

Absolute and relative risks of electronic cigarettes

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Work of the COT on e-cigarettes

- The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) recently reviewed the absolute and relative risks to human health from chemicals alone and in combination present in, and formed during the use of, ENDS (e-cigarettes)
- This work was initiated following an horizon scanning exercise in Feb 2016 and was at the request of the Department of Health and Social Care (DHSC) and Public Health England (PHE)
- THE COT published a statement summarising its conclusions in July 2020 (<https://cot.food.gov.uk/sites/default/files/2020-09/COT%20E%28N%29NDS%20statement%202020-04.pdf>)
- The work of the COT will contribute to PHE's review of the evidence for the role of ENDS in public health
- I chair the COT, but whilst this presentation has been informed by the work of the Committee, the views expressed are my own and do not necessarily reflect those of the COT

Electronic nicotine delivery systems (ENDS) or e-cigarettes



Pascal Le Segretain | Getty Images



Reuters | Mark Blinch

The risk of Coronary Heart Disease is reduced by 50% after 1 year of smoking abstinence

Stopping smoking reduces the risk of fatal heart and lung diseases

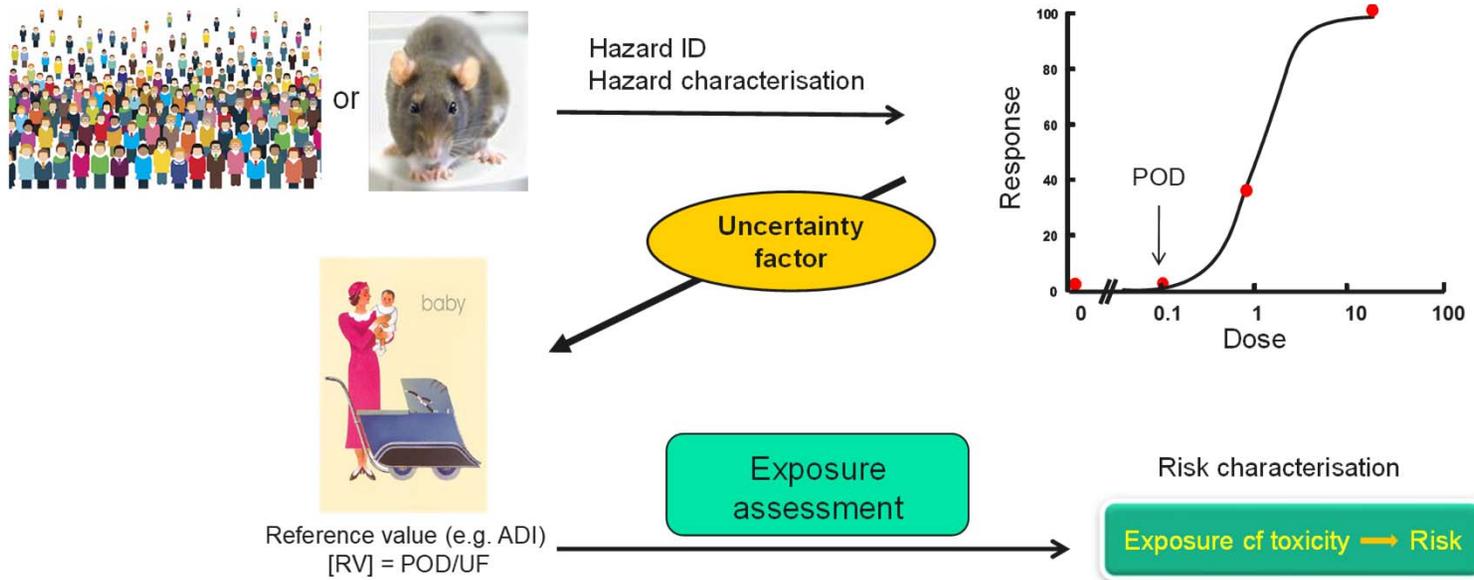
Toxicological concerns

- Potential adverse health effects of acute (one off) and chronic (regular/daily) exposure in:
 - Users of conventional cigarettes who switch to ENDS
 - Non-smokers who take up ENDS
 - Bystanders
- Specific sub-populations who may be at increased risk
 - Teenagers (≤ 18 years old)
 - Infants and young children
 - Pregnant women (possible exposure of fetus)
 - Allergic subjects
 - Pre-existing disease e.g. asthma

Toxicological database

- Experimental studies
 - Nature of test material
 - Are users/bystanders exposed to the substance being tested
 - How does the dose/concentration relate to ENDS users/bystanders
 - Generation of test emissions
 - Duration of exposure
- Human studies
 - Confounding in studies of former smokers
 - Pre-existing effects from smoking
 - Degree of cigarette abstinence
 - Duration of observational and interventional studies

Assessment of absolute and relative risk



- Absolute risk: $RV/Exposure$ or $MOE (POD/Exposure) \geq \text{target value}$
- Relative risk: $Risk_{ENDS}$ cf $Risk_{Conventional\ cigarettes}$

Effects of major chemicals in e-cigarettes

- The liquid in e-cigarettes, propylene glycol and/or vegetable glycerine (glycerol) is relatively non-toxic at the levels present when inhaled over the short to medium term
 - This applies to both absolute and relative risk, in users and in bystanders
 - There is uncertainty about the effects of long-term, repeated exposure in users
- Nicotine has a range of pharmacological effects, including addiction. The CNS effects of nicotine are what can persuade a cigarette smoker to switch
 - Hence relative risk in users switching from conventional cigarettes cf absolute risk in naïve users and bystanders will have different implications for direct impact on human health

Effects of flavourings in e-cigarettes

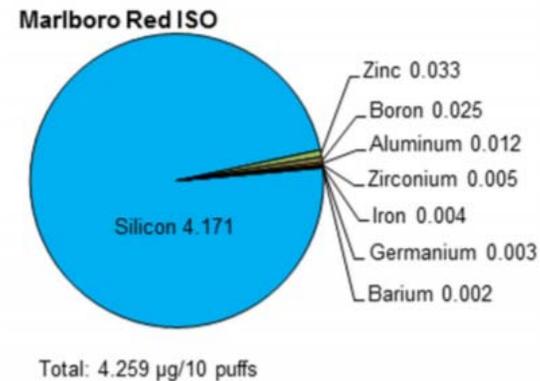
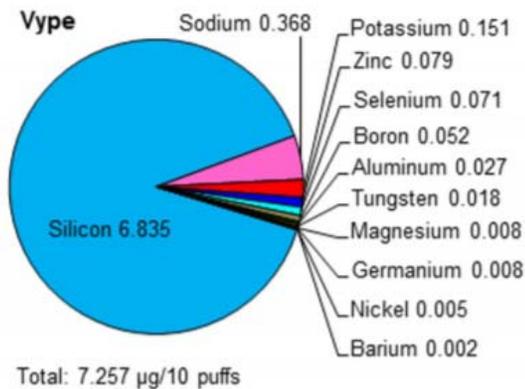
- Many of the most widely used flavourings used in e-cigarettes are also used in food (and some in conventional cigarettes)
- Once in the body, the effects will be the same, concentration for concentration, as when ingested orally
- The exception would be any local effects in the lung
- Evidence to date has not indicated any particular concern, but additional data would be helpful
 - Some flavourings are potential sensitizers, e.g. cinnamaldehyde, but the risk from exposure via e-cigarettes is not known

Flavourings in e-cigarettes – effect of heat

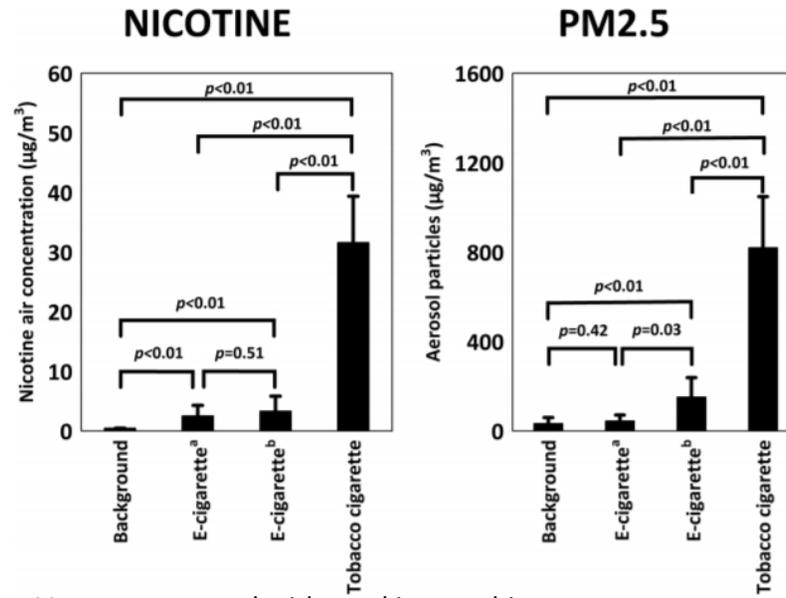
- The process of heating may result in thermal degradation of flavourings
- The extent of degradation is low at normal vaping temperatures
- Many of the heat-generated products will also be found after culinary use, and no adverse effects are observed
 - But some of the products may be volatile, leading to greater exposure on inhalation
- The main difference is the possibility of local effects in the lung
 - Exposures would normally be low and in general adverse effects would not be anticipated

Possible contaminants in e-cigarettes

- The most toxic chemicals found with conventional cigarettes are either not present, or are present at much lower levels in e-cigarettes
 - For example, levels of the tobacco-specific nitrosamine NNK in e-cigarettes are < 0.3% levels with conventional cigarettes
 - Williams et al (2017) analysed for 36 elements in ENDS and conventional cigarettes
 - Mercury was not detected in ENDS. Lead, rubidium, arsenic, silver, cobalt, bismuth, palladium and cadmium were rarely found in ENDS



Indoor air concentrations



^aVapour generated with smoking machine

^bVapour exhaled by users

Czogala et al Nicot
Tob Res. 2014

- The margins of daily exposure to nicotine in bystander adults and children 1-6 years of age range from well below a level of potential concern to up to 5 times a level of protentional concern
 - Some individuals in an environment where there is habitual heavy use of ENDS may be at risk of pharmacological effects of nicotine (e.g. CNS, CV)
- Further work is needed on the nature and effects of PM2.5 emitted from ENDS

Conclusions

- E-cigarettes are not without risks
- The effects of chemicals in e-cigarettes will depend not only on their toxicity but also on the amount present
- The evidence suggests that the risk posed by e-cigarettes to users is substantially less than that posed by conventional cigarettes, but at present we cannot quantify precisely by how much less
 - Any risk reduction will vary with the effect of concern
- Risks to bystanders are low to very low
- The toxicity of ENDS is only one part of the complex risk-benefit assessment necessary to determine their role in public health
- There are a number of data gaps, including long term effects in users