**A YOUNG PEOPLE’S PUBLIC HEALTH EMERGENCY**

**Professor Andy Bush**

Professor of Paediatrics and Paediatric Respirology, Imperial College
Consultant Paediatric Chest Physician, Royal Brompton & Harefield NHS Foundation Trust

Sydney Street, London SW3 6NP
NIHR Senior Investigator Emeritus
Email: a.bush@imperial.ac.uk

**Dr Jayesh Mahendra Bhatt**

Consultant Respiratory Paediatrician

Nottingham Children’s Hospital

University Hospitals NHS Trust

Queen's Medical Centre

Nottingham NG7 2UH

Email: jayesh.bhatt@nuh.nhs.uk

**Professor Gary James Connett**

Consultant Respiratory Paediatrician

Southampton Children's Hospital

Southampton, SO16 6YD

Email: Gary.connnett@uhs.nhs.uk

**Prof Iolo Doull**

Consultant Respiratory Paediatrician

Children's Hospital for Wales

Cardiff CF14 4XW

Email: doullij@cf.ac.uk

**Dr Francis J Gilchrist**

Institute of Applied Clinical Science

Keele University

Keel, ST5 5BG

Email: Francis.Gilchrist@uhnm.ngs.uk

**Professor Jonathan Grigg**

Centre for Child Health

Blizard Institute

Queen Mary University of London

London E1 2AT

Email: j.grigg@qmul.ac.uk

**Dr Simon C Langton Hewer**

President, British Paediatric Respiratory Society

Consultant Respiratory Paediatrician

Bristol Royal Hospital for Children

Bristol BS2 8BJ

Simon.langtonhewer@bristol.ac.uk

**Dr Julian Legg**

Secretary, British Paediatric Respiratory Society,

Consultant Respiratory Paediatrician,

Southampton Children’s Hospital,

Southampton SO16 6YD

Jpl2@soton.ac.uk

**Professor Warren Lenney**

Professor of Respiratory Child Health,

Keele University, Keele,

North Staffordshire ST5 5BG

Email: w.lenney46@hotmail.co.uk

**Dr Ian P Sinha**

Consultant Respiratory Paediatrician

Alder Hey Children’s Hospital

Liverpool L12 2AP

Email: Iansinha@liv.ac.uk

While some countries have banned the use of e-cigarettes or vaping products altogether (e.g., India), and others have strongly advised against their use (e.g., Australia), in the UK, Public Health England (PHE) appears to be a lone voice in stating that vaping is 95% safer than smoking tobacco. Here we consider whether vaping can be considered safe; whether vaping is a means of smoking cessation or at least harm reduction; and the correct response to the spiralling epidemic of vaping in the young.

Whether vaping is safe, or safer than smoking, can only be answered if the total contents of each of the thousands of available vaping liquids can be itemised and subjected to short and long-term toxicity testing. To our knowledge, no such database exists; reassurances and extrapolations are no substitute for data. In one expert briefing,1 it was asserted that “most of the flavours are used in food and, at the relatively low temperatures used in e-cigarettes, they’re not going to give rise to hazardous by-products”. Evidence to support the assertion is scarce and e-liquids contain a multitude of other substances known to be toxic to the lungs, such as ethyl maltol, linalool, methyl cyclopentalone, β-damascone, ethyl vanillin and many others, in flagrant breech of EU directives.

With 1888 lung injuries and 37 deaths attributed to the use of e-cigarette or vaping products in the USA,3 any uncertainty about acute toxicity can be eliminated. Most cases of e-cigarette, or vaping, product use associated lung injury (EVALI) were in young men, some of whom presented with fulminant respiratory failure. One case of EVALI4 has been reported in the UK. Although 80% of such cases are associated with modification of e-liquids, with substances such as tetrahydrocannabinol (THC) oil, 20% are associated with pure commercially available fluids. No e-liquid, therefore, should be considered safe to use, especially by young people. One could also ask whether allowing the general sale of devices which allow inhalation of toxic amounts of substances of abuse is sensible public policy.

The presentation of EVALI is highly variable. Inflammation is a common feature, dominated by neutrophils and alveolar fat-laden macrophages. A wide variety of pathologies have been described, including hypersensitivity pneumonitis, pulmonary haemorrhage, respiratory bronchiolitis-associated interstitial lung disease, and eosinophilic pneumonia.5 Research in animal and human models shows the cellular mechanisms by which e-cigarette liquid constituents damage the respiratory system and causes inflammation; for example, vaping promotes migration of neutrophils along with destructive enzyme activity that destroys tissues and causes COPD.6

To claim vaping is safer than tobacco smoking by benchmarking the levels of chemicals in e-cigarettes with those in tobacco products is wrong. The variable nature of how these e-liquids are produced and used, and evolving technology, mean establishing what constitutes acceptable levels is difficult. The lack of regulation by the vaping industry, and its quality control processes, preclude any monitoring or accountability even if an acceptable level were to be established.

For decades, the long-term effects of tobacco were not determined, and the reporting of the dangers of tobacco were subsequently greatly hindered by the obfuscation and data-suppression of the tobacco industry. As the tobacco industry is also responsible for the manufacturing of e-cigarettes, we are at risk of a similar scenario. We cannot determine long-term toxicity of vaping without long-term studies, and until these have been done, reassurances about safety are ill-founded.

Is vaping useful for smoking cessation or at least, harm reduction? Randomised controlled trials are needed to provide evidence that vaping is more effective than pharmacological methods, nicotine replacement by other routes, or financial incentives in helping people to quit smoking. Advertisements should reflect the evidence available and until that point, e-cigarettes should not be marketed as safe or as a valid cessation tool and there should be tighter government regulation. It is also worth noting that NICE excluded the use of e-cigarettes as aids to smoking cessation guidelines. Given the above considerations, current smokers who cannot quit might still decide for themselves that vaping is safer than smoking tobacco; however, they should know that there is as yet no evidence to support this conclusion.

What about the vaping epidemic in young people? The area of most concern is the use of e-cigarettes or vaping products by young people and others who have never smoked. A US survey7 in 2019 found that 40·5% of 12th-grade students have tried e-cigarettes, 35·1% within the past year, and 25·4% in the previous month. The corresponding figures for 2017 are 15·0 %, 18·8%, and 11·0 %. We are nurturing a new generation of nicotine addicts. Even were there only nicotine in e-cigarettes, this itself is harmful.8 Also, the way some e-cigarettes have been marketed to young people (eg, JUULs look like USB memory sticks and have flavours that are attractive to young people) is deliberate—the view the US Food and Drug Administration has taken.9 Given the addictiveness of nicotine e-cigarettes and targeted marketing, it is perhaps unsurprising there is mounting evidence suggesting that e-cigarettes are a gateway to cigarette smoking in children and young people.10

It is surely a priority to prevent young people from starting vaping and protecting their health. NICE does not acknowledge e-cigarettes as a smoking cessation tool. The evidence of e-cigarettes as a harm reduction tool is very weak. We are facing a public health emergency as droves of young people are taking up vaping - advertising of e-cigarettes and their use in a place of work, exactly as is the case for tobacco, must be totally banned. The sale of e-cigarettes to the public should be banned, because this is placing them readily in the hands of young people. They should only be available on a prescription basis from smoking cessation clinics (although NICE would challenge their use even there). PHE must stop promoting vaping as 95% safer than smoking and instead respond to the actual health emergency in young people. Vaping and smoking are both much more dangerous than abstinence, which should be the message from all responsible bodies.

**References**

1 Hawkes N. Experts defend vaping’s safety after US deaths. BMJ 2019; 367: 16027.

2 Vardavas C, Girvalaki C, Vardavas A, Papadakis S, Tzatzarakis M, Behrakis P, Tsatsakis A. Respiratory irritants in e-cigarette refill liquids across nine European countries: a threat to respiratory health? Eur Respir J. 2017 Dec 21;50(6). pii: 1701698. doi: 10.1183/13993003.01698-2017. Print 2017 Dec

3 US Centers for Disease Control and Prevention. Outbreak of lung injury associated with the use of e-cigarette, or vaping, products.<https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html> (accessed Nov 5, 2019).

4 Nair N, Hurley M, Gates S, Davies P, Chen IL, Todd I, Fairclough L, Bush A, Bhatt JM. Life-threatening hypersensitivity pneumonitis secondary to e-cigarettes. Arch Dis Child. 2019 Nov 11. pii: archdischild-2019-317889. doi: 10.1136/archdischild-2019-317889. [Epub ahead of print]

5 Sommerfeld CG, Weiner DJ, Nowalk A, Larkin A. Hypersensitivity Pneumonitis and Acute Respiratory Distress Syndrome From E-Cigarette Use. Pediatrics. 2018; 141. pii: e20163927. doi: 10.1542/peds.2016-3927. Epub 2018 May 17.

6 Reinikovaite V, Rodriguez IE, Karoor V, Rau A, Trinh BB, Deleyiannis FW, Taraseviciene-Stewart L. The effects of electronic cigarette vapour on the lung: direct comparison to tobacco smoke. Eur Respir J. 2018; 51(4). pii: 1701661. doi: 10.1183/13993003.01661-2017. Print 2018 Apr.

# 7 Miech R, Johnston L, O’Malley PM, Bachman JG, Patrick ME. Trends in adolescent vaping, 2017-2019. N Engl J Med 2019; epub

8Roza SJ, Verburg BO, Jaddoe VW, *et al*. Effects of maternal smoking in pregnancy on prenatal brain development. The Generation R Study. Eur J Neurosci 2007; 25: 611–7.

9<https://www.fda.gov/news-events/press-announcements/statement-fda-commissioner-scott-gottlieb-md-new-enforcement-actions-and-youth-tobacco-prevention>

10Conner M, Grogan S, Simms-Ellis R, *et al.* Do electronic cigarettes increase cigarette smoking in UK adolescents? Evidence from a 12-month prospective study. Tob Control 2017:pii: tobaccocontrol-2016-053539. doi: 10.1136/tobaccocontrol-2016-053539. [Epub ahead of print].doi:10.1136/tobaccocontrol-2016-053539