Written evidence submitted by London Southbank University and the University of East London (ECG0018)

This submission is from Dr Lynne Dawkins, Associate Professor, Dr Sharon Cox, Research Fellow, based at the Centre for Addictive Behaviours Research, London South Bank University, and Mrs Catherine Kimber, PhD candidate at the University of East London. Lynne Dawkins has been conducting research on smoking and smoking cessation since 1996 and on electronic cigarettes since 2009. She is an assistant editor for the journal Addiction and has been invited to speak at numerous national and international conferences and meetings on the topic of e-cigarettes. She has published over 30 peer-reviewed papers including twelve on e-cigarettes. Sharon Cox has over ten years’ experience of working in drug and alcohol clinical and academic practice, she was responsible for the day-to-day running of the project which forms the evidence base for this submission. Catherine Kimber has over 4 years of research experience on the use of electronic cigarettes and co-authored 4 peer-reviewed publications on e-cigarette puffing topography. Together, their most recent work on compensatory puffing forms the basis of this submission.

1. Article 20 of the Tobacco Products Directive (EU-TPD) specifies that e-liquids should not contain nicotine in excess of 20 mg/mL. Vapers using higher nicotine e-liquid concentrations have been compelled to switch to lower nicotine concentrations since the introduction of the TPD. This upper limit is arbitrary and is not based on empirical evidence. In fact, it may increase harm if smokers cannot achieve the nicotine delivery they need to suppress cravings for tobacco, which in turn may dis-incentivise switching to electronic cigarettes and expose high nicotine-dependent smokers, willing to switch to e-cigarettes, to greater risks of relapse.

2. We have conducted several studies exploring the puffing patterns and toxicant/carcinogen exposure in vapers using high and low nicotine concentration e-liquid. In our first study (Dawkins, Kimber, Doig, Feyerabend, & Corcoran, 2016) eleven experienced vapers completed 60 minutes of ad libitum vaping under low (6 mg/mL) and high (24 mg/mL) nicotine e-liquid conditions in two separate sessions in a laboratory setting. We measured puff number, puff duration and volume of liquid consumed. Number of puffs was significantly higher, and puff duration significantly longer, in the low compared with the high nicotine concentration condition, resulting in a doubling of e-liquid consumed. Our results suggest that, like tobacco smokers, vapers engage in compensatory puffing when switching to a lower nicotine concentration e-liquid.

3. More recently (Cox et al., 2016; Dawkins et al., manuscript under review) in a CRUK funded study, we have replicated this effect of compensatory puffing in a group of 20 vapers in a real-world setting. Participants increased their daily puff number and puff duration and consumed more liquid a day in the low versus high nicotine condition. This was particularly pronounced when power setting (voltage) was fixed. When changes to power settings were permitted, participants increased the voltage to a greater extent in the low (0.5v) vs. high nicotine (0.3v) condition. Despite the more intensive puffing with the lower nicotine concentration e-liquid, nicotine craving and withdrawal symptoms were higher, and overall satisfaction was lower, in the low nicotine e-liquid condition.

4. Given the overall increase in the amount of e-liquid consumed and the fact that more intensive puffing patterns can lead to over-heating the atomiser coil (Kosmider et al., 2014), resulting in increased production of carcinogens (Kosmider, Kimber, Kurek, Corcoran & Dawkins, 2017); compensatory puffing with lower nicotine concentration e-liquid may increase health risk. In our CRUK study, we also measured urinary levels of formate, a metabolite of the known human carcinogen, formaldehyde. Formate levels were significantly higher when participants used a low nicotine concentration e-liquid, nicotine craving and withdrawal symptoms were higher, and overall satisfaction was lower, in the low nicotine e-liquid condition.

5. In a further study (Kosmider et al., 2017), we replicated the puffing patterns obtained from our participants in the Dawkins et al. (2016) study (described above) using a smoking machine to generate e-cigarette aerosol. Formaldehyde, acetaldehyde and acetone levels were significantly higher in aerosols from the 6mg/mL compared with 24mg/mL puffing regimen. We have observed similar effects based on our real-world puffing patterns from the 20 vapers in the CRUK-funded study (manuscript in preparation).

6. Together, these findings suggest that, when vapers switch to a lower nicotine concentration e-liquid, they engage in compensatory puffing behaviour, taking more puffs per day and increasing their puff duration. This, in turn is associated with higher levels of carbonyls (formaldehyde, acetaldehyde...
and acetone). Over time, the trend among vapers has been to switch to lower nicotine concentrations - this may be due to the EU-TPD implementation, personal choice or concerns over the addictiveness of nicotine. However, our data suggest that reducing nicotine content in e-liquid may not have the desired harm-minimisation effect. The cap on nicotine concentration at 20 mg/mL set by the EU-TPD may therefore have the unintended consequence of encouraging use of lower nicotine concentration e-liquid in turn, increasing exposure to carbonyl compounds through compensatory puffing. It is recommended that the cap on nicotine-containing e-liquid is therefore reconsidered in the light of our research findings.

November 2017

References


