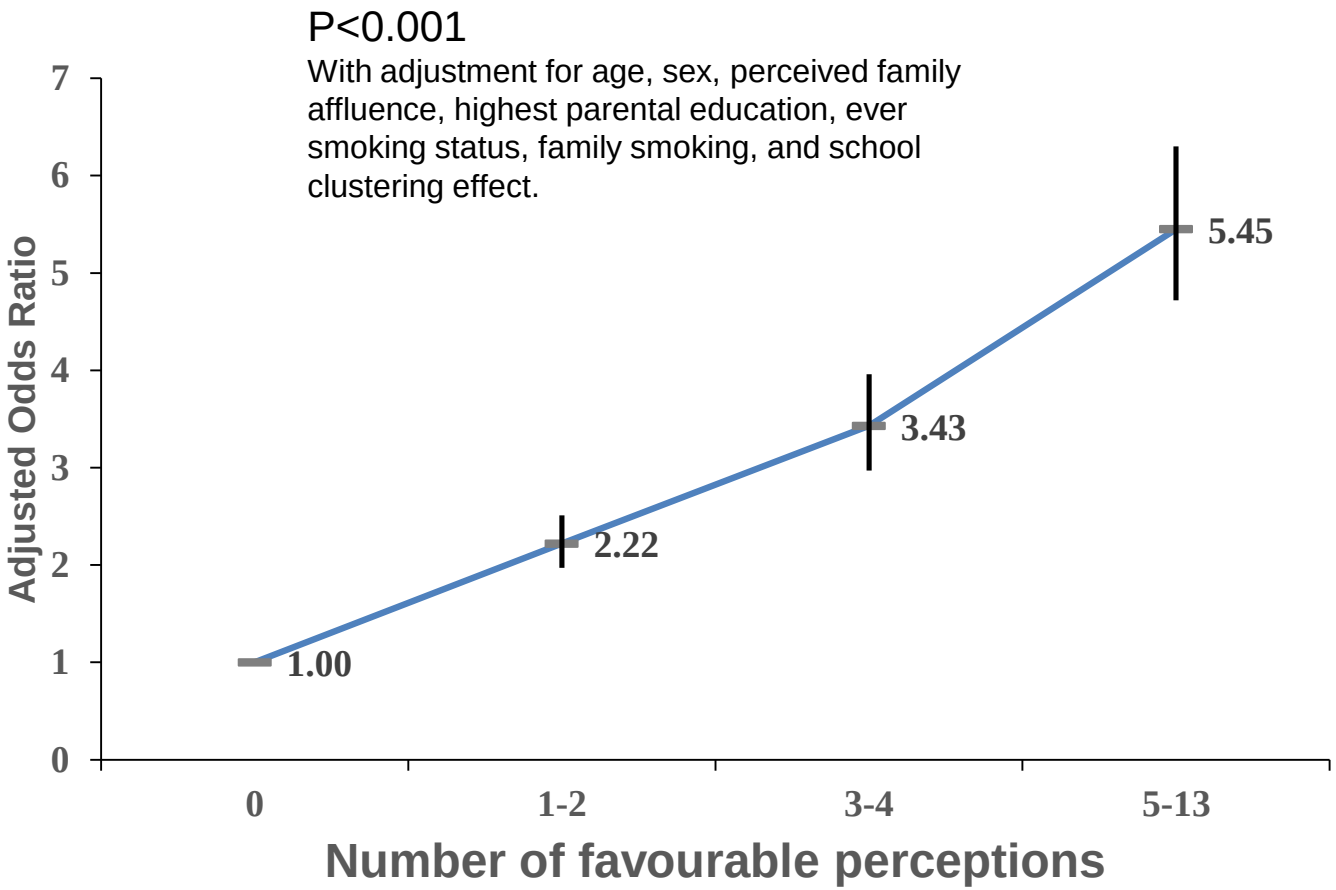
- About **1/2** adolescents perceived any advantages of e-cig over cig



School-based Survey on Smoking among Students 2014/15 (92 secondary schools – 40202 S1-6 students)

International Journal of Environmental Research and Public Health
MDPI
Leung LT, et al. Int J Environ Res Public Health 2018;15(1).

More favourable perceptions were associated with higher intention to use e-cig in never e-cig users

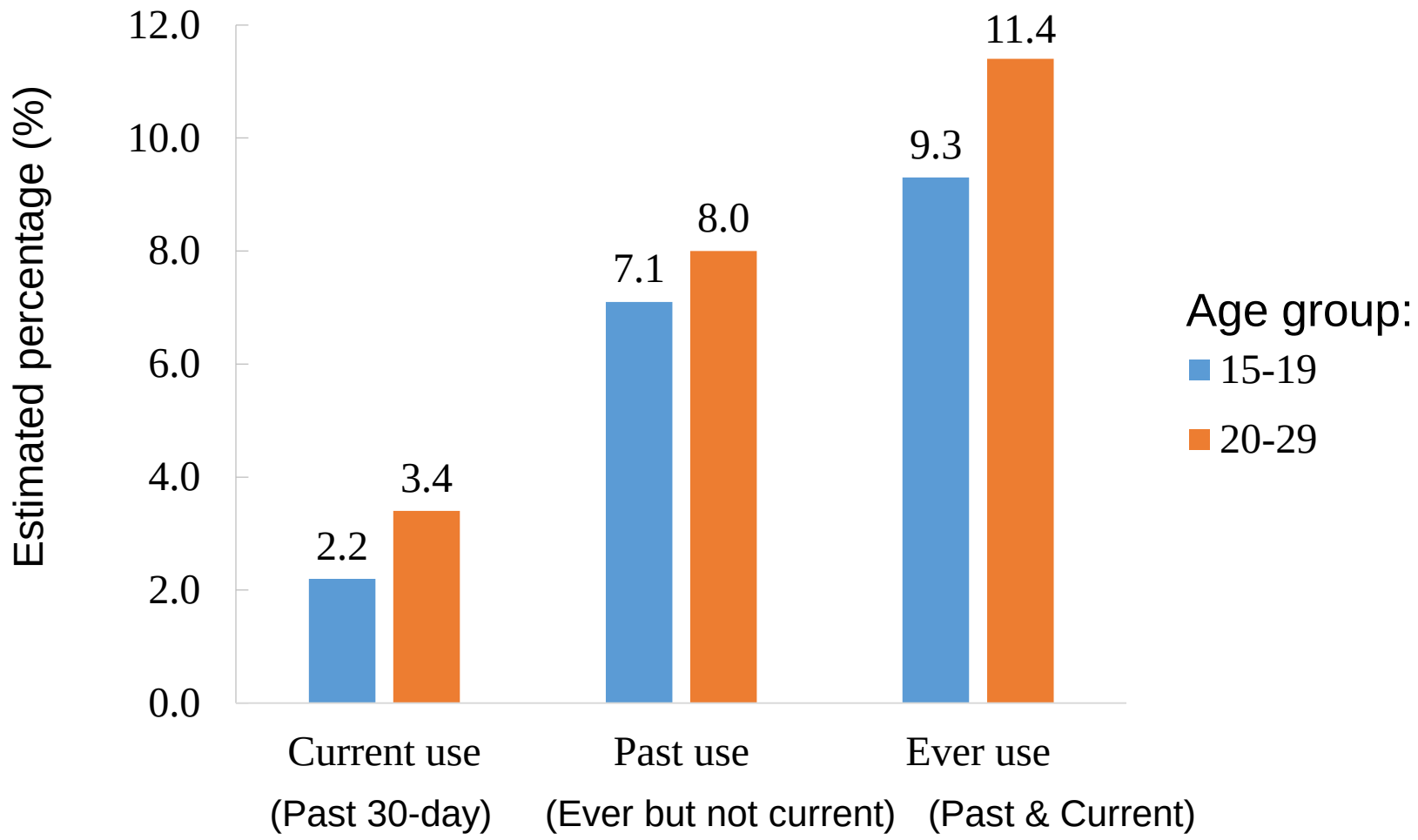


International Journal of Environmental Research and Public Health
MDPI

School-based Survey on Smoking among Students 2014/15 (92 secondary schools – 40202 S1-6 students)

Leung LT, et al. Int J Environ Res Public Health 2018;15(1).

HTP users among adolescents and young adults (2018)



BMJ Journals

Tobacco Control

Tobacco Control-related Policy Survey, 2018
(Random digit dialing landline survey; 5132 respondents)
Wu SY, et al. Tobacco Control. (in press)

6. Global positions and actions

Few support for e-cigs

Public Health England

Evidence review of e-cig and HTP 2018

- Vaping poses only a small fraction of the risks of smoking
- **Switching completely** from smoking to vaping conveys substantial health benefits over continued smoking
- Encourage and support **complete cessation of tobacco use**.
- **Regulatory levers** on heated tobacco products should be applied to favour the least harmful options
  - such as taxation and accessibility restrictions

McNeill A, et al. Evidence review of ecigarettes and heated tobacco products 2018. A report commissioned by Public Health England. London: Public Health England.

thebmj

BMJ 2018;360:k1262 doi: 10.1136/bmj.k1262 (Published 19 March 2018)

Check for updates

LETTERS

Public Health England prematurely endorses e-cigarettes

Aryeh Greenberg *core medical trainee year 2*[1], Ricardo J Jose *clinical lecturer in respiratory medicine*[2]

We were struck by the permissiveness of the report commissioned by Public Health England on e-cigarettes compared with a contemporaneous US academy report.[1-3]

The PHE review states that "e-cigarette use alone or in combination with licensed medication and behavioural support . . . appear to be helpful in the short term."[1] By contrast, the US review says, "There is insufficient evidence . . . about the effectiveness of e-cigarettes as cessation aids."[3]

PHE says that "e-cigarettes are attracting very few young people who have never smoked into regular use,"[1] but the US report concludes, "There is substantial evidence that e-cigarette use increases risk of ever using combustible tobacco cigarettes among youth."[3]

Both reports corroborate the purported reduction in harm afforded by e-cigarettes compared with tobacco cigarettes.[1 3] But the US reviewers say that "there is no available evidence whether or not e-cigarette use is associated with clinical cardiovascular outcomes . . . and respiratory diseases,"[3] whereas PHE concludes that these putative risks are "substantially below" those of smoking.[1]

The US review says that "there is no available evidence whether or not e-cigarette use is associated with intermediate cancer endpoints."[3] Yet PHE promotes the finding that "the cancer potencies of e-cigarettes" are "largely under 0.5% of the risk of smoking."[1 4]

We understand that such conflict, existing as it does among tobacco experts, reflects a wider uncertainty surrounding the long term health risks of e-cigarettes. That PHE, whose purpose is "to protect and improve the nation's health,"[5] should sanction e-cigarette use citing an embryonic and inconclusive evidence base, is astonishing. When over 75% of acute NHS trusts are in financial deficit,[6] a decision backing NHS investment in e-cigarettes is even more perplexing. The PHE report represents an unduly premature endorsement of e-cigarettes to the smoking public.

Competing interests: None declared.

Full response at: http://www.bmj.com/content/360/bmj.k575/rr.

1 McNeill A, Brose LS, Calder R, Bauld L, Robson D. *Evidence review of e-cigarettes and heated tobacco products 2018. A report commissioned by Public Health England.* PHE, 2018.
2 Wise J. Doctors should state clearly that vaping is much lower risk than smoking, says report. *BMJ* 2018;360:k575. 10.1136/bmj.k575 29437663
3 National Academies of Sciences, Engineering, and Medicine. Public health consequences of e-cigarettes. 2018. https://www.nap.edu/catalog/24952/public-health-consequences-of-e-cigarettes
4 Stephens WE. Comparing the cancer potencies of emissions from vapourised nicotine products including e-cigarettes with those of tobacco smoke. *Tob Control* 2017;27:10-7. 10.1136/tobaccocontrol-2017-053808 28778971
5 Public Health England. About us. https://www.gov.uk/government/organisations/public-health-england/about
6 NHS Improvement. Quarterly performance of the NHS provider sector: quarter 2 2017-18. https://improvement.nhs.uk/resources/quarterly-performance-nhs-provider-sector-quarter-2-201718/

Source: https://publichealthmatters.blog.gov.uk/2018/02/20/clearing-up-some-myths-around-e-cigarettes/

thebmj

BMJ 2018;360:k1262 doi: 10.1136/bmj.k1262 (Published 19 March 2018)

Check for updates

LETTERS

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We understand
tobacco experts

THE LANCET

EDITORIAL | VOLUME 386, ISSUE 9996, P829, AUGUST 29, 2015

Editorial

E-cigarettes: Public Health England's evidence-based confusion

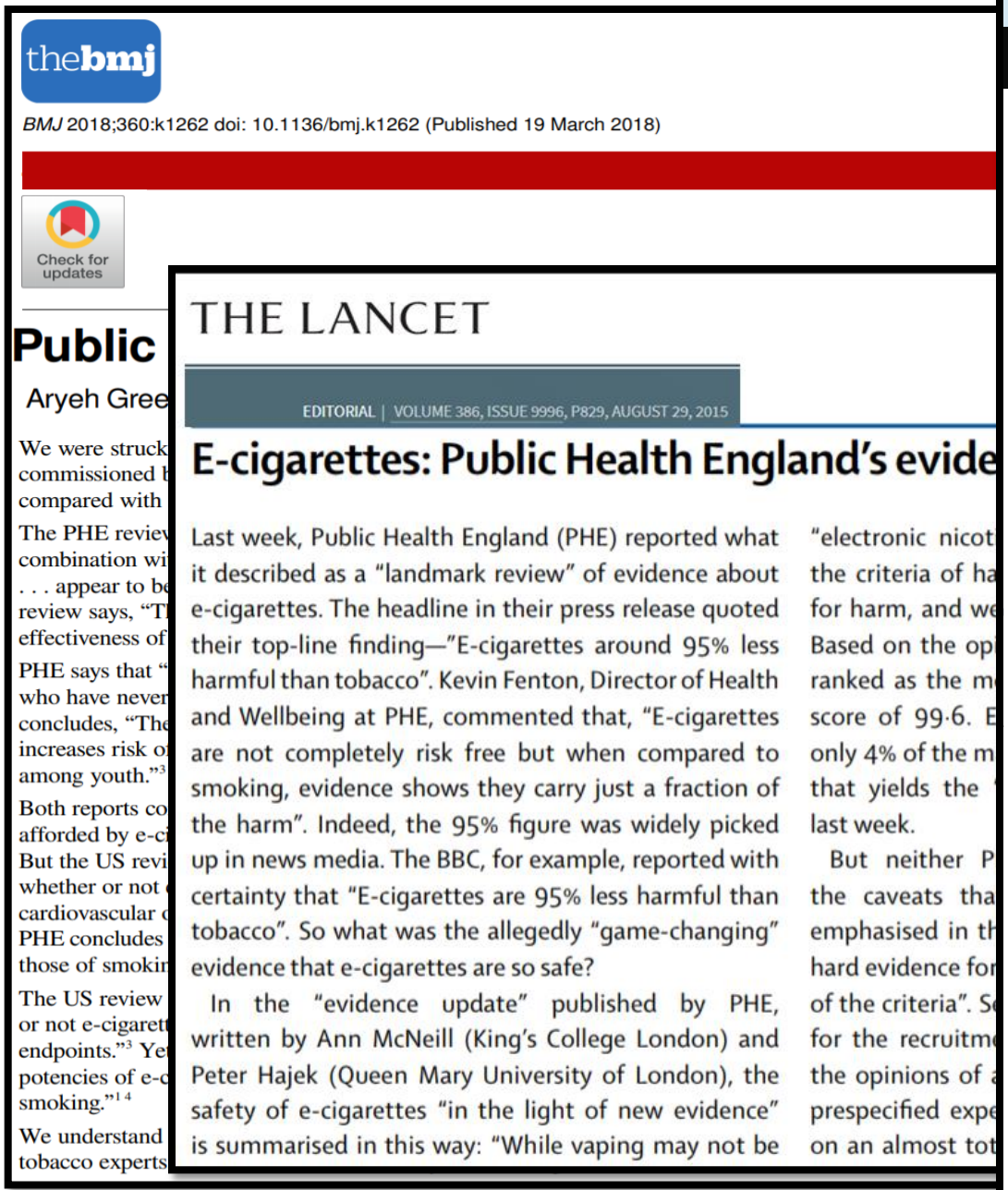
Last week, Public Health England (PHE) reported what it described as a "landmark review" of evidence about e-cigarettes. The headline in their press release quoted their top-line finding—"E-cigarettes around 95% less harmful than tobacco". Kevin Fenton, Director of Health and Wellbeing at PHE, commented that, "E-cigarettes are not completely risk free but when compared to smoking, evidence shows they carry just a fraction of the harm". Indeed, the 95% figure was widely picked up in news media. The BBC, for example, reported with certainty that "E-cigarettes are 95% less harmful than tobacco". So what was the allegedly "game-changing" evidence that e-cigarettes are so safe?

In the "evidence update" published by PHE, written by Ann McNeill (King's College London) and Peter Hajek (Queen Mary University of London), the safety of e-cigarettes "in the light of new evidence" is summarised in this way: "While vaping may not be "electronic nicotine delivery system products"), and the criteria of harms. The group scored the products for harm, and weightings were applied to the results. Based on the opinions of this group, cigarettes were ranked as the most harmful nicotine product with a score of 99·6. E-cigarettes were estimated to have only 4% of the maximum relative harm. It is this result that yields the "95% less harmful" figure reported last week.

But neither PHE nor McNeill and Hajek report the caveats that Nutt and colleagues themselves emphasised in their paper. First, there was a "lack of hard evidence for the harms of most products on most of the criteria". Second, "there was no formal criterion for the recruitment of the experts". In other words, the opinions of a small group of individuals with no prespecified expertise in tobacco control were based on an almost total absence of evidence of harm. It is

Charles Platiau/Reuters/Corbis

Sources: https://publichealthmatters.blog.gov.uk/2018/02/20/clearing-up-some-myths-around-e-cigarettes/
Greenberg A, Jose RJ. BMJ. 2018, 19; 360.



Sources: https://publichealthmatters.blog.gov.uk/2018/02/20/clearing-up-some-myths-around-e-cigarettes/
Greenberg A, Jose RJ. BMJ. 2018, 19; 360.
Polosa R. The Lancet. 2015, 386(10000):1237-8.

U.S. FOOD & DRUG ADMINISTRATION

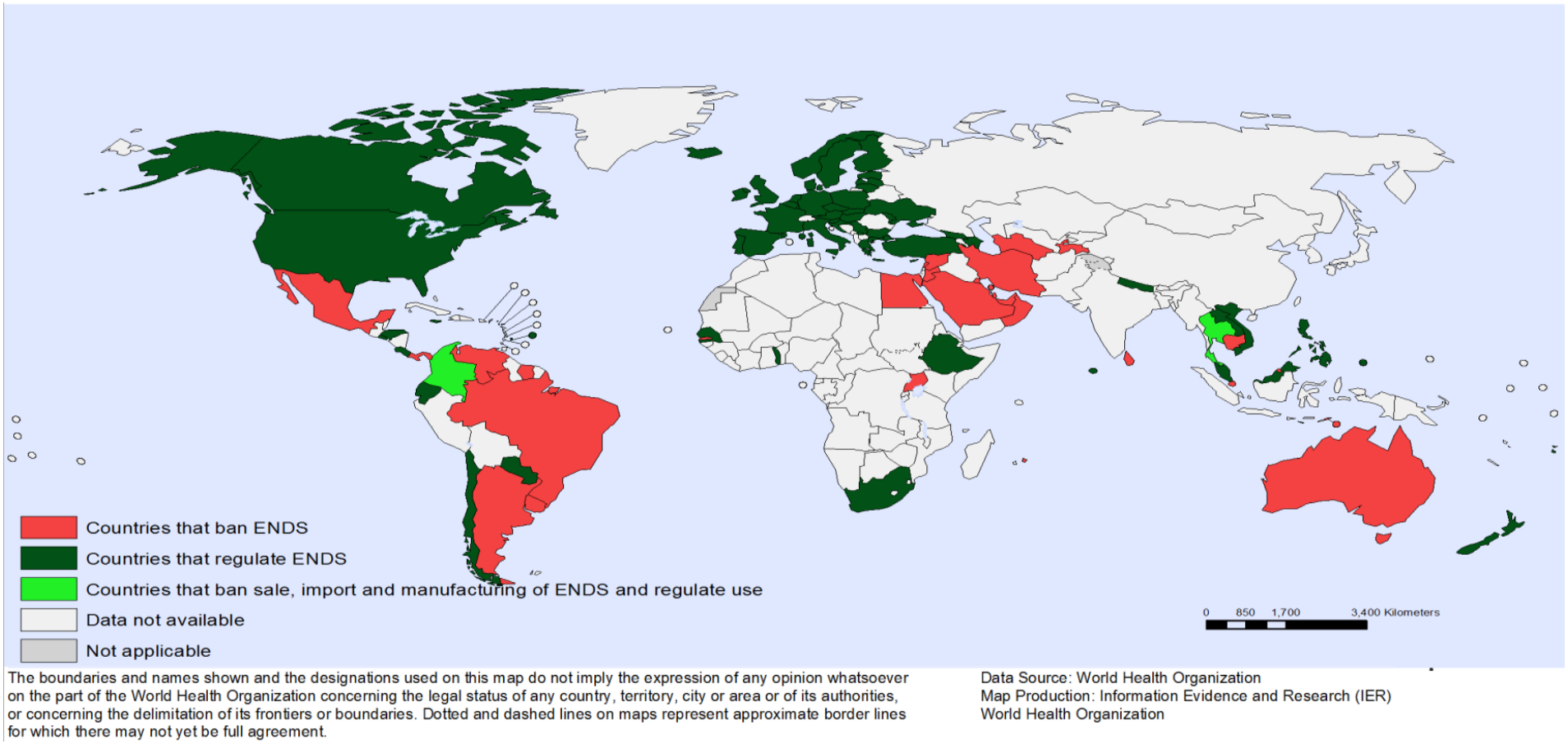
Compensations for the epidemic

US FDA

- Youth use of e-cigs has reached an epidemic proportion.
- Cracking down on retail sales of e-cigs to minors.
- Still promote the potential of e-cigs to help adult smokers quit combustible cigs, but can't come at the expense of kids.

We cannot allow a whole new generation to become addicted to nicotine. Sep 12, 2018

Mapping of ENDS ban/regulation



Source: https://globaltobaccocontrol.org/e-cigarette/; WHO internal database

Country Laws Regulating E-cigs

Sale
29 countries ban sale of all types of e-cigs
45 countries regulate sale or require marketing authorization prior to sale
7 countries prohibit sale of nicotine-containing e-cigs
5 countries do not have regulations on sale beyond age of majority purchase rules
Advertising, promotion and sponsorship
67 countries prohibit or regulate e-cig marketing

Source: https://www.globaltobaccocontrol.org/e-cigarette/policy-domains

WHO's recommendations

- Prevent the initiation by non-smokers and youth with special attention to vulnerable groups.
  Ban the sale, distribution, advertising, promotion and sponsorship of ENDS at least among minors.
- Minimize potential health risks to ENDS/ENNDS users and protect non-users from exposure to their emissions.
- Prevention of unproven health claims being made about ENDS/ENNDS
- Protect tobacco control activities from all commercial and other vested interests related to ENDS/ENNDS
- Heated tobacco products should be subject to the policy and regulatory measures applied to all other tobacco products, in line with the WHO Framework Convention on Tobacco Control (WHO FCTC).

Sources: Electronic Nicotine Delivery Systems Report (FCTCCOP/6/10), WHO Framework Convention on Tobacco Control, 21 July 2014
Decision (FCTC/COP7/(9)), WHO Framework Convention on Tobacco Contro2l, 18 October 2014
WHO Heated tobacco products (HTPs) information sheet

WHO's recommendations

WHO FRAMEWORK CONVENTION ON TOBACCO CONTROL

- Prevent the initiation by non-smokers and youth with special attention to vulnerable groups.
  Ban the sale, distribution, advertising, promotion and sponsorship of ENDS at least among minors.
- Minimize potential health risks to ENDS/ENNDS users and protect non-users from exposure to their emissions.
- Prevention of unproven health claims being made about ENDS/ENNDS
- Protect tobacco control activities from all commercial and other vested interests related to ENDS/ENNDS
- Heated tobacco products should be subject to the policy and

At the current time, WHO is not in a position to recommend ENDS as quitting aids and recommends that smokers willing to quit should use available proven quitting methods.

ERS's position on Heated tobacco products

- Are harmful and addictive
- Undermine smokers' wish to quit
- Undermine ex-smokers' wish to stay smoke-free
- Are a temptation for non-smokers and minors
- Impose a risk of re-normalisation of smoking
- Impose a risk of dual use with conventional cigarettes

ERS position paper on heated tobacco products. A statement prepared by the ERS Tobacco Control Committee. 2018.

ERS's position on Heated tobacco products

ERS EUROPEAN RESPIRATORY SOCIETY

- Are harmful and addictive
- Undermine smokers' wish to quit
- Undermine ex-smokers' wish to stay smoke-free
- Are a temptation for non-smokers and minors
- Impose a risk of re-normalisation of smoking
- Impose a risk of dual use with conventional cigarettes

ERS cannot recommend any product that is damaging to the lungs and human health.

We should not allow debate around the new tobacco products to distract us from the main job at hand – promoting regulatory measures that we know are effective at reducing smoking and continue to support those who wish to quit smoking.

Acknowledgements

We are grateful for the following funding sources

- Food and Health Bureau
  - School-based Survey on Smoking among Students 2012/13, 2014/15, 2016/17
- Research Grant Council
  - School-based Survey on Perception of Smoking among Students
- Tobacco and Alcohol Control Office, Department of Health
  - Youth Quitline
- Hong Kong Council on Smoking and Health
  - “Quit to Win” Contest
  - Interactive Education Theatre

References

1. Davis B , Williams M , Talbot P . IQOS: Evidence of pyrolysis and release of a toxicant from plastic. Tob Control 2019;28:34–41.
2. Wang MP, Ho SY, Leung LT, et al. Electronic cigarette use and respiratory symptoms in Chinese adolescents in Hong Kong. JAMA Pediatrics 2015:1-2.
3. Wu SY, Wang MP, Li WH, Kwong AC, Lai VW, Lam TH. Does Electronic Cigarette Use Predict Abstinence from Conventional Cigarettes among Smokers in Hong Kong? Int J Environ Res Public Health. 2018;15(3).
4. Kulik M C, Lisha N E, Glantz S A. E-cigarettes Associated With Depressed Smoking Cessation: A Cross-sectional Study of 28 European Union Countries. American Journal of Preventive Medicine, 2018, 54(4):603-609.
5. Glantz S A, Bareham D W. E-Cigarettes: Use, Effects on Smoking, Risks, and Policy Implications[J]. Annual Review of Public Health 2018;39:215-235.
6. Hajek P, Phillips-Waller A, Przulj D, Pesola F, Myers Smith K, Bisal N, Li J, Parrott S, Sasieni P, Dawkins L, Ross L. A randomized trial of e-cigarettes versus nicotine-replacement therapy. New England Journal of Medicine. 2019 Feb 14;380(7):629-37.
7. Wang M P, Ho S Y, Leung L T, et al. Electronic cigarette use and its association with smoking in Hong Kong Chinese adolescents. Addictive Behaviors, 2015, 50:124-127.
8. Conner M, Grogan S, Simms-Ellis R, et al. Do electronic cigarettes increase cigarette smoking in UK adolescents? Evidence from a 12-month prospective study. Tobacco Control, 2018, 27(4):365-372.
9. Leung LT, Ho SY, Chen J, et al. Favourable perceptions of electronic cigarettes relative to cigarettes and the associations with susceptibility to electronic cigarette use in Hong Kong Chinese adolescents. Int J Environ Res Public Health 2018;15(1).
10. Wu SY, Wang MP, Ho DS, et al. Heated tobacco products use in Chinese adults in Hong Kong: a population-based cross-sectional study. Tobacco Control. (in press)
11. European Public Health Association. Facts and fiction on e-cigs. Aug 2018.
12. McNeill A, Brose LS, Calder R, Bauld L & Robson D (2018). Evidence review of ecigarettes and heated tobacco products 2018. A report commissioned by Public Health England. London: Public Health England.

References

13. European Public Health Association. Facts and fiction on e-cigs. Aug 2018.
14. Electronic Nicotine Delivery Systems Report (FCTCCOP/6/10), WHO Framework Convention on Tobacco Control, 21 July 2014
15. Decision (FCTC/COP7/(9)), WHO Framework Convention on Tobacco Contro2l, 18 October 2014
16. WHO Heated tobacco products (HTPs) information sheet
17. ERS position paper on heated tobacco products. A statement prepared by the ERS Tobacco Control Committee. 2018.
18. Pieper, Elke, et al. "Tabakerhitzer als neues Produkt der Tabakindustrie: Gesundheitliche Risiken." Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz 2018; 61.11: 1422-1428.
19. Chen J, Ho SY, Leung LT, Wang, MP and Lam TH. School-level electronic cigarette use prevalence and student-level tobacco use intention and behaviours. Scientific Reports, 2019 ; 9(1):1690.
20. Cullen, Karen A., Bridget K. Ambrose, Andrea S. Gentzke, Benjamin J. Apelberg, Ahmed Jamal, and Brian A. King. "Notes from the field: Use of electronic cigarettes and any tobacco product among middle and high school students—United States, 2011–2018." Morbidity and Mortality Weekly Report. 2018; 67(45): 1276.
21. Alzahrani, T., Pena, I., Temesgen, N., & Glantz, S. A. Association between electronic cigarette use and myocardial infarction. American journal of preventive medicine. 2018,55(4), 455-461.
22. Lee HW, Park SH, Weng MW, Wang HT, Huang WC, Lepor H, Wu XR, Chen LC, Tang MS. E-cigarette smoke damages DNA and reduces repair activity in mouse lung, heart, and bladder as well as in human lung and bladder cells. Proceedings of the National Academy of Sciences. 2018,13;115(7):E1560-9.
23. Rossheim ME, Livingston MD, Soule EK, Zeraye HA, Thombs DL. Electronic cigarette explosion and burn injuries, US Emergency Departments 2015–2017. Tobacco control. 2018;0:1–3. doi:10.1136/tobaccocontrol-2018-054518.
24. Brownson EG, Thompson CM, Goldsberry S, Chong HJ, Friedrich JB, Pham TN, Arbabi S, Carrougher GJ, Gibran NS. Explosion injuries from e-cigarettes. New England journal of medicine. 2016, 6;375(14):1400-2.