E-cigarettes provide vapers with nicotine: Is this THE PROBLEM?

Peter Hajek
Declaration of interest

- I have no links with any e-cigarette (EC) manufacturers

- My research into safety and effects of EC is funded by National Institute of Health Research, UK Centre for Tobacco and Alcohol Studies and UK Medicines Regulatory Agency
Current paradox

- Even the hard-core anti-EC activists agree that smoking kills and that EC are much safer.
- Yet they want EC banned or suppressed.
- Stopping smokers from switching seems price worth paying - for what?
Some tentative observations on the anti-EC sentiment

- Sees the main goals of ‘tobacco control’ 1. to fight the tobacco industry and 2. to eradicate nicotine use
- Preventing smoking-related disease (goal 3.) is also important, but less than 1+2
- No involvement with smoking cessation or relevant research
- Without EC, all three goals achieved in a few decades. EC take care only of 3. and threatens the two key priorities
Concerns about nicotine

- Poisonous
- Addictive
- Damages adolescent brain
Toxicity of nicotine and e-liquid

- Common claim: 30-60mg lethal if ingested
- Traced to 19th century made-up figure*
- Suicide attempts by up to 1,500 mg in e-liquid: ‘Voluminous vomiting’ and full recovery in a few hours
- Nicotine from tobacco, NRT and e-liquids: Millions exposed, fatal poisonings extremely rare

* Mayer, Arch Toxicol 2014
Addictiveness of nicotine and EC

- Cigarettes are highly addictive to non-smokers, BUT
- Hard to get animals to self-administer nicotine on its own (unlike cocaine, heroin and alcohol)
- Not addictive in NRT – never-smokers are not becoming daily users
- Not addictive in EC (so far) – never-smokers are not becoming daily vapers
What about research showing a huge upsurge in youth vaping???

- As EC use spreads, more non-smokers try vaping
- This gets misreported as regular use
How the trick is done (in US surveys)

- Did you ever use an EC = USER
- Have you used EC on at least one of the past 30 days; In the past 30 days did you use an e-cigarette = CURRENT USER
- ‘Smoker’ and ‘Current smoker’ normally mean someone who smokes daily
- ‘EC user’ and ‘Current EC user’ imply the same, but mark people who tried EC once
Informative questions (UK surveys)

- If Yes to Have you ever tried an EC?
- How often if at all, do you currently use an EC?
  - Daily
  - Less than daily, but at least once a week
  - Less than weekly, but at least once a month
  - Less than monthly
  - Not at all
ASH survey of 11-18 year olds, March 2015

- Of those who tried EC, 81% tried only once or twice; those who vaped more often were nearly all smokers

- HBSC and CHETS surveys in Wales (2015): Same results


- EC dependence potential is currently very low, but it may not remain so, vigilance is needed
Nicotine and adolescent brain

- Animal studies - brain damage from early and high nicotine dosing. Relevance to smoking unclear
- Earlier initiation of smoking linked to heavier smoking and less quitting, could be causal
- Limit access to nicotine in adolescence
EC is protective? US National Youth Survey 2011-2014

Percentage of high school students who used EC, hookah and cigarettes in the past 30 days.

Ever tried cigarettes:
2011 – 29%
2012 – 26%
2013 – 25%
2014 – 22%
Concern that dual users increase toxin/nicotine intake

- 40 smokers wanting to quit
- At baseline urine samples for 3-HPMA (metabolite of acrolein), cotinine and CO
- Given a cig-a-like EC (2.4% nicotine)
- Followed up at 4 weeks, tests repeated
- 6 dropped out, 16 abstinent; 18 ‘dual users’

Smokers using EC for 4 weeks and abstinent from smoking
Smokers using EC for 4 weeks and still smoking (dual users)
Passive vaping?

- Unlike smoking, exhaled vapour does not expose bystanders to carbonyls or phenolics (Long 2014) or volatile compounds (Marco 2015).

- Particulates: smoker’s home=576 PM2.5; vaper’s=10; smoke/vape free homes=10 (Fernandes 2015).

- Negligible nicotine on surfaces (Goniewitz 2014), a baby would need to lick 30m² of floor to ingest 1mg of nicotine.
EC and nicotine delivery
Nicotine in e-liquids

- Poor labelling poses little risk to users; labelling accuracy now mostly acceptable
- From consumers’ perspective, a general indication of e-liquids strength (mild, moderate, strong) provides sufficient information
- DIY liquid for dilution (150mg/ml) may become an issue with illogical EU ruling
Liquid strength is much less important than the device

- Correlation between nicotine in e-liquid and in vapour: $r=0.06$, $p=0.92$
- Reasonable consistency across batches

Goniewicz, Hajek, McRobbie, Addiction 2013
New vapers improve somewhat with practice

- PK data on first use (G1 product) and after 4 weeks of use (N=6)
- 24% increase in peak nicotine (4.6 to 5.7 ng/ml; NS), overall AUC intake increase p < .05

Hajek et al. Nicotine and Tobacco Research 2015,
Second generation e-cigs provide nicotine faster and at higher levels

Experienced vapers get close to smoking levels

- 8 experienced vapers abstained overnight (7 used tank)
- Smoked 10 puffs over 5 minutes and then an hour of ad-lib vaping

Vansickle & Eissenberg Nicotine & Tobacco Research 2013
How quick is the absorption?

- **Own brand cigarette**
- **Own brand EC**
- **EC 1 (18mg)**
- **EC 2 (20mg)**
- **EC 3 (4.8%)**
- **EC 4 (16.8mg)**
Future of nicotine

- Re-normalisation of smoking is a bogus concern, but re-normalisation of nicotine use is a possibility
- If EC get better in ticking the right boxes for smokers, they may start attracting non-smokers too
- The overall use of nicotine may not increase much (as with snus), but it could
The nicotine/cigarette market

The cigarette and nicotine market are both declining

N=78696 adults

Nicotine data only from last year smokers
nondaily nicotine: <1 pw=0.1, 1+ pw=0.5

Daily smoking and snus use in men aged 35-44, Sweden

Statistics Sweden/SCENIHR 2008
A cautionary tale
Swedish snus
Proof of concept

- Swedish Snus was banned in Europe in 1992 on the same pre-cautionary principles invoked for EC regulation (dangers of nicotine, gateway to smoking, residual risk)

- Allowed in Sweden, enabling a natural experiment
Current smokers, European Union, 2012
Eurobarometer 385, 2012

Prevalence (%)
Respiratory cancers in men aged 45-64, EU 2001-3, Eurostat 2006

Deaths per 100,000
What does it mean?

- If snus not banned and only 50% of Swedish adoption rate: >20,000 lung cancers per year would be avoided, plus a big chunk of other smoking related diseases
- Despite this, the ban was renewed in 2014!
- People responsible for the ban should be held accountable for avoidable deaths
- The same group imposed the damaging EC regulation to start in 2016
Summary

- Anti-EC activists are concerned that use of nicotine has been declining and EC may re-introduce it.
- The issue should be discussed honestly, without misleading smokers and regulators with bogus concerns and misinterpretation of evidence.
- The snus story shows how ideology can damage public health.