1. Introduction

I write to follow up on the oral evidence I gave to the Parliamentary Committee on Wednesday 1st May, as there were a few additional issues I wanted to address which some of the other witnesses had suggested I could answer.

As mentioned in my oral evidence, I am a scientist who has worked in the field of tobacco and nicotine use for nearly 40 years: my degree was in psychology and zoology; my PhD on the development of dependence on smoking; I have published >450 peer-reviewed publications across prevention, cessation, harm reduction and local, national and international policy; I have been a member of the Royal College of Physicians Tobacco Advisory Group since 1998; I have chaired a number of policy groups including the WHO Scientific Advisory Committee on Tobacco Product Regulation and the WHO Europe Partnership Project Group to Reduce Tobacco Dependence, and currently Co-Chair the ASH-led Mental Health & Smoking Partnership. I was awarded the WHO World No Tobacco Day Tobacco Control Medal in 1998 and the Doll-Wynder Prize by the international Society for Research on Nicotine and Tobacco in 2020.

2. Overall health risks of vaping

The research I refer to below is drawn largely from the *'Nicotine Vaping in England'* 2022 evidence review of nicotine vapes for which I was lead author. In this, we drew evidence from systematic reviews of the literature on the health risks of vaping compared with smoking and compared with not vaping and smoking. We assessed biomarkers of exposure (these assess internal exposure to nicotine and potential toxicants from tobacco smoke or vaping product aerosol ingredients in body fluids) and biomarkers of potential harm (physical changes in the body which provide surrogate end points for disease). We also reported data from the MHRA Yellow Card reports, and fires, explosions and poisons related to vaping. In synthesising data from all these sources, we concluded that '*Vaping poses only a small fraction of the risks of smoking, but this does not mean vaping is risk-free, particularly for people who have never smoked'*. Although we did not identify any long-term studies, it is *incorrect* to say that we do not know anything about the long-term risks of vaping. Biomarkers are frequently used in public health where long-term population harms cannot be directly assessed through epidemiological studies, as they provide a basis from which future disease risks can be inferred.

Our conclusion was reiterated by the recently published Royal College of Physicians report *'E-cigarettes and Harm Reduction'* to which I was also a contributor. These findings also concur with the Cochrane review of nicotine vaping for smoking cessation, which analyse adverse effects in randomised controlled trials where vapes are used for smoking cessation and found no significant differences in Adverse Events between participants who were randomised to receive an e-cigarette to help them stop smoking compared with licensed nicotine replacement therapy.

3. Second hand exposure to vaping (Second hand vape, SHV)

An earlier witness had referred this question to me, but I was not asked it in my session.

First, it is worth noting that the aerosol from vapes is very different from cigarette smoke. First, vaping aerosol results from exhaled breath only whereas cigarette smoke contains sidestream smoke from the lit end of the burning cigarette in addition to exhaled breath. Secondly, cigarette smoke contains a mixture of carbonaceous particles, containing thousands of chemicals of which 70 are known carcinogens whereas vaping aerosol is qualitatively different being a mixture of liquid particles which dissipate quickly.

In our 2022 evidence review, we included 6 papers on SHV which were biomarker of exposure studies. They were all short-term with the longest study being one week. Short exposure to SHV in confined spaces did not result in detectable levels of the biomarkers studied. Even atypically high exposure for approximately 6 hours in 4 e-cigarette conventions where there were up to 1500 vapers present (hence exposure was far higher than would usually be the case), resulted in only 3 chemicals tested having higher levels in those exposed. These were nicotine and cotinine (a metabolite of nicotine) and acrolein (a volatile organic compound) but as the authors stated, there are many other endogenous and environmental sources of acrolein exposure (such as food) which may have contributed to this.

The recent RCP report identified 2 further studies, both cross-sectional, in which people who did not vape were exposed to vaping for at least 1, and 12, months. In both studies, cotinine (nicotine metabolite) was significantly higher in those exposed to SHV than those who were not. The report stated that cotinine levels were very low and unlikely to potentiate dependence. One of the studies also found that there was no difference between exposed and unexposed groups in tobacco specific nitrosamines (cancer causing biomarkers of exposure) and 27 different metals, with the exception of cobalt which has a half-life of 5 years (meaning that the elevated cobalt levels could have come from other sources, such as previous smoking in the unexposed group). The other study where SHV exposure was reported to be daily for at least one year, also reported significantly higher levels of one inflammatory biomarker in the exposed group, although it is unclear whether they were also exposed to tobacco smoke.

4. Harms to young people from vaping

This issue was frequently referred to by the committee. Some studies do indicate that young people who vape report subjective symptoms, such as respiratory symptoms, similar to those in smokers, and we have a similar study in the pipeline. It is not clear however whether these are acute reactions to the inhalation or indicators of some health risks. In relation to biomarkers, which are objective measures as indicated above, our 2022 evidence review found few studies examining children who vaped. However, those that did had largely similar findings to the adult studies, i.e. lower levels of biomarkers of exposure than smokers.

I am also involved in a study led by Prof Hammond from Canada examining biomarkers of exposure in 16-19 year old vapers, smokers and non-users, which is consistent with the above. This study, which is only currently publicly available as a poster (POS4-61), indicated that nearly all biomarkers of exposure of potential toxicants which were tested were significantly lower than in smokers, and the same or slightly higher than non-users. Nicotine metabolites indicated that nicotine exposure was similar among smokers and vapers. It is very widely accepted that whilst being the addictive substance, nicotine contributes very little to the overall harms caused by smoking. Indeed the recent RCP report highlighted this, whilst recommending more research to determine the long-term effects of nicotine exposure without confounding from long-term tobacco use.

The harms to the adolescent brain were referred to by other witnesses. The UK Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) reviewed toxicological data for e-cigarettes. They found no data on the direct effects of nicotine in humans to examine. Whilst animal studies show that this is biologically plausible, the Committee cautioned against trying to quantify the effects of nicotine in humans based on animal studies given the unclear relationship of dosing to human exposures.

Obviously, it is better for young people not to vape. But we need to be careful to ensure potential health risks of vaping are put in the context of the much more harmful cigarette smoking, so young people who are vaping are not driven to smoke instead.

5. **Flavours**

In oral evidence I mentioned concerns that restricting flavours could have the unintended consequence of keeping some smokers smoking or resulting in some former smokers who currently vape, relapsing back to vaping. In support of this, I mentioned one longitudinal international study that I was involved in which dual users (people who vaped and smoked) who used fruit and other sweet-flavoured e-liquids were more likely to have stopped smoking at follow-up compared with those who used tobacco flavours. This was mirrored by a longitudinal study in the US which found that adults who smoked at baseline who began vaping non-tobacco-flavoured e-cigarettes were more likely to stop smoking at follow-up than those who began vaping tobacco-flavoured e-cigarettes. This unintended consequence has also been found in examination of sales data in the US where some states have banned certain flavours whilst others have not. This research found '*a tradeoff of 12 additional cigarettes for every 1 less 0.7mL ENDs (e-cigarette) pod sold due to ENDS flavor restrictions. Furthermore, cigarette sales increase even among brands disproportionately used by underage youth*'.

A recent study indicated that regular vaping helped smokers to stop who were not intending to quit. It remains therefore vitally important that smokers can easily access a range of these products which they are willing to use regularly to help them to stop. Flavours are likely to play an important role in this.

6. **Cycle of disadvantage**

I was asked about choosing between adult smokers and young never-smokers and mentioned that I thought this was a false dichotomy and they were not irreconcilable. I referred to the fact that adult smokers will negatively affect children (and others) in their environment – first, through passive smoke exposure (more than 5000 children every year are admitted to hospital for passive smoke exposure, which incidentally compares with 40 admissions in the under 20-year-olds for possible vaping related disorders), and secondly because evidence indicates that one of the main risk factors for youth smoking is parental smoking.

Given higher smoking rates in disadvantaged societal groups, this means that children from disadvantaged backgrounds could benefit greatly from reductions in adult smoking by reducing second hand exposure, reducing smoking uptake by the children themselves, but also smoking induced poverty and death and disease which deprives them of parents and grandparents as carers.

7. **Equating vaping and smoking in regulations**

I mentioned that I was wary of treating vaping the same as smoking in relation to advertising regulations, and this would also apply to putting e-cigarettes in with the rising age of sale regulations for cigarettes. This is because it would send completely the wrong message implying that both products are equally harmful, which they are not, and could then have an unintended consequence of keeping smokers smoking. As outlined above, vapes and tobacco cigarettes are qualitatively very different products (one burns smoke, the other heats an e-liquid). Additionally, if a concern is raised about a constituent it can be removed from e-liquids, which cannot be done with the thousands of chemicals generated at very high temperatures found in tobacco *smoke*. Indeed, many potentially harmful constituents are *already* prohibited in e-cigarettes. This includes diacetyl, which is

responsible for 'popcorn lung' (bronchiolitis obliterans) which was referred to in the hearings as a consequence of nicotine vaping. The relationship between 'popcorn lung' and nicotine vaping is however a myth as detailed here (pt 28).

8. Conclusion

I hope this is helpful and I would be happy to provide further details of any of the above. I would like to conclude by saying that given the prevalence of vaping in the UK, and expressed concerns about potential health risks, it is regrettable that a cohort study examining the health risks of vaping has not been established in the UK. Government is missing a unique opportunity not to require this be set up so that we can develop an evidence base on the long-term impact of vaping.

9. References

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