Electronic Cigarettes: What are they and are they effective?

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Disclosures

**E-cigarette Industry:**
- Undertaken research for e-cigarette companies
- Received products for research purposes
- Received funding for speaking at research conferences

**Tobacco Industry:**
- No funding received
- No conflict of interest

**Pharmaceutical Industry:**
- No funding received
- No conflict of interest
E-Cigarettes (ECs): What are they?
First Generation ECs ('cigalikes')

- Disposable
- Re-chargeable with pre-filled cartridges
Second Generation ECs

- Refillable with liquids
Third Generation ECs (‘mods’)
The Liquid

Contents

• Propylene glycol and/or Vegetable glycerine (glycerol)
• Nicotine (in mg/ml; ranging from 0-36)
• Flavourings (e.g. tobacco, mint, fruit)
• Additives
History

• Introduced into Chinese market in 2004 and Europe in 2006 (Ruyan)

• Rapidly growing market:
  – EC use in smokers in UK increased from 2.7% in 2010 to 6.7% in 2012 (Dockrell et al., 2013)
  – Estimated 1.3m current EC users in the UK (ASH, June 2013)

• Production mainly in China but increasing in EU and US.
Who Uses Them?
Findings from representative samples of the general population:

- Proportion of EC users: 2 to 8 times higher in current smokers than in former smokers
- Little evidence of use in never smokers (0.5% tried ECs)
- Compared with non-users, EC users tended to be:
  - Younger
  - Better educated
  - Higher income
  - No clear association with gender

Sources:
Patterns of use in regular users

<table>
<thead>
<tr>
<th>Product type</th>
<th>%</th>
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<tbody>
<tr>
<td>‘Cigarette-like’</td>
<td>18</td>
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<tr>
<td>‘Second generation’</td>
<td>72</td>
</tr>
<tr>
<td>‘Mods’</td>
<td>9</td>
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<table>
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<tr>
<th>Strengths used</th>
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<tbody>
<tr>
<td>18mg/ml</td>
<td>49</td>
</tr>
<tr>
<td>11mg/ml</td>
<td>33</td>
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<tr>
<td>combine strengths</td>
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</tr>
<tr>
<td>0 mg/ml only</td>
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<table>
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<tr>
<th>Preferred flavour</th>
<th>%</th>
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<tbody>
<tr>
<td>Tobacco</td>
<td>53</td>
</tr>
<tr>
<td>Fruit</td>
<td>33</td>
</tr>
<tr>
<td>Mint/menthol</td>
<td>28</td>
</tr>
</tbody>
</table>

Average duration: 10 months

From Dawkins et al. (2013) *Addiction*
E-Cigarettes: Are they effective?

- For tobacco craving
- For nicotine delivery
- For smoking cessation
Effects on Tobacco Craving

- ECs can reduce craving in deprived smokers but not as effectively as tobacco cigarette (Bullen et al., 2010; Vansickel et al., 2010)

- Placebo (0mg/ml) EC also associated with decline in craving after 5 mins and...

- Further reduction in craving with nicotine EC after 20 mins (Dawkins et al., 2012)
Nicotine Delivery in Naive EC Users

• Bullen et al. (2010):
  – Compared the 0mg, 16mg (Ruyan) EC with nicorette inhalator and tobacco smoking
  – EC reached max blood level of 1.3ng/ml in 20 mins

• Eissenberg (2010):
  – Compared 2 brands of 16mg ECs to tobacco smoking
  – Only tobacco smoking raised blood nicotine levels

• Ineffective vaping in naive users
• Ineffective first generation devices?
Nicotine Delivery: Experienced EC users using their own devices

Effective nicotine delivery in 8 experienced ‘vapers’ using 2\textsuperscript{nd} generation devices

From Vansickel & Eissenberg, (2013)
Nicotine Delivery in regular users

Effective nicotine delivery with ‘cigalike’ cartomizer device in 14 regular users

From Dawkins & Corcoran (2013)
Surveys of EC users

Approx. 15 surveys report high quit rates e.g.:

• 74% reported not smoking for at least a few weeks since starting to use the EC
• 14% dramatically reduced their cigarette consumption
  (Dawkins et al., 2013)

• 92%: EC helped to reduce my smoking
• 96% (ex-smokers): EC helped me to stop smoking
  (Etter & Bullen, 2011)

• Non-representative samples = over-estimates of quit rates
Effects of ECs on smoking behaviour

• **Survey of smokers who had purchased an EC:**
  – 31% abstinent from smoking at 6 months
  – Those using EC > 20x/day: quit rate 70%

• **Study of 40 smokers not willing to quit**
  – 6 months smoking abstinence or 50% reduction shown in 55%

Sources: Siegel et al. (2011); Polosa et al. (2011):
Randomised Controlled Trials

• ‘Categoria’ 7.2mg nicotine EC vs. 4.8mg nicotine EC vs. no nicotine EC
  • 300 smokers (unwilling to quit)
  • 1 year abstinence rates: 13%, 9% and 4%
  (Caponnetto et al. 2013)

• ‘Elusion’ 16mg nicotine EC vs. nicotine patch vs. no nicotine EC
  • 657 participants
  • 6 month abstinence rates: 7.3%, 5.8% and 4.1%
  (Bullen et al. 2013)
Summary:

• ECs deliver nicotine via inhaled vapour
• Used by smokers wanting to quit/replace or reduce tobacco smoking
• And with increasing popularity
• Moderately effective at alleviating tobacco craving...
• And can effectively deliver nicotine (at least in habitual users)
• RCTs suggest cessation rates at least comparable with NRT....
• But as yet no RCTs on non-‘cigalike’ devices.