Free markets. Real Solutions.

R STREET POLICY STUDY NO. 11
November 2013

THE PROMISE OF E-CIGARETTES FOR TOBACCO HARM REDUCTION

Dr. Joel L. Nitzkin

CONTENTS

INTRODUCTION AND ABSTRACT

Nicotine vaporizers, usually referred to as e-cigarettes, show substantial promise as a vehicle for tobacco harm reduction (THR). Skyrocketing sales of e-cigarettes, consumer advocacy for these products, and a flood of new scientific papers relating to these products suggest the possibility that e-cigarettes may be the greatest advance in reducing tobacco-attributable illness and death in decades. Moreover, progress to date has been accomplished at no cost to the taxpayer and with little or no recruitment of teen non-smokers.

This paper makes the case for the Food and Drug Administration (FDA) and other public health authorities to add a THR element to current public health programming, highlighting e-cigarettes as a THR modality under FDA guidance, skillfully crafted to recognize both the potential public health benefits and theoretical harms of a THR initiative.

Optimal FDA regulation will involve strict control of the quality of manufacture and marketing without threatening the removal of e-cigarettes from the market, even on a temporary basis, and without stifling continuing product improvement.

There currently exists strong opposition to THR within the public health community. While those familiar with the scientific literature readily agree that smoke-free tobacco products present far less risk of potentially fatal tobacco-attributable illness than cigarettes, they object to any consideration of THR because of their unsubstantiated belief that a THR initiative would necessarily increase the number of teens initiating tobacco/nicotine use and necessarily decrease quit rates.

Reconsideration of this intense distrust of all non-pharmaceutical tobacco/nicotine products will open major new opportunities to reduce tobacco-related addiction, illness and death. We now know about the huge differences in risk, comparing cigarettes to the smokeless tobacco products available on the U.S. market. We know more about the lack of attractiveness of e-cigarettes to non-smoking teens and non-smoking adults. We also know that, for a large number of mental health patients, self-administered nicotine is highly effective in helping them get through the day.

Experience to date with currently unregulated e-cigarettes strongly suggests they already are securing substantial public health benefits among current smokers without increasing teen initiation of tobacco/nicotine use and without adverse impact on quit rates.

Many in the public health community seem unaware of the research findings demonstrating the potential public health benefits of a THR initiative. They seem unaware of the research findings demonstrating both the relative safety and unattractiveness to non-smokers of e-cigarettes. This paper is intended to help close these gaps.

TOBACCO HARM REDUCTION

Tobacco harm reduction (THR) is envisioned in the United States as a public health communication initiative to inform smokers who are unwilling or unable to quit that they could substantially reduce their risk of potentially fatal tobacco-attributable cancer, heart and lung disease by switching to a lower-risk smoke-free product.

Lower risk does not mean no risk. Nicotine is addictive and not risk free. Other chemical substances found in at least trace amounts in virtually all tobacco/nicotine products convey a risk of illness above what would be expected from total abstention from tobacco/nicotine use. Thus, for optimal public health benefit, a THR initiative would encourage smokers to switch to much lower-risk products without causing teens and other non-users to initiate tobacco/nicotine use.

STEP-DOWN IN RISK FROM CIGARETTE SMOKING TO E-CIGARETTE VAPOR

1. Cigarettes

The Centers for Disease Control and Prevention estimates there are 443,000 tobacco-related deaths annually in the United States and all are from cigarette use.[1] Deaths from other forms to tobacco are so small and so hard to estimate that they are not estimated or tracked by the CDC.

Tobacco cigarettes are the most hazardous and addictive of tobacco products, and the product most attractive to teens. There was no pandemic of tobacco-related addiction, illness and death until the advent of the machine-made cigarette.

For most of the past half-century, cigarettes have been so dominant in the United States that anti-smoking advocates came to use the terms "cigarette" and "tobacco" as if they were synonymous. Working from the seemingly reasonable, but demonstrably untrue, premise that all tobacco products were equally hazardous, and that tobacco companies were evil, many anti-smoking advocates have maintained that blocking introduction of any new tobacco product would protect the health of the public.

2. Environmental tobacco smoke (ETS)

Tobacco smoke is a witch's brew of toxic chemical substances from the incomplete combustion of tobacco. The main component is carbon monoxide, but it also includes other gasses and tarry particulate residue containing most of the nicotine and the worst of the carcinogens.[2]

About 85% of environmental tobacco smoke (ETS), commonly called "second hand smoke," is the smoke that curls off the end of a cigarette when no-one is puffing on it. Solid particles make up about 10% of the smoke, including the tar and most of the nicotine. The mainstream smoke exhaled by the smoker includes only what is left after much of what was inhaled is absorbed by the smoker.

ETS increases the risk of lung cancer and other cancers; heart and lung disease; the risk of low birth weight; and is suspected of increasing the risk of birth defects. CDC estimates that approximately 49,000 non-smokers die in the United States from exposure to ETS.[3] In addition, ETS is known to irritate the eyes, throat, and respiratory mucous membranes.[4]

E-cigarettes have no products of combustion. Nothing curls off the end of an e-cigarette when no one is puffing on it. The mainstream vapor exhaled by the user includes only the tiniest traces of chemical contaminants.

2. Smokeless tobacco products on the U.S. market

The smokeless tobacco products which have been on the U.S. market since the 1980s are estimated to pose a risk of potentially fatal illness less than 2% the risk posed by cigarettes.[5]

E-cigarettes are one of a number of smoke-free tobacco/nicotine alternatives to cigarettes that can reduce the risk of tobacco-attributable illness and death by 98% or better, while satisfying the smoker's urge for nicotine. These include chewing tobacco; snus and other snuff products; dissolvables (sticks, strips and orbs), and e-cigarettes. Options also include use of pharmaceutical nicotine replacement therapy (NRT) products such as patches, gum, lozenges, and inhalers on a long-term basis in a harm-reduction mode.

4. E-cigarettes

E-cigarettes are currently the most prominent and promising THR option. These metal or plastic tubes use a battery,

1. Centers for Disease Control and Prevention, "CDC Fact Sheet – Tobacco-Related Mortality," Aug. 1, 2013. http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/tobacco_related_mortality/index.htm

2. Terry Martin, "Environmental Tobacco Smoke," About.com, March 29, 2013. http://quitsmoking.about.com/cs/secondhandsmoke/g/ETS.htm

3. Centers for Disease Control and Prevention, "Smoking & Tobacco Use," Aug. 1, 2013. http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/tobacco_related_mortality/index.htm

4. California Environmental Protection Agency, "Fact Sheet: Environmental Tobacco Smoke: A Toxic Air Contaminant," Oct. 18, 2006. http://www.arb.ca.gov/toxics/ets/factsheetets.pdf

5. Brad Rodu, "The scientific foundation for tobacco harm reduction, 2006-2011," *Harm Reduction Journal,* July 2011. www.harmreductionjournal.com/content/8/1/19

heating element and small amount of nicotine-containing fluid to give smokers nicotine without the high concentration of thousands of other toxic chemicals that exist in cigarette smoke. E-cigarettes also emulate the cigarette-handling ritual and the feel of cigarette smoke in the mouth and throat.

E-cigarettes are unique in the U.S. marketplace in that they are the only smoke-free tobacco products that do not carry mandated warnings about cancer or other diseases. They are also unique in terms of their skyrocketing sales. Bonnie Herzog, Wells Fargo's managing director for beverage, tobacco and convenience store research, predicted in January 2013 that "consumption of e-cigs may overtake traditional cigarettes in the next decade."[6] At that time, e-cigarette sales were projected at $1 billion for 2013. In mid-September, Herzog upped her projection to "around $2 billion by the end of the year and up to $10 billion by 2017," adding that she expects electronic products would overtake tobacco cigarettes within the next decade.[7]

5. Environmental e-cigarette vapor

E-cigarette vapor, as exhaled by the e-cigarette user, poses no significant risk to bystanders.[8] An October 2012 study published in *Inhalation Toxicology* found that, for all byproducts measured, e-cigarettes produced very small exposures relative to tobacco cigarettes, indicating no apparent risk to human health from e-cigarette emissions.[9] Further research presented to Europe's Society for Research on Nicotine and Tobacco compared total organic carbons in a test chamber five hours after smoking or "vaping," finding no detectable levels of acrolein, toluene, xylene and polycyclic aromatic hydrocarbons (PAH) in the e-cigarette vapor compared to high levels in the cigarette chamber.[10]

In tests comparing the effects of e-cigarette vapor to cigarette smoke on cell cultures of myocardial cells, the vapor had minimal impact on the cells, while the smoke killed almost all of them.[11]

The e-cigarette vapor inhaled by users consists mainly of water, propylene glycol and glycerin, with small amounts of nicotine and flavoring. There is no carbon monoxide, no tar, and no products of combustion. There is no side-stream smoke or vapor. None. Propylene glycol and glycerin are generally recognized as safe. Propylene glycol has been used as the propellant in asthma inhalers and is the main ingredient in theatrical fog.

If the nicotine and trace carcinogens in e-cigarette vapor presented any significant hazard to bystanders, those advocating for banning e-cigarette use in non-smoking areas could have and should have included pharmaceutical nicotine inhalers in their proposed bans. The fact that they have not done so suggests a perception that no such hazard exists.

6. Pharmaceutical nicotine replacement therapy products

Long-term use of pharmaceutical nicotine replacement therapy products, such as Nicorette, Commit, and others, is perceived by public health authorities to pose no risk of tobacco-attributable illness and death, despite the presence of many of the same trace contaminants that exist in e-cigarettes.

Nitrosamine levels in e-cigarettes have been found to be similar to the levels in Nicorette gum and NicoDerm patches, but less than one-hundredth to one-thousandth the level in a wide range of smokeless tobacco and cigarette products.[12]

The major problem with current reliance on pharmaceutical nicotine replacement therapy products is that they fail about 90% of the smokers who use them, even under the best of study circumstances.[13] The need to add a THR element to current tobacco control programming is largely based on experience to-date that large numbers of smokers who are unable or unwilling to quit using the pharmaceutical products can eliminate almost all exposure to the many toxins in cigarettes by switching to e-cigarettes.[14] [15]

6. Josh Sanburn, "Can Electronic Cigarettes Challenge Big Tobacco?", *Time*, Jan. 8, 2013. http://business.time.com/2013/01/08/can-electronic-cigarettes-challenge-big-tobacco/

7. Vranks, " Analyst Confirms Projection That E-Cigarettes Will Overtake Traditional Cigarettes in the Next Decade," *Vape Ranks,* Sept. 16, 2013. http://vaperanks.com/analyst-confirms-projection-that-e-cigarettes-will-overtake-traditional-cigarettes-in-the-next-decade/#sthash.tYRn3D5q.dpuf

8. Igor Burstyn, "Peering through the mist: What does the chemistry of contaminants in electronic cigarettes tell us about health risks?", July-August 2013. http://publichealth.drexel.edu/SiteData/docs/ms08/f90349264250e603/ms08.pdf August 2013.

9. Timothy R. McAuley et al "Comparison of the effects of e-cigarette vapor and cigarette smoke on indoor air quality," *Inhalation Toxicology*, October 2012.

10. Konstantinos Farsalinos, Giorgio Romagna et al, 2012 congress of the Society for Research on Nicotine and Tobacco Europe.

11. Konstantinos Farsalinos et al, Tobacco Marketing Association 2013.

12. Zachary Cahn and Michael Siegel, "Electronic cigarettes as a harm reduction strategy for tobacco control: a step forward or a repeat of past mistakes?", *Journal of Public Health Policy,* February 2011. http://www.ncbi.nlm.nih.gov/pubmed/21150942

13. Moore D, Aveyard P, Connock M, Wang D, Fry-Smith A, Barton P, "Effectiveness and safety of nicotine replacement therapy-assisted reduction to stop smoking: systematic review and meta-analysis," BMJ 338:b1024 2009.

14. Igor Burstyn, "Peering through the mist: What does the chemistry of contaminants in electronic cigarettes tell us about health risks?", July-August 2013. http://publichealth.drexel.edu/SiteData/docs/ms08/f90349264250e603/ms08.pdf August 2013.

15. Timothy R. McAuley et al "Comparison of the effects of e-cigarette vapor and cigarette smoke on indoor air quality," *Inhalation Toxicology*, October 2012.

WHY THE OBJECTIONS TO E-CIGARETTES FROM PUBLIC HEALTH ADVOCATES?

Objections to e-cigarettes by public health advocates are theoretical in nature. They are based on a distrust of all non-pharmaceutical tobacco-related companies and the false premise that we do not know what e-cigarettes contain. We actually know more about e-cigarette liquid and vapor than we do about the chemical make-up of cigarette smoke.

Those opposing e-cigarettes are quick to point out that they have not been approved by FDA. This is true. Unfortunately, this reflects on the sad state of the FDA's Center for Tobacco Products. We are now four years past the establishment of the center under the Family Smoking Prevention and Tobacco Control Act. The center is literally tied in knots by provisions of the law, by forces in the tobacco industry that have twice defeated FDA in court, and by forces in the public health community dedicated to a "tobacco-free society."

In this context, the phrase "tobacco-free society" means a society free of non-pharmaceutical tobacco products. This goal rules out endorsement of any non-pharmaceutical tobacco product by any public health authority for any purpose.

Much of the objection to e-cigarettes stems from an FDA press conference held July 22, 2009, just one month after President Obama signed the Tobacco Control Act into law. This press conference roundly condemned e-cigarettes on the basis that e-cigarette fluid contains trace carcinogens and that one of the 20 samples tested showed a trace amount of diethylene glycol – the main ingredient in automobile antifreeze.

What FDA did not say in that press conference was that e-cigarette fluids, with the exception of the one showing a trace of diethylene glycol, showed the same trace carcinogens in about the same concentrations as the pharmaceutical NRT products approved by FDA (Nicorette, Commit, and others). The one trace of diethylene glycol was so small that one would have to consume the e-cigarette equivalent of about 1,500 cigarettes in a single day to reach the minimal toxic dose of this liver toxin. Moreover, the sample was from an e-cigarette company that has since gone out of business.

Over the past four years, public health advocates have embellished, exaggerated and distorted statements from that January 2009 press conference to suggest that e-cigarettes might be even more harmful than cigarettes. It simply is not so. FDA, for its part, continues to repeat statements from this conference, but is careful not to compare the hazard posed by e-cigarette vapor to the hazard posed by cigarette smoke.

There seems to be a never-ending string of statements and remarks by public health authorities demeaning e-cigarettes that show total disregard of well-established scientific findings. The most recent appear to be two quotes from authority figures in a Sept. 19, 2013 article published by *WebMD*.[16] In the piece, Norman Edelman, chief medical officer of the American Lung Association said:

> "They are nicotine delivery devices intended to be used like a cigarette. What happens to someone who stops inhaling the tars of cigarettes and inhales only the nicotine? We don't know. There is at least the potential for harm."

This quote suggests total ignorance of the experience with FDA-approved pharmaceutical nicotine inhalers, which have a spotless safety record and no allegations of potential harm.

The article also quoted FDA spokesperson Rita Chapelle saying of e-cigarettes:

> "We are concerned about the potential for addiction and abuse of these products. We don't want the public to perceive them as a safer alternative to cigarettes."

Chapelle apparently does not know or chooses to ignore the fact that the cancer, heart and lung disease associated with cigarettes are due to the witch's brew of chemicals present in cigarette smoke, not the nicotine. She also seems unconcerned about the potential for abuse of the pharmaceutical NRT products (gum, patches, lozenges, inhalers) sold on open shelves in drug and grocery stores with no enforcement of age restrictions on sales.

FDA has yet to yet to specify product safety guidelines for any tobacco product, and has yet to extend its regulatory authority to cover e-cigarettes and a wide range of other tobacco/nicotine products. Thus, the fact that e-cigarettes are not approved by the FDA is not the fault of the e-cigarette companies, or due to a lack of research into the relative safety, potential public health benefits or attractiveness to non-smoking teens of e-cigarettes.

Some anti-smoking researchers – such as Stanton Glantz, director of the Center for Tobacco Control Research and Education at the University of California, San Francisco – have offered misleading comparisons of e-cigarettes and nicotine inhalers that compare the amount of carcinogen in single cartridges of each product. A correct re-analysis demonstrated that nicotine inhalers have higher amounts of six carcinogens, including five to ten times the amount of three heavy metals, when user exposure to anticipated daily doses of e-cigarette vapor and nicotine inhalers are compared.[17]

16. Daniel J. DeNoon, "No-Smoke Electronic Cigarettes Draw Criticism From FDA, Medical Groups," *WebMD*, Sept. 19, 2013. http://www.webmd.com/smoking-cessation/features/ecigarettes-under-fire

Framing e-cigarette vapor to be as harmful as cigarettes is not erring on the side of protecting the public. The alternative to use of e-cigarettes is not abstention from tobacco use, but continuation of cigarette use. Misrepresenting e-cigarettes has the practical effect of reinforcing tobacco cigarettes as the dominant product for nicotine consumption. It does nothing to reduce teen initiation of tobacco/nicotine products. It protects cigarettes from competition from these much less-hazardous products.

LACK OF ATTRACTIVENESS OF E-CIGARETTES TO NON-SMOKING TEENS AND ADULTS

Two recently published studies conducted by public health non-profits – one in the United States and the other in the United Kingdom – show that teens are very aware of e-cigarettes, but researchers were unable to find even a single non-smoking teen who had taken them up. One study published online in the *Journal of Environmental and Public Health* and co-authored by Dr. Jonathan Winickoff, chairman of the American Academy of Pediatrics' Tobacco Consortium, was able to find only six nonsmokers who had ever used e-cigarettes in a national survey of 3,240 adults, including 1,802 non-smokers.[18]

A second study from Action on Smoking and Health (ASH-UK) also contradicts the anti-smoking groups' contention that electronic cigarettes appeal to nonsmokers, especially youth. ASH-UK were unable to find a single nonsmoker in Great Britain – either youth or adult – who regularly uses electronic cigarettes.[19] The group's study was based on a survey of 12,171 adults and 2,178 children ages 11-18 in February and March of 2013.

The ASH-UK study found awareness of electronic cigarettes was 67% among those between the ages of 11 and 18 and 83% among those between the ages of 16 and 18. Nevertheless, it found that among young people who had never smoked, "0% report continued e-cigarette use and 0% expect to try an e-cigarette soon." The study also found that, among adults who had never smoked, none reported current electronic cigarette use.[20]

17. Michael Siegel, "Anti-Smoking Researcher Misleads Public with Invalid Comparison of E-Cigs and Nicotine Inhaler: Correct Analysis Shows that Nicotine Inhalers Have Higher Amounts of Six Carcinogens," *Tobacco Analysis*, July 25, 2013. www.tobaccoanalysis.blogspot.com/2013/07/anti-smoking-researcher-misleads-public.html

18. Robert McMillen, Jeomi Maduka and Jonathan Winickoff, "Use of Emerging Tobacco Products in the United States," *Journal of Environmental and Public Health*, March 2012 www.hindawi.com/journals/jeph/2012/989474/

19. Action on Smoking and Health, "Use of e-cigarettes in Great Britain among adults and young people," May 2013. http://ash.org.uk/files/documents/ASH_891.pdf

20. Ibid.

In early September 2013, CDC published a study showing that e-cigarette use among middle and high school students had doubled from 2011 to 2012.[21] In response to these data, CDC Director Dr. Thomas Frieden proclaimed:

> "The increased use of e-cigarettes by teens is deeply troubling…Many teens who start with e-cigarettes may be condemned to struggling with a lifelong addiction to nicotine and conventional cigarettes."

As an independent public health physician, I am troubled by this statement, because a careful reading of the CDC study and review of the data presented leads to a very different conclusion. The approximate doubling in use of e-cigarettes by teens is exactly the same increase shown in overall e-cigarette sales. Other data in the CDC report show the vast majority of such use was in teen smokers, not teen non-smokers. No CDC data was presented on daily use of either cigarettes or e-cigarettes. The fact that the increase in use by teens was no greater than the increase in use by adults suggests that, if any teens are being addicted to nicotine through e-cigarettes, that number is exceedingly small. No data was presented suggesting that teens starting with e-cigarettes had transitioned to tobacco cigarettes. Thus, the CDC data are fully consistent with the results of the other two recent surveys, referenced above.

These surveys show that the currently unregulated e-cigarettes attract almost no non-smokers. This, in turn, suggests that it should be possible to endorse these products to smokers without fear that large numbers of teen and other non-smokers will be attracted by such endorsement.

CONSUMPTION OF CIGARETTES BY MENTAL HEALTH PATIENTS

Adults who suffer from depression are twice as likely to smoke and also smoke more heavily than other adults, according to a survey from the National Center for Health Statistics.[22] Persons with a mental disorder in the month prior to a national comorbidity survey consumed approximately 44.3% of the cigarettes smoked by this nationally representative sample.[23]

Anecdotal reports indicate that depressed patients and those with bipolar disorder and/or schizophrenia find nicotine to

21. Centers for Disease Control and Prevention, "Notes from the Field: Electronic Cigarette Use Among Middle and High School Students — United States, 2011–2012," Sept. 6, 2013. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6235a6.htm

22. Phys.org, "Depressed adults smoke more: study," April 14, 2010. http://phys.org/print190471659.html

23. Karen Lasser et al, "Smoking and mental illness: A population-based prevalence study," Journal of the American Medical Association, Nov. 22, 2000. http://www.ncbi.nlm.nih.gov/pubmed/11086367

be a highly beneficial drug that enables them to get through the day in emotional balance and with substantially fewer side effects that usually prescribed medications. The reports noted above and these anecdotal observations clearly indicate that nicotine is beneficial for a significant portion of the population, and that total elimination of non-prescription nicotine, as desired by many anti-tobacco advocates would be harmful to these mental health patients.

CONCLUSION

Experience to date with e-cigarettes, now well documented in the scientific literature, suggests that they already secure substantial public health benefits among current smokers without increasing teen initiation of tobacco/nicotine use. The continuing condemnation of e-cigarettes by many tobacco control advocates suggests they simply are not familiar with the evidence in favor of public health endorsement of e-cigarettes as a harm reduction modality. One hopes that skillfully crafted FDA regulation to assure the quality of manufacture and restrict marketing to teens will facilitate capture of the public health benefits e-cigarettes can offer to smokers without increasing teen initiation of tobacco/nicotine use. This paper is intended to bring the scientific literature in favor of promoting e-cigarettes as a tobacco harm reduction modality to the attention of tobacco control advocates.

INTRODUCTION TO DR. NITZKIN AND DISCLAIMER

Dr. Joel L. Nitzkin is senior fellow in tobacco policy for the R Street Institute. Dr. Nitzkin is a public health physician, board certified in preventive medicine as his medical specialty. He has been a local health director, a state health director and president of two national public health organizations.

Since the mid-1990s, Dr. Nitzkin has been in the private practice of public health as a health policy consultant. In this capacity, he has taken on a number of research and teaching assignments for federal, state and local public health agencies; assisted with accreditation of a managed care organization; and done substantial expert witness work related to communicable disease control, quality of health care, and tobacco control.

In 2007, while serving as co-chair of the Tobacco Control Task Force of the American Association of Public Health Physicians, Dr. Nitzkin played a lead role in exploring policy options for reducing tobacco-attributable illness, death and property damage in the United States. It was this effort that focused his attention on tobacco harm reduction as a potential life-saving measure and on other problematic aspects of current American tobacco control policy.

The views expressed in this policy study are entirely those of Dr. Nitzkin. They do not reflect position statements formally adopted by AAPHP, R Street or any other organization he is affiliated with. Dr. Nitzkin has never received financial support from any tobacco, e-cigarette or pharmaceutical enterprise. His affiliation with R Street is based on shared concerns about the direction of federal tobacco policy since adoption of the FDA tobacco law. R Street Institute is a Washington-DC based think tank that respects the role of government in regulating industry to protect health and the environment, but strongly opposes undue governmental interference with market forces. R Street designated tobacco harm reduction as one of their priority issues after FDA attempted to remove e-cigarettes from the market by declaring them to be an unapproved drug-device combination subject to the provisions of the drug law.

Additional bibliographic references dealing with these and other issues are available on request from Dr. Nitzkin at jln@jln-md.com .