

ANALYSIS

ESSAY

E-cigarettes: the best and the worst case scenarios for public health—an essay by Simon Chapman

Considerable energy is going into envisioning the likely benefits and harms of the proliferation of e-cigarettes, the use of which is growing exponentially in some countries. **Simon Chapman** reflects on two possible long term patterns of use and argues that we must not repeat the mistakes with the way in which tobacco was sold and marketed

Simon Chapman *professor of public health*

School of Public Health, University of Sydney 2006, Australia

The World Health Organization's recent report on electronic nicotine delivery systems repeatedly notes the poverty of evidence to guide policy. It recommends that governments regulate the products, their promotion, and where they can be used in public as well as supporting research into their safety and efficacy in smoking cessation.^{1 2} The report is due for consideration at the sixth conference of the parties to the WHO Framework Convention on Tobacco Control, which will be held on 13-18 October 2014 in Moscow.

In this essay, I consider the best and worst case scenarios for e-cigarettes; claims that they assist in smoking cessation and their value if users continue to smoke; and, finally, the tobacco industry's interests in these products.

Best case scenario

The best outcome with e-cigarettes would be a massive, rapid migration of smokers into vaping, akin to the magnitude of the replacement of film by digital cameras. Unparalleled declines in diseases caused by smoking would occur, starting with cardiovascular and respiratory diseases and followed years later by cancers caused by smoking. Overwhelmingly, vapers would be smokers whose principal motivation was smoking cessation. Although some might vape and smoke ("dual users") temporarily, nearly all would completely quit smoking.

Uptake of vaping among former smokers and never smoking children would be extremely low, and longitudinal studies of children who started vaping would show negligible transition to smoking. Like adults, children would use e-cigarettes as a gateway out of smoking, not into it.

Continuing research would affirm that direct and secondhand vape was inconsequential to any health outcome, despite the particle sizes of vape being comparable with those in cigarette smoke.³ Public awareness of this would reduce antipathy to

vaping in enclosed areas, and vapers would feel less antisocial and welcomed into areas from which smoking is exiled.

The tobacco industry, seeing its tobacco sales in free fall, would divest itself of smoked tobacco products and drop all global opposition to effective tobacco control, such as standardised packs and tax rises.

As rates of smoking disease plummet the inventors of e-cigarettes would share the Nobel prize for medicine. The history of tobacco control would have a final chapter on the triumph of harm reduction and the role of innovation. E-cigarettes would have made smoking history.

Worst case scenario

The story could, however, be very different. Under the worst case scenario global uptake of e-cigarettes would be on the scale of cell phones. Most smokers would switch, but many who would never have smoked—including children—would start vaping, attracted by its coolness and "no risk" hype and then maintained by nicotine dependency.

However, to the delight of the tobacco industry the long decline in the number of smokers would stall because most vapers would also keep smoking. Many smokers would prevaricate, convinced that reducing rather than quitting was good enough. The number quitting would be eclipsed by those taking up vaping who had never smoked. Substantial proportions of non-smoking vapers, particularly young people, would drift into smoking. They might find the rigmarole of buying and refilling capsules inconvenient, or simply be curious about how smoking compared. Many would find the nicotine jolt from cigarettes more satisfying than e-cigarettes.⁴ The net impact would be an increase in smoking prevalence or a slowing of its decline.

Following emerging evidence about angiogenesis and apoptosis,^{3,5} the International Agency for Research in Cancer's recent decision to give priority to examining the role of nicotine in cancer⁶ would produce consensus that it is far from being "as safe as coffee," as e-cigarette advocates had been advising.

Longitudinal studies would show that daily lung basting with the nicotine and fine particles⁷ in vapour—averaging 150 puffs a day (around 55 000 a year)⁸—over many years is far from benign, but by then the imagined benevolent harm reducing genie would be well out of the bottle, strongly resisting being returned.

Governments would have allowed e-cigarette advertising, reprising the same themes used to promote cigarettes. The public smoking "performance" would be fully resocialised, signifying all that smoking did 50 years ago: elegance, sexuality, modernity, freedom. A teenager without a highly personalised e-cigarette would be semiotically naked.

All smoke-free areas would allow vaping, but emerging evidence about harms⁹ would meet the decades long resistance and "smokers'/vapers' rights" arguments fought over cigarette smoke.¹⁰

Public health experts who threw all caution to the wind, and vilified those who wanted good evidence to lead policy, would be written into public health history as overly excitable, amnesic, or myopic quislings, willingly or unwittingly orchestrated by commercial interests.

Cessation

So where do we stand today? The central platforms of the promise of e-cigarettes are smoking cessation and harm reduction via the seemingly undeniable logic of "every cigarette forgone to vaping is harm reducing."

Vapers' chat rooms brim with jubilant testimony about permanent quitting. That is undeniably good news for those who have quit. But claims about stratospheric rates of smoking cessation from such communities¹¹ are valueless in estimating potential population cessation impacts across all e-cigarette users, for the same reason we would never use data from whisky appreciation societies to generalise about national Scotch consumption.

The most important data on outcomes from "real world" population cessation are from England.¹² Twenty per cent of those attempting to quit with e-cigarettes in the past year were not smoking on the day they were questioned, compared with 15.4% of those who attempted to quit unassisted and 10.1% of those who used over the counter nicotine replacement therapy. Substantial relapse would be expected from all of these groups. An 80% failure rate with relapse to follow, is a long way from the miracle cure currently being hyped.

Reduced use

There is strong evidence for a causal association between disease and early uptake, amount smoked, and duration of smoking, but the evidence on "reverse engineering" harm by continuing to smoke while cutting back is far from strong. A 2007 systematic review¹³ examining the health effects of reducing smoking by more than half found only "small health benefit." Since then, four cohorts¹⁴⁻¹⁶ of a total of 535 620 people followed for up to 25 years have reported findings such as, "no evidence that smokers who cut down their daily cigarette consumption by >50% reduce their risk of premature death significantly."¹⁶ The largest, from Korea,¹⁴ found no association between smoking

reduction and all cancer risk but a significant decrease in risk of lung cancer, with the size of risk reduction "disproportionately smaller than expected."

The impact of any smoking cessation policy or strategy is a function of its effectiveness multiplied by its reach. So here, there is cause for some optimism. The rapid growth in e-cigarette use in some nations, despite the modest early results on quitting may nonetheless translate into a large number of ex-smokers across the population who attribute their quitting to e-cigarettes. But that would be only part of the story. What proportion of these quitters would have stopped anyway had e-cigarettes been unavailable? Would we just be seeing substitution of cessation methods? Would the overall cessation volume rise? How many vapers who did not quit and became dual users might have prevaricated and kept smoking because they vaped?

Why are tobacco companies investing in e-cigarettes?

All tobacco transnationals have now acquired e-cigarettes lines. Tellingly, no company has stated that it is actively working to decrease cigarette sales or desisted from aggressively opposing effective tobacco control policy.

Only the most naive or captured advocates for vaping could fail to acknowledge that the tobacco industry wants people who vape to smoke and vape, not vape instead of smoking. To the credit of some advocates, nascent policy proposals to accelerate the decline of smoking and calls for governments to set dates for combustible tobacco to be "phased out" have been made. But to date, no government has even gestured serious intent about this.

Big tobacco is already buying out e-cigarette minnows and shutting out competition through patent law actions. Here it is following its global playbook in buying up almost all small national tobacco companies. Many e-cigarette start-ups may be salivating at the prospect of getting rich quickly, but what will be the public health outcome of this entirely predictable momentum?

Big tobacco thinks all its Christmases have come at once. E-cigarettes will allow companies to profit from nicotine addiction around the clock: in places where you cannot smoke, you may be able to vape if WHO's recommendations are ignored. E-cigarettes can also offer a cornucopia of child friendly flavours familiar at pre-schoolers' birthday parties. With e-cigarette advertising awash across all media, those arguing that there will be no major collateral benefits for tobacco companies via smoking are myopic.

E-cigarettes also promise hope of new respectability to tobacco companies. The same tobacco company staff who scheme to attack effective tobacco control and bust open low income, high illiteracy markets¹⁷ with cigarette promotions, suddenly have opportunities to present themselves as the harm reducing solution to the "terrible" health problems that arise because of their work.

Disturbingly, some experienced in tobacco control are now aggressively advocating the importance of freely advertising e-cigarettes to promote wider uptake. For decades the tobacco industry maintained the public farce that they had no interest in children smoking and that their advertising was crafted to attract only smokers, with some magic barrier preventing it from attracting the attention of non-smokers and especially children. Privately, they of course understood completely that, "The base of our business is the high school student"¹⁸ and that voluntary

controls were, “A phony way to show sincerity, as we all well know.”¹⁹

Yet today, some public health advocates of e-cigarettes blindly insist that the deluge of advertising will have zero effect on non-smoking teenagers and is not “intended” to catch their interest. Big tobacco must find it hard to believe its luck that it has such people on tap to make these arguments for them. In Utah, the state with the lowest tobacco use in the US, the department of health reports that use of e-cigarettes in high school students has tripled since 2011. Seven per cent of grade 10 students were current users. Nearly one third of these reported that they had never smoked cigarettes.²⁰

Nations with advanced tobacco control programmes have achieved all time lows with youth smoking. In Australia today only 3.4% of 12-17 year olds smoke daily.²¹ This reduction is slowly starving the tobacco industry. But in the name of accommodating the pleas of often exaggerated claims about the size of the smoking population who “cannot” quit, some policy approaches to e-cigarettes risk placing these invaluable, hard won gains at risk.

Smokers desperate to quit should be able to access e-cigarettes at pharmacies, perhaps with a permit or prescription. Nearly every nation has such a system of controlled access to drugs with abuse or dependency potential. Only two countries, the US and New Zealand, allow direct to consumer advertising of prescribed or restricted drugs. Only people with commercial interests and extremist advocates argue that it is a sensible idea to attract children into addiction.

Scheduling e-cigarettes would allow them to be overseen for quality and safety, carefully monitored through research, with their availability relaxed or tightened on the basis of evidence or benefits or harms. Every imaginable mistake was made with the way tobacco was sold and marketed. Early caution is critical if we are not to repeat those mistakes with a product that so far has an unimpressive record in doing what its advocates claim for it and which threatens to renormalise the smoking performance and possibly hold many smokers longer in their addiction. WHO is to be commended for its caution.

Competing interests: I have read and understood BMJ policy on declaration of interests and have no relevant interests to declare.

Provenance and peer review: Commissioned; not externally peer reviewed.

- 1 World Health Organization Conference of the Parties to the WHO Framework Convention on Tobacco Control. Electronic nicotine delivery systems. Sixth Session, Moscow 13-18 October 2014, Provisional agenda item 4.4.2. http://apps.who.int/gb/ctc/PDF/cop6/FCTC_COP6_10-en.pdf.
- 2 Iacobucci G. WHO calls for ban on e-cigarette use indoors. *BMJ* 2014;349:g5335.
- 3 Grando SA. Connections of nicotine to cancer. *Nature Rev* 2014;14:419-29.
- 4 Martinez-Sanchez JM, Balbe M, Fu M, Martin-Sanchez JC, Salto E, Gottlieb M, et al. Electronic cigarette use among adult population: a cross-sectional study in Barcelona, Spain (2013-2014). *BMJ Open* 2014;4:e005894.
- 5 Cardinale A, Nastrucci C, Cesario A, Russo P. Nicotine: specific role in angiogenesis, proliferation and apoptosis. *Crit Rev Toxicol* 2012;42:68-89.
- 6 Straif K, Loomis D, Guyton K, Grosse Y, Lauby-Secretan B, El Ghissassi F, et al. Future priorities for the IARC Monographs. *Lancet Oncol* 2014;15:683-4.
- 7 Fuoco FC, Buonanno G, Stabile L, Vigo P. Influential parameters on particle concentration and size distribution in the mainstream of e-cigarettes. *Environ Pollut* 2014;184:523-9.
- 8 Etter JF, Bullen C. A longitudinal study of electronic cigarette users. *Addict Behav* 2014;39:491-4.
- 9 Schober W, Szendrei K, Matzen W, Osiander-Fuchs H, Heitmann D, Schettgen T, et al. Use of electronic cigarettes (e-cigarettes) impairs indoor air quality and increases FeNO levels of e-cigarette consumers. *Int J Hyg Environ Health* 2014;217:628-37.
- 10 Champion D, Chapman S. Framing pub smoking bans: an analysis of Australian print news media coverage, March 1996-March 2003. *J Epidemiol Community Health* 2005;59:679-84.
- 11 Farsalinos KE, Romagna G, Tsiapras D, Kyrzopoulos S, Voudris V. Characteristics, perceived side effects and benefits of electronic cigarette use: a worldwide survey of more than 19,000 consumers. *Int J Environ Res Pub Health* 2014;11:4356-73.
- 12 Brown J, Beard E, Kotz D, Michie S, West R. Real-world effectiveness of e-cigarettes when used to aid smoking cessation: a cross-sectional population study. *Addiction* 2014;109:1531-40.
- 13 Pisinger C, Godtfredsen NS. Is there a health benefit of reduced tobacco consumption? A systematic review. *Nicotine Tob Res* 2007;9:631-46.
- 14 Song YM, Sung J, Cho HJ. Reduction and cessation of cigarette smoking and risk of cancer: a cohort study of Korean men. *J Clin Oncol* 2008;26:5101-6.
- 15 Hart C, Gruer L, Bauld L. Does smoking reduction in midlife reduce mortality risk? Results of 2 long-term prospective cohort studies of men and women in Scotland. *Am J Epidemiol* 2013;178:770-9.
- 16 Tverdal A, Bjartveit K. Health consequences of reduced daily cigarette consumption. *Tob Contr* 2006;15:472-80.
- 17 Agaku IT, Filippidis FT. Prevalence, determinants and impact of unawareness about the health consequences of tobacco use among 17 929 school personnel in 29 African countries. *BMJ Open* 2014;8:e005837.
- 18 Achey TL. Lorillard research. 1978. <http://legacy.library.ucsf.edu/tid/gqs84a00/pdf>.
- 19 Knight J, Chapman S. “A phony way to show sincerity, as we all well know”: tobacco industry lobbying against tobacco control in Hong Kong. *Tob Contr* 2004;13(suppl 2):13-21.
- 20 Utah Department of Health. Electronic cigarette use among Utah students (grades 8, 10, and 12) and adults. 2013. http://health.utah.gov/opa/publications/hsu/1312_ECig.pdf.
- 21 Australian Institute of Health and Welfare. NDSHS 2013 data and references. Supplementary tables. 2014. www.aihw.gov.au/alcohol-and-other-drugs/ndshs/2013/data-and-references/.

Cite this as: *BMJ* 2014;349:g5512

© BMJ Publishing Group Ltd 2014

Simon Chapman is professor of public health at the University of Sydney. He was inaugural deputy editor, then editor of *Tobacco Control* for 17 years and is now emeritus editor. In 2003 he was awarded the American Cancer Society's Luther Terry Medal for outstanding individual leadership in tobacco control and in 2013 made an officer in the Order of Australia for his contributions to public health.