

3세대 전자담배와 금연진료

백 유 진
한림의대

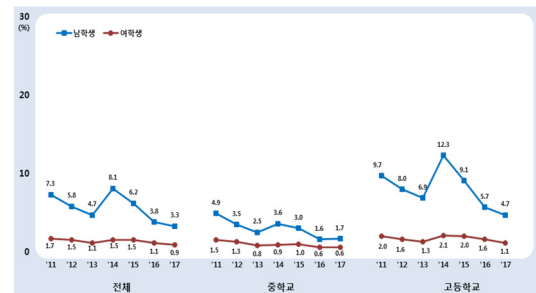
연수강좌

흡연자가 신종담배를 사용하는 이유 - 3가지

- 1) as an aid to smoking cessation
- 2) as a safer alternative to conventional cigarettes
- 3) as a way to conveniently get around smoke-free laws

국내 전자담배 사용현황(청소년)

- 전자담배 현재 사용율은 2014년 이후 감소 추세



출처: 청소년건강행태온라인조사

전자담배 논란

- 전자담배는 더 안전한가?
 - 사전주의 원칙 (precautionary principle) vs 담배의 해로움 줄이기 (harm reduction)
- 전자담배는 금연에 도움이 되는가?
 - 대부분 국가에서 불인정 vs 영국 인정
- 담배규제정책과의 충돌 및 간섭
 - 재정상화 (renormalization)
 - 비흡연자(특히 청소년)의 니코틴 의존 유도
 - 담배 회사의 새로운 시장 확대

BIG TOBACCO & E-CIGS

All major tobacco companies have e-cigarette products on the market or under development.

COMPANY	E-CIG
Loftland	Blue Series
Imperial	Proforce
BAT	Edge
Altria	Mark Ten
Reynolds	Close
JTI	E-Lites
PMI	Discrete

Cho HJ, 2016

JUUL, 4세대 전자담배



화제의 전자담배 줄 (Juul), 국내에 공식 출시한다

[단독]전자담배 '줄', 기존 세율 적용...니코틴
1% ↓ 6월 출시

줄, 니코틴 함량 5% 아닌 1% 미만으로 출시
기재부 "줄, 합성니코틴 아냐...기존 세율 적용"
탈루스코리아 법인 지난해 12월 종료에 설립

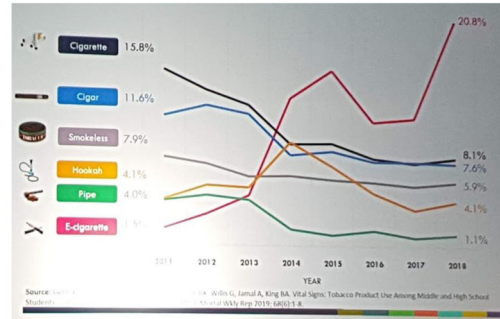
출처: 2019-05-13 조선 11:33:52
수정: 2019-05-13 조선 11:39:52

화제의 폐쇄형 시스템(이하 CSV) 전자담배 '줄(Juul)'이 국내에 정식으로 출시된다. 줄을 제작한 미국의 본사는 한국에 '줄랩스코리아'를 설립하고, 론칭에 필요한 KC인증을 획득하는 등 출시에 박차를 가하고 있다. 현재 주요 편의점 업체와 입점에 관해 논의 중인 것으로 알려졌으며, 이르면 5월 말 혹은 6월 초에 출시할 예정이다.

한편, KT&G도 CSV 전자담배를 출시할 준비를 마쳤다. 두 회사 모두 공식적인 론칭 일정을 발표할 바 없으나, 줄 보다 한 발 빠르게 출시함으로써 시장 주도권을 잡을 것으로 알려졌다.

출처: 이대원/이데일리

Current Tobacco Use (미국 청소년: 2011-2018)

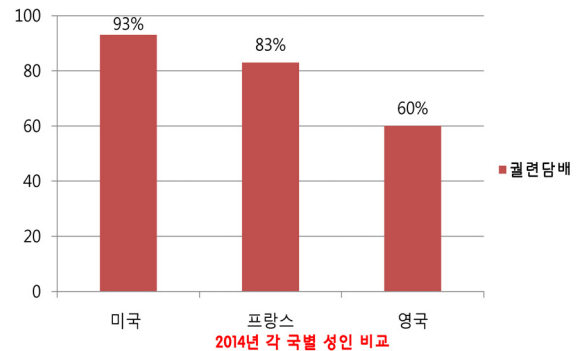


A New Challenge

- ▶ Until recently, most e-cigarette liquids carried 1%–2% nicotine with a few at 3% labelled as 'super high' intended for the 'two packs a day smoker.'
- ▶ In 2015, JUUL introduced a 5% (59 mg/mL) pod vaping device with a novel nicotine chemistry (nicotine salts) which improved palatability enabling higher concentrations without undue bitterness.
- ▶ Following JUUL's phenomenal success in the marketplace, numerous knock-off devices were introduced which emulated, or even exceeded, JUUL's very high nicotine level.
- ▶ All purveyors of high-nicotine e-liquids offer them in sweet and fruity flavours.
- ▶ Bulk high-nicotine e-liquids, typically sold in 30 mL bottles, represent a poisoning risk for children.
- ▶ Nicotine percentage is inconsistently portrayed on labels.

Jackler RK, Ramamurthi D. *Tob Control* 2019;0:1–6. doi:10.1136/tobaccocontrol-2018-054796

Conventional cigarettes use(%) among e-cigarette users



2014년 각 국별 성인 비교

UK Off. Natl. Stat. 2016. *Adult smoking habits in Great Britain: 2014.*

Potential Effects of E-cigarettes on biological systems

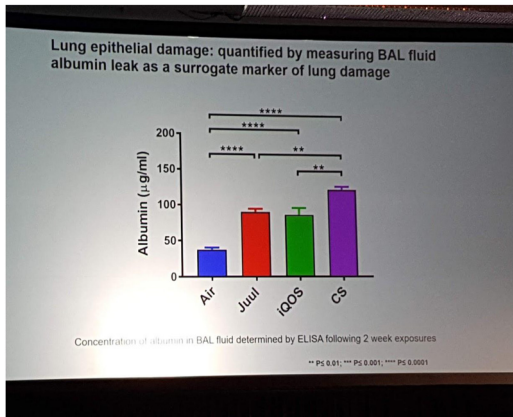
System	Effects of e-Cigarettes
Pulmonary system	Upper and lower respiratory tract irritation ^{9,26,27} Bronchitis, cough, and emphysema ^{9,26,27}
Immune system	Inflammation induction ²⁸ Reduce immune efficiency ²⁹
Central nervous system	Behavioral changes ⁹ Memory impairment (animal models) ^{9,10} Tremor and muscle spasms ¹⁰
Miscellaneous	Ocular irritation ⁹ Contact dermatitis and burns ^{9,31} Nausea and vomiting ^{9,31} Throat and mouth irritation ^{30,31}

Impact of Electronic Cigarettes on the Cardiovascular System. *J Am Heart Assoc.* 2017. 30:6(9).

Chemicals Emitted in e-Cigarette Vapors and Their Potential Health Effects

Chemical	Chemical concentration range	Biological system affected
Nicotine	ND to 38.6 mg/mL ^{32,33}	Lung tumor promotion ³⁴ Addiction ³⁵ Gastrointestinal carcinogen ³⁶ Raises blood pressure and heart rate ³⁷ Reduces bone development in adolescents ³⁸
Cotinine	ND ³⁹	Reduces fertility and reproduction ⁴⁰
Aldehydes	Acetaldehyde: 0.11 to 2.04 µg/10 puff ^{41,42} Acrolein: 0.044 to 0.16 µg/10 puff ^{43,44} Formaldehyde: 0.2 to 27.1 µg/10 puff ^{45,46}	Carcinogen ⁴⁷ Aggravation of alcohol-induced liver damage ⁴⁸ Ocular irritation ⁴⁹ Respiratory irritation ⁵⁰ Gastrointestinal irritation ⁵¹
o-Alkyl benzothioamides	ND to 7.1 µg/10 puff ⁵²	Unknown
Acetone	ND to 10.2 ⁵³	Genetic damage ⁵⁴ Weakness of embryonic and foetal ⁵⁵ Ocular irritation ⁵⁶
Volatile organic compounds	Propylene glycol: 0 to 82.05 mg/10 puff ⁵⁷	Throat and airway irritation ⁵⁸ Carcinogen ⁵⁹ Genetic damage ⁶⁰ Increases airway risk in children ⁶¹ Ocular irritation ⁶²
Glycerin	75 to 225 µg/10 puff ⁶³	Liquid pneumonia ⁶⁴ Ocular, dental, and pulmonary irritation ⁶⁵
3-Methylbutyl-3-methylthiocyanate	1.5 to 16.5 µg/10 puff ⁶⁶	Unknown
Tar	<0.03 µg/10 puff ⁶⁷	CNS damage ⁶⁸ Respiratory damage ⁶⁹
Nitrosamines	NNN: 0.8 to 4.3 ng/10 puff ⁷⁰ NNK: 1.1 to 28.3 ng/10 puff ⁷¹	Carcinogen ⁷²
Metals	Chromium: ND to 0.020 µg/10 puff ⁷³ Cadmium: ND to 0.002 µg/10 puff ⁷⁴ Lead: 0.025 to 0.17 µg/10 puff ⁷⁵	Pulmonary irritation and inflammation, nasal mucosa atrophy and ulceration ⁷⁶ Neonatal mouse airway injury, reduce fertility and reproduction ⁷⁷ Pulmonary and nasal irritation ⁷⁸ Hypertension induction ^{79,80} Respiratory damage ⁸¹
Nickel	0.0075 to 0.25 µg/10 puff ⁸²	Carcinogen ⁸³ CNS and pulmonary damage ⁸⁴ Respiratory damage ⁸⁵

ND indicates not detected; CNS, central nervous system; NNN, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNK, N-nitrosamines.
*Variable concentrations found in plasma after using e-cigarettes⁸⁶



2019 SRNT

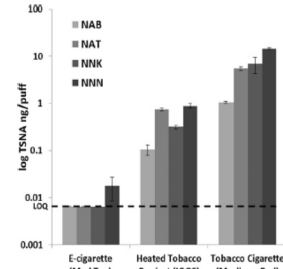
Tobacco-specific nitrosamines (TSNA) in heated tobacco product IQOS

Yields of tobacco-specific nitrosamines (TSNA) (per puff) in aerosols generated from IQOS heated tobacco product (12 puffs/HeatStick), MarkTen e-cigarette (55 puffs) and smoke from Marlboro Red 100 combustible cigarettes (8 puffs/cigarette).

The data presented are log transformed.

LOQ, limit of quantitation; NAB, N'-nitrosoanabasine; NAT, N'-nitrosoanatabine;

NNK, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN, N'-nitrosornicotine.

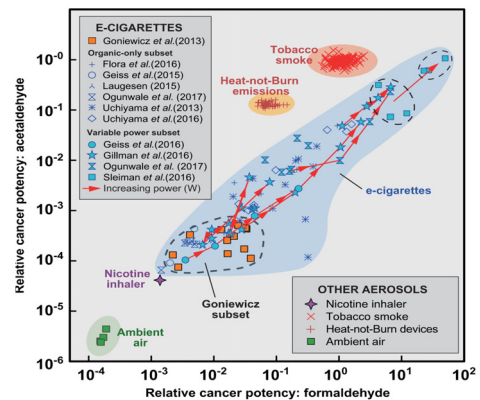


Tob Control November 2018 Vol 27 No 1

신종담배 독성학

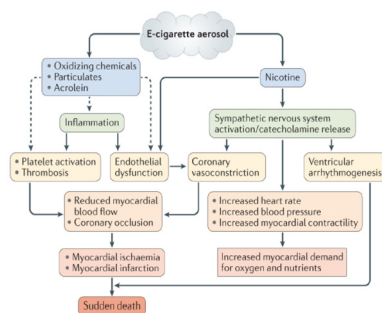
- Fresh air is better than smoke; nonsmokers should avoid exposure to tobacco smoke, IQOS and JUUL aerosols. (모든 간접노출 회피)
- WBC, markers of lung inflammation, and albumin leak(a surrogate marker of lung damage) significantly elevated in animals exposed to tobacco smoke and aerosols from IQOS and JUUL. (연기/증기 노출시 염증반응 물질 증가)
- Still unknown, if there is a benefit gained by smokers who switch to IQOS and/or JUUL; toxicology needs to mimic conditions by which alternative nicotine products will be used. (변경시 이득?)

담배제품의 발암성 비교



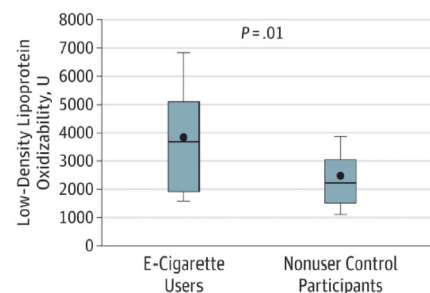
Stephens WE. Tob Control 2018;27:10-17.

Overview of mechanisms by which electronic cigarette use might cause acute cardiovascular events



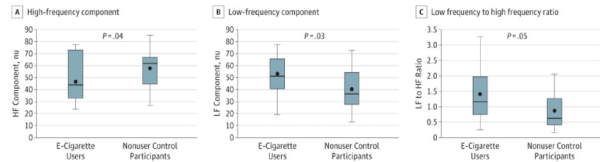
Nat Rev Cardiol. 2017 August ; 14(8): 447-456

전자 담배와 콜레스테롤



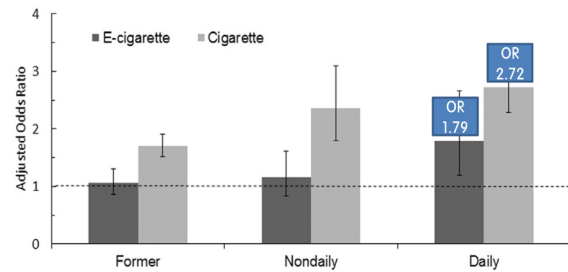
JAMA Cardiol. 2017 March 01; 2(3): 278-284.

전자담배와 심박동수 변이(HRV)



JAMA Cardiol. 2017 March 01; 2(3): 278-284.

전자담배, 일반담배의 심근경색 발생률



(미국 국건강자료_2014, 2016) Am J Prev Med 2018;55(4):455-461.

(액상형) 전자담배와 심장영향

- The population risk versus benefit for use of electronic cigarettes (ECs) is strongly influenced by the relative safety of ECs compared with conventional cigarettes
- The exposure of EC users to potentially toxic chemical emissions is difficult to quantify, given the numerous types of EC devices, different e-liquids, and disparities in individual use patterns
- EC emissions of concern for cardiovascular health include nicotine, oxidizing chemicals, aldehydes (especially acrolein), and particulates
- Nicotine might contribute to acute cardiovascular events, particularly in people with underlying cardiovascular disease, primarily by sympathetic neural stimulation and systemic release of catecholamines
- The cardiovascular risk of EC use is likely to be much less than that of cigarette smoking

(액상형) 전자담배는 금연에 도움?

RESEARCH ARTICLE PLOS ONE | <https://doi.org/10.1371/journal.pone.0199047> July 9, 2018

Are electronic nicotine delivery systems helping cigarette smokers quit? Evidence from a prospective cohort study of U.S. adult smokers, 2015–2016

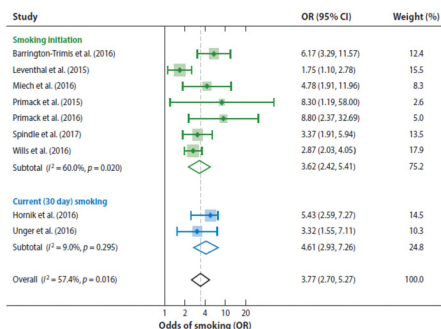
Scott R. Weaver^{1,2*}, Jidong Huang^{3,4}, Terry F. Pechacek^{2,3}, John Wesley Heath², David L. Ashley^{1,4}, Michael P. Eriksen^{2,3}

1 Division of Epidemiology & Biostatistics, School of Public Health, Georgia State University, Atlanta, GA, United States of America, **2** Tobacco Center of Regulatory Science (TCORS), School of Public Health, Georgia State University, Atlanta, GA, United States of America, **3** Division of Health Management & Policy, School of Public Health, Georgia State University, Atlanta, GA, United States of America, **4** Division of Environmental Health, School of Public Health, Georgia State University, Atlanta, GA, United States of America

Conclusions

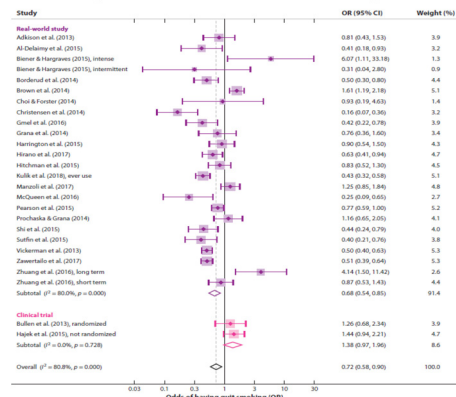
We found no evidence that ENDS use, within context of the 2015–2016 US regulatory and tobacco/vaping market landscape, helped adult smokers quit at rates higher than smokers who did not use these products. Absent any meaningful changes, ENDS use among adult smokers is unlikely to be a sufficient solution to obtaining a meaningful increase in population quit rates. Additional research is needed to reconcile the divergent literature and monitor the impact of ENDS in an environment of rapidly evolving markets and regulatory policies.

Ever e-cigarette use among never smokers at baseline quadruples the odds of being a smoker at follow-up



Soneji S, Barrington-Trimmis J, Wills TA, Leventhal A, Unger JB, et al. 2017. Association between initial use of e-cigarettes and subsequent cigarette smoking among adolescents and young adults: a systematic review and meta-analysis. *JAMA Pediatr.* 171:788-797

Smokers who use e-cigarettes are significantly less likely to have stopped smoking than smokers who do not use e-cigarettes



Zhuang YL, Cummings SE, Sun JY, Zhu S-H. 2016. Long-term e-cigarette use and smoking cessation: a longitudinal study with US population. *Tob Control* 25:PP-95

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

NRT 군

- 패치, 껌, 로젠즈, 구강 분무
- 복합사용 격려
- 제품은 본인 선택
- 사용기간: 3개월
- 행동요법: 매주 상담, 최소 4주 이상
- 1년 금연유지율

E-Cig 군

- EC type: 2세대 refillable EC, 가향 및 농도는 본인 선택
- 18mg/ml 니코틴 포함
- 30ml 병
- 필요시 다른 제품으로 변경(가향, 농도 등)
- 행동요법: 매주 상담, 최소 4주 이상
- 1년 금연유지율

N Engl J Med 2019;380:629-37.

Table 2. Abstinence Rates at Different Time Points and Smoking Reduction at 52 Weeks.^a

Outcome	E-Cigarettes (N=438)	Nicotine Replacement (N=446)	Primary Analysis: Relative Risk (95% CI) [†]	Sensitivity Analysis: Adjusted Relative Risk (95% CI)
Primary outcome: abstinence at 52 wk — no. (%)	79 (18.0)	44 (9.9)	1.83 (1.30-2.58)	1.75 (1.24-2.46) [‡]
Secondary outcomes				
Abstinence between wk 26 and wk 52 — no. (%)	93 (21.2)	53 (11.9)	1.79 (1.32-2.44)	1.82 (1.34-2.47) [‡]
Abstinence at 4 wk after target quit date — no. (%)	192 (43.8)	134 (30.0)	1.45 (1.22-1.74)	1.43 (1.20-1.71) [‡]
Abstinence at 26 wk after target quit date — no. (%)	155 (35.4)	112 (25.1)	1.40 (1.14-1.72)	1.36 (1.15-1.67) [‡]
Carbon monoxide-validated reduction in smoking of ≥50% in participants without abstinence between wk 26 and wk 52 — no./total no. (%)	44/345 (12.8)	29/393 (7.4)	1.75 (1.12-2.72)	1.73 (1.11-2.69) [‡]

N Engl J Med 2019;380:629-37.

Results

- EC 군 중 1년 성공자 80% 가 EC 를 52주 째에도 사용 중
- NRT 군 중 1년 성공자 9% 가 52주 째에도 NRT 사용 중
- 두 제품 모두 껌련보다는 만족도가 낮음
- EC 군이 NRT 군 보다 만족도가 높음

N Engl J Med 2019;380:629-37.

액상형 전자담배 사용과 일반담배 흡연량(국내)

전자담배1> 지난 1년간, 니코틴 액상형 전자담배를 사용해 본 적이 있습니까?

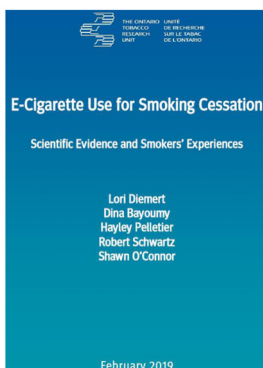
	예	아니오	무응답
전체 (466명)	55(11.8%)	56(12%)	355(76.2%)

전자담배5> 니코틴 액상형 전자담배를 사용한 이후, 일반담배의 흡연량은 전자담배 사용 전 보다 줄어났습니까, 아니면 줄어들었습니까?

	일반 담배 흡연량이 줄어남	변화 없음	일반 담배 흡연량이 늘어남	모르겠다	해당 없음
전자담배 경험자 전체 55명	12(21.8%)	20(36.4%)	11(20%)	1(1.8%)	11(20%)

국민건강영양조사 기반의 흡연자 패널4차 추적조사. 2018

Key Findings



- Vaping to quit smoking is now one of the most frequently used methods tried by smokers wanting to quit
- The evidence to support e-cigarettes as an effective smoking cessation aid remains inconclusive
- Newer e-cigarette devices may be more effective for smoking cessation than earlier generation devices
- Future research regarding the efficacy of e-cigarettes with combination cessation therapies, such as behavior therapy and prescription medication, is needed
- Smokers' experiences with vaping to quit were reflected in 7 key themes: positive attributes, positive outcomes, relationships, vaping devices, limitations to vaping, health concerns, and social challenges
- Research is needed to determine how smokers' experiences can inform future cessation programming

A Presidential Advisory From the American Heart Association 2019

- In general, **providers should screen for all tobacco use in all patients**, with the understanding that current tobacco use is not restricted to the use of cigarettes or smokeless tobacco and may involve a variety of different use patterns, devices, and modalities.
- **They should encourage patients to first consider established pharmacological and behavioral smoking cessation therapies** and should be prepared specially to counsel their youth and adolescent patients to avoid or quit the use of all tobacco products, including e-cigarettes, hookah, cigarillos, cigars, smokeless tobacco, and combustible cigarettes.
- **Youth substance use prevention programs should target reduction of e-cigarette use.**

신종담배와 금연진료 - 흡연력 확인 어려움

- CO 측정시 detection 이 잘 되지 않음
- 타당성 있는 금연성공률 측정이 곤란
- 요코티닌 등의 고가/불편한 검사 필요
- 문진을 통한 담배사용 조사의 번거로움
- **금연진료의 동력상실**

국건영 흡연설문조사(기준)

4. 현재 담배를 피우십니까?

① 매일피움 → 4-1. 하루 평균 흡연량은 몇 개비입니까? 개비 (→ 5번으로)

② 가끔피움 → 4-2. 최근 1달 동안 흡연일수는 몇 일입니까? 일

4-3. 흡연한 날 하루 평균 흡연량은 몇 개비입니까? 개비 (→ 5번으로)

③ 과거에는 피웠으나 현재 피우지 않음

4-4. 과거 흡연 기간은 얼마나 되었습니까?
 년 개월

4-5. 과거 담배를 피울 때 하루 평균 흡연량은 얼마나 됩니까?
 개비

4-6. 담배를 끊은지 얼마나 되었습니까?
 년 개월 (→ 6번으로)

→ 5. 앞으로 1개월 안에 담배를 끊을 계획이 있습니까?

① 1개월 안에 금연할 계획이 있다
② 6개월 안에 금연할 계획이 있다
③ 6개월 이내는 아니지만 언젠가는 금연할 생각이 있다
④ 현재로서는 전혀 금연할 생각이 없다

4. 지금까지 권련형 전자담배(가열담배, ㉠아이코스, 글로, 릴 등)를 피운 적이 있습니까?

- ① 예
② 아니오 (→ 5번으로)

→ 4-1. 현재 권련형 전자담배(가열담배, ㉠아이코스, 글로, 릴 등)를 피우십니까?

① 매일 피운다 → 4-1-1. 하루 평균 권련형 전자담배(가열담배, ㉠아이코스, 글로, 릴 등) 흡연량은 몇 개비입니까?
 개비 (→ 5번으로)

② 가끔 피운다 → 4-1-2. 최근 1달 동안 권련형 전자담배(가열담배, ㉠아이코스, 글로, 릴 등) 흡연일수는 며칠입니까? 일

4-1-3. 흡연한 날 하루 평균 권련형 전자담배(가열담배, ㉠아이코스, 글로, 릴 등) 흡연량은 몇 개비입니까?
 개비 (→ 5번으로)

③ 과거에는 피웠으나 현재 피우지 않는다

5. 지금까지 액상형 전자담배를 사용한 적이 있습니까?

- ① 예
② 아니오 (→ 6번으로)
- 5-1. 최근 1달 동안 액상형 전자담배를 사용한 적이 있습니까?
- ① 예
② 아니오

6. 지금까지 사용해본 것을 모두 표시해 주십시오.

※ 일반담배, 권련형 액상형 전자담배는 제외합니다.

- ① 머글는담배(스누스)
② 물담배
③ 시가
④ 기타()
⑤ 피운적 없다 (→ 7번으로)

→ 6-1. 최근 1달 동안 사용해본 것을 모두 표시해 주십시오.

※ 일반담배, 권련형 액상형 전자담배는 제외합니다.

- ① 머글는담배(스누스)
② 물담배
③ 시가
④ 기타()
⑤ 피운적 없다

결론

- 다양한 신종담배가 전세계적으로 유행하는 단계
- 제 4세대 (액상형) 전자담배는 미국에서 큰 유행
- 의료진과 전문가에 의한 금연약물요법과 상담은 니코틴 의존도가 높은 담배사용자들에게 금단증상을 완화시켜 보다 편하게 금연을 유지할 수 있도록 도와주는 가장 유용한 방법이며, (액상형) 전자담배는 부득이 한 경우 사용을 고민
- 신종담배의 유행에 대비한 보건의료계, 정부의 대책 마련이 절실 (특히 청소년 대상)