



Biology of Cancer and AIDS

Nicotine delivery systems



Current cigarette smoking among U.S. high school students **lowest in 22 years**



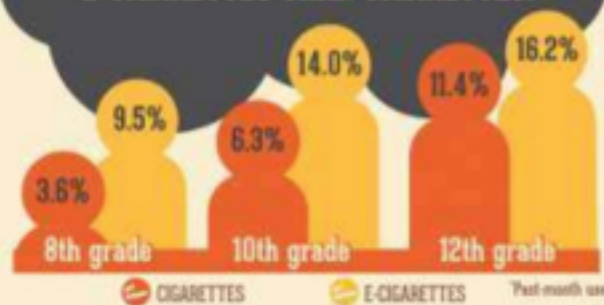
National Youth Risk Behavior Surveys, 1991-2013

www.cdc.gov/yrbs



Teens and E-cigarettes

TEENS ARE MORE LIKELY TO USE E-CIGARETTES THAN CIGARETTES.*¹



Clearing the air: Confessions of a former Juul addict

The Juul through the eyes of a college student



TOBACCO USE AMONG MIDDLE AND HIGH SCHOOL STUDENTS—UNITED STATES, 2011-2015

There has been **no significant change in overall tobacco use** among high school students since 2011.



3 million middle and high school students were **current users of e-cigarettes** in 2015

up from
2.46 million
in 2014.



There was a **significant decrease in current cigarette use** among high school students from 2011–2015



8 yrs of surveys in this class
(N = ~ 7500 students)
Decrease in smoking ~13%
Vaping increase to ~20%

IT TAKES
HEALTHY NERVES
TO RUN JOE AT
BILLIARDS!

■ SOL. HUNTERBACH

Fun Small Prints

¹After smoking Cansh for

SURGEON GENERAL'S WARNING: Quitting Smoking Now Greatly Reduces Serious Risks to Your Health.

AND WIN IT WITH SPUD

Does winter make your head feel stuffy? Shivers-heightened awareness push you from heavy sleeping "terrors" to too. Then you're there were reasons for staying in KOOA.

They're still: melancholic, light up and feel the instant acknowledgment. Nausea long, the classic Turkish Cypriot welcome is all there. Nausea long, come the and longer way, and and and, your mouth clean and fresh.

Change to ECHO. It's a change for the better. And that's why the E & W responds for America nationally merchandise merchandise.

**28% LESS
NICOTINE**

than the average of the k values

"I love to see a man smoke a Cigarillo"

Fun S

CAME

"There's n



A month-after-tastings cigarette comparison, measuring those important factors of taste, smoothness that affect the taste of cigarettes, prices. Lucky Strike is the best made of all.

BACK | NEXT

Smoking: Major Timelines

- 1730: VIRGINIA: First American tobacco factories begun in Virginia--small snuff mills
- 1760: Pierre Lorillard establishes tobacco manufacturing in New York City. P. Lorillard is the oldest tobacco company in the US
- **1791: London physician John Hill reports cases in which use of snuff caused nasal cancers**
- 1828: GERMANY: Heidelberg students Ludwig Reimann and Wilhelm Heinrich Posselt purified nicotine and determines that it is a "dangerous poison"
- 1836: USA: Samuel Green of the New England Almanack and Farmers Friend writes that tobacco is an insecticide, a poison, a filthy habit, and can kill a man.
- **1847: ENGLAND: Philip Morris opens shop; sells hand-rolled Turkish cigarettes.**
- **1852: Matches are introduced, making smoking more convenient.**
- 1855: "Annual Report of the New York Anti-Tobacco Society for 1855" calls tobacco a "fashionable poison," warns against addiction and claims half of all deaths of smokers between 35 and 50 were caused by smoking
- 1862: First Federal tax on cigarettes
- 1874: Washington Duke & Sons builds tobacco factory in Durham NC
- 1876: Benson and Hedges begins in London
- 1880: James B. Duke bought the rights to the first cigarette-making machine; cigarette use increased.
- **1881: Cigarette rolling machine invented. Prior to this, all cigarettes sold were hand-rolled.**
- **1889: Annual cigarette production in US is 2.4 billion and 140 die of lung cancer worldwide**
- 1889: Buck Duke forms American Tobacco Company (ATC)
- 1899: R.J Reynolds begins manufacturing chewing tobacco
- **1901: Philip Morris (PM) starts to sell Marlboro**
- 1913: RJR introduces Camels
- 1927: Lucky strike advertises to women
- 1938: Dr. Pearl publishes "Tobacco smoking and longevity" in Science
- **1954: Marlboro man created**
- **1964: Surgeon generals report "Smoking and Health"**
- **1971: TV ads banned in US**
- **1974: Health warnings added to cigarette packs**
- 1991: 92% of six-year olds can match Joe Camel to his product
- **1991: "Marlboro man" Wayne McLaren dies of lung cancer**
- 1994: Tobacco CEOs deny Nicotine is addictive and smoking causes cancer
- **1996: Liggett admits nicotine is addictive and smoking causes cancer**
- 1996: Researchers link benzopyrene and P53 mutation
- 2008: Approximately 440,000 deaths attributed to cigarette smoking



Safer Alternatives?



The scale of unused patents to improve safety of cigarettes

What the patents claim to do	Number of patents*	Published
Reduce tar	11	1974 to 1998
Remove or reduce carbon monoxide (CO)	14	1972 to 1997
Remove or reduce hydrocarbons	8	1971 to 1988
Remove or reduce hydrogen cyanide (HCN)	11	1971 to 1988
Remove or reduce nitrosamines (a suspected carcinogen in humans)	6	1979 to 1998
Remove or reduce nitrogen-based substances	14	1980 to 1998
Remove potassium nitrate	2	1978 and 1986
Remove polonium (a radioactive compound)	2	1971 and 1980
Remove metals carbonyls	1	1972
Reduce aldehyde	1	1988
Remove or reduce other miscellaneous compounds	7	1976 to 1998

Source: ASH and ICRF

*Some patents claim to have more than one benefit

Patents to protect health shunned

Pressure group Action on Smoking and Health (ASH) and the Imperial Cancer Research Fund (ICRF) published the report on Wednesday.

It claims the tobacco industry has investigated and patented technologies that could lead to "the safer cigarette", but has chosen to ignore them.

It lists 57 devices that would reduce the dangers to health of smoking. Details of all the patents and when they were filed are posted on the Internet.

Dr Martin Jarvis of the ICRF's health behaviour unit helped launch the report.

He said: "The cigarette is like a dirty syringe for taking the drug nicotine. What we now know is that the tobacco companies could have made it less dirty."

Health Savers

Patented devices ignored by tobacco companies:

► Catalysts

If added to cigarettes, these could reduce levels of carbon monoxide and nitrous oxides

Result:

Reduction in heart disease

► Manufacture

Processes that would reduce levels of a carcinogens in lung tissue

Result:

Reduction in cancer

► Filters

Chemical filters that would remove large quantities of hydrogen cyanide and hydrogen sulphide

Result:

Reduction in respiratory illness

SOURCE: ASH, ICRF

Tobacco Facts

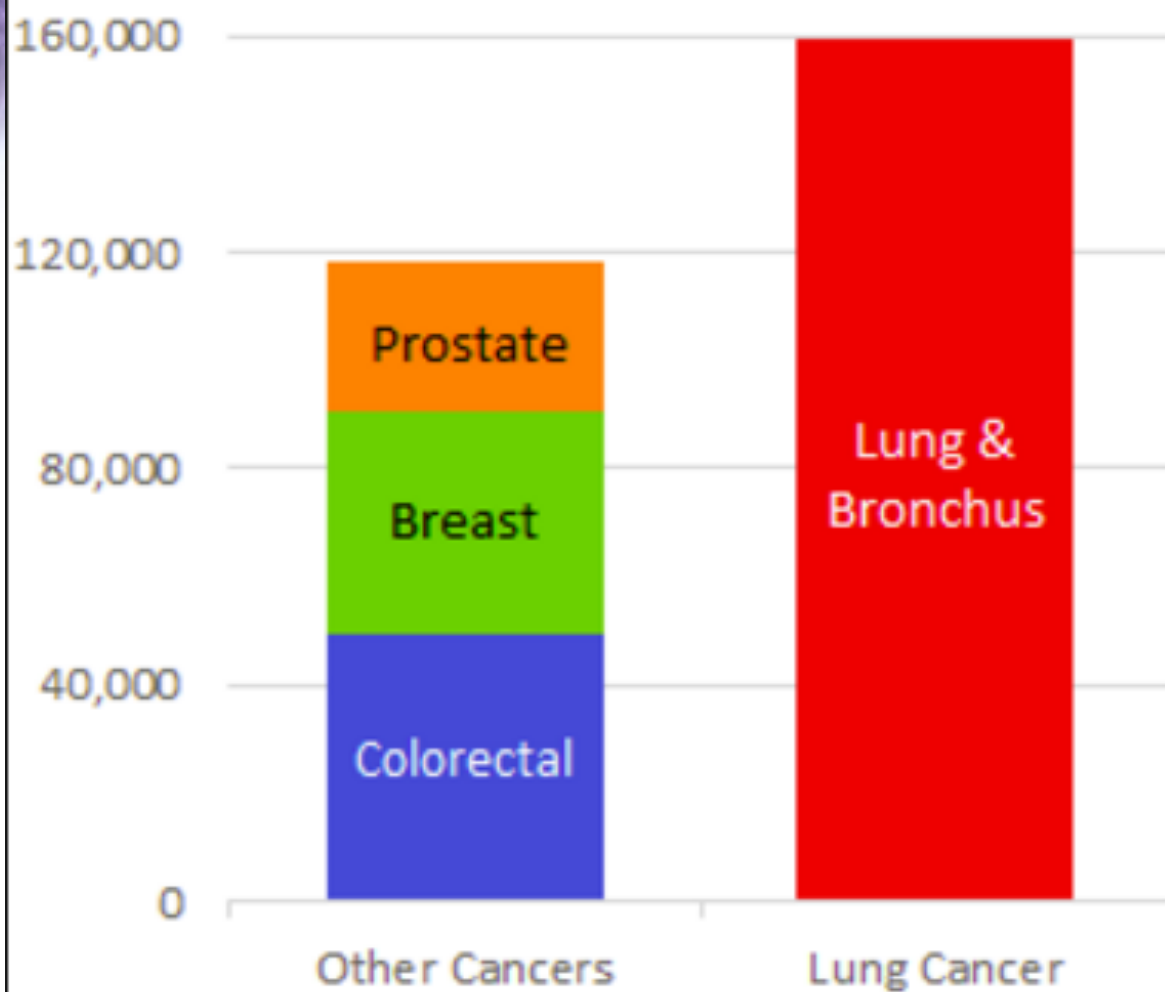
❑ Every 10 seconds, somewhere in the world, someone dies of tobacco-related causes.

❑ **Tobacco products are the only legal consumer products that can be LETHAL when used exactly as the manufacturer intends.**

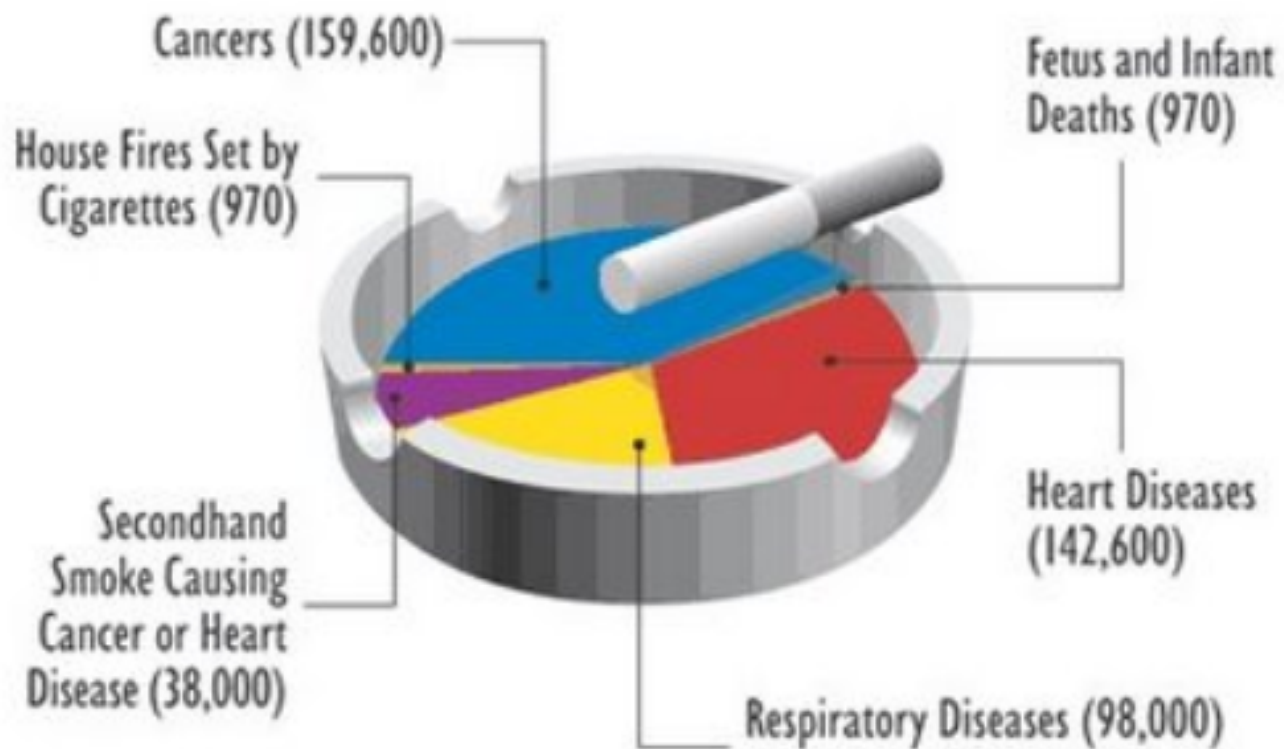


Since 1964, more than 12 million Americans have died prematurely from smoking, and another 25 million U.S. smokers alive today will most likely die of a smoking-related illness.

Estimated Cancer Deaths by Site, 2015²



440,000 Deaths Each Year Caused by Smoking

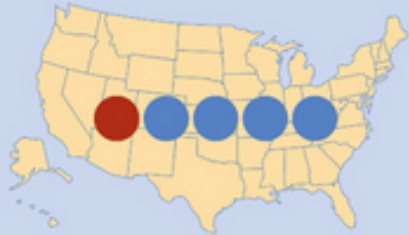


All numbers are rounded.



Tobacco Facts

20% of deaths in America are the result of smoking⁽¹⁾



\$10.4 Billion

spent by the U.S. tobacco industry on advertising and promotion in 2008⁽⁴⁾

\$193 Billion

spent every year for direct medical costs and lost productivity due to smoking-related premature deaths in America⁽²⁾



80%

of adult smokers begin smoking before the age of 18⁽³⁾



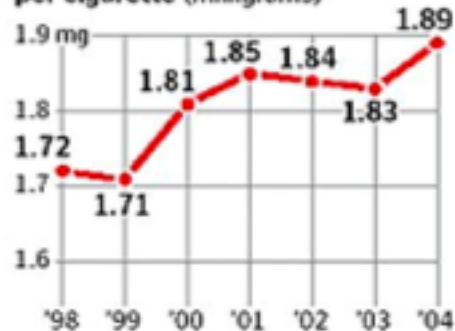
167

kids try their first cigarette every HOUR⁽²⁾

Facts About Addiction to Nicotine

The average amount of nicotine in cigarette smoke has increased 10 percent since 1998.

Average nicotine yield per cigarette (milligrams)



SOURCE: Mass. Tobacco Control Program

Average nicotine yield by brand* per cigarette (milligrams)

Brand	1998	2004	Increase
Basic	1.58	1.79	13%
Camel	1.86	1.93	4%
Doral	1.48	1.73	17%
Kool	1.53	1.83	20%
Marlboro	1.74	1.89	9%
Newport	2.20	2.42	10%

Average for all brands 10%

*Numbers are average of all subbrands within the brand family. Individual subbrands may be higher or lower than average figures.

SOURCE: Mass. Tobacco Control Program

ED WIEDERER/GLOBE STAFF

Falling Blood
Nicotine Level

Brain
Releases
Dopamine

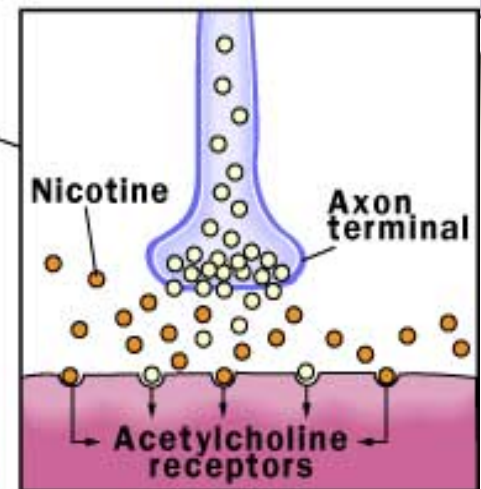
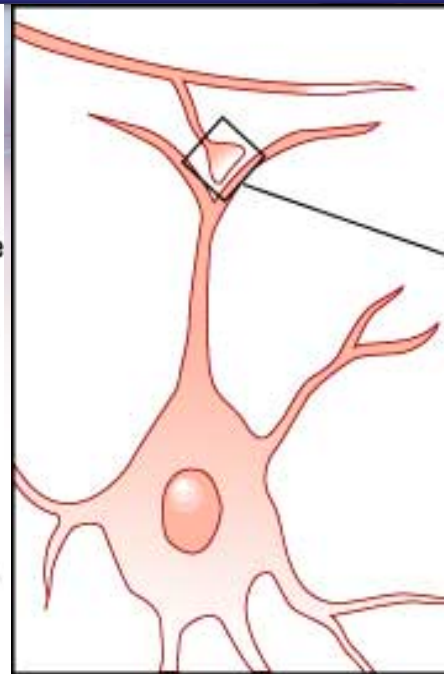
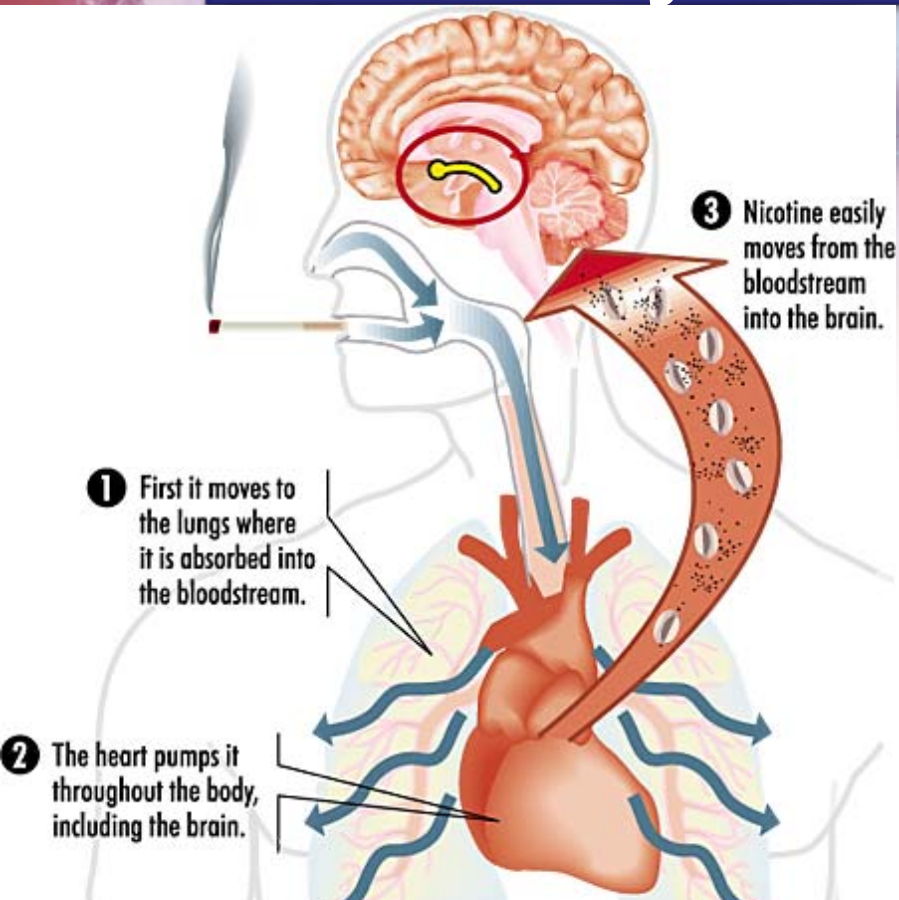


Inhale New
Nicotine

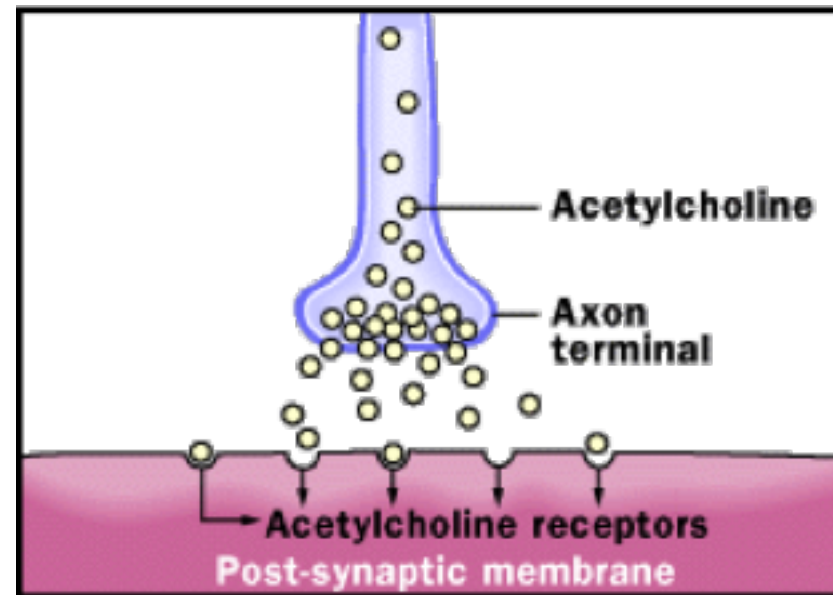
Brain
Generates
Crave

- ❑ Nicotine is the tobacco plant's natural protection from being eaten by insects
- ❑ Within 8 sec. of first-ever puff, nicotine arrives at brain's reward pathways
- ❑ Once inside the brain, nicotine gains direct and indirect control over the flow of more than 200 neurochemicals
- ❑ Men who don't quit smoking lose an average of 13.2yrs of life; women lose an avg of 14.5 yrs.

Pathway to Nicotine Addiction



©2001 How Stuff Works



©2000 How Stuff Works

DRUG [3]

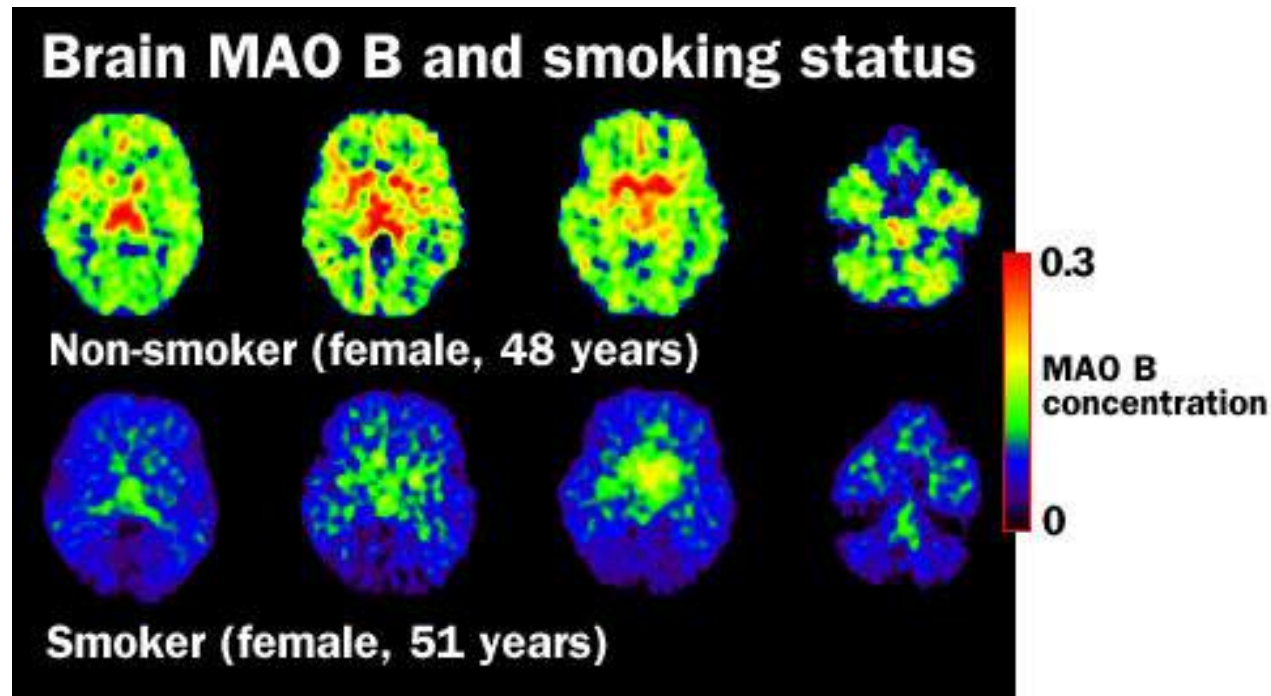
% who get addicted after trying

Tobacco	31.9
Heroin	23.1
Cocaine	16.7
Alcohol	15.4

MAO* - Neurotransmitter breakdown enzyme

*MAO monamine oxidase

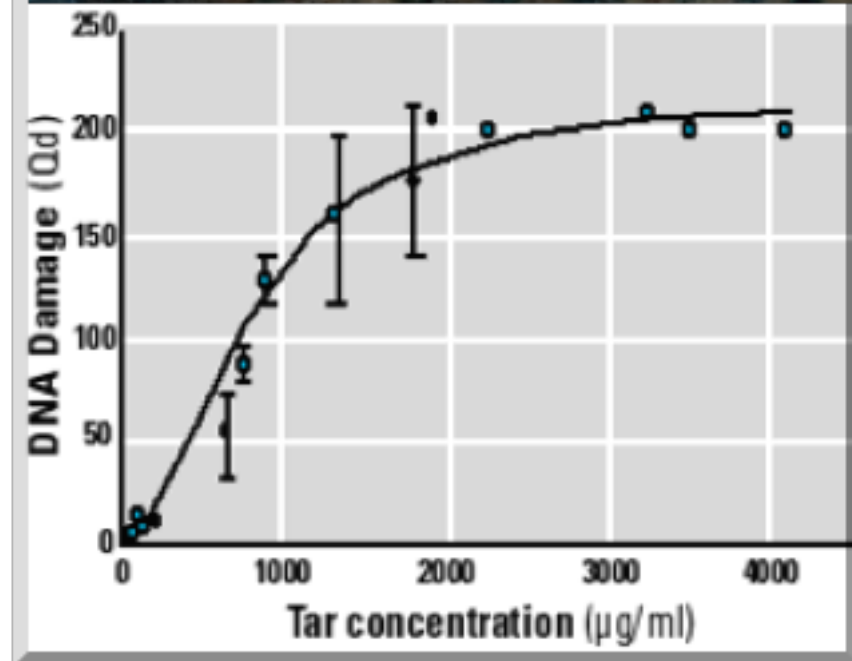
Smoke inhibits MAO = more/longer nicotine effect+ effect



Cigarette Tar



- ❑ Cigarette tar is the sticky brown substance which causes yellow-brown stains on fingers, teeth, clothes and furniture.
- ❑ Tar is a mixture of substances that together form a sticky mass in the lungs
- ❑ Tar in cigarettes also paralyses the cilia, the small hairs which protect and clean the lungs
- ❑ The last puff can contain more than twice as much tar as the first puff.



Plot of Qd (DNA damage quotient in rat thymocytes) versus the concentration of tar in environmental tobacco smoke (ETS) solutions

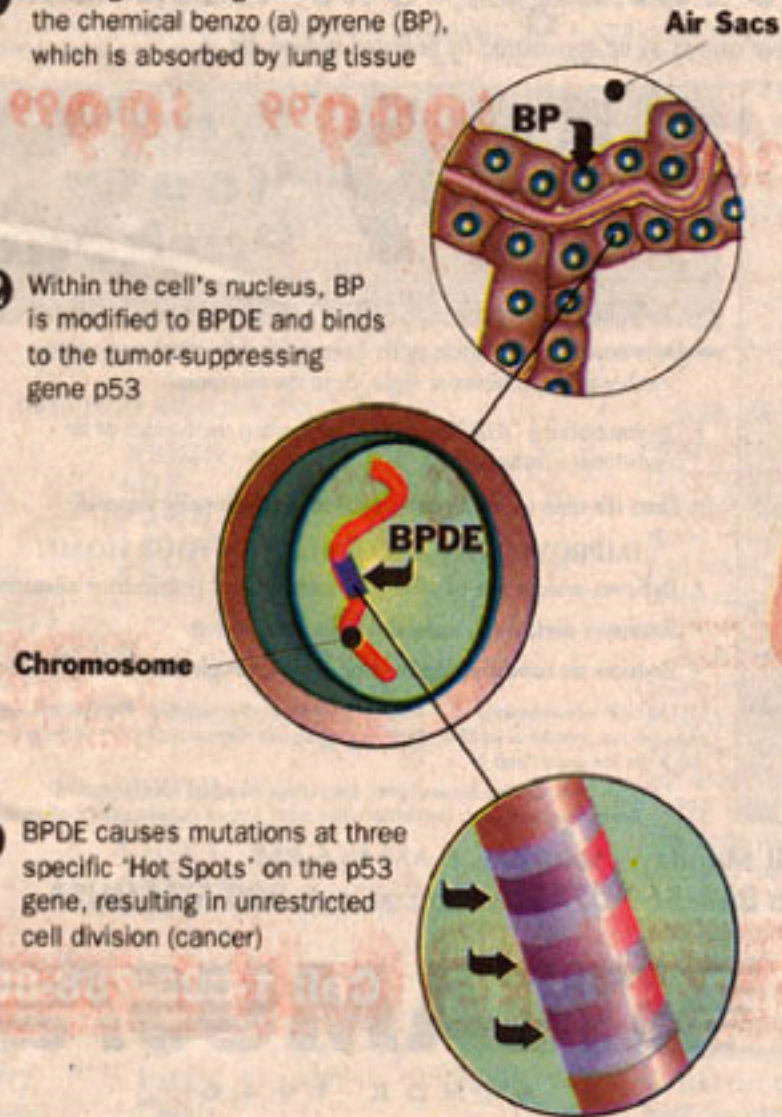
The Smoking Gun: Linking Cigarettes to Cancer



- 1 Burning tars in cigarettes create the chemical benzo (a) pyrene (BP), which is absorbed by lung tissue

- 2 Within the cell's nucleus, BP is modified to BPDE and binds to the tumor-suppressing gene p53

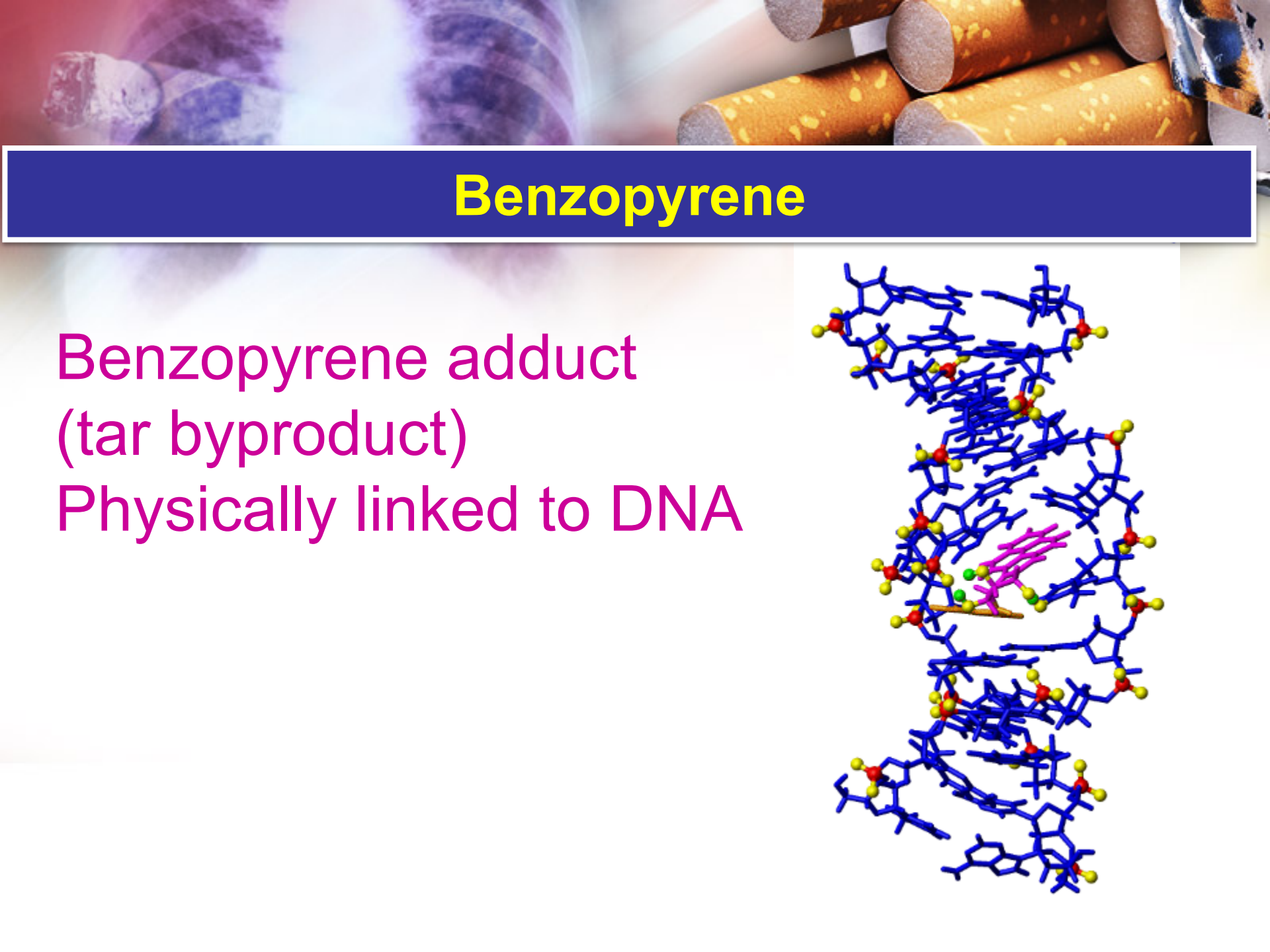
- 3 BPDE causes mutations at three specific 'Hot Spots' on the p53 gene, resulting in unrestricted cell division (cancer)



Source: George B. Johnson, Washington University

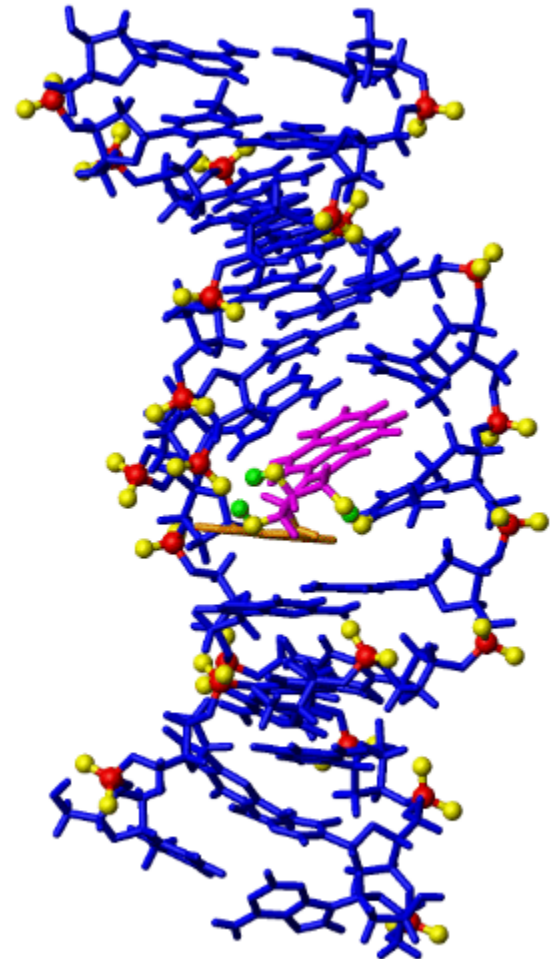
Graphic by Randy Phillips/Post-Dispatch

Benzopyrene diol epoxide



Benzopyrene

Benzopyrene adduct
(tar byproduct)
Physically linked to DNA



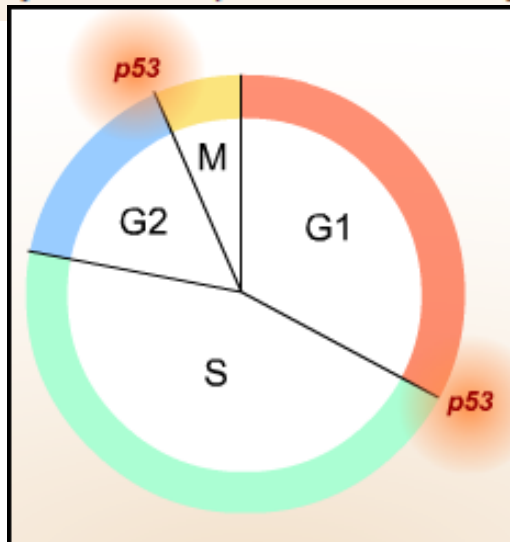
Mutations of *p53* and *K-ras* in Lung Cancer

p53

Mutations in the *p53* gene are found in 70% of lung tumors, the highest rate for any cancer. The *p53* protein is a tumor suppressor, analogous to car brakes, because its activity helps counter tumor development. *P53* occupies a “checkpoint” in the cycle of cell division, where it “senses” DNA damage or mutations. The cell cycle is composed of four stages:



CHROMOSOME 17

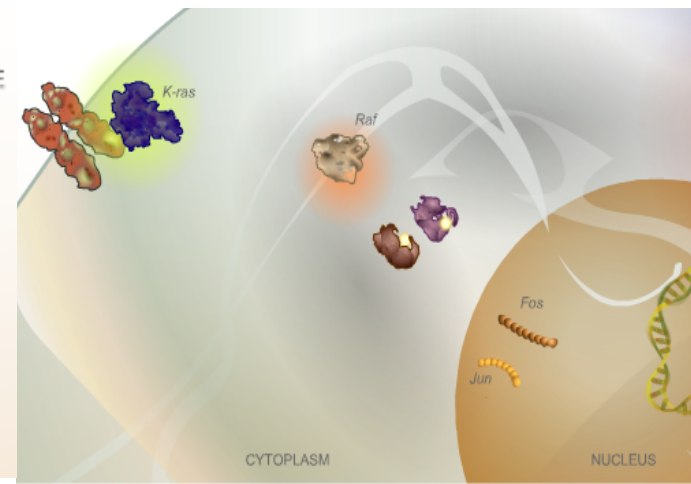


K-ras

The protein produced by the *K-ras* gene is a tumor “activator.” *K-ras* is analogous to a car accelerator, because its overactivity contributes to tumor development. The *K-ras* protein resides on the inner side of the cell membrane, where it conducts growth signals from cell-surface receptors to the nucleus. This process is called signal transduction.



CHROMOSOME 12



- ❑ P53 acts as a checkpoint into the critical Synthesis (S) and Mitosis (M) Phases.
- ❑ After receiving information from DNA repair systems, p53 can signal the cell to stop dividing, allowing time for a mutation to be repaired before it is passed on to daughter cells.

- ❑ Mutations in *K-ras* gene result in a K-ras protein that is essentially stuck in an “on” position, perpetuating a signaling cascade in the absence of any real signal from a growth factor.

E - Cigarettes

Electronic cigarette

An electronic cigarette, developed by a Chinese company, gives the user nicotine but no fire, no tar, no carbon monoxide, no ash and no stub.

Light Simulates cigarette glow, indicates when device is ready for use and works as battery indicator

Electronic components Such as control circuits, pneumatic airflow sensor

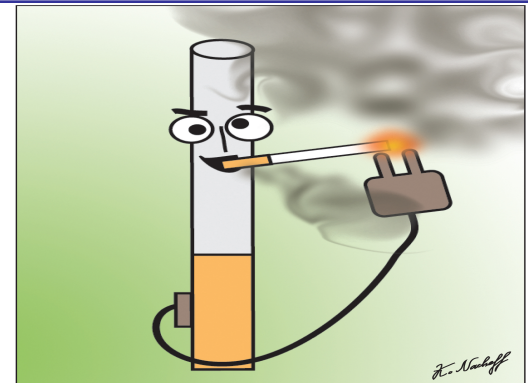
Vaporizer Atomizes the nicotine smoking liquid in the liquid container

Nicotine liquid container



Electronic cigarette	Comparison	Regular cigarette
One e-cigarette	Equivalent	6-7 cigarettes
100	Puffs per cigarette	15
6-24 mg.	Nicotine level	0.6-2.4 mg.
E-cigarette with 24 mg of nicotine: 0.16 mg/puff	Nicotine per puff	Cigarette with 1.8 mg of nicotine: 0.16 mg/puff

Concentrations range from Zero Nicotine, low and midrange doses (**6–8 mg/ml and 10–14 mg/ml respectively**), to high and extra-high doses (**16–18 mg/ml and 20–54 mg/ml respectively**)



CDC Home



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

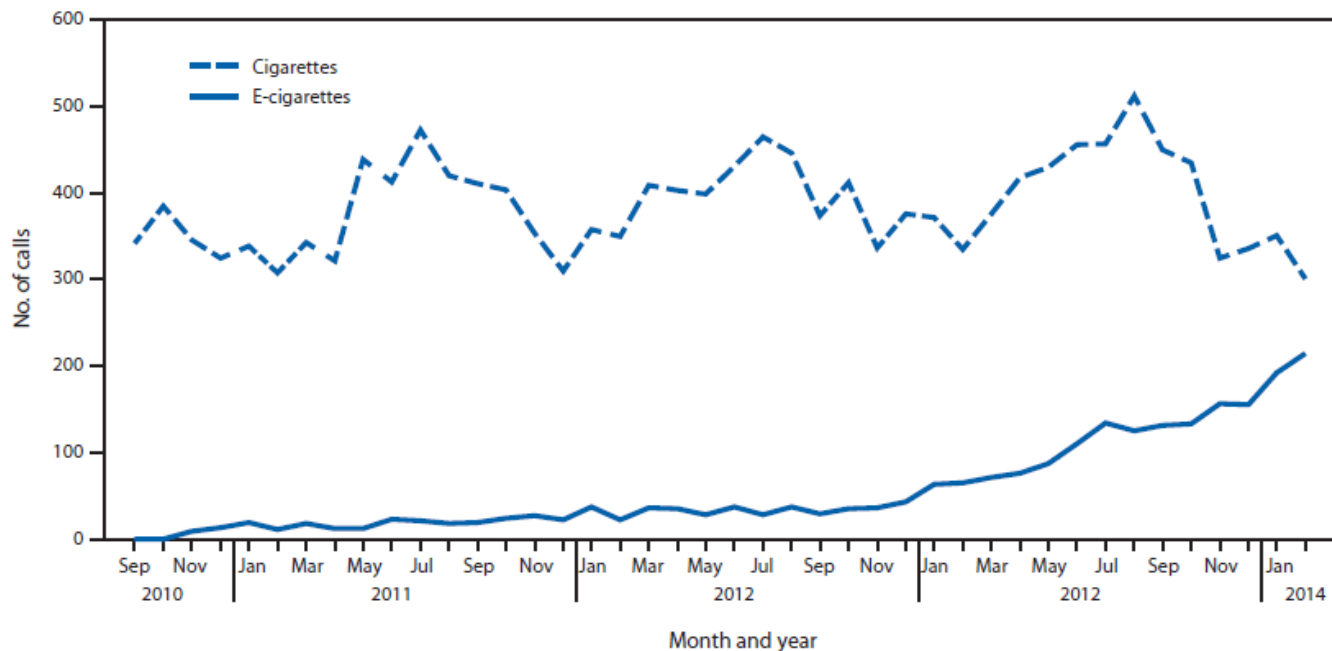
A-Z Index A B C D E F G H I J K L M N O P Q R S T U V W

Morbidity and Mortality Weekly Report (MMWR)



Lindsay Fox/Flickr

FIGURE. Number of calls to poison centers for cigarette or e-cigarette exposures, by month — United States, September 2010–February 2014



Alternate Text: The figure above shows the number of calls to poison centers for cigarette or e-cigarette exposures, by month, in the United States during September 2010–February 2014. E-cigarette exposure calls per month increased from one in September 2010 to 215 in February 2014.

Poison center calls involving e-cigarettes

250

200

150

100

50

0

215

Calls per Month

1

Call per Month

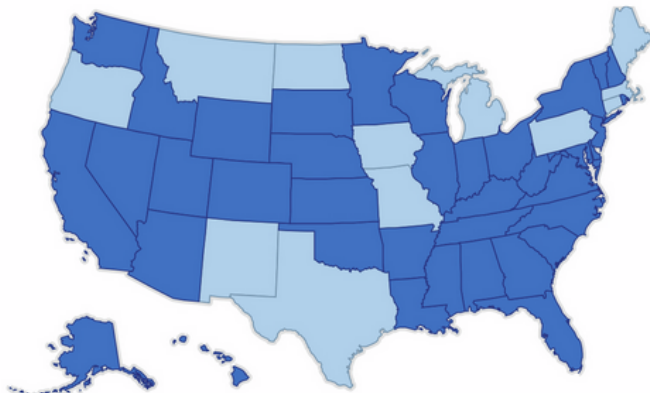
September 2010

February 2014



States barring e-cigarette sales to minors

■ Yes ■ No



Source: Tobacco Free Kids



The US has been called a "wild west" for e-cigarette regulation since vaping is not currently regulated at the federal level. Right now, the FDA is moving to bring e-cigarettes under its jurisdiction through the Tobacco Control Act. While that's in the works, states have been filling the gap with their own **rules and regulations**.

So far, 38 states have moved to ban e-cigarettes for minors. But only a few—Colorado, Nevada, North Carolina, South Dakota, West Virginia, and Wyoming—define e-cigarettes as tobacco products.

Of the remaining states that restrict sales to minors, 13 states explicitly exempt e-cigarettes from inclusion as a tobacco product and 19 define them in their own separate category. This means e-cigarettes don't face the same stringent restrictions regarding packaging, marketing, and second-hand exposure around regular tobacco products.



efforts to exclude e cigs
from tobacco laws

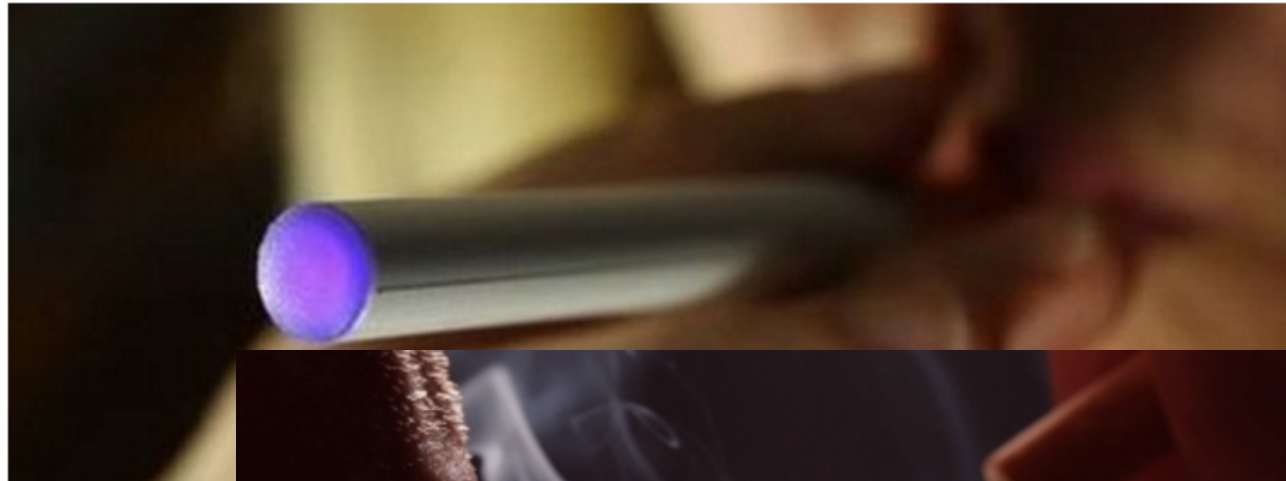
The World Health Organization has called e-cigarettes safety "**illusive**", since the ingredients they contain are not always disclosed and there is not "adequate data on emissions." When it comes to helping people quit smoking, they also say the science is not conclusive. The US **Centers for Disease Control** takes a similar stance: that there is not enough evidence to understand the health impact of vaping. They warn of the potential for nicotine addiction, **poisoning**, and call for more robust regulation.

"These tactics to undermine effective policies stand to make smoking and the behavior of smoking socially acceptable again," said Cathy Callaway, associate director of state and local campaigns for the American Cancer Society Cancer Action Network. "If the industry can keep people addicted to tobacco products, they'll be more likely to continue to purchase products, and the industry makes money."

E-cigarettes could be prescribed by the NHS to help smokers quit, report says

By Adam Brimelow
Health correspondent, BBC News

🕒 19 August 2015 | Health | 💬



AUGUST 16, 2015

**SMOKING IN CARS WITH CHILDREN ILLEGAL
STARTING OCTOBER 1, 2015**

Pimp My Vape: The Rise of E-Cigarette Hackers

4.4k
SHARES



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WHAT'S THIS?



Teens Use E-Cigarettes to 'Vape' Pot

Live Science - Sep 7, 2015

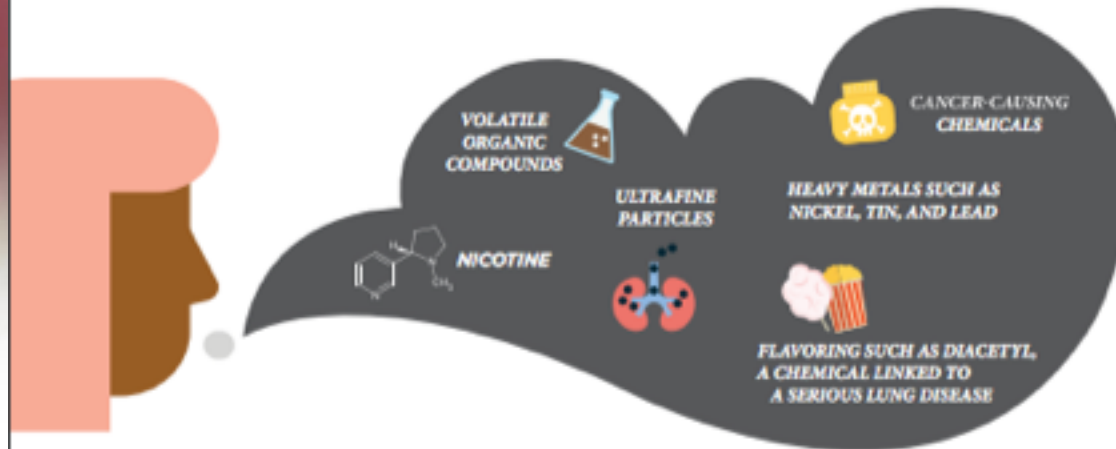
However, the safety of **vaping pot** versus smoking it has not been well-established, the researchers write today (Sept. 7) in the journal ...

Teens find a new use for e-cigarettes: **Vaping marijuana**

Highly Cited - USA TODAY - Sep 6, 2015

Explore in depth (234 more articles)

E-cigarette aerosol is not harmless. It can contain harmful ingredients. However, e-cigarette aerosol generally contains fewer harmful chemicals than smoke from burned tobacco products, like regular cigarettes.



Most e-cigarettes contain **nicotine**, which is highly addictive and can **harm brain development**, which continues until about **age 25**.



YOUNG PEOPLE WHO USE E-CIGARETTES MAY BE MORE LIKELY TO GO ON TO USE REGULAR CIGARETTES.



Popcorn lung

bronchiolitis obliterans

Association Between Initial Use of e-Cigarettes and Subsequent Cigarette Smoking Among Adolescents and Young Adults: A Systematic Review and Meta-analysis.

Soneji S^{1,2}, Barrington-Trimis JL³, Wills TA⁴, Leventhal AM³, Unger JB³, Gibson LA⁵, Yang J⁶, Primack BA⁷, Andrews JA⁸, Miech RA⁹, Spindle TR¹⁰, Dick DM¹⁰, Eissenberg T¹⁰, Hornik RC⁵, Dang R², Sargent JD^{1,2}.

Author information

Abstract

IMPORTANCE: The public health implications of e-cigarettes depend, in part, on whether e-cigarette use affects the risk of cigarette smoking.

OBJECTIVE: To perform a systematic review and meta-analysis of longitudinal studies that assessed initial use of e-cigarettes and subsequent cigarette smoking.

RESULTS: Among 17 389 adolescents and young adults, the ages ranged between 14 and 30 years at baseline, and 56.0% were female. The pooled probabilities of cigarette smoking initiation were 30.4% for baseline ever e-cigarette users and 7.9% for baseline never e-cigarette users. The pooled probabilities of past 30-day cigarette smoking at follow-up were 21.5% for baseline past 30-day e-cigarette users and 4.6% for baseline non-past 30-day e-cigarette users. Adjusting for known demographic, psychosocial, and behavioral risk factors for cigarette smoking, the pooled odds ratio for subsequent cigarette smoking initiation was 3.62 (95% CI, 2.42-5.41) for ever vs never e-cigarette users, and the pooled odds ratio for past 30-day cigarette smoking at follow-up was 4.28 (95% CI, 2.52-7.27) for past 30-day e-cigarette vs non-past 30-day e-cigarette users at baseline. A moderate level of heterogeneity was observed among studies ($I^2 = 60.1\%$).

CONCLUSIONS AND RELEVANCE: e-Cigarette use was associated with greater risk for subsequent cigarette smoking initiation and past 30-day cigarette smoking. Strong e-cigarette regulation could potentially curb use among youth and possibly limit the future population-level burden of cigarette smoking.

The lead author of this Cochrane Review, Jamie Hartmann-Boyce from the Cochrane Tobacco Addiction Group, said, "The randomized evidence on smoking cessation is unchanged since the last version of the Review. We are encouraged to find many studies are now underway, particularly as electronic cigarettes are an evolving technology. Since the last version of the Review, 11 new observational and uncontrolled studies have been published. In terms of quitting, these can't provide the same information we get from randomized controlled trials, but they contribute further information on the side effects of using electronic cigarettes to quit smoking. None detected any serious side effects, but longer term data are needed."



Evidence for Everyday Health Choices



Electronic cigarettes (ECs) containing nicotine may increase the chance of quitting smoking long term compared to using ECs without nicotine, but better evidence is needed to be certain about these findings. No serious side effects were associated with their use (up to 2 years). How effective they are compared with nicotine patches is unknown



Cochrane review. 2 randomized controlled trials with >600 smokers, using real or placebo (fake) ECs, and data from observational studies

Help to quit
smoking:
electronic
cigarettes





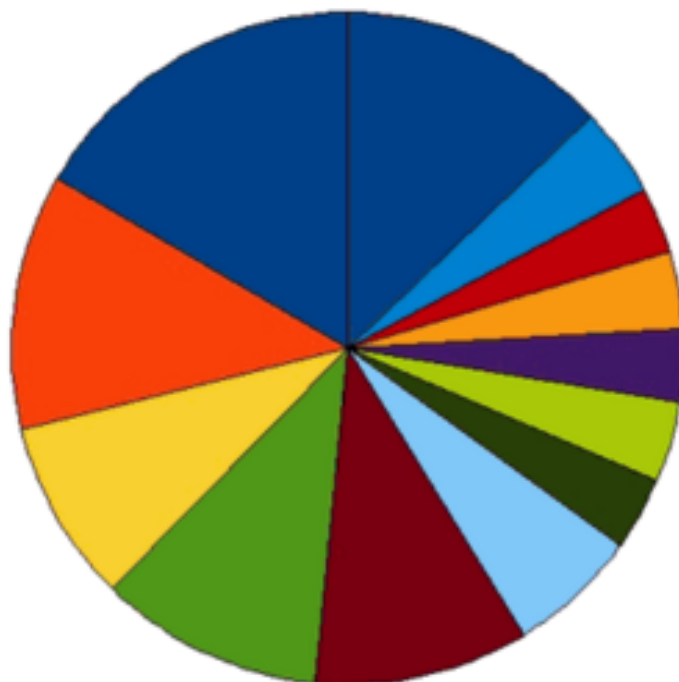
Could Our Government Do More?

Some believe that:

- ☐ There is not much interest by the government to get people to quit smoking.
- ☐ Government pays medical cost if people get sick
- ☐ If you smoke, you will die early enough so that you will not draw a lot of money on your social security
- ☐ Some argue that the government saves money if you smoke and get lung cancer or heart disease
- ☐ Tobacco tax goes back to the government

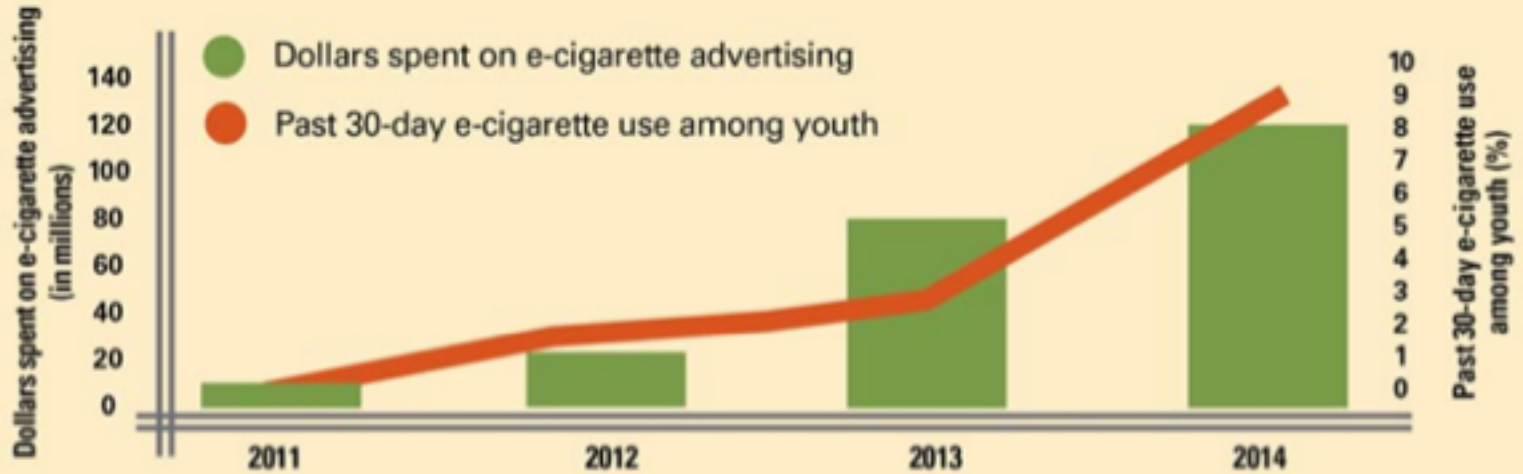
NH State Revenues for Year Ending 30 June 2011

General and Education Funds Combined



State Property Tax \$363.6M	BPT \$269.9M	BET \$191.5M	Meals & Rooms \$235.6M
Tobacco \$226.4M	Alcohol \$137.7M	Interest & Dividends \$77M	Insurance \$84.9M
Communications \$76.6M	Real Estate Trans- fer \$80.5M	Lottery & gambling \$69.9M	Medicaid En- hancement
Other \$283.1M			

E-cigarette use among youth is rising as e-cigarette advertising grows



SOURCE: National Youth Tobacco Survey, 2011-2014; Kim et al (2014), Truth Initiative (2015).



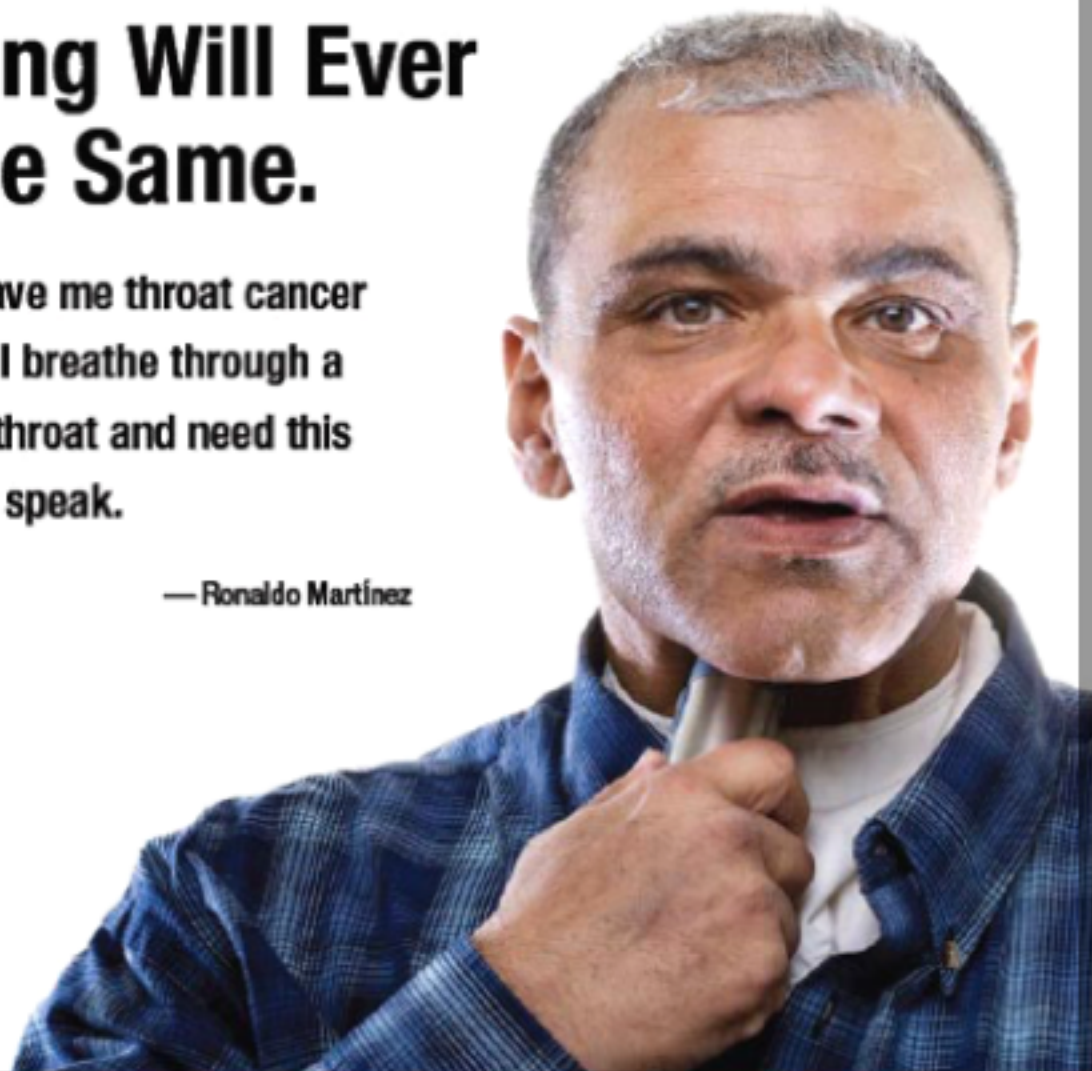
Cost of a 30 second Super Bowl Commercial

~ 5 Million Dollars

Nothing Will Ever Be the Same.

Smoking gave me throat cancer
at 39. Now I breathe through a
hole in my throat and need this
machine to speak.

—Ronaldo Martínez



QUIT SMOKING TODAY

FOR HELP CALL 311

The New York City Department of Health and Mental Hygiene • Michael R. Bloomberg, Mayor • Thomas R. Frieden, M.D., M.P.H., Commissioner

