Electronic Nicotine Delivery Devices (ENDS): Update

K. Michael Cummings, PhD, MPH
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Outline

● What are e-cigarettes and how have they evolved over the past three years?

● What does the market place look like today?

● Who is using e-cigarettes and why?

● Can e-cigarettes help smokers quit?

● What are safety concerns?

● Bottom line: Friend or Foe?
What are E-cigarettes?
Electronic cigarettes (i.e., e-cigarettes) are battery-powered devices that deliver nicotine in an aerosol.
Ingredients

Cigarettes versus E-cigarettes

- Tobacco – different blends
- Man-made tobacco
- Pesticide resides
- Paper
- Cellulose Acetate
- Glue & Ink
- Water
- 600 or so additives
  - High Fructose corn Syrup
  - Flavoring agents (menthol, cocca)
  - Glycerol
  - Propylene Glycol
  - Diammonium Phosphate
  - Ammonium Hydroxide
  - 9000 chemicals, 60+ carcinogens

- Glycerol
- Water
- Propylene Glycol
- Nicotine
- Flavoring agents
Not just for nicotine inhaling…

HEALTH

No Smoke, but Haze Around E-Joint

By KIRA PEIKOFF    JAN. 12, 2015
The e-cigarette invented in 1963
The e-cigarette invented again within the secret business records of RJR in 1969.
E-Cigarette Inventor Complains about Lack of Financial Rewards

As the widely-acknowledged inventor of the modern electronic cigarette, you would think Hon Lik is a very rich man, but in a recent interview with AFP, the co-founder of Chinese e-cig producing company Ruyan says the numerous copycats of his designs and the legal disputes with Chinese authorities have prevented him from reaping serious financial rewards.

In the vaping community, 57-year-old Hon Lik is known as the father of the electronic cigarette. After losing his father to smoking-induced lung cancer, the Chinese inventor tried breaking his own pack-a-day habit with the help of nicotine patches. “In the evenings I sometimes forgot to take off my nicotine patch, which gave me nightmares all night,” he told Agence France-Press. It was during one of those restless nights that he got the idea for the innovative device now used by millions of ex-smokers around the world. Hon dreamed he was drowning in a sea that turned into a giant cloud of vapor and says the nightmare inspired him to create a cigarette that produced vapor instead of smoke. After scribbling the idea on a piece of paper that very night, he spent a whole year perfecting the design. In 2003 he patented the invention and presented it to his bosses at a company called Golden Dragon Holdings, who were so impressed with the idea that they sold it to Ruyan, which literally means “like smoke”.

E-cigarettes invented again in 2003 by Hon Lik, sold by Runyan.
Three main types of e-cigarettes today

1st generation Disposables
2nd generation Refillable cartridge
3rd generation Tank systems
CARTRIDGES & E-LIQUID (E-JUICE)

Nicotine amounts by strength:

- Extra Strong: 24-36 mg
- Full Flavored: 16-18 mg
- Light: 10-12 mg
- Ultra Light: 6-8 mg
- Zero-nicotine: 0 mg
Can E-cigarettes deliver nicotine?
Older studies (from a few years ago) may not be relevant as the newer products deliver nicotine more effectively.

- 23 e-cigarette users
- Cross-over design
- First vs. third generation product
- Same nicotine amount 18mg/ml

Farsalinos et al. 2014
E-cigarettes: Nicotine Delivery

• E-cigarettes can deliver nicotine to the user
  – Blood plasma nicotine concentrations increase after inhalation of e-cigarette aerosol (Vansickel, 2013)
  – Cotinine a biomarker for nicotine, has been detected in the saliva of e-cigarette users (Etter, 2014)

• Similar to nicotine replacement therapy - NRT(patch, gum, etc.), there is a clear mechanism for them to function as a smoking cessation aid (Stead, 2014)
Distribution of nicotine dependence scores for exclusive users of different types of tobacco products
THE MARKET PLACE
$3.5 BILLION IN SALES IN 2015

• FDA estimates
  • 2/3rd of the market are disposable (cig-alike) products and an increasing share are refillable cartridge products sold primarily in retail outlets alongside cigarettes
  • 1/3rd of the market are tank systems largely sold online and in vape shops
  • A multitude of products styles
    • 640 to 880 different e-cigarette devices
    • 4000 to 8000 different varieties of e-liquids
What about the cigarette companies?
INTRODUCING NEW ZONNIC
NICOTINE MINI LOZENGE

$5.49* or less.

One less cigarette. One more victory.®
That’s how ZONNIC helps you quit.

Find ZONNIC near you at zonnic.com

How to choose

2mg: If you have your first cigarette more than 30 minutes after you wake up.

4mg: If you have your first cigarette less than 30 minutes after you wake up.

How to use

Pop the lozenge in your mouth. Let it dissolve. Don’t chew, crush or swallow.

FREE
PACK OF ZONNIC MINI LOZENGES

$2 OFF
ANY PACK OF ZONNIC

*Most users as directed. Behavioral support program increases chance of success. Individual results may vary.
Some old products concepts reinvented

Revo 2015

R.J. Reynolds

Revo, the next generation of RJ Reynolds’ Eclipse cigarette, was launched in 2015.

Revo was pulled from the test market within months of its release due to lack of interest in the brand.

Like Premier and Eclipse, Revo uses a carbon tip to light the rod to heat rather than burn tobacco.
About Philip Morris USA
Like Accord, IQOS is a smokeless cigarette with real tobacco refills that are heated instead of burned to produce a tobacco-flavored vapor.
iQOS: I Quit Ordinary Smoking?

Analysts expect iQOS will rejuvenate sales growth despite some cannibalization.

Revenue

Source: Wells Fargo Securities
Take home message

• The market place of nicotine delivery products is rapidly evolving

• Expansion of the market will be influenced by product regulations
Did You Know...

Currently, there are more than 3,000 [E-Liquid] flavors available in the market, and an average of over 300 flavors are being added to the list every month.

- Technavio
BEST PRACTICES FOR MIXING

HOW TO FILL YOUR TANK
NJOY tanks are top filled to help prevent spills. To fill, unscrew the mouthpiece and tilt to a 45° angle. Make sure to avoid the center hole! For best results, use a new tank for each recipe, and replace after 2 weeks of use.

COUNT DROPS FOR MORE PRECISION
Each .10 ml of e-liquid is roughly equivalent to 5 drops.

MIX IT UP
For best mixing, layer the flavors (add half of each and repeat), roll the tank a few times and let it sit for a few minutes.

SOME FLAVORS MAKE A BIG IMPACT
Use care when adding Double Espresso, Vanilla Bean, Butter Crunch, and Single Malt Scotch—a little goes a long way.

EXPERIMENT WITH SWAPPING SIMILAR INGREDIENTS
If you have a favorite fruit flavor (Peach Tea, Blood Orange, Black & Blueberry, or Pomegranate) feel free to substitute it in any recipe you like.

GO DIY
Don’t feel discouraged if your first experiment isn’t a keeper. Most of the flavor in an e-liquid is experienced as aroma, and aromas don’t always combine in the same ways as food. Sometimes they sing like you might expect, and sometimes they fall flat.

VAPING E-LIQUIDS

AVAILABLE IN 10 FLAVORS AND 2 NICOTINE STRENGTHS
BLACK & BLUE BERRY
BUTTER CRUNCH
VANILLA BEAN
BLOOD ORANGE
SINGLE MALT SCOTCH
DOUBLE ESPRESSO
POMEGRANATE
MINT
PEACH TEA
CLASSIC TOBACCO

VAPING MIXOLOGY
Recipe Book

A COMPLETE GUIDE TO EVERYTHING YOU NEED TO KNOW ABOUT VAPING

HowToNJOYvaping.com

VAPE YOUR TREAT BY MIXING FLAVORS!

NJOY VAPING

Intended for adult consumers of legal smoking age.
Recipes are for vaping e-liquids only. Never eat or drink!
Trends in E-cigarette use?

Electronic cigarettes on the rise

By Briar Burley
Newsbeat reporter
Ever used E-Cigarettes Among Smokers at Wave 8 (Jul 2010-Jun 2011) and Wave 9 (Feb-Sep 2013)

Current E-Cigarette Use Among Smokers at Wave 8 (Jul 2010-Jun 2011) and Wave 9 (Feb-Sep 2013)

* Among cohorts only
Current smoking

Figure 8.1. Prevalence of current cigarette smoking among adults aged 18 and over: United States, 1997–2015
WHO IS USING ENDS AND WHY?
<table>
<thead>
<tr>
<th>Smoke Status</th>
<th>Proportion who use e-cigarettes</th>
<th>Weighted base (000s)</th>
<th>Unweighted sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoker</td>
<td>12</td>
<td>9,633</td>
<td>610</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>5</td>
<td>10,728</td>
<td>750</td>
</tr>
<tr>
<td>Never smoked</td>
<td>0</td>
<td>29,112</td>
<td>1,710</td>
</tr>
</tbody>
</table>

Source: Integrated Household Survey, Office for National Statistics

1 Q1 2014 relates to the period 1 January 2014 to 31 March 2014.
2 Weighted bases are given to the nearest thousand.

UK Office for National Statistics
Reasons for using e-cigarettes

(ASH smokefree adult, 2016)
Electronic Cigarettes Overtaking Nicotine Replacement Therapy

Rapid rise of vaping dent
GlaxoSimeKline’s sales of nicotine patches and gum
Chief executive said company explored idea of competing by making their own e-cigarettes before deciding not to

GlaxoSimeKline (GSK) is feeling the heat from the rapid growth in sales of electronic cigarettes, with enthusiasm for the nicotine delivery devices dampening sales of the British drugmaker’s patches and gum, its chief executive said.
Aids used in quit attempt in past 12 months

N=7,796 adults tried to stop or who stopped in the past year; respondents could use more than one method.
Association between electronic cigarette use and changes in quit attempts, success of quit attempts, use of smoking cessation pharmacotherapy, and use of stop smoking services in England: time series analysis of population trends

Emma Beard,1,2 Robert West,1 Susan Michie,1 Jamie Brown1,2

Principal findings

The increase in e-cigarette use in England has been positively associated with the success rates of quit attempts after adjustment for a range of confounding variables. No clear association has emerged between e-cigarette use and prevalence of quit attempts or use of licensed NRT bought over the counter, prescription treatment, or behavioural support. However, use of e-cigarettes in quit attempts has been negatively associated with use of NRT on prescription.

BMJ 2016;354:i4645 | doi:10.1136/bmj.i4645
How long current vapers have been vaping (ASH smokefree adult, 2016)

GB adults currently using e-cigarettes: smokers (n=330); ex-smokers (n=329)
Frequency of use among current vapers (ASH smokefree adult, 2016)

GB adults currently using e-cigarettes: smokers (n=330); ex-smokers (n=329)
Type of e-cigarette most often used by current vapers (ASH smokefree adult, 2016)

GB adults currently using e-cigarettes: smokers (n=330); ex-smokers (n=329)
Reasons for not trying e-cigs among those never tried *(ASH smokefree adult, 2016)*

- I am concerned they are not safe enough
- I do not want to substitute one addiction for...
- I do not think they would help me to quit or cut...
- I do not want to quit smoking
- I am not addicted to smoking and don’t need...
- I do not like the way they look
- Haven’t got around to it yet
- They cost too much
- There are too many products to choose from
- I would be embarrassed to use them in public
- Other
- Using other things to help me quit smoking
- They are too difficult to get hold of
Relative harm cigs/ecigs among adults

(ASH smokefree adult, 2013-16)
Harm perceptions predict use
(*Internet cohort survey 2012-14*)

Among baseline non-users, 23% were using e-cigarettes 1 year later

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>N (% of 1588)</th>
<th>% using e-cig 1 year later</th>
<th>Adj. OR</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-cigarettes at least as harmful / don’t know</td>
<td>590 (37.2)</td>
<td>19.2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>E-cigarettes less harmful</td>
<td>998 (62.8)</td>
<td>25.4</td>
<td>1.39</td>
<td>1.08</td>
<td>1.80</td>
</tr>
<tr>
<td>Male (referent)</td>
<td>930 (58.6)</td>
<td>19.7</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>658 (41.4)</td>
<td>27.8</td>
<td>1.55</td>
<td>1.21</td>
<td>1.97</td>
</tr>
<tr>
<td>Ex-smoker (referent)</td>
<td>209 (13.2)</td>
<td>11.5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Current smoker</td>
<td>1379 (86.8)</td>
<td>24.8</td>
<td>2.60</td>
<td>1.67</td>
<td>4.07</td>
</tr>
</tbody>
</table>

Also adjusted for age, gender, annual income and education

Brief report

Prevalence and Correlates of the Belief That Electronic Cigarettes are a Lot Less Harmful Than Conventional Cigarettes Under the Different Regulatory Environments of Australia and the United Kingdom

Hua-Hie Yong PhD¹, Ron Borland PhD¹, James Balmford PhD¹, Sara C. Hitchman PhD²,³, K. Michael Cummings PhD⁴, Pete Driezen MSc⁵, Mary E. Thompson PhD⁶
Belief about e-cig harmfulness relative to conventional cigs (2013 survey data)

A lot less harmful belief higher in the UK than in AU but Don’t Know responses higher in AU than in the UK
WHAT ABOUT KIDS?

E-cigs
In 2013, more than a quarter million middle and high school students never smoked regular cigarettes but had used e-cigarettes...

3 times as many as 2011!
Past 30-Day Use among High School Students

Frequency of E-Cigarette Use and Cigarette Smoking by American Students in 2014

Kenneth E. Warner, PhD

Introduction: High school students’ electronic cigarette (e-cigarette) use rose rapidly in 2014, to levels higher than cigarette smoking, which declined significantly. This study assesses how frequency of e-cigarette use is associated with students’ smoking status.

Methods: Using Monitoring the Future data in 2015, this study evaluated the association between students’ smoking and frequency of 30-day e-cigarette use in 2014, focusing on high school seniors. Previous research has considered only whether e-cigarettes were used at all during the past month.

Results: Non-smokers were far less likely than smokers to have used an e-cigarette ($p<0.001$). E-cigarette use frequency rose with the amount of ever smoking ($p<0.001$). However, among current smokers, there was no difference in e-cigarette use by very light smokers ($<1$ cigarette/day); light smokers ($1–5$ cigarettes/day); and heavy smokers ($\geq1/2$ pack/day) ($p=0.99$). Because most students have never smoked, never smokers constituted 29% of all seniors who used an e-cigarette. Among tenth- and eighth-graders, 43% and 48% of past-month e-cigarette users had never smoked.

Conclusions: Non-smoking high school students are highly unlikely to use e-cigarettes; among those who do, most used them only on 1–2 of the past 30 days. By contrast, current smokers are likely to use e-cigarettes and on many more days. It is unclear whether students’ e-cigarette use represents short-term experimentation or future sustained use, and whether it will eventually increase or decrease youth smoking and nicotine addiction. More sophisticated research methods, employing better data, will be essential to unravel the mystery that is the e-cigarette phenomenon.

# Progression: Frequency of Use

## Frequency of Past 30-Day Use of E-Cigarettes and Cigarettes (NYTS, 2014)

<table>
<thead>
<tr>
<th>Days used/month</th>
<th>% High School Users</th>
<th>% High School Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Of ENDS</td>
<td>Of Cigarettes</td>
</tr>
<tr>
<td>1-2 days</td>
<td>45.4</td>
<td>37.0</td>
</tr>
<tr>
<td>3-5 days</td>
<td>16.2</td>
<td>12.3</td>
</tr>
<tr>
<td>6-9 days</td>
<td>12.0</td>
<td>9.7</td>
</tr>
<tr>
<td>10-19 days</td>
<td>10.9</td>
<td>9.4</td>
</tr>
<tr>
<td>20-29 days</td>
<td>5.8</td>
<td>9.0</td>
</tr>
<tr>
<td>All 30 days</td>
<td>9.7</td>
<td>22.6</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Past 30-Day E-Cigarette Use: Use Leveled Off/Dropped Slightly

**Source:** Monitoring the Future, 2015 (Table 3)
Substance Vaporized the Last Time e-Cigarette Used

SOURCE: University of Michigan, 2015 Monitoring the Future Study
Starter & gateway product
HELP ME CRUSH THE EVIL NICK O’TEEN!
HIJACKER OF HEALTH. FOE OF THE FIT.
NEVER SAY YES TO A CIGARETTE!
CONCLUSIONS AND RELEVANCE In this national sample of US adolescents and young adults, use of e-cigarettes at baseline was associated with progression to traditional cigarette smoking. These findings support regulations to limit sales and decrease the appeal of e-cigarettes to adolescents and young adults.
E-Cigarettes and Future Cigarette Use

Jessica L. Barrington-Trima, PhD, Robert Urman, PhD, Kiros Berhane, PhD, Jennifer B. Unger, PhD, Tess Boley Cruz, PhD, Mary Ann Pents, PhD, Jonathan M. Smet, MD, Adam M. Leventhal, PhD, Rob McConnell, MD

**BACKGROUND:** There has been little research examining whether e-cigarette use increases the risk of cigarette initiation among adolescents in the transition to adulthood when the sale of cigarettes becomes legal.

**METHODS:** The Children’s Health Study is a prospectively followed cohort in Southern California. Data on e-cigarette use were collected in 11th and 12th grade (mean age = 17.4); follow-up data on tobacco product use were collected an average of 16 months later from never-smoking e-cigarette users at initial evaluation (n = 146) and from a sample of never-smoking, never e-cigarette users (n = 152) frequency matched to e-cigarette users on gender, ethnicity, and grade.

**RESULTS:** Cigarette initiation during follow-up was reported by 40.4% of e-cigarette users (n = 59) and 10.5% of never users (n = 16). E-cigarette users had 6.17 times (95% confidence interval: 3.30–11.6) the odds of initiating cigarettes as never e-cigarette users. Results were robust to adjustment for potential confounders and in analyses restricted to never users of any combustible tobacco product. Associations were stronger in adolescents with no intention of smoking at initial evaluation. E-cigarette users were also more likely to initiate use of any combustible product (odds ratio = 4.98; 95% confidence interval: 2.37–10.4), including hookah, cigars, or pipes.

**CONCLUSIONS:** E-cigarette use in never-smoking youth may increase risk of subsequent initiation of cigarettes and other combustible products during the transition to adulthood when the purchase of tobacco products becomes legal. Stronger associations in participants with no intention of smoking suggests that e-cigarette use was not simply a marker for individuals who would have gone on to smoke regardless of e-cigarette use.
Longitudinal study of e-cigarette use and onset of cigarette smoking among high school students in Hawaii

Thomas A Wills, Rebecca Knight, James D Sargent, Frederick X Gibbons, Ian Pagano, Rebecca J Williams

ABSTRACT

Objective: Use of electronic cigarettes (e-cigarettes) is prevalent among adolescents, but there is little knowledge about the consequences of their use. We examined, longitudinally, how e-cigarette use among adolescents is related to subsequent smoking behaviour.

Methods: Longitudinal school-based survey with a baseline sample of 2338 students (9th and 10th graders, mean age 14.7 years) in Hawaii surveyed in 2013 (time 1, T1) and followed up 1 year later (time 2, T2). We assessed e-cigarette use, tobacco cigarette use, and psychosocial covariates (demographics, parental support and monitoring, and sensation seeking and rebelliousness). Regression analyses including the covariates tested whether e-cigarette use was related to the onset of smoking among youth who had never smoked cigarettes, and to change in smoking frequency among youth who had previously smoked cigarettes.

Results: Among T1 never-smokers, those who had used e-cigarettes at T1 were more likely to have smoked cigarettes at T2; for a complete-case analysis, adjusted OR=2.87, 95% CI 2.03 to 4.05, p<0.0001. Among ever-smokers at T1, using e-cigarettes was not related to significant change in their frequency of smoking at T2. Uptake of e-cigarette use among T1 never-users of either product was predicted by age, Caucasian or Native Hawaiian (vs Asian-American) ethnicity, lower parental education and parental support, higher rebelliousness, and perception of e-cigarettes as healthier.

Conclusions: Adolescents who use e-cigarettes are more likely to start smoking cigarettes. This result together with other findings suggests that policies restricting adolescents' access to e-cigarettes may have a rationale from a public health standpoint. May contribute to renormalising smoking, which could increase smoking initiation and deter quitting among adolescents. However, there is little evidence from longitudinal studies on the relationship between adolescent e-cigarette use and smoking. One study with adolescents and one with young adults have found that e-cigarette use is positively related to initiation of smoking. Furthermore, cross-sectional studies have reported a relationship between e-cigarette use among adolescent and young adult non-smokers, and intention to smoke. Because of the policy implications, it is important to have evidence from different settings on the relation between e-cigarette use and smoking.

To address this question, we measured e-cigarette use and smoking on two occasions (1 year apart) among high school students. Our primary aim was to test whether e-cigarette use is related to the onset of smoking; thus, among adolescents who had never smoked at time 1 (T1), we determined the likelihood of smoking at time 2 (T2) as a function of previous e-cigarette use. A second aim was to determine longitudinal predictors for e-cigarette uptake, as most previous studies have been cross-sectional. A third aim was to determine if e-cigarette use was associated with smoking reduction among baseline smokers. All analyses controlled for a range of demographic and psychosocial covariates, variables that could be correlated with e-cigarette use and with smoking.

METHODS

Schools on the island of Oahu, Hawaii, were selected to be representative of school systems in Hawaii. Previous studies have shown that precipitation...
A Molecular Basis for Nicotine as a Gateway Drug

Eric R. Kandel, M.D., and Denise B. Kandel, Ph.D.

Priming with nicotine has been shown to lead to enhanced cocaine-induced locomotor activity and increased initial self-administration of cocaine among adolescent, but not adult, rats. Whether e-cigarettes will prove to be a gateway to the use of combustible cigarettes and illicit drugs is uncertain, but it is clearly a possibility.
Why the so-called gateway concern for nicotine exposure from ENDS may not really be an issue

The finding of a positive association between vaping and cigarette smoking is not unexpected nor is it adequate evidence that vaping causes cigarette smoking. A more likely explanation is that factors that predispose adolescents to take up vaping are the same as those factors that increase the odds of smoking. The real question is whether the marketing of e-cigarettes increases harm. Here the evidence is rather weak so far...

First, though the use of ENDS has apparently risen, much of this use is occasional experimentation rather than entrenched frequent or daily use indicative of nicotine addiction.

Second, coinciding with the growth in ENDS use there has been a dramatic decline in teenage smoking, just the opposite of what would be predicted if the gateway hypothesis was true.

Third, almost all adolescent users of ENDS are former or current smokers (>90%), and therefore ENDS represents a change in the way nicotine is being used by adolescents (cleaner vs dirtier).
The Application of a Decision-Theoretic Model to Estimate the Public Health Impact of Vaporized Nicotine Product Initiation in the United States

David T. Levy PhD¹, Ron Borland PhD², Andrea C. Villanti PhD, MPH³, Raymond Niaura PhD⁴, Zhe Yuan MS¹, Yian Zhang MS¹, Rafael Meza PhD⁴, Theodore R. Holford PhD⁵, Geoffrey T. Fong PhD⁶,⁷,⁸, K. Michael Cummings PhD, MPH⁹, David B. Abrams, PhD¹,²,¹⁰

Abstract

Introduction: The public health impact of vaporized nicotine products (VNP)s such as e-cigarettes is unknown at this time. VNP uptake may encourage or deflect progression to cigarette smoking in those who would not have otherwise smoked, thereby undermining or accelerating reductions in smoking prevalence seen in recent years.

Methods: The public health impact of VNP use are modeled in terms of how it alters smoking patterns among those who would have otherwise smoked cigarettes and among those who would not have otherwise smoked cigarettes in the absence of VNPs. The model incorporates transitions from trial to established VNP use, transitions to exclusive VNP and dual use, and the effects of cessation at later ages. Public health impact on deaths and life years lost is estimated for a recent birth cohort incorporating evidence-informed parameter estimates.

Results: Based on current use patterns and conservative assumptions, we project a reduction of 21% in smoking-attributable deaths and of 20% in life years lost as a result of VNP use by the 1997 US birth cohort compared to a scenario without VNPs. In sensitivity analysis, health gains from VNP use are especially sensitive to VNP risks and VNP use rates among those likely to smoke cigarettes.

Conclusions: Under most plausible scenarios, VNP use generally has a positive public health impact. However, very high VNP use rates could result in net harms. More accurate projections of VNP impacts will require better longitudinal measures of transitions into and out of VNP, cigarette and dual use.
CAN E-CIGARETTES HELP PEOPLE TO STOP SMOKING?
Effectiveness of e-cigarettes for Smoking Cessation

• 2014 Cochrane review of two RCTs (McRobbie, et al., 2014)
  – E-cigarettes with nicotine help smokers stop smoking compared with placebo e-cigarettes (no nicotine), reduce their cigarette consumption
    • BUT cautioned that there was uncertainty

• Other observational studies are generally in line with results of the RCTs, but more higher quality evidence is still needed (McNeill, Public Health England, 2015)
E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis

Sara Kalkhoran, Stanton A Glantz

Summary

Background Smokers increasingly use e-cigarettes for many reasons, including attempts to quit combustible cigarettes and to use nicotine where smoking is prohibited. We aimed to assess the association between e-cigarette use and cigarette smoking cessation among adult cigarette smokers, irrespective of their motivation for using e-cigarettes.

Methods PubMed and Web of Science were searched between April 27, 2015, and June 17, 2015. Data extracted included study location, design, population, definition and prevalence of e-cigarette use, comparison group (if applicable), cigarette consumption, level of nicotine dependence, other confounders, definition of quitting smoking, and odds of quitting smoking. The primary endpoint was cigarette smoking cessation. Odds of smoking cessation among smokers using e-cigarettes compared with smokers not using e-cigarettes were assessed using a random effects meta-analysis. A modification of the ACROBAT-NRSI tool and the Cochrane Risk of Bias Tool were used to assess bias. This meta-analysis is registered with PROSPERO (number CRD42015020382).

Findings 38 studies (of 577 studies identified) were included in the systematic review; all 20 studies with control groups (15 cohort studies, three cross-sectional studies, and two clinical trials) were included in random effects meta-analysis and sensitivity analyses. Odds of quitting cigarettes were 28% lower in those who used e-cigarettes compared with those who did not use e-cigarettes (odds ratio [OR] 0.72, 95% CI 0.57–0.91). Association of e-cigarette use with quitting did not significantly differ among studies of all smokers using e-cigarettes (irrespective of interest in quitting cigarettes) compared with studies of only smokers interested in cigarette cessation (OR 0.63, 95% CI 0.45–0.86 vs 0.86, 0.60–1.23; p=0.94). Other study characteristics (design, population, comparison group, control variables, time of exposure assessment, biochemical verification of abstinence, and definition of e-cigarette use) were also not associated with the overall effect size (p≥0.77 in all cases).

Interpretation As currently being used, e-cigarettes are associated with significantly less quitting among smokers.
Electronic Cigarettes for Smoking Cessation: A Systematic Review

Muhammad Malas MPH¹, Jan van der Tempel MPhil², Robert Schwartz PhD³, Alexa Minichiello MScP³, Clayton Lightfoot BA⁴, Aliya Noormohamed MSPH⁵, Jaklyn Andrews MA⁴, Laurie Zawertailo PhD⁵, Roberta Ferrence PhD⁶

Abstract

Background and Aims: Electronic cigarettes (e-cigarettes) have been steadily increasing in popularity among smokers, most of whom report using them to quit smoking. This study systematically reviews the current literature on the effectiveness of e-cigarettes as cessation aids.

Methods: We searched PubMed, MEDLINE, PsycINFO, CINAHL, ERIC, ROVER, Scopus, ISI Web of Science, Cochrane Library, the Ontario Tobacco Research Unit (OTRU) library catalogue, and various gray literature sources. We included all English-language, empirical quantitative and qualitative papers that investigated primary cessation outcomes (smoking abstinence or reduction) or secondary outcomes (abstinence-related withdrawal symptoms and craving reductions) and were published on or before February 1, 2016.

Results: Literature searches identified 2855 references. After removing duplicates and screening for eligibility, 62 relevant references were reviewed and appraised. In accordance with the GRADE system, the quality of the evidence in support of e-cigarettes' effectiveness in helping smokers quit was assessed as very low to low, and the evidence on smoking reduction was assessed as very low to moderate. The majority of included studies found that e-cigarettes, especially second-generation types, could alleviate smoking withdrawal symptoms and cravings in laboratory settings.

Conclusions: While the majority of studies demonstrate a positive relationship between e-cigarette use and smoking cessation, the evidence remains inconclusive due to the low quality of the research published to date. Well-designed randomized controlled trials and longitudinal, population studies are needed to further elucidate the role of e-cigarettes in smoking cessation.
Electronic cigarettes for smoking cessation (Review)

Hartmann-Boyce J, McRobbie H, Bullen C, Begh R, Stead LF, Hajek P

Authors’ conclusions

There is evidence from two trials that ECs help smokers to stop smoking in the long term compared with placebo ECs. However, the small number of trials, low event rates and wide confidence intervals around the estimates mean that our confidence in the result is rated ‘low’ by GRADE standards. The lack of difference between the effect of ECs compared with nicotine patches found in one trial is uncertain for similar reasons. None of the included studies (short- to mid-term, up to two years) detected serious adverse events considered possibly related to EC use. The most commonly reported adverse effects were irritation of the mouth and throat. The long-term safety of ECs is unknown. In this update, we found a further 15 ongoing RCTs which appear eligible for this review.
Use of ecigs among baseline smokers at 1 year follow-up (Brose et al, 2015)

Raw data shown.* shows significantly different from non-users after adjusting for confounding factors.
Quitting in relation to type & frequency of e-cig use at follow up (Hitchman et al, 2015)

Raw data shown; * shows significantly different from non-users after adjusting for confounding factors.
Quit and Smoking Reduction Rates in Vape Shop Consumers: A Prospective 12-Month Survey

Riccardo Polosa 1,2,*, Pasquale Caponnetto 1,2, Fabio Cibella 3 and Jacques Le-Houezec 4,5

Abstract: Aims: Here, we present results from a prospective pilot study that was aimed at surveying changes in daily cigarette consumption in smokers making their first purchase at vape shops. Modifications in products purchase were also noted. Design: Participants were instructed how to charge, fill, activate and use their e-cigarettes (e-cigs). Participants were encouraged to use these products in the anticipation of reducing the number of cig/day smoked. Settings: Staff from LIIF contacted 10 vape shops in the province of the city of Catania (Italy) that acted as sponsors to the 2013 No Tobacco Day. Participants: 71 adult smokers (>18 years old) making their first purchase at local participating vape shops were asked by professional retail staff to complete a form. Measurements: Their cigarette consumption was followed-up prospectively at 6 and 12 months. Details of products purchase (i.e., e-cigs hardware, e-liquid nicotine strengths and flavours) were also noted. Findings: Retention rate was elevated, with 69% of participants attending their final follow-up visit. At 12 month, 40.8% subjects could be classified as quitters, 25.4% as reducers and 33.8% as failures. Switching from standard refillables (initial choice) to more advanced devices (MODs) was observed in this study (from 8.5% at baseline to 18.4% at 12 month) as well as a trend in decreasing the e-liquid nicotine strength, with more participants adopting low nicotine strength (from 49.3% at baseline to 57.1% at 12 month). Conclusions: We have found that smokers purchasing e-cigarettes from vape shops with professional advice and support can achieve high success rates.
MUSC Naturalistic e-cigarette study

- Randomized study, 46 adult smokers given free e-cigarette samples for 3 weeks (BluCig) and told to use them as they wish, 22 smokers not provided e-cigarettes

- Subjects followed for 3 weeks and an additional 3 months to assess use of e-cigs and smoking behavior
Results

• **21 day period**
  – E-cigarette group used on average 16.2 days; 39% used daily throughout
  – In the e-cigarette group cigarettes per day decreased 38% vs 0% in control group
  – 41% independently purchased additional product vs 14% in the control group

• **3 month outcomes**
  – E-cigarette group reported more quit attempts (44% vs 23%)
  – Any period of cessation for 7-days (15% vs 5)
  – Slightly higher (non-significant) cessation at 3-months (7% vs 5%, point prevalence abstinence)
E-cigs Studies

E-cigarette regulatory environment:

• UK & US – liberal policy with few restrictions on sale & marketing of ecigs

• AU & CA – restrictive policy where retail sale of nicotine containing ecigs are banned.

Study aimed to understand whether & how differing policy environment might affect ecig use, perceived risk and its effectiveness for quitting.
Effectiveness of using e-cig for quitting: Outcome=Sustained abstinence 1m or more (No meds/ecig as ref)

<table>
<thead>
<tr>
<th>Help at last quit attempt</th>
<th>US &amp; UK (liberal policy)</th>
<th>AU &amp; CA (restrictive policy)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=757 (n=805)</td>
<td>N=1042 (n=1235)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No meds or no e-cigarette</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>308</td>
<td>555</td>
</tr>
<tr>
<td></td>
<td>57.1</td>
<td>56.2</td>
</tr>
<tr>
<td></td>
<td>ref</td>
<td>ref</td>
</tr>
<tr>
<td></td>
<td>1.95</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>1.19-3.21**</td>
<td>0.18-0.71**</td>
</tr>
<tr>
<td>E-cigarette only</td>
<td>145</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>66.9</td>
<td>28.0</td>
</tr>
<tr>
<td></td>
<td>1.95</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>1.19-3.21**</td>
<td>0.18-0.71**</td>
</tr>
<tr>
<td>NRT only</td>
<td>145</td>
<td>286</td>
</tr>
<tr>
<td></td>
<td>63.5</td>
<td>54.2</td>
</tr>
<tr>
<td></td>
<td>1.62</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>0.98-2.65</td>
<td>0.83-1.62</td>
</tr>
<tr>
<td>Varenicline or bupropion only</td>
<td>100</td>
<td>222</td>
</tr>
<tr>
<td></td>
<td>73.0</td>
<td>67.1</td>
</tr>
<tr>
<td></td>
<td>2.07</td>
<td>1.68</td>
</tr>
<tr>
<td></td>
<td>1.14-3.77*</td>
<td>1.15-2.44**</td>
</tr>
<tr>
<td>Combination help or Don’t Know</td>
<td>107</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td>57.9</td>
<td>48.4</td>
</tr>
<tr>
<td></td>
<td>1.55</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>0.92-2.61</td>
<td>0.62-1.59</td>
</tr>
</tbody>
</table>

NB. N=number of individuals; n=number of observations; OR adjusted for age, sex, country, ethnicity, baseline educ, income, HSI, quit intention, recent quit attempt, # quit attempts, quit recency, survey wave, survey mode, interwave interval & wave of recruitment;
Take Home Message

• Some evidence for effectiveness of e-cigarettes for smoking cessation, but more research needed
  – Evidence not as strong as for NRT
  – Differences across countries with more restrictive vs. more liberal policies e-cigarette policies

• Type and frequency of use are associated with cessation
  – More intense users/daily tanks users more likely to quit
  – Less intense/non-daily ciga-like users less likely to quit

• Smokers using e-cigarettes to quit should be supported (i.e., vape shops might actually be helpful not a hindrance)
QUIZ

HAVE ANY NICOTINE INHALING DEVICES BEEN APPROVED AS A STOP SMOKING TREATMENT?
PRESS RELEASE

First Regulatory Authorisation for Voke® Nicotine Inhaler

By
Published: Sept 12, 2014 2:00 a.m. ET

LONDON, September 12, 2014 /PRNewswire via COMTEX/ -- LONDON, September 12, 2014 /PRNewswire/ --
Quiz
When did the FDA last approve a new stop smoking medication?
2006

CHANTIX™ (varenicline) TABLETS

Starting Month PAK

Continuing Month PAK
Public health success story

Cigarette smoking on the wane

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>2014</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Per capita cigarette consumption:</td>
<td>4266</td>
<td>1129</td>
<td>73%</td>
<td></td>
</tr>
<tr>
<td>Adult male smoking prevalence:</td>
<td>52%</td>
<td>19%</td>
<td>63%</td>
<td></td>
</tr>
<tr>
<td>Adult female smoking prevalence:</td>
<td>34%</td>
<td>15%</td>
<td>55%</td>
<td></td>
</tr>
</tbody>
</table>

Cigarette smoking on the wane
But, how successful have we really been?

- Still 42+ million smokers
- Smoking is still the leading cause of preventable death
- Smoking rates are still high among key sub-populations
Cigarette smoking is increasingly seen among the poor: Trends by smoking by poverty status, US: 1983-2009

*Before 1992, current smokers were defined as persons who reported having smoked ≥100 cigarettes and who currently smoked. Since 1992, current smokers were defined as persons who reported having smoked ≥100 cigarettes during their lifetime and who reported now smoking every day or some days.

Source: various National Health Interview Surveys from 1983 - 2009, National Center for Health Statistics, CDC.
39% of adults with a psychiatric diagnosis smoke compared to 16% without a diagnosis.
Maybe we need to consider adding some new tools to the tobacco control toolbox
Looking for the next breakthrough in tobacco control and health

David Swannor  
Adjunct Professor, Faculty of Law, University of Ottawa, Canada; Honorary Lecturer, Division of Epidemiology and Public Health, University of Nottingham, UK  
dswanor@uottawa.ca

Derek Yach  
Executive Director, the Vitality Institute, New York, USA  
dyach@thevitalitygroup.com
In effect, what anti-smoking policies have done to date is to motivate smokers to want to quit, while doing exceedingly little to facilitate the sought behaviour change. To be maximally effective,
social isolation for those who still smoke. Smokers are clearly looking for viable options, while few are being offered. This failure to give acceptable alternatives to smokers is particularly hard to justify when we know, for instance, that genetic factors play a huge role in nicotine dependence and the ability to quit and that a great deal of smoking can be explained by self-medication with nicotine to treat a wide range of conditions. [7,8]
as it is unethical. It is far easier to move consumers off smoking than to move them off nicotine, and doing so delivers nearly all of the health benefits of total cessation. [10]
The Washington Post

How e-cigarettes could save lives

© Bobby Yip / Reuters/REUTERS - Anti-smoking advocates should welcome electronic cigarettes, writes Sally Satel.
Separating the nicotine from the smoke is an old idea.

“Smokers smoke for the nicotine, but die from the tar”
Professor Mike Russell, Maudsley Smokers Clinic, 1979
The future of nicotine replacement

MICHAEL A. H. RUSSELL

ICRF Health Behaviour Unit, Institute of Psychiatry, 101 Denmark Hill,
London SE5 8AF, UK

Abstract
Following in the wake of progress forged by nicotine chewing gum, a new generation of nicotine replacement products will soon be available as aids to giving up smoking. These range from nicotine skin patches, which take 6–8 hrs to give very flat steady-state peak blood levels, to nicotine vapour inhalers which mimic the transient high-nicotine boli that follow within a few seconds of each inhaled puff of cigarette smoke. Other products undergoing clinical trials include a nasal nicotine spray and nicotine lozenges. It is argued here that it is not so much the efficacy of new nicotine delivery systems as temporary aids to cessation, but their potential as long-term alternatives to tobacco that makes the virtual elimination of tobacco a realistic future target. Their relative safety compared with tobacco is discussed. A case is advanced for selected nicotine replacement products to be made as palatable and acceptable as possible and actively promoted on the open market to enable them to compete with tobacco products. They will also need health authority endorsement, tax advantages and support from the anti-smoking movement if tobacco use is to be gradually phased out altogether.
Sweden - proof of concept

• Use of snus, a low nitrosamine smokeless tobacco product
  – Not safe, but safer than smoking cigarettes

• Widely used for many decades

• Overall tobacco use about the same as other EU countries, but cigarette smoking prevalence much lower
Not the cleanest— but clean enough?
Safety Concerns with ENDS
E-cigarettes are safer than smoking cigarettes, but they are not completely safe.
Electronic cigarette explodes in man’s mouth, takes out teeth

A Florida man trying to kick the smoking habit was puffing on an electronic cigarette when a faulty battery caused it to explode in his mouth, taking out some of his front teeth and a chunk of his tongue, fire officials said.
Subject: Fire Risk of Electronic Cigarettes (e-cigarettes) in Checked Baggage

Purpose: This SAFO alerts operators to recent incidents involving e-cigarettes in checked baggage and recommends carriage of such devices in the passenger cabin only.

Background: On August 9, 2014, at Boston’s Logan Airport, an e-cigarette contained in a passenger’s checked bag in the cargo hold of a passenger aircraft caused a fire that forced an evacuation of the aircraft. On January 4, 2015, at Los Angeles International Airport, a checked bag that had missed its flight was found to be on fire in a baggage area. Emergency responders attributed the fire to an overheated e-cigarette inside the bag. These incidents and several others occurring outside of air transportation have shown that e-cigarettes can overheat and cause fires when the heating element is accidentally activated or left on. This danger may be exacerbated by the growing trend of users modifying and rebuilding their reusable e-cigarette devices (personal vaporizers) and interchanging original and aftermarket batteries, heating elements, and vaporizing components.
Calls to Poison Centers for Exposures to Electronic Cigarettes — United States, September 2010–February 2014

Kevin Chatham-Stephens, MD\textsuperscript{1}, Royal Law, MPH\textsuperscript{2}, Ethel Taylor, DVM\textsuperscript{2}, Paul Melstrom, PhD\textsuperscript{3}, Rebecca Bunnell, ScD\textsuperscript{3}, Baoguang Wang, MD\textsuperscript{4}, Benjamin Apelberg, PhD\textsuperscript{1}, Joshua G. Schier, MD\textsuperscript{2} (Author affiliations at end of text)

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

Total = 2,577,557

2014 Annual Report of the American Association of Poison Control Centers’ National Poison Data System (Table 17A)
E-cigarettes, Vaping: Worse than smoking due to cancer-causing components found in brands!

By Ryan Inayed | June 3, 2013 12:26 PM EST

E-Cigarette or vaping is no less dangerous than actual smoking as cancer-causing components were found on certain brands by experts, leading to a discouragement of use and ban in certain countries such as France.

French Researchers Forbids E-Cigarette

French Health Minister Marisol Touraine wants to ban e-cigarettes on public places and must be subject under the same measures applied on tobacco, restricting sale to individuals under 18 years of age.

"The e-cigarette is not an ordinary product. We need to apply the same measures as there are for tobacco. That means making sure it cannot be smoked in public places, that its sale is restricted to over 18 years old and that firms are not allowed to advertise the products," according to the minister, quoted by The Local France daily.

The said electronic devices have been found with nicotine in May 2011 and the French health agency AFSSAPS advised residents to avoid such products.
Hidden Formaldehyde in E-Cigarette Aerosols

Figure 1. Daily Exposures to Formaldehyde Associated with Cigarettes and E-Cigarettes.
### Toxicants in Vapor

<table>
<thead>
<tr>
<th>Toxic compound</th>
<th>Conventional cigarette [µg]</th>
<th>Electronic cigarette [µg per 15 puffs]</th>
<th>Conventional vs. electronic cigarette</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>1.6-52</td>
<td>0.20-5.61</td>
<td>9</td>
</tr>
<tr>
<td>Acetaldehyde</td>
<td>52-140</td>
<td>0.11-1.36</td>
<td>130</td>
</tr>
<tr>
<td>Acrolein</td>
<td>4.6-14</td>
<td>0.07-4.19</td>
<td>4</td>
</tr>
<tr>
<td>Toluene</td>
<td>6.4-9.0</td>
<td>0.02-0.63</td>
<td>23</td>
</tr>
<tr>
<td>NNN</td>
<td>0.012-0.37</td>
<td>0.00008-0.00043</td>
<td>145</td>
</tr>
<tr>
<td>NNK</td>
<td>0.009-0.08</td>
<td>0.00011-0.00283</td>
<td>30</td>
</tr>
<tr>
<td>Cd</td>
<td>0.03-0.35</td>
<td>0.001-0.022</td>
<td>16</td>
</tr>
<tr>
<td>Ni</td>
<td>0.003-0.60</td>
<td>0.011-0.029</td>
<td>15</td>
</tr>
</tbody>
</table>

Goniewicz et al. Tob Control 2013
Exposure to Nicotine and Selected Toxicants in Cigarette Smokers Who Switched to Electronic Cigarettes: A Longitudinal Within-Subjects Observational Study

Maciej L. Goniewicz PharmD, PhD¹,², Michal Gawron PharmD², Danielle M. Smith MPH¹, Margaret Peng BSc³, Peyton Jacob III PhD³, Neal L. Benowitz MD³
Study Design

- Observational study of 20 tobacco cigarette smokers
- Subjects were provided with electronic cigarettes (1st generation) with cartridges containing 16 mg of nicotine
- Subjects were asked to substitute their regular cigarettes with e-cigarettes for 2 weeks and use them *ad lib*
- Subjects attended three study sessions:
  - at the day of switching (baseline)
  - after one week of using e-cigarettes
  - after two weeks of using e-cigarettes
- Each subject provided three urine samples

*Figure 1. Participant flow chart.*
Results

A. Cigarette and E-cigarette Consumption

B. Exhaled Carbon Monoxide

C. Nicotine Intake
Figure 3. Changes in select carcinogen levels over 2 weeks of electronic cigarette (e-cigarette) use among 20 smokers (mean ± SD). *Denotes statistically significant differences from baseline according to repeated measure analysis of variance (p < .05).

**Conclusions:** After switching from tobacco to e-cigarettes, nicotine exposure remains unchanged, while exposure to selected carcinogens and toxicants is substantially reduced.
What about heart disease?
SILLY LILY GETS CARRIED AWAY
BOOZY SINGER COLLAPSES AT NETTING HILL CARNIVAL. PAGES 4 & 5

E-CIGS SERIOUSLY DAMAGE HEART

VAPING AS BAD AS FAGS
Cardiovascular toxicity of nicotine: Implications for electronic cigarette use

Neal L. Benowitz, MD<sup>a,b,c,#</sup>, and Andrea D. Burbank, MD<sup>c</sup>

<sup>a</sup>Division of Clinical Pharmacology and Experimental Therapeutics, Medical Service, Department of Medicine, University of California, San Francisco, San Francisco, CA
<sup>b</sup>Department of Bioengineering and Therapeutic Sciences, University of California, San Francisco, San Francisco, CA
<sup>c</sup>Center for Tobacco Control Research and Education, University of California, San Francisco, CA

**ABSTRACT**

The cardiovascular safety of nicotine is an important question in the current debate on the benefits vs. risks of electronic cigarettes and related public health policy. Nicotine exerts pharmacologic effects that could contribute to acute cardiovascular events and accelerated atherogenesis experienced by cigarette smokers. Studies of nicotine medications and smokeless tobacco indicate that the risks of nicotine without tobacco combustion products (cigarette smoke) are low compared to cigarette smoking, but are still of concern in people with cardiovascular disease. **Electronic cigarettes deliver nicotine without combustion of tobacco and appear to pose low-cardiovascular risk, at least with short-term use, in healthy users.**
Long-term effect of reduced smoking on BP in smokers switching to ECs

Systolic BP changes at Week 52 from baseline

Long-term effect of reduced smoking on BP in smokers switching to ECs

Systolic BP changes at Week 52 from baseline

<table>
<thead>
<tr>
<th>Side effects/accidents</th>
<th>Total (n = 19,353)</th>
<th>Current smokers (n = 3682)</th>
<th>Former smokers (n = 15,671)</th>
<th>Statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dual users</td>
<td>Single users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension (N = 2162)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worse</td>
<td>19 (0.8)</td>
<td>6 (1.5)</td>
<td>13 (0.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stable</td>
<td>944 (39.9)</td>
<td>194 (49.7)</td>
<td>750 (38.0)</td>
<td>$\chi^2 = 33.8$</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Improved</td>
<td>1149 (49.9)</td>
<td>139 (35.6)</td>
<td>1040 (52.7)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Take Home Message

• Lowered BP and improved BP control in hypertensive patients;
• Improvements also reported in dual users;
• A helpful alternative to cigarettes, even in smokers with hypertension.
What about respiratory health?
An Unexpected Consequence of Electronic Cigarette Use

Lindsay McCauley, DO; Catherine Markin, MD, FCCP; and Danielle Hosmer, MD

CHEST 2012; 141(4):1110–1113 Laboratory Tests and Imaging Findings

Diagnosis: Exogenous lipoid pneumonia due to e-cigarette use

Figure 2. Photomicrograph of BAL sample shows lipid-laden macrophages (Oil-Red-O stain, original magnification ×100).
Survey in two large German vape forums, confined to ex-smokers who had fully switched to vaping for at least one month.

Chronic effect of abstinence/reduction on spirometry in smokers switching to ECs

Chronic effect of abstinence/reduction on spirometry in smokers switching to ECs

Persisting Long Term Benefits of Smoking Abstinence and Reduction in Asthmatic Smokers Who Have Switched to Electronic Cigarettes

Riccardo Polosa, Jaymin B. Morjaria, Pasquale Caponnetto, Massimo Caruso, Davide Campagna, Maria Domenica Amaradio, Giovanni Ciampi, Cristina Russo, and Alfredo Fisichella
FEV1

Improvement from baseline to 24 months

p=0.005
mean increase of 100mls

Regular EC use

**FEF25-75**

Improvement from baseline to **24 months**

- Improvement from baseline to 24 months: **p=0.006**
  - Mean increase of 250 ml/sec

- Harm reversal!

Regular EC use

- 3rd F/up Visit

*Polosa et al. Discov Med 2016*
Many of the hazardous chemicals in cigarette smoke are not detectable in vaping products or if found at all are present in concentrations that are much lower than in cigarette smoke.

While nicotine is the main addictive chemical in tobacco and vaping products, we now know that nicotine by itself has relatively minor health effects except for in pregnancy and perhaps in those with pre-existing cardiac disease.

For smokers the evidence suggests they would certainly be better off trading in their Marlboros for a vaping product. Compared to cigarette smoking ENDS poses a much lower risk to health, unlikely to exceed 5% of the harm from smoking.

People who vape and also keep smoking cigarettes probably negate some of the real health benefits to be gained by using ENDS, but there may still be a benefit.

Take Home Message
E-cigarette Friend or Foe?
Four Avenues of Health Interventions

1. Prevention – keep nonsmokers from starting
2. Cessation – help smokers to quit
3. Protection of Third Parties – 2nd-hand smoke, fires
4. Reduced risk - alternative nicotine products
Failure to Play all Four Suits in the deck is NOT a Winning Strategy!

• **Avoids reliance on one-off gains**
  - Hike in cigarette taxes
  - Passage of a clean indoor air law
  - New pack warnings

• **Misses synergies between strategies**
  - Exploiting cross-elasticities
    • Adding ‘Facilitation’ to ‘Motivation’