# Electronic cigarette and stop to smoking

**Ewha Womans University School of Medicine**

**천 은 미**

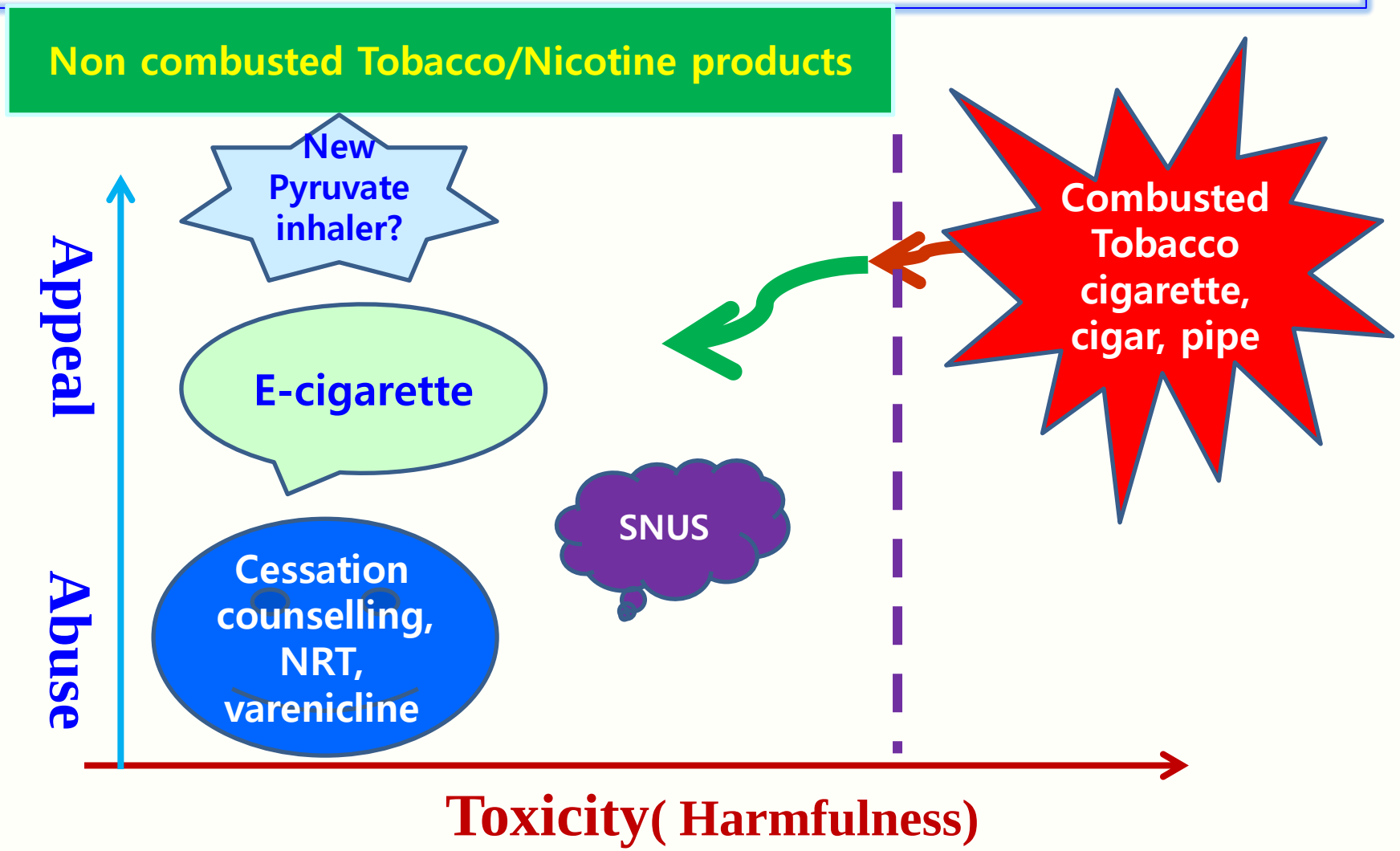
# Development of smoking


1st
Conventional
cigarette

2nd
Smokeless
tobacco

3rd
Electronic
cigarette

# Harm reduction model of smoking



# Focus on eliminating combustible tobacco products

① Smokeless tobacco (Snus)

② Electronic cigarettes

❖FDA approved medicines(Treatment method)

(*nicotine replacement therapy*, *varenicline*, *bupropion*)

# Snus (smokelss tobacco)

- ✓ Smokeless snuff tobacco used in Sweden
- ✓ Delivers harmful substances

Take a pouch

**Place it behind upper lip**

**30 min stay in**

# Relation between conventional vs snus and cardiovascular events

- Followed up 12 yrs (n = 135, 036)
  - *Never tobacco use vs Snus: (RR **1.4**)*
  - *Never tobacco use vs Smokers: (RR **1.9**)*

*Bolinder G et al. Am J Public Health 1994;84:399*

  - Never tobacco vs Snus (OR 0.89 ,95% CI 0.62 to 1.29)
  - Never tobacco vs Smokers(OR 1.87, 95% CI 1.40 to 2.48).

*Huhtusaari F et al. BMJ 1992;41:1252*

# Abstinence rate between varenicline vs snus

***Nicotine chewing gum (reference OR = 1)***

① Varenicline (*OR* = 4.95)

② Swedish Snus ( *OR* = 2.68)

*Karl EL et al. Nicotin Tob Res 2010 12(8):817*

## Positive effect by snus in reducing smoking rate

- The availability and use by men of snus, is recognized to have contributed to the low prevalence of smoking in Swedish men and consequent low rates of lung cancer.

# Negative effect by snus in smoking

- ✓ Snus may lead to **dual use** rather than replace cigarettes.
- ✓ **Nicotine addiction** may be strengthened by snus use.
- ✓ Snus use may lead to **fewer attempts to quit smoking.**
- ✓ Snus serve as a **gateway to smoking**

# The history of Electronic-cigarette

- **Invented by Chinese pharmacist Hon Lik in 2003.**
- **E- cigarettes introduced to U.S. market in 2007.**

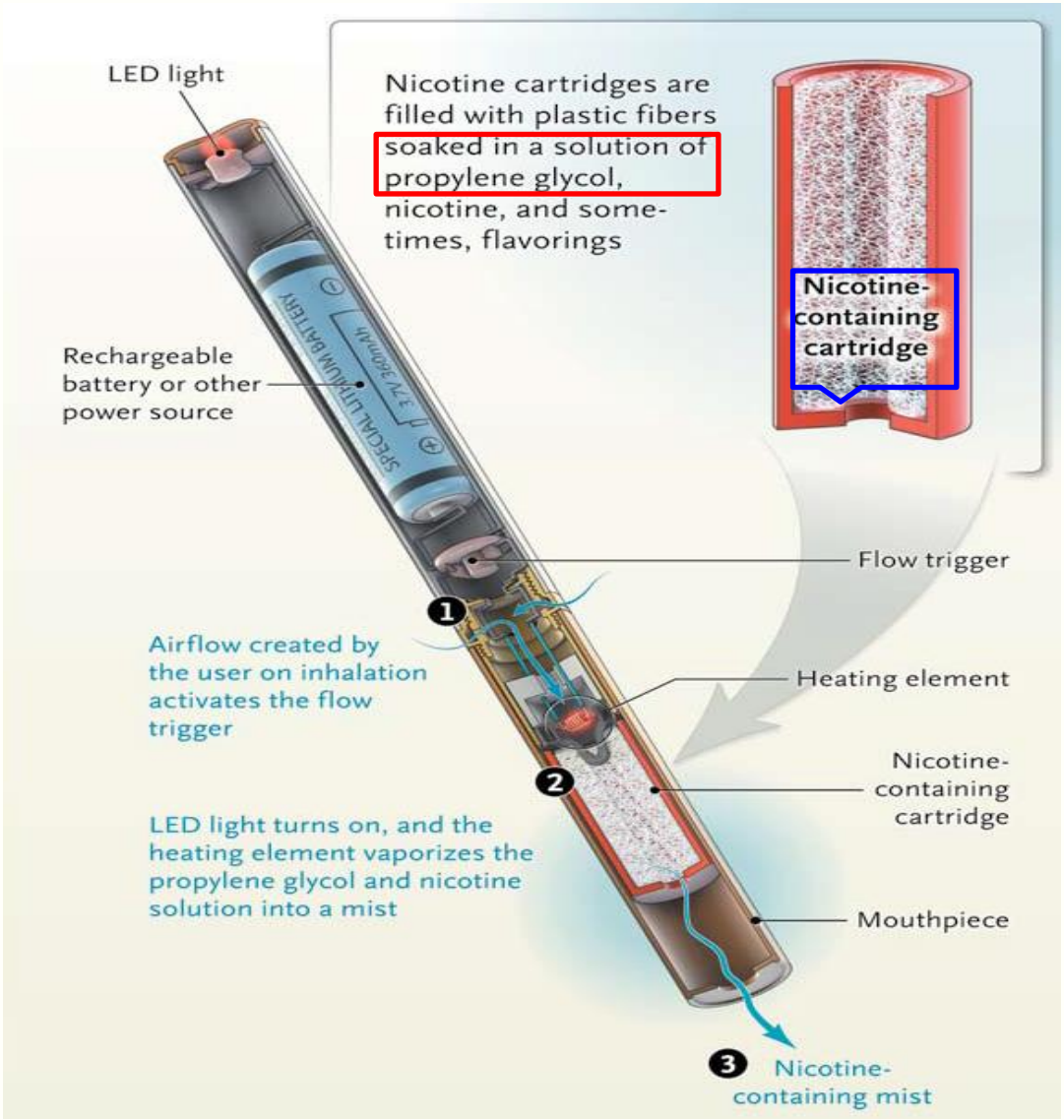

# E-cigarettes : What are the unknown features?

- Tobacco-free nicotine delivery devices ?
- Look & like a traditional or a fashion accessory
- Do not provide information on the chemicals used
- Nicotine levels are formulated to target strengths
- Measured levels not matched the label claim

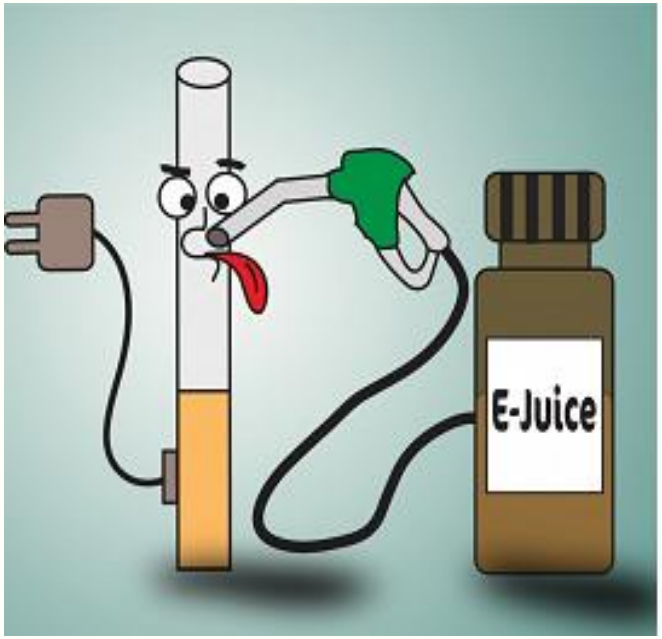
# The variable shapes of E-cigarette

- E-cigarettes look like conventional cigarettes, cigars. Some resemble as pens and USB

# The structure of E-cigarette




**Cartridges contain up to 20mg of nicotine.**




*from NEJM 365;3 21, 2011*

# The main components of E- cigarette

## Liquid


- E-liquid, called E-Juice,
- the fuel of electronic smoking device
- different flavors, different amounts of nicotine

## ***Strength of the liquid***

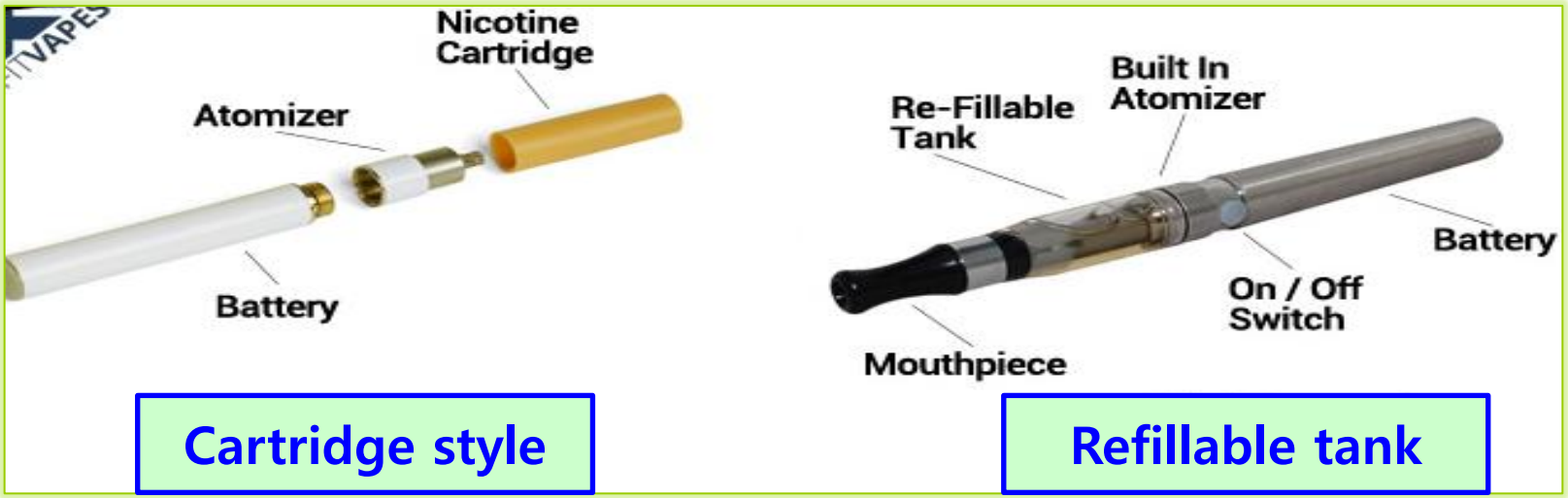
**6 mg/ml**: Low volume smoker, less than half a pack/d

**12 mg/ml:** Average smoker, between ½ and full pack /d

**18 mg/ml:** High volume smoker, more than a pack/d

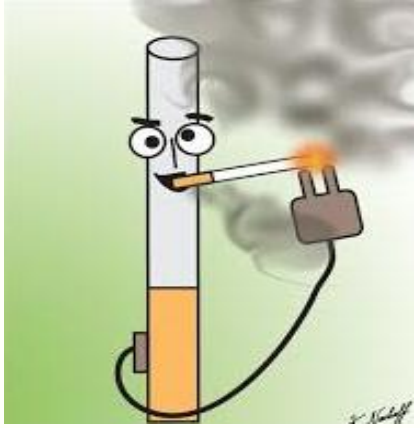
**24 mg/ml:** Chain smoker, the highest strength

# Cartridge




- Cartomizer, cartridge, clearomizer, tank
- Piece that holds the reservoir of e-liquid
- Several flavors, tobacco, menthol, chocolate, vanilla, fruit flavors
- Power needed to generate the atomizer and vaporize the e-liquid

# Batteries




22.58


420 650 900
420 650 900
420 650 900
900mah Designer Batteries

# E- Cigarettes Users profile, Utilization, Satisfaction and Perceived efficacy

- 3587 participants (70% former smokers, 61% men)

  96% said helped to quit or reduce smoking

  former smokers to avoid relapse or an aid to quit

*Jean FE et al. 2011 Addiction 106:2011*

## Reason for using ( Perception)

| | | | |
|---|---|---|---|
| **Less toxic than tobacco** | **84%** | **Cheaper than smoking** | **57%** |
| **Deal with craving** | **79%** | **Deal with withdrawal sx** | **67%** |
| **Where smoking was prohibited** | **39%** | **Quit or avoid relapsing** | **77%** |

# Perception of E-Cigarette Harm and Correlation With Use Among U.S. Adolescents

**National Youth Tobacco Survey (*n* = 24,658)**

- Among those trying E-cigarettes

**71.8%** believed E-cigarettes were less harmful.

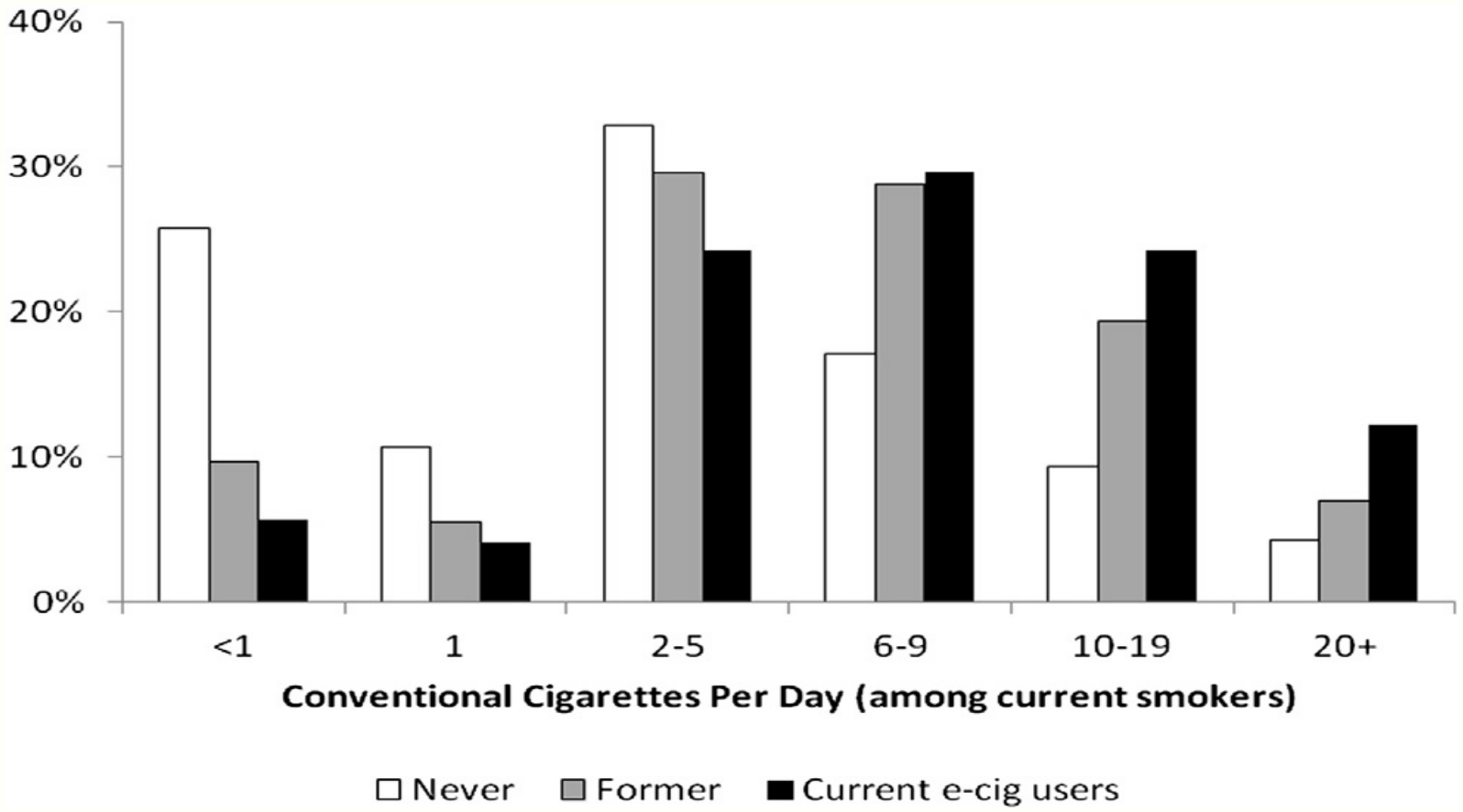
*Nicotine Tob Res (2015) 17 (3): 330*

# Analysis of ever E-cigarette use and current E-cigarette use and cigarette smoking for 2011 and 2012 surveys

| | Cigarette smoking status | | Abstinence from cigarettes | | |
|---|---|---|---|---|---|
| **Dependent Variable** | **Ever Smoking (≥100 cigs)** | **Current Smoking (≥100 cigs, ≥1 cig past 30 days)** | **30-day abstinence** | **6-month abstinence** | **1-year abstinence** |
| | **OR (95%CI)** | **OR (95%CI)** | **OR (95%CI)** | **OR (95%CI)** | **OR (95%CI)** |
| **Cigarette experimenters** (≥1 puff of a cigarette, n=10,850) | | | | | |
| **Ever E-cig use** | **6.31** (5.39-7.39) | **5.96** (5.67-6.27) | **0.24** (0.21-0.28) | **0.24** (0.21-0.28) | **0.25** (0.21-0.30) |
| **Current E-cig** | **7.42** (5.63-9.79) | **7.88** (6.01-10.32) | **0.11** (0.08-0.15) | **0.11** (0.08-0.15) | **0.12** (0.07-0.18) |
| **Ever cigarette smokers** (≥100 cigs, n=1,832) | | | | | |
| **Ever E-cig use** | - | - | 0.61 (0.42-0.89) | 0.53 (0.33-0.83) | 0.32 (0.18-0.56) |
| **Current E-cig** | - | - | 0.35 (0.18-0.69) | 0.30 (0.13-0.68) | 0.34 (0.13-0.87 |

*Lauren M. Et alJAMA Pediatr. 2014 ; 168(7): 610–617*

# E- cigarette use among Korean Adolescents
## : Cross-sectional study

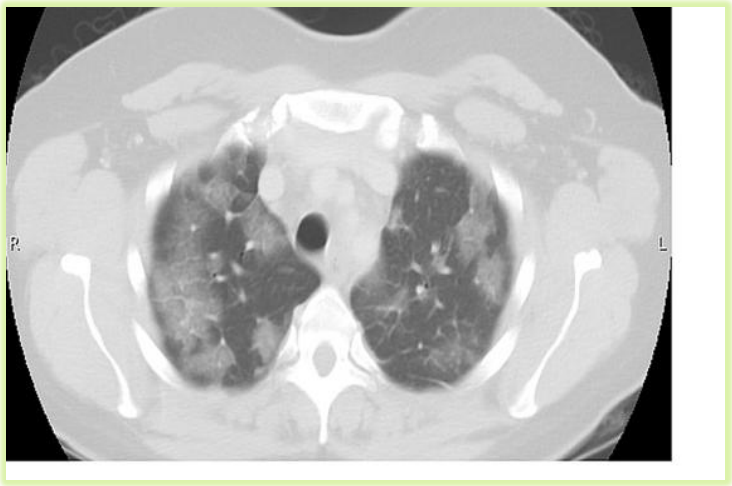


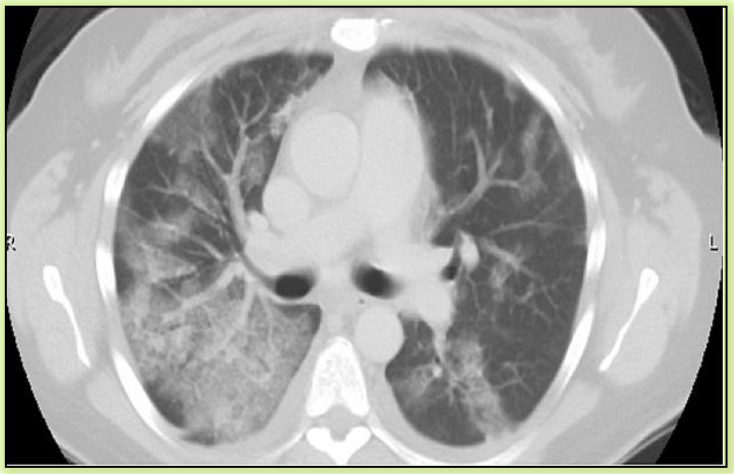

**Among current smokers, current E-cigarette users smoke more conventional cigarettes than former E-cigarette or never users ($p < .0001$).**

*Lee S et al. J of Adol Health 2014;54: 684*

# Unexpected consequence of E- cigarette use

## (Lipoid pneumonia due to glycerin based E-cigarettes)





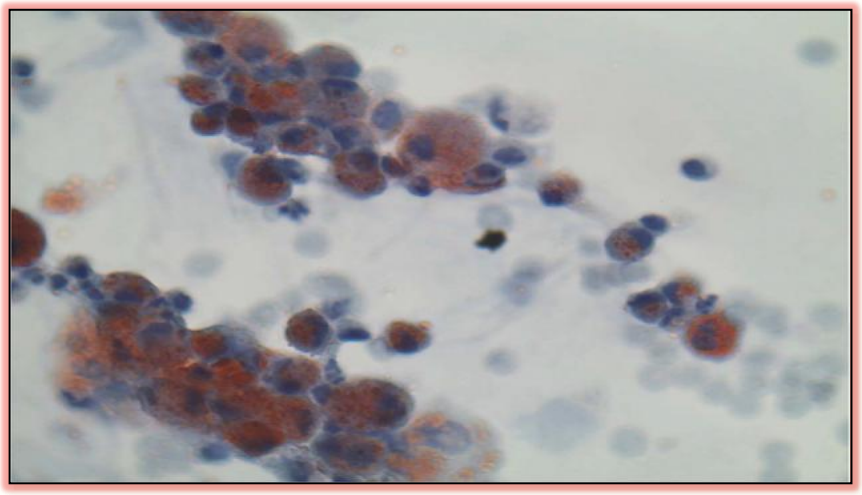


Figure 2. Photomicrograph of BAL sample shows **lipid-laden macrophages** (Oil-Red-O stain, original magnification 3 100).

Figure 1. Representative CT images show the **"crazy paving"** pattern of patchy ground glass superimposed on interlobular septal thickening. A, Bilateral upper lobes. B, Bilateral lower lobes. *Downloaded Linsay M. CHEST 2012; 141( 4 ): 1110 – 1113*

# More on Nicotine Poisoning in Infants by E-cigarettes and misuse of nicotine solution

- Reported exposure to nicotine solution 105 cases in 2013
- 4 adults instilled nicotine refill solution instead of eye drops, resulting in considerable but transient irritation in each case

*N Engl J Med 2014; 371:880*

# E- cigarettes Prevalence
## : Increase of doubling every year

**E-cigarette Ever use** < 1% in 2009

> 3% in 2010

> 7% in 2011

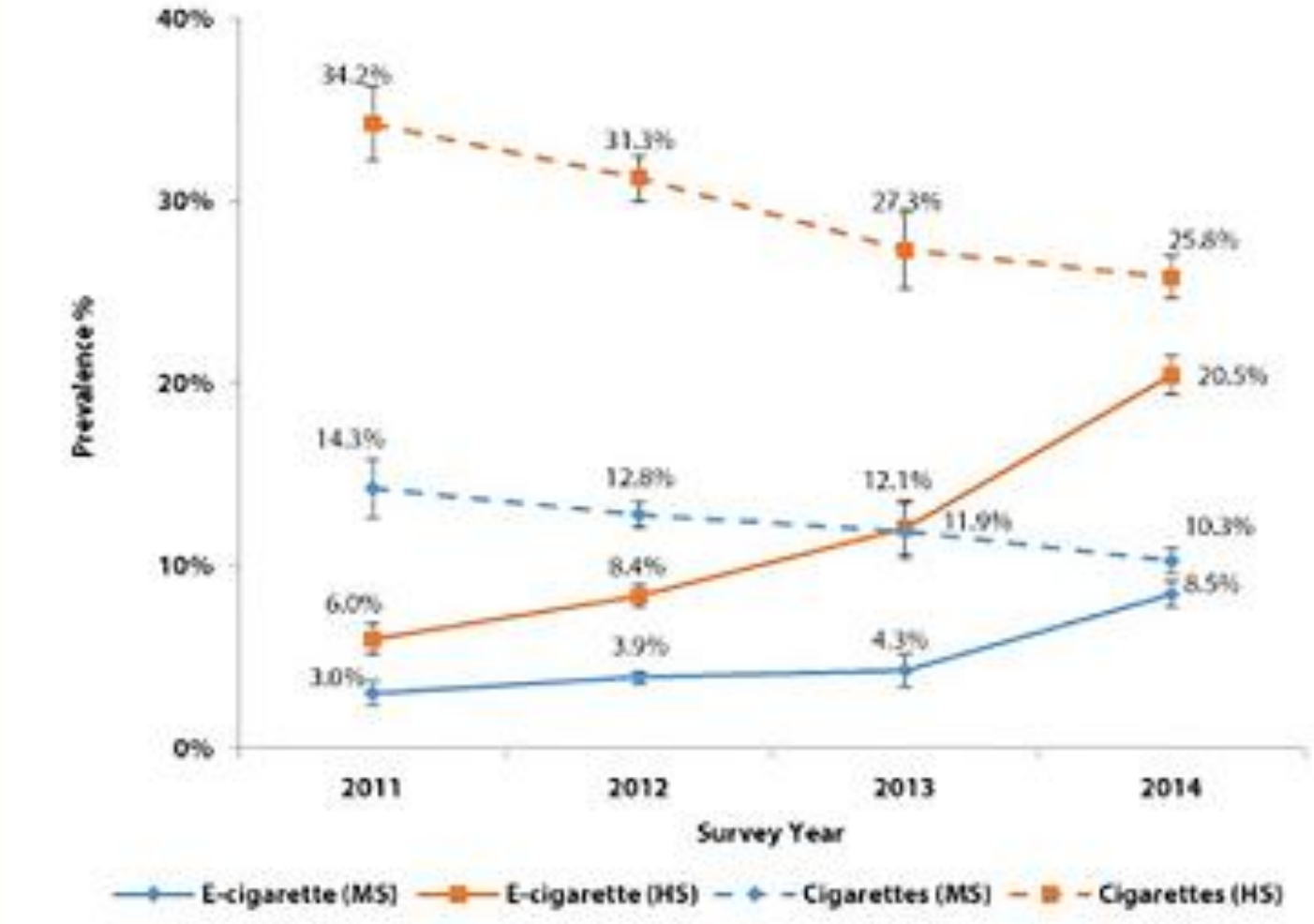
*Am J Public Health 2013;103(3):556*

**High school students were increasing every year**

Ever use : 4.7% in 2011 vs 10% in 2012

*MMWR Morb Mortal Wkly Rep 2013;62(35):729*

# Electronic cigarette and traditional cigarette use among middle and high school students in Florida 2011-2014




Plos One 2015;10(5)

# E-Cigarettes and the Tobacco “Endgame

- **E-cigarettes sales**

① $650 million a year in Europe

② $1.7 billion in the United States in 2013.

- **Eventually eclipse tobacco cigarettes.**
- **gateway” or “bridge**” product, leading to an increase in underage smoking

*N Engl J Med 2014; 370:293*

# The bridge effect of E-cigarettes in middle & high school

- **Among never-smokers** used e-cigarettes,

➢ **43.9%** : used conventional cigarettes.

**Among never smokers** never used e-cigarettes,

➢ **21.5%** : used conventional cigarettes.

*Bunnell et al. Nicotine & Tobacco research 2014;20*

# Early adolescent E-cigarette use
## : substance use pathway (alcohol)?

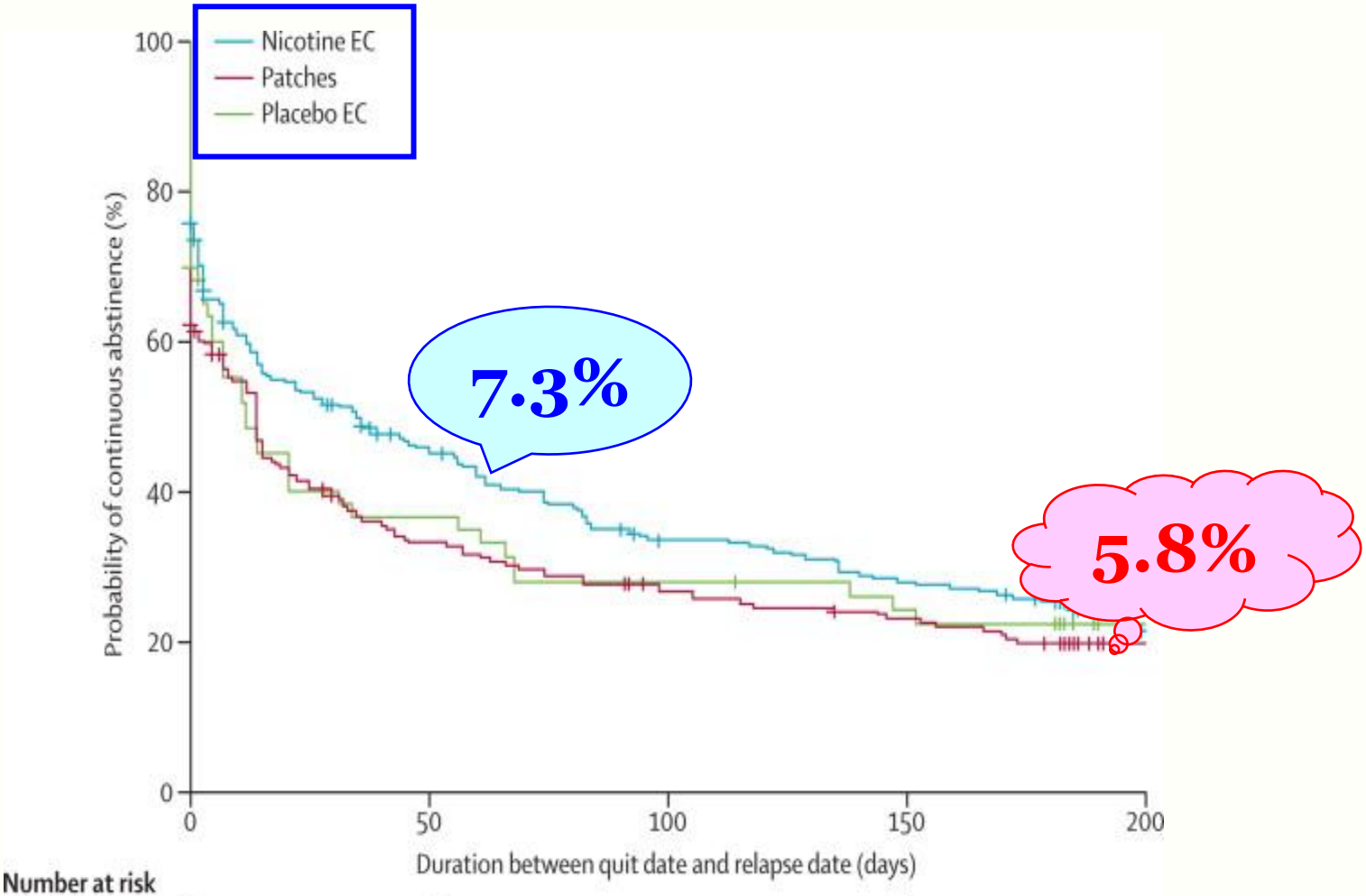
- ✓ E-cigarette users were significantly more likely than non-users to use both conventional cigarettes & alcohol.

*Addict Behav. 2015;42:73–8*

- ✓ E-cigarette use is additive to other tobacco use and increases the risk for alcohol use.

*Alfgeir LK, et al. BMC Medicine (2015) 13:103*

# E-cigarettes for smoking cessation: Effect or not?




*Bullen et al.* *The Lancet, 2014, 382*

# The effect of E-cigarettes for conventional cigarette smoking

- Use of e-cigarettes **does not discourage**, and may encourage, conventional cigarette use
- E-cigarettes may contribute **to nicotine addiction** and are unlikely to discourage conventional cigarette

# Variations in Label Information and Nicotine Levels in Electronic Cigarette Refill Liquids

① 32 sampled liquids (17 Koreans) showed lack of informations, common in domestic brand (made by China).

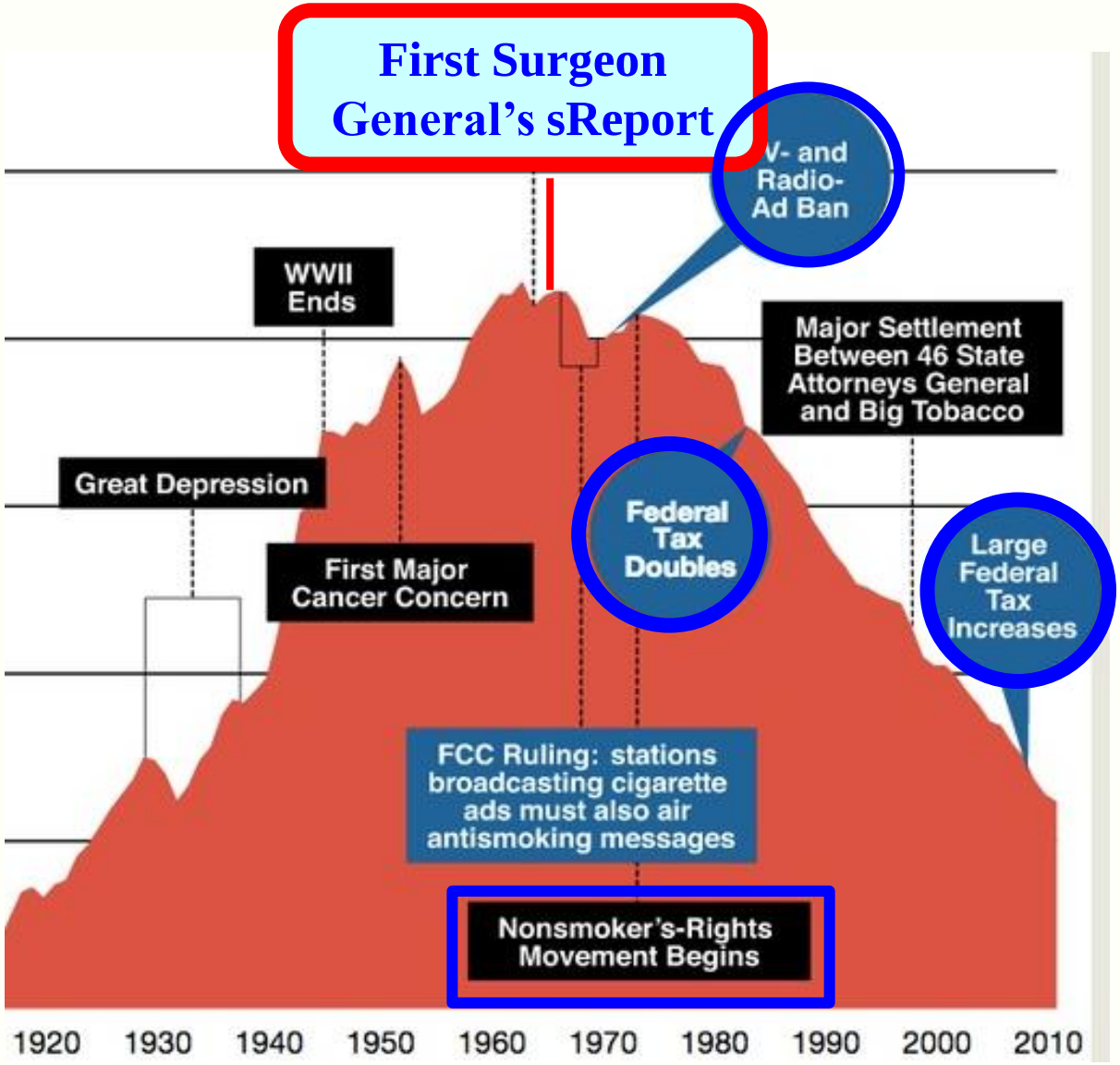
② Health warnings were less in Korean than imported liquids.

③ None of the domestic brands reported nicotine content.

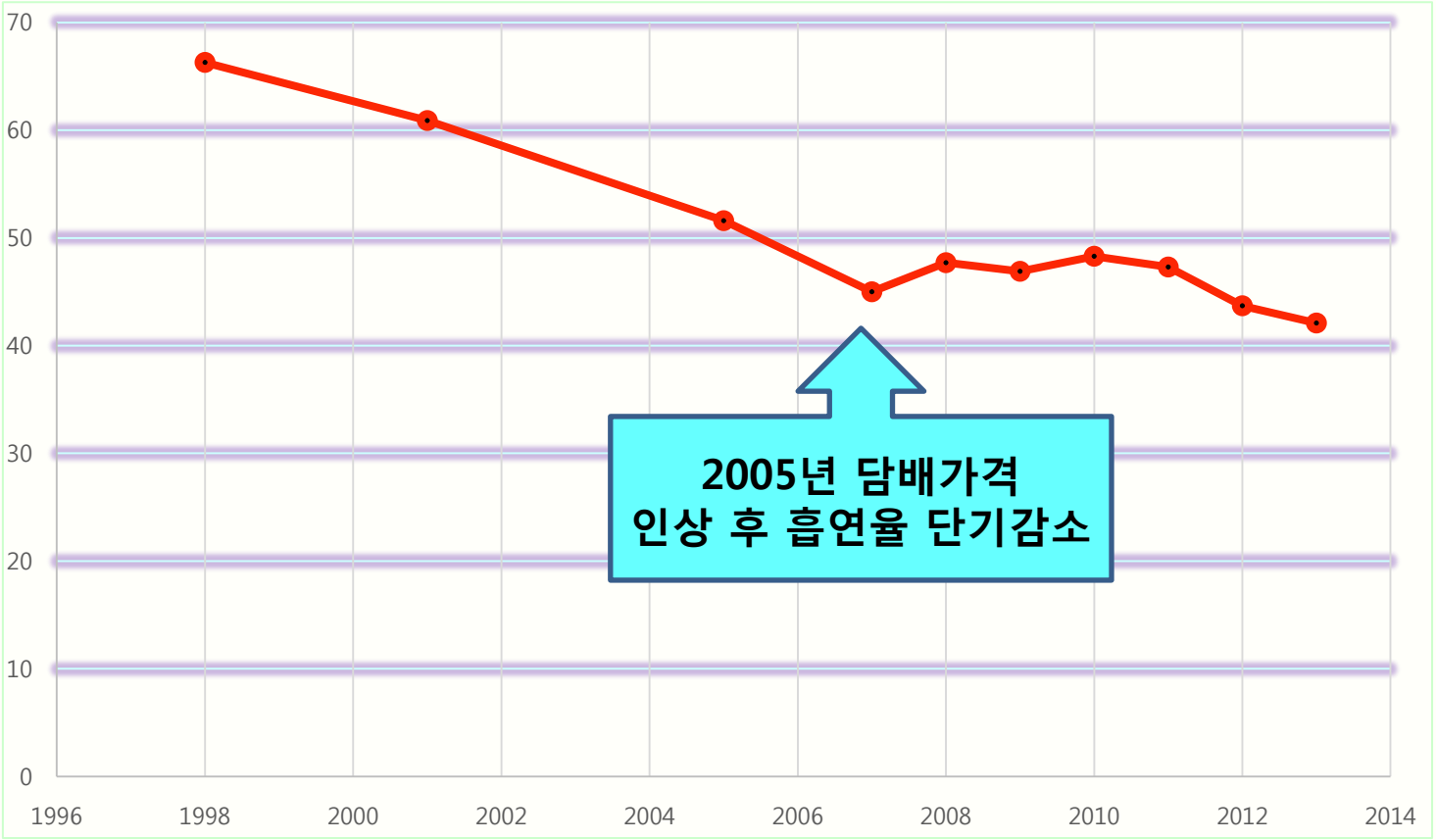
④ ***Urgent need for national labeling standards and measurement of concentration levels of other toxic or carcinogenic compounds in the liquids.***

*Int. J. Environ. Res. Public Health* ***2015****, 12(5), 4859*

# Decline of smoking rate in USA



# 국내 남자 흡연율 연도별 변화


출처: 2013 국민건강영양조사 KNHANES VI-I

# Benefits of smoking cessation

- Quitting by the age of **35~44** years can avoid risk of dying *NEJM 2013;368:341*

  Quitting smoking increase life expectancy up to 10 years *BMJ 2004;328:1519*


# Physician' role for smokers to quit smoking

- A reduction in physician smoking precedes decreases in population
  - 80% of smokers see a physician each year.
  - 70% of smokers want to quit


- Prevalence of smoking among Korean pulmonologists
- *Nonsmokers 138(85.7%) / Current smokers 23(14.3%)*

# Guideline of Smoking Cessation Practice

## Counselling(advice)

① 5A’S

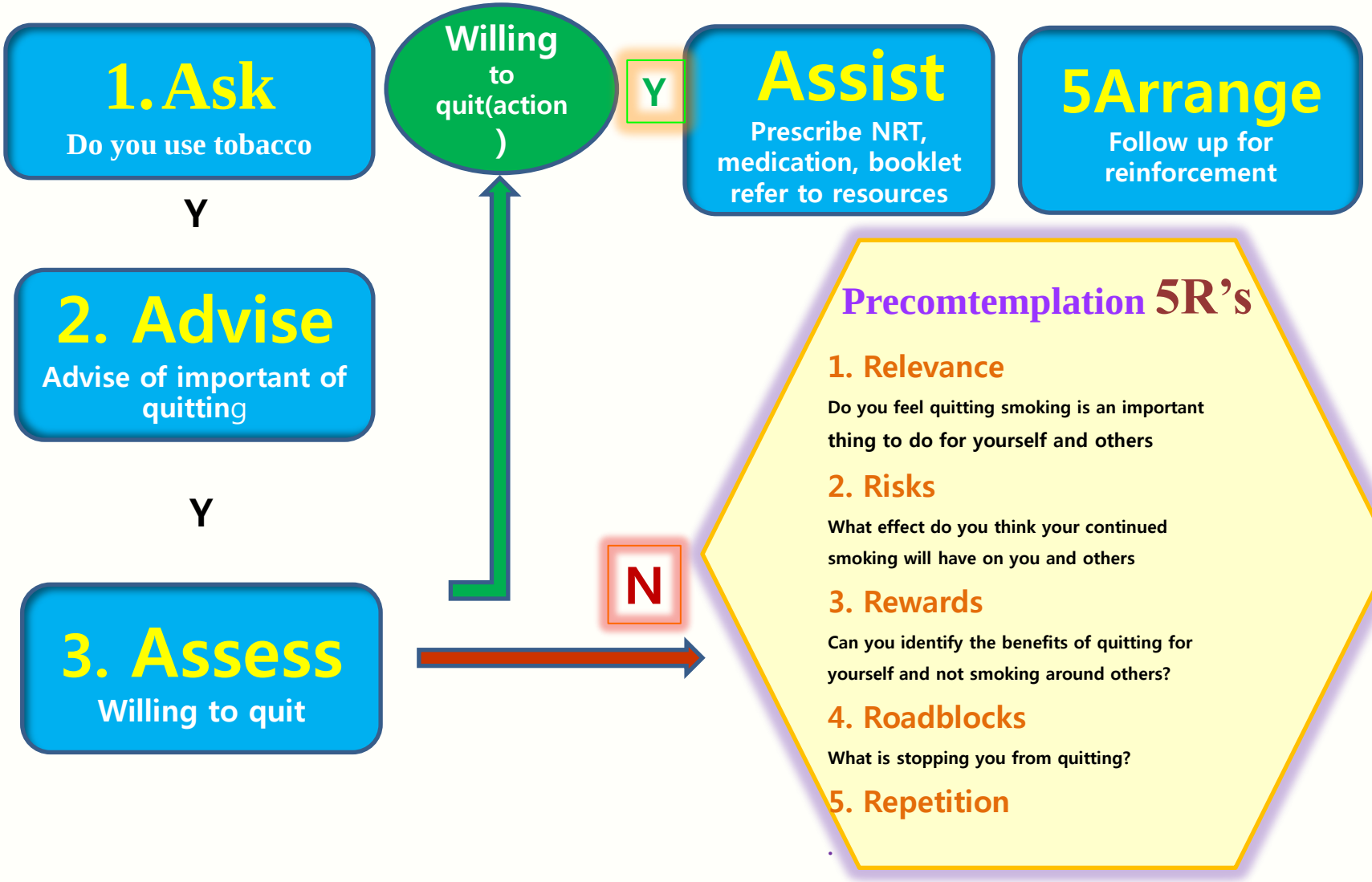
② 5R’S

## Medications

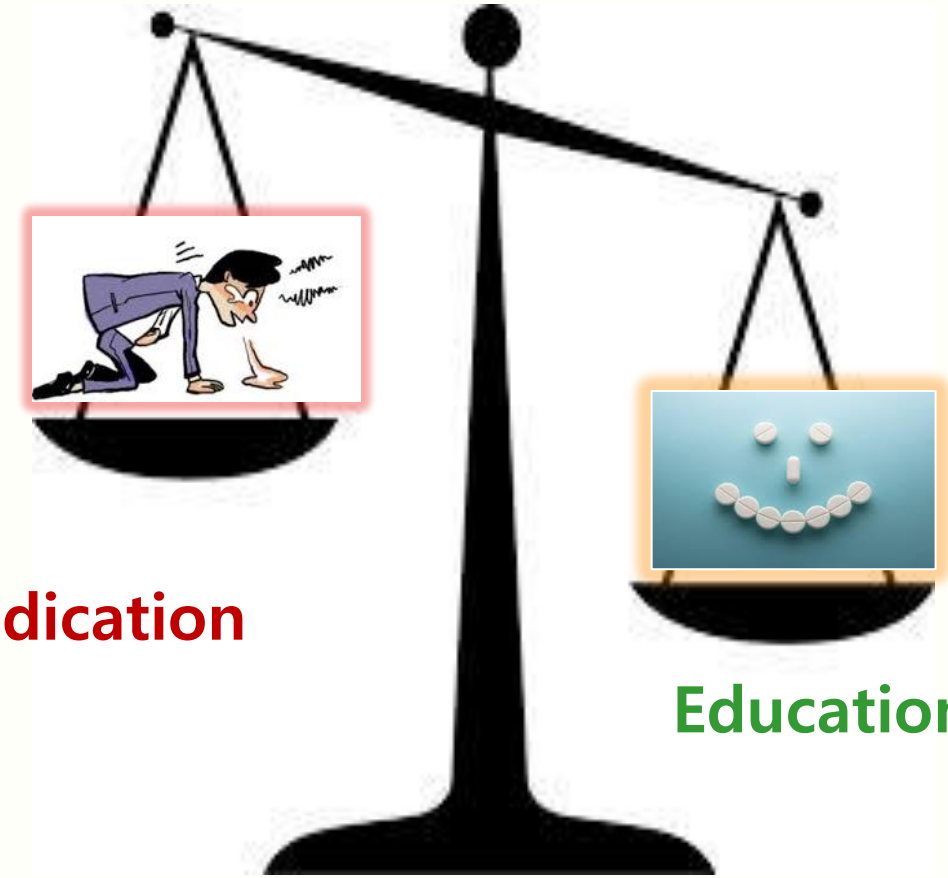
## Special situations treat

# 5A's Brief tobacco interventions

## Precomtemplation 5R's



# Success Rates of smoking cessation according to combined medications



2~3 %

Self / No medication

20~40%

Education & Medication

# FDA-approved smoking cessation medications

① **Bupropion SR** (wellbutrine, Zyban)

② **Varenicline** ( champix, chantix).

③ **Nicotine patch**(gum,lozenge,nasal spray,inhaler)

# First- line Medication for smoking cessation

## Bupropion SR (zyban, wellbutrin)

First FDA approved medication

**Side effects:** Insomnia, headache, abnormal dream

❖ **Not recommended** for people under 18 years of age

## Combination effect with other drugs

✓ Bupropion SR & NRT: delay, do not prevent **weight gain**

✓ Bupropion SR & nortriptyline

: effective in patients with a past history of **depression**

# First- line Medication for smoking cessation

## Varenicline ( Chantix, champix)

non-nicotine medication approved by FDA in 2006

### Side effects:

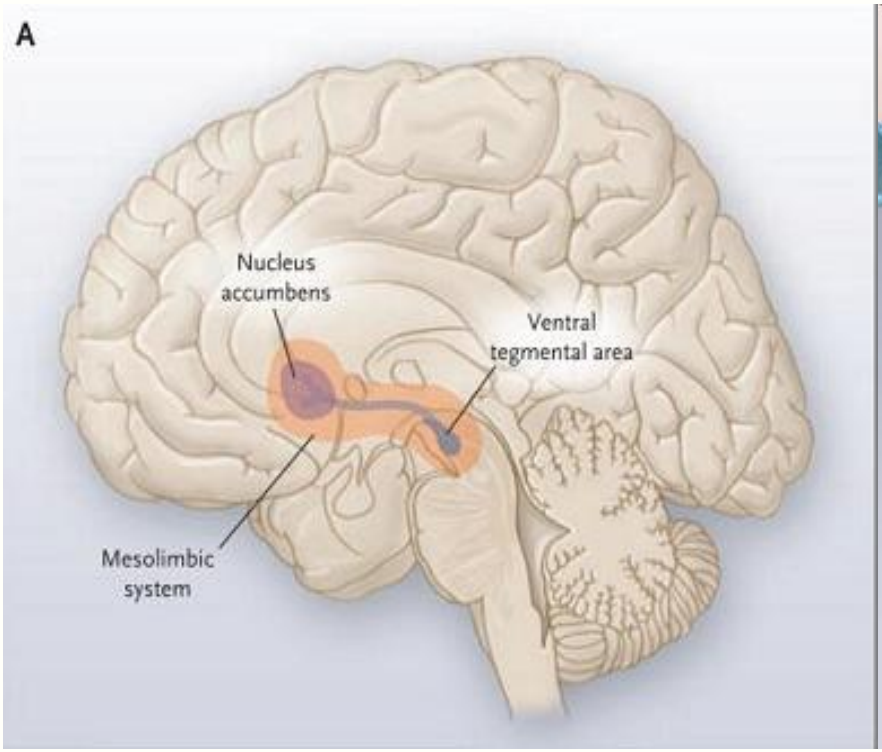
Nausea( 29.4%), headache, insomina, attempted suicide

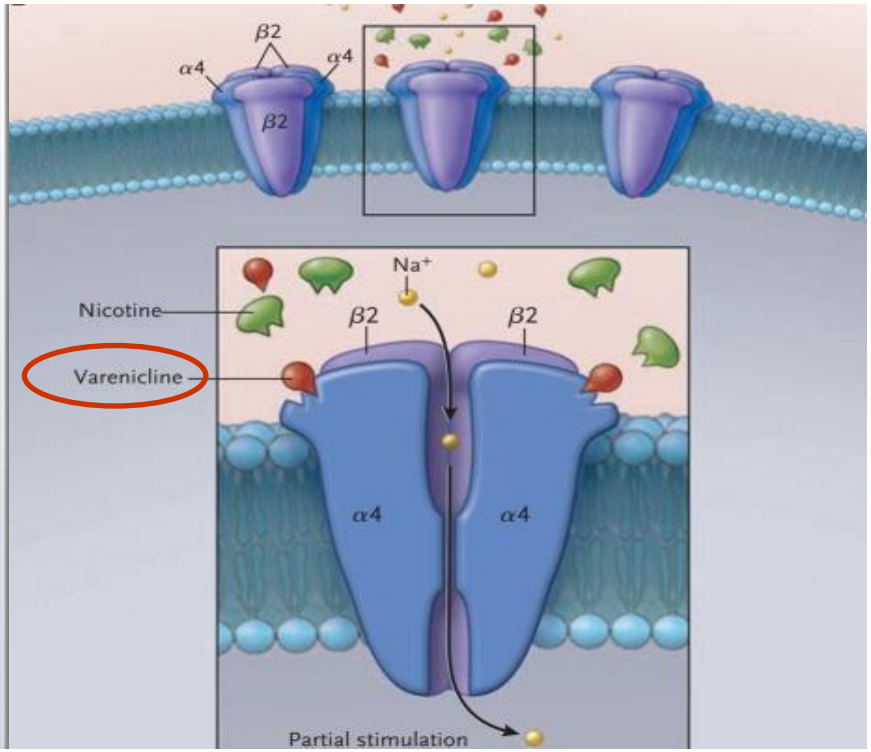
❖ Not recommended for people under 18 years of age.

### Mechanism:

Selectively and competitively binds to $\alpha_4\beta_2$ nicotinic receptors in the brain, producing both agonist and antagonist effects

# Nicotine Addiction: Varenicline mechanism




*N Engl J Med. 2010 Jun 17; 362(24): 2295–2303.*

# Effectiveness and Abstinence Rates of varenicline

## Compared With Placebo or Nicotine Patch at 6-Months

| Medication | Arms | Abstinance rate (95% CI) | OR vs Placebo (95% CI) | OR vs Nico patch* (95% CI) |
|---|---|---|---|---|
| **Monotherapies** | | | | |
| Varenicline (2 mg/d) | 5 | 33.2 (28.9-37.8) | 3.1 (2.5-3.8) | 1.6 (1.3-2.0) |
| Nicotine nasal spray | 4 | 26.7 (21.5-32.7) | 2.3 (1.7-3.0) | 1.2 (0.9-1.6) |
| Varenicline (1 mg/d) | 3 | 25.4 (19.6-32.2) | 2.1 (1.5-3.0) | 1.1 (0.8-1.6) |
| Nicotine inhaler | 6 | 24.8 (19.1-31.6) | 2.1 (1.5-2.9) | 1.1 (0.8-1.5) |
| Bupropion SR | 26 | 24.2 (22.2-26.4) | 2.0 (1.8-2.2) | 1.0 (0.9-1.2) |
| Nicotine patch (6-14 weeks) | 32 | 23.4 (21.3-25.8) | 1.9 (1.7-2.2) | 1.0 |
| Long-term nicotine patch (>14 weeks) | 10 | 23.7 (21.0-26.6) | 1.9 (1.7-2.3) | 1.0 (0.9-1.2) |
| Nortriptyline | 5 | 22.5 (16.8-29.4) | 1.8 (1.3-2.6) | 0.9 (0.6-1.4) |
| Nicotine gum (6-14 weeks) | 15 | 19.0 (16.5-21.9) | 1.5 (1.2-1.7) | 0.8 (0.6-1.0) |

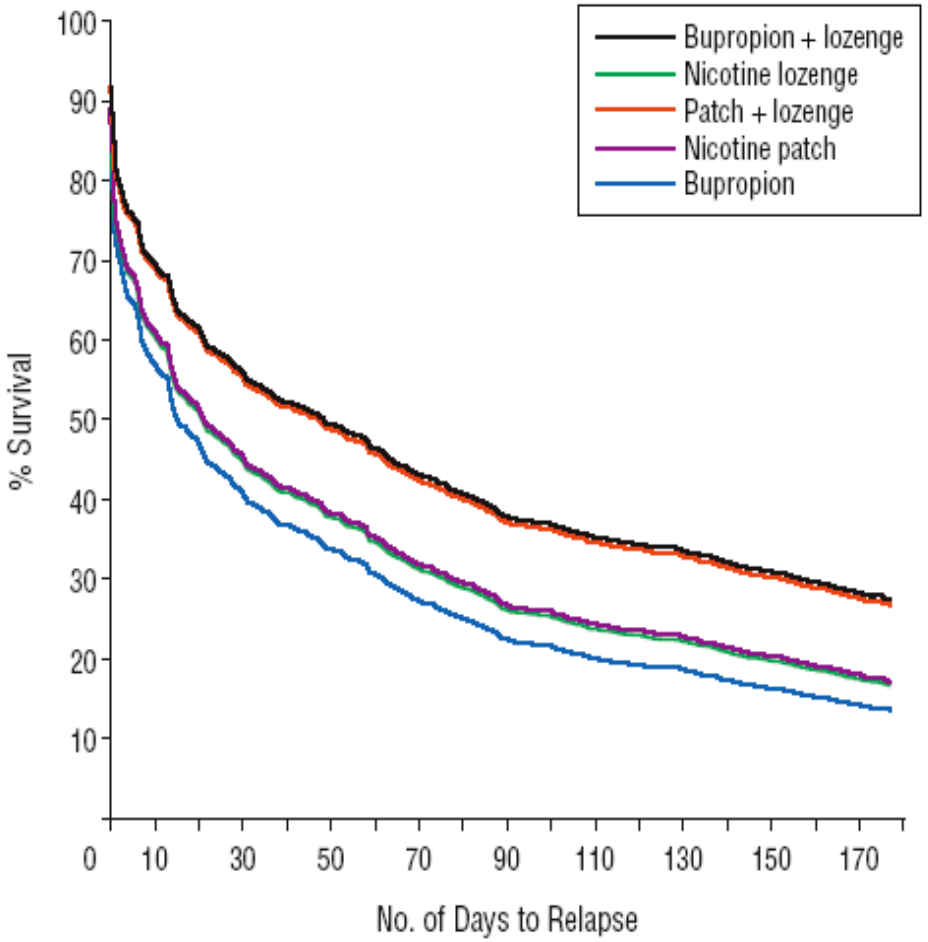
**Fiore MC, Jaén CR, Baker TB, et al. Treating Tobacco Use and Dependence: 2008 Update.*

# Extended Duration of Transdermal Nicotine Therapy

| Predictor | Stand (n = 286) n (%) | Extended (n= 282) n(%) | OR | 95% CI | p |
|---|---|---|---|---|---|
| Treatment Arm (week 8) | 86 (30.1%) | 98 (34.8%) | 1.23 | 0.87 - 1.76 | 0.25 |
| **Treatment Arm (week 24)** | 58 (20.3%) | 89 (31.6%) | **1.81** | 1.23 - 2.66 | ***0.002** |
| Treatment Arm (week 52) | 41 (14.3%) | 41 (14.5%) | 1.01 | 0.63 - 1.62 | 0.95 |
| Time-point (Week 24vs 8) | | | 0.59 | 0.45 - 0.77 | < .001 |
| Time-point (Week 52vs24) | | | 0.39 | 0.29 - 0.52 | < .001 |

*Ann Intern Med 2010;22:152:144*

# Combination pharmacotherapy of first line medications




Cox regression survival analysis: survival curves

- RCT of 1346 smokers
- Combination pharmacotherapy increased abstinence compared with monotherapies.

*Smith SS, et al. Arch Intern Med 2009;169:2148-55*

# Efficacy of Varenicline Combined With Nicotine Replacement Therapy vs Varenicline Alone for Smoking Cessation: RCT

Table 2. Continuous Abstinence and Point Prevalence Abstinence Rates (n=435)

| Time Since TQD | Time Period | Per-Protocol Analysis No. (%) Varenicline and Active Nicotine Patch (n = 216) | Per-Protocol Analysis No. (%) Varenicline and Placebo Patch (n = 219) | Per-Protocol Analysis OR (95% CI) | Per-Protocol Analysis *P* Value | Multiple Imputation Analysis of Main Outcomes No. (%)[a] Varenicline and Active Nicotine Patch (n = 216) | Multiple Imputation Analysis of Main Outcomes No. (%)[a] Varenicline and Placebo Patch[b] | Multiple Imputation Analysis of Main Outcomes OR (95% CI) | Multiple Imputation Analysis of Main Outcomes *P* Value |
|---|---|---|---|---|---|---|---|---|---|
| **Continuous abstinence rates** | | | | | | | | | |
| 8 wk | Weeks 5-8 | 96 (44.4) | 76 (34.7) | 1.50 (1.02-2.22) | .04 | | | | |
| 12 wk | Weeks 9-12 | 99 (45.8) | 70 (32.0) | 1.80 (1.22-2.66) | .003 | 120 (55.4) | 90 (40.9) | 1.85 (1.19-2.89) | .007 |
| 16 wk | Weeks 9-16 | 84 (38.9) | 56 (25.6) | 1.85 (1.23-2.79) | .003 | | | | |
| 24 wk | Weeks 9-24 | 71 (32.9) | 42 (19.2) | 2.06 (1.33-3.21) | .001 | 106 (49.0) | 71 (32.6) | 1.98 (1.25-3.14) | .004 |
| **Point Prevalence Abstinence Rates** | | | | | | | | | |
| 1 wk | Week 1 | 69 (31.9) | 61 (27.9) | 1.22 (0.81-1.83) | .35 | | | | |
| 2 wk | Week 2 | 98 (45.4) | 95 (43.4) | 1.08 (0.74-1.58) | .68 | | | | |
| 4 wk | Week 4 | 110 (50.9) | 87 (39.7) | 1.57 (1.08-2.30) | .02 | | | | |
| 8 wk | Week 8 | 109 (50.5) | 96 (43.8) | 1.31 (0.90-1.90) | .17 | | | | |
| 12 wk | Week 12 | 116 (53.7) | 87 (39.7) | 1.76 (1.20-2.58) | .003 | 138 (63.9) | 112 (51.2) | 1.68 (1.07-2.66) | .03 |
| 16 wk | Week 16 | 104 (48.1) | 81 (37.0) | 1.58 (1.08-2.32) | .02 | | | | |
| 24 wk | Week 24 | 94 (43.5) | 63 (28.8) | 1.91 (1.28-2.84) | .001 | 141 (65.1) | 101 (46.7) | 2.13 (1.32-3.43) | .002 |

*JAMA. 2014;312(2):155-161*

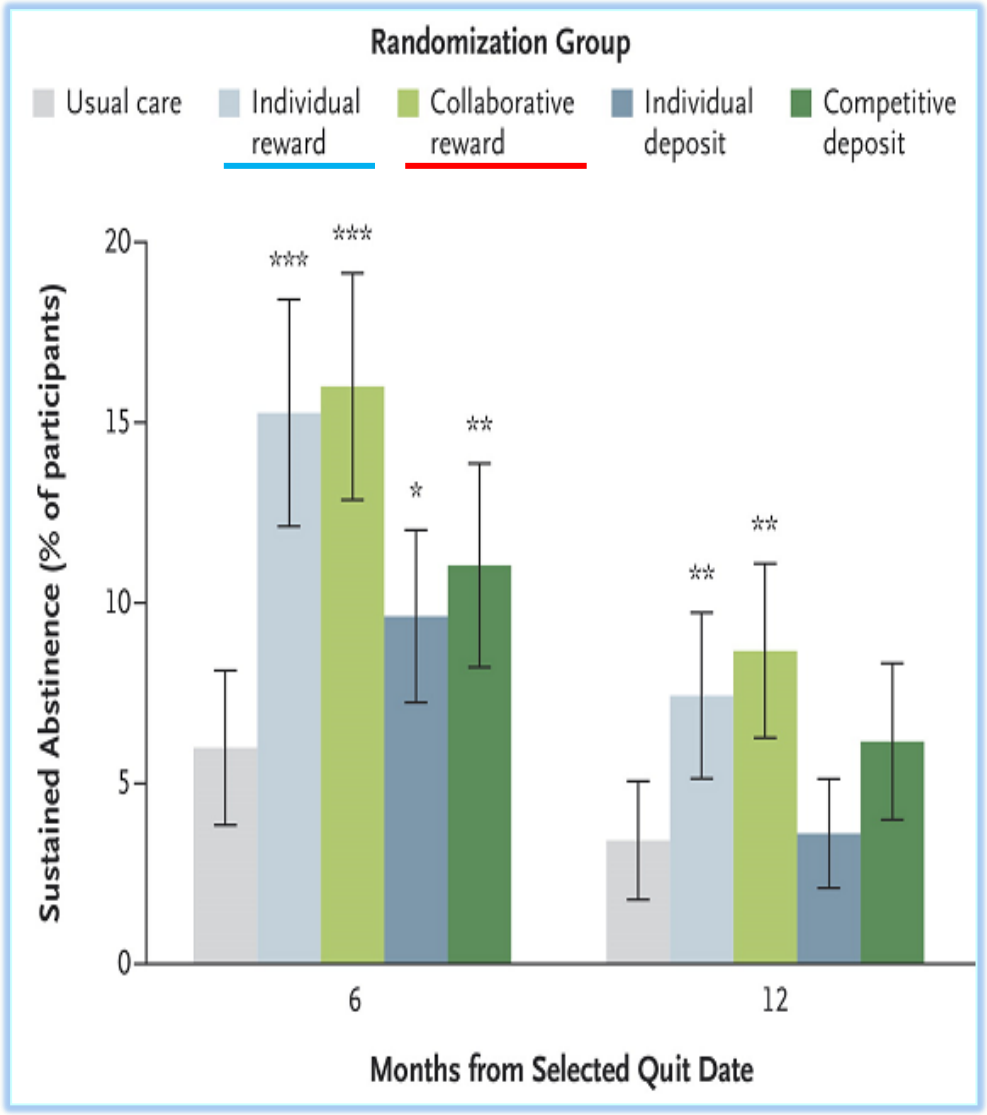
# Sustained Care Intervention and Post discharge Smoking Cessation Among Hospitalized Adults: A Randomized Clinical Trial

Table 3. Tobacco Abstinence Rates After Discharge by Treatment Group[a]

| Outcome Measure | No. (%) of Patients | | Relative Risk (95% CI) | *P* Value |
|---|---|---|---|---|
| | Sustained Care (n = 198) | Standard Care (n = 199) | | |
| Biochemically confirmed | | | | |
| Abstinent for past 7 d[b] | | | | |
| 6-mo follow-up | 51 (25.8) | 30 (15.1) | 1.71 (1.14-2.56) | .009 |
| Self-report | | | | |
| Abstinent for past 7 d[c] | | | | |
| 1-mo follow-up | 103 (52.0) | 78 (39.2) | 1.33 (1.07-1.65) | .01 |
| 3-mo follow-up | 89 (44.9) | 73 (36.7) | 1.23 (0.96-1.56) | .10 |
| 6-mo follow-up | 81 (40.9) | 56 (28.1) | 1.45 (1.10-1.92) | .008 |
| Abstinent since hospital discharge[c] | | | | |
| 1-mo follow-up | 91 (46.0) | 66 (33.2) | 1.39 (1.08-1.78) | .01 |
| 3-mo follow-up | 67 (33.8) | 47 (23.6) | 1.43 (1.04-1.97) | .03 |
| 6-mo follow-up | 54 (27.3) | 32 (16.1) | 1.70 (1.15-2.51) | .007 |

*2014 JAMA312(7):719-728*

# The Effect of Randomized Trial of Four Financial-Incentive Programs for Smoking Cessation




**Rates of Sustained Abstinence from Smoking at 6 and 12 Months**

The primary outcome was sustained abstinence through 6 months.

Asterisks indicate P values (* for P<0.05, ** for P<0.01, and *** for P<0.001) for the comparison of the four intervention groups to usual care

*Down from N Engl J Med 2015 13*

# Special considerations of treatments in smoking cessation

- **The Nicotine patch** : safe for cardiovascular patients
- **Varenicline**: carefully for cardiovascular patients
- **Bupropion** : effective in mental illness. schizophrenia
- **NRT + Varenicline** : in severe withdrawal symptoms
- **Varenicline + bupropion** : *not recommended*,

  increased depression

# Smoking rate and mental illness

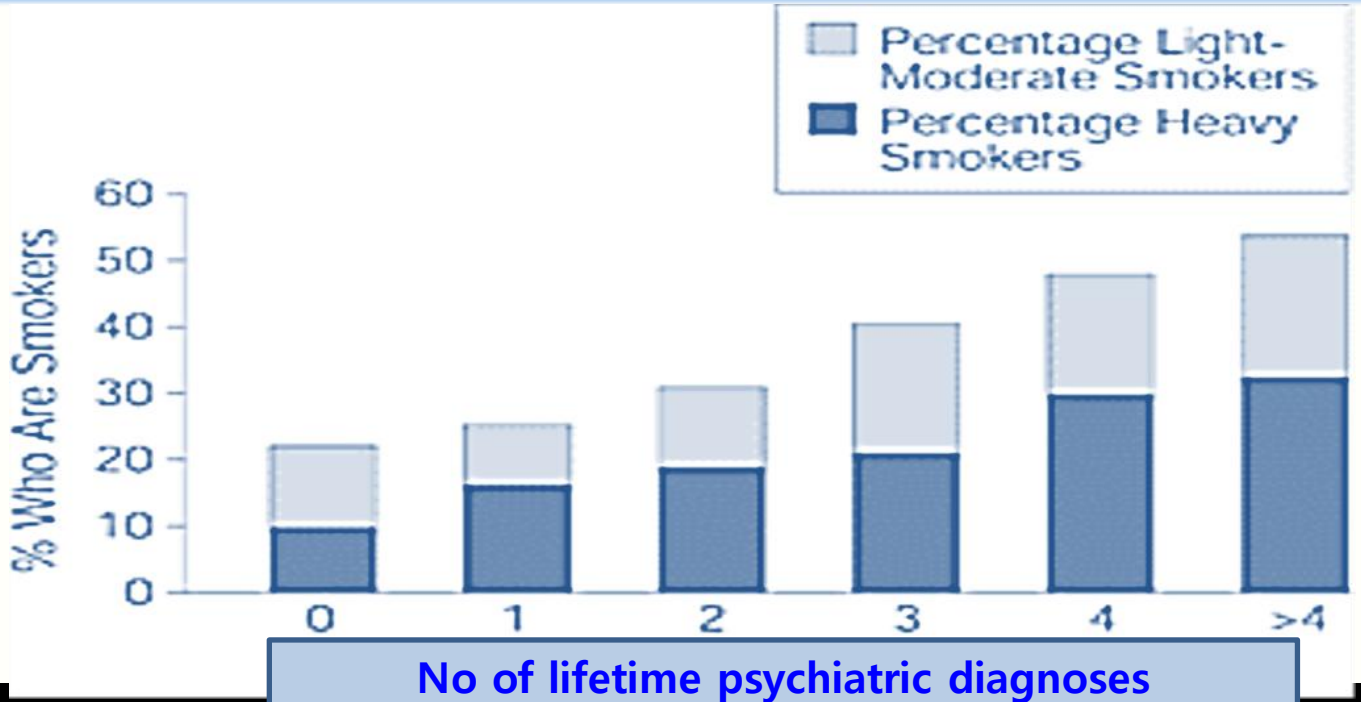



**Table 2.** Smoking Status According to Psychiatric Diagnosis*

| Psychiatric Diagnosis† | US Population, % | Current Smokers, % | Lifetime Smokers, % |
|---|---|---|---|
| Total | 100 | 28.5 | 47.1 |
| No mental illness | 50.7 | 22.5 | 39.1 |
| Ever mental illness | 49.3 | 34.8‡ | 55.3‡ |
| Any mental illness in past month | 28.3 | 41.0‡ | 59.0‡ |

JAMA 2000;284:2606

# 특수 상황의 여성 흡연자의 치료

① 흡연을 한 번이라도 한 적이 있는 **임산부 흡연율** 7.71%

② 금연한 임산부의 70%가 출산 후 **6개월 내에** 다시 흡연을 함

➢ **Counselling & support treatment in pregnancy.**

- 콜 센터, 마트의 **여성 감정근로자의** 흡연율은 월등히 높음.

(홈쇼핑 텔레 마케팅 조사: 20대 47.5%, 30대 43.8%)

➢ Quitline, mobile service, 찾아가는 서비스

# 청소년들의 흡연유형과 치료

## 청소년의 흡연 유형에 따른 금연프로그램

- 인지행동프로그램, 행동주의 프로그램

- 학업중단 청소년 흡연율: 57%
- 보호관찰 청소년 흡연율: 90%

❖18세 미만 청소년은 약물 요법을 사용하지 않으며 Counselling 이 주요 치료방법

# Smoking cessation clinic in OPD

① Questionnarie for smoking habits

② Co check by CO meter/urine nicotine

③ Slide education for smoking cessation

④ Booklets for medications and tips

# Effective tips for smokers to quit smoking


① **Quit a day as a special day(birthday)**

② **Don’t buy tobacco** and throw all kinds related smoking

③ **Take medications** which help to quit smoking.

④ **Don’t drink alcohol and coffee**:

⑤ **Carry gum** & don’t take a lot of candy/ chocolate

# 경청해 주셔서 감사합니다