

Science and Technology Committee

Oral evidence: [E-cigarettes](#), HC 505

Tuesday 9 January 2018

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[Watch the meeting](#)

Members present: Norman Lamb (Chair); Vicky Ford; Bill Grant; Darren Jones; Stephen Metcalfe; Carol Monaghan; Neil O'Brien; Graham Stringer; Martin Whitfield.

Questions 1 - 132

Witnesses

[I](#): Professor Peter Hajek, Professor of Clinical Psychology, Queen Mary University of London; Professor Mark Conner, Professor of Applied Social Psychology, University of Leeds; and Professor Riccardo Polosa, Professor of Internal Medicine, University of Catania.

[II](#): Dr Lion Shahab, Senior Lecturer in Health Psychology, University College London; Dr Jamie Brown, Deputy Director, Tobacco and Alcohol Research Group, University College London; and Professor Paul Aveyard, Co-ordinating Editor, Cochrane Tobacco Addiction Group.

Written evidence from witnesses:

- [Professor Peter Hajek](#)
- [Professor Mark Conner](#)
- [Professor Riccardo Polosa](#)
- [Tobacco and Alcohol Research Group, University College London](#)
- [The Cochrane Tobacco Addiction Group](#)

Examination of witnesses

Witnesses: Professor Hajek, Professor Conner and Professor Polosa.

Q1 **Chair:** Good morning, all of you. In a moment, I will ask you to introduce yourselves briefly. I would be grateful if you could all try to keep your answers as succinct as possible. Don't feel that all of you have to answer every question. If you feel that there is something you can add to what others have said, or if you disagree, please come in, but we have quite a lot to get through during the session. We will start by each of you introducing yourselves.

Professor Polosa: I am an academic who has specialised for many years in lung conditions such as asthma and COPD. Nine years ago, I began to focus on electronic cigarettes. Since then, I have published more than 50 papers of peer-reviewed research in that area, which makes me the most published academic in the world on the subject.

Chair: Thank you very much.

Professor Polosa: Thanks to me, obviously, because I had to do all the hard work. Please excuse me if my command of the English language is not perfect.

Q2 **Chair:** It seems pretty impressive. Thanks for coming over from Italy for the session. It is appreciated.

Professor Conner: I am Mark Conner. I am professor of applied social psychology at the University of Leeds. I lead a group that does work on health behaviours for the past 30 years or so. We do some work on smoking, mainly smoking initiation in adolescents and the relationship between e-cigarettes and smoking initiation.

Professor Hajek: I am Peter Hajek. I am a professor of clinical psychology at Queen Mary. I have been doing research into smoking for quite some time. I have done a number of studies on the safety of e-cigarettes and their effects on smokers.

Q3 **Chair:** Excellent. I will start with some questions. In terms of their impact on health, can you talk about the main differences between conventional cigarettes and e-cigarettes? Can you indicate what harmful things are in conventional cigarettes, but are absent from e-cigarettes, and what potentially harmful things are in e-cigarettes, but are not in conventional cigarettes? If you could address those issues, I would be very grateful. Who wants to start?

Professor Polosa: I can start, as it is my area of great interest. In relation to the potential harmful effect on users, the scientific evidence shows very clearly that we see exactly the opposite. We saw a lot of benefits after many years of exclusive use of these products, particularly in areas like respiratory diseases and cardiovascular diseases.

Q4 **Chair:** You are talking about the benefits for people who have shifted



from conventional cigarettes to e-cigarettes.

Professor Polosa: Yes. We are talking about people who decided by themselves to shift from tobacco combustibles to these new technologies, so it is more like a naturalistic study than a randomised control trial. We see, to my great surprise, that we can detect improvements in these individuals' objective and subjective respiratory outcomes.

There is room for improvement in these people. That improvement can be detected by switching studies, which have been demonstrated and published in the area of asthma. That is very interesting, because asthmatic people have very twitchy airways and tend to react quite strongly, with asthma attacks, even to the super-clear air of the Alp mountains—just because it is cold—but, with these technologies, they did not.

In the area of COPD, we discovered that continuous and regular use of these products reduced by 50% the number of respiratory exacerbations. I am sure that my distinguished colleague Professor Hajek can add more on exacerbation rates. That is a very important topic, because it can save the NHS a lot of money. We also saw improvements in blood pressure in those with a very high blood pressure level at baseline.

Very recently, we completed a small but seminal and important study on vapers who had never smoked in their lives. The 3.5-year time point revealed that their high-sensitivity CT scans were completely clean. There was no evidence of popcorn lung disease, COPD or lipid pneumonia.

Q5 **Chair:** Is 3.5 years enough to identify any long-term trends?

Professor Polosa: That is a very good question. It may not be, but there is evidence in the literature, from autopsy studies and high-resolution CT scans, of damage in the lungs of young smokers even at 2.5 years. Although we need to build more of a knowledge base in this area, I think that we are looking at a very interesting health revolution.

Professor Conner: I have nothing to add.

Professor Hajek: The question has been covered very well. I could add that we have two ways of looking at it; there is logic and there is data. The logic tells you that most of the chemicals that are dangerous to smokers are absent, or present in very small amounts, in e-cigarettes. As far as we know, none of the chemicals that are specific to e-cigarettes and are not present in smoking poses major health harm.

Basically, the data back that up. Recently, there was a detailed paper about kinds of carcinogens, comparing the risk of cancer from smoking and from vaping. That paper took at face value some of the studies on e-cigarettes that actually fry the e-liquid and therefore produce aldehydes, which could be carcinogenic, but even taking into account those studies, which do not reflect what vapers are taking in, the conclusion was that



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the cancer risk is less than 0.5% of the cancer risk from smoking. We are talking about a massive difference in the risks.

Public Health England and the Royal College of Physicians are trying to put those risks in perspective by saying that vaping may pose up to 5% of the risk of smoking or is at least 95% safer than smoking. That is not an attempt to pinpoint with great accuracy the exact risk, but just an attempt to give some idea of the scale, so that smokers can make informed choices. I think that saying that vaping poses up to 5% of the risk of smoking is cautious. It will probably be much less.

I would like to make a couple of points. One is that some health risks may emerge. This is still an area of research and investigation, so those estimates may need to be revised. They are based on the best of current knowledge.

Q6 Chair: What are the areas we should focus on in terms of the research gaps on the safety of e-cigarettes?

Professor Hajek: Are you asking about the areas my unit is focusing on or about what needs to be done generally?

Chair: Generally.

Professor Hajek: The potential is that those 5% are likely to be pulmonary risks, which could be related to some flavourings, for instance. They are safe to eat, but inhaling them may have some adverse effects. It would still be a tiny fraction of the risk of smoking. There could also be issues with some of the materials used to make e-cigarettes. The important point is that they will be remediable risks that you can do something about. If you discover that a certain flavouring is not good, you just remove it. If there is an issue with some material, you can replace it. What some countries are doing—trying to stop the use of e-cigarettes until we have 100% certainty about their safety—is illogical and counterproductive. These are hypothetical smaller risks, whereas the competing product—the one we are trying to get rid of, which is being replaced by e-cigarettes—is proven to be massively dangerous.

Q7 Chair: In some areas, restrictions are imposed on the use of e-cigarettes. What about any potential risks of secondary vaping from e-cigarettes? Is there anything we need to be worried about there?

Professor Hajek: Not really. There are some people who find it unpleasant. Of course, vapers should use common courtesy, but I do not think that there are any health risks at all. With smoking, you have sidestream smoke. With vaping, the only thing released into the atmosphere is the vapour that has been inhaled and is being exhaled. We know that vapers take in hardly any toxic chemicals themselves. What they exhale, which is diluted in the air, is unlikely to do anything.

There have been two concerns. One was about particulate matter, and one was about nicotine itself. With particulate matter, it depends on what



is in the particles. Particulate matter from diesel cars is dangerous to your health, but the particulate matter that you inhale when you take a shower is neutral to health. Whatever those particulates are, they hardly feature at all. There was a very detailed study monitoring air quality in low-income homes over two weeks. It was extremely sensitive. It detected particulate matter from burning candles, as well as pollution in the homes of smokers, of course. In the homes of vapers, there was none, so that is not an issue.

Most of the nicotine itself is retained by the vapor. What is exhaled is so minuscule that it cannot cause any physiological reaction. It gets deposited on surfaces if you vape for a long time, but even that is negligible. Somebody calculated that a baby would have to lick 30 square metres of floorboards or windows to get 1 mg of nicotine.

Professor Polosa: May I add a few points about the second-hand vaping issue? It is very important to try to understand why we are discussing second-hand exposure. It is very well known historically that combustible cigarette smoke is a big cause of diseases, mainly because of sidestream smoke and the smoke that is generated between puffs. An electronic cigarette does not operate on the same principle. It does not have the deadly sidestream smoke and does not generate any smoke or aerosol between operating cycles.

Aerosols are emitted by these products only when you exhale. That sets the principle that, on common sense, you will immediately identify that there is less risk just because of that. If you then consider that, as Public Health England and the Royal College of Physicians have already emphasised in their comprehensive reviews, these aerosols are 95% less harmful than common tobacco, you will immediately realise that, from a percentage point of view, the risks will be minuscule. Frankly, I would be more concerned personally to go out of the Westminster Parliament and breathe your air in the square than to have a vaping person sitting next to me.

Q8 **Chair:** Can I ask about the issue of regulation? Given your views on the relative risk of conventional smoking compared with e-cigarette vaping, what are your views on the regulation of e-cigarettes? Am I right in saying that the directive introduces a limit of 20 mg per millilitre? Is that rational in public health terms? Could you address those issues?

Professor Polosa: As many people in this room well know, there was nothing really rational in tobacco products directive 2, mainly because very little information was available at the time the directive was drafted.

Q9 **Chair:** Are you talking particularly about its application to e-cigarettes?

Professor Polosa: Yes, definitely. I am sorry; thank you for the clarification.

In relation to the specific question of the 10 ml refill bottle, the guiding principle at the time was to limit the exposure of toddlers and infants to



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nicotine. That is the only thing I can think of. No consideration was given to the fact that such accidental exposure can be prevented by simple systems, such as child-proof caps. The unintended consequence of that is that people are trying to buy nicotine in bulk, so that they can prepare much larger refill bottles at home at half or a tenth of the price.

There is nothing wrong with the way the English Government handled the tobacco products directive. I think you did a great job by not adding extra regulations to the structure, but perhaps we need to be bolder and to start challenging the initial provisions in TPD2 at European level, because the limitation on the bottles means nothing in terms of public health.

Q10 **Chair:** Peter, do you want to add something on the 20 mg limit in particular?

Professor Hajek: It forces vapers to vape more vigorously. Although we think that the risks are small, you still increase your risk if you have to puff much more and go through more liquid to get the nicotine you need, so that particular rule is particularly unhelpful. Of course, other bits of the tobacco products directive are equally bad, but we are stranded with it, as far as I understand.

Q11 **Chair:** What change do you think should be made? Given that the UK is exiting the EU, are there opportunities in that process to refine the regulations to improve their impact on public health?

Professor Hajek: The whole regulation needs to be revised. There are a number of articles regarding the size of the bottles, which leads to fiddly waste and makes vaping less attractive to smokers. There are nonsensical warnings, which are compulsory. There is a lot of regulation that regulates e-cigarettes much more strictly than conventional cigarettes, which makes no sense whatsoever. You really want to have a regulation that encourages smokers to make the switch and makes vaping more attractive to them than smoking. This is trying to do exactly the opposite. It is a bad regulation.

Q12 **Chair:** Mark, do you want to add anything?

Professor Conner: No.

Q13 **Chair:** Riccardo, you may make a very quick comment.

Professor Polosa: I am sorry if I am taking up too much space. One reason why the size of the refill bottles should be rethought is that it would help more smokers thinking of switching, because the unit cost of the refill bottle would come down sensibly. I believe that one reason why the tobacco control policy has worked so well in this country is the integration of the tobacco harm reduction principle through vaping into good, existing, solid, very well-implemented tobacco control policies, such as high taxation for tobacco combustibles, so that the common guy down the street, in Trafalgar Square, thinks, "These fags are going to cost me too much money. What shall I do?" One of the main reasons why



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they try vaping is the cost issue. The cost issue would be enhanced by enlarging the refill bottle.

Q14 **Chair:** You think that is a more significant issue than the limit of 20 mg.

Professor Polosa: I think so. It is more important. On the limit of 20 mg, we battled quite a lot during 2013 because we wanted to give vapers more options—to go up to 36 mg per millilitre. Now we realise that with the innovation in technology, even 20 mg is quite a high concentration level. Many people tend to buy 0.9 or 0.6. They are quite happy with the level of nicotine they can get from that very low concentration in their bottles. That is mainly because innovation and the technology of the atomisers have improved so much, enabling more nicotine to be extracted from the liquid.

Chair: Do you want to come in quickly on that, Stephen?

Q15 **Stephen Metcalfe:** Riccardo and Peter, you have presented a fairly convincing case that, almost without putting any caveats on it, e-cigarettes are a significant contribution to public health. You are both nodding. What I cannot quite understand is why the Surgeon General in the States was so anti e-cigarettes and vaping, and muddled the waters, perhaps, of the very clear information that you are giving. Can you elaborate on why you think that was the case? Were there any concerns other than public health at play?

Chair: Could you keep your answers brief?

Professor Hajek: Nicotine is a big bugbear in America. They are really scared of nicotine. It is the ethos of the war on drugs; they want to protect children from nicotine. There is a lot of misunderstanding about nicotine. If you want me to elaborate, I can. Most people believe that nicotine is highly addictive. Cigarettes are highly addictive, but nicotine is not. We do not really see vaping hooking people on nicotine. I can explain that, because it is a statement that surprises a lot of people. Nicotine on its own—

Q16 **Stephen Metcalfe:** I think we are going to move on to nicotine. The issue was really about why the Surgeon General made a statement that is so clearly opposed to the one that you are making here.

Professor Conner: This speaks a bit more to my area of expertise. One of the concerns that I pick up in the US is about the impact among adolescents who are not smoking. Is the effect of their using e-cigarettes worse than not smoking at all? In particular, there is the issue, which we will get on to later, of the relationship between trying e-cigarettes and progressing to smoking.

Q17 **Chair:** That is the issue. In that case, do you think that his warning is rational or that it contradicts the evidence?

Professor Conner: They are placing weight on different things. My take on it is that in adult smokers there is not much of an issue. The



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introduction of e-cigarettes is going to be a public good. In adolescents, it is more debatable. The evidence is probably still in favour of its being a good thing, but it is a bit more mixed.

Professor Polosa: A few months ago, we published a critique of the report by the Surgeon General in relation to adolescents and the use of nicotine. The main problem with the document, which is an excellent document for reference purposes, is that all the critique about nicotine was about the nicotine in tobacco smoke. That is a big problem. If you do not decouple nicotine from tobacco smoke, you are still raising the concern that applies to combustible tobacco. That is one of the reasons why people in the US keep on going, even though they do not have evidence. To my knowledge, there are only a few papers—or no papers—demonstrating the effect of pure nicotine on health effect indicators.

One of the problems with our US colleagues is that they feel a bit envious that they did not get this idea before the Europeans. That is the only thing I can think of. It does not make sense. It is so logical and common-sensical. I must acknowledge that in the US they also have a very large, bureaucratic structure that revolves around the issue of nicotine: "Nicotine addiction is bad for you." For us in Europe, nicotine as an addiction is not such a big deal, decoupled from tobacco smoke. It is in the coffee culture—

Q18 **Chair:** Could you be brief, please? It is wonderful having you here from Italy, but do keep it brief.

Professor Polosa: Yes. I think I have explained it.

Chair: Thank you very much. That is fantastic.

Q19 **Vicky Ford:** Before I ask my question, I have a yes/no question. Have you or your research ever received funding from a tobacco company or from a seller of e-cigarettes? It is a yes/no question. If the answer is yes, will you send us the details in writing?

Professor Polosa: All the research I have talked about today has received no tobacco funding.

Q20 **Vicky Ford:** Has other research that you have done received tobacco funding?

Professor Polosa: In the past, yes. I have done some research on combustibles showing smoking cessation.

Q21 **Vicky Ford:** Could you put that to us in writing?

Professor Polosa: Definitely.

Q22 **Vicky Ford:** Thank you. There is a lot of evidence about existing smokers moving on to e-cigarettes. You have talked a lot about the comparison between smoking and e-cigarettes. I now want to go into the issue of nicotine itself and the idea that, in some way, nicotine is considered risk



free. We have had evidence suggesting otherwise. Is nicotine harmful in itself? What are the long-term effects of nicotine dependency, and how are they significant? Is it even possible to analyse the long-term effects of e-cigarettes yet, given the short time we have had them available?

Professor Polosa: We now have a great opportunity to test this hypothesis. We could not do so with tobacco combustibles, because the nicotine was in a cocktail of 7,000 different chemicals, which adds to the addiction. Now, with these new technologies, we can isolate the effect of nicotine, but the studies are not ready yet. We need to design them and to carry them out. Have I answered your question?

Q23 **Vicky Ford:** Yes. Other bits of evidence that we have received suggest that there are studies that look at links to the impact of nicotine as a promoter of cancer, and on uric disease and on mental health.

Professor Polosa: You are referring mainly to in vitro studies, animal studies and some acute studies. I am a clinician; I deal with patients. I run a smoking cessation clinic. I can tell you that none of those studies has clinical or prognostic significance. The IARC—the International Agency for Research on Cancer—has stated clearly that nicotine is not a cancerogenic substance. There is no evidence that nicotine can cause COPD or asthma. That is it. I can provide a reference for what I am saying, obviously.

Professor Conner: I have nothing to add.

Q24 **Vicky Ford:** Not on the mental effects of nicotine.

Professor Conner: No. Generally speaking, we are very early in those studies. The problem, of course, is that in human studies you see hardly anyone who is using just e-cigarettes. Most people are using some sort of combination.

Q25 **Vicky Ford:** Is there anything on the impact of nicotine itself?

Professor Conner: No.

Professor Hajek: We have data on the impact of nicotine itself from people who become long-term users of nicotine replacement treatments. It is not a huge sample, but it is very reassuring. We have a huge population of data from Sweden and Norway on people who use snus, which is a nicotine-containing tobacco product. There is no sign of an increase in cancer that is linked to nicotine. There are some pancreatic cancer concerns, but there are nitrosamines in those products; the concerns are not nicotine linked. Smoking-linked lung cancer is gone. The same applies to heart disease. Riccardo said that there are some animal data and in vitro data that suggest that, if you put cells in nicotine in huge doses, it damages them. From human data, I do not think we have any evidence of nicotine being that harmful.

Q26 **Chair:** We have evidence from a Dr Cope that talks about influence on “mood disorders, such as depression, anxiety and schizophrenia.” Do you



have any comments on that?

Professor Polosa: Yes. We conducted a study on schizophrenics with electronic cigarettes. The main reason was that these people smoke a lot, of course. They are not capable of quitting. It is very unlikely that people with mental illnesses such as schizophrenia will be successful long term. We completed a study, which was published four or five years ago. Now we have completed another one, together with the City University of New York, that shows the same very good, positive outcomes. The study shows that people using electronic cigarettes—in this case, a very popular cigalike in the US—can reduce smoking or abstain from smoking. At the same time, we are not causing any decompensation of their psychological disease. That is very important. When we switch people from tobacco cigarettes to NRT, one of the problems we see immediately is decompensation of their psychological disease, so we need to readjust the drugs.

Q27 **Vicky Ford:** All the evidence you have discussed so far is comparing people who smoke with people who vape, not people who do not smoke with people who vape. Is that correct?

Professor Polosa: They were people who smoked and then switched to vaping.

Q28 **Vicky Ford:** Exactly. Your evidence is not based on non-smokers.

Professor Polosa: It is very difficult to have vapers who are non-smokers. As you know, the Eurobarometer shows that 0.1% of non-smokers all over Europe vape. That is one in 1,000. It is very difficult to recruit such people.

Q29 **Vicky Ford:** Yes, because it is very new. To go back to the issue of snus, which Peter raised, we have had evidence from Dr Combes and Professor Balls that increases in other cancers, such as oral and pancreatic cancer, can be linked to snus.

Professor Hajek: There is no increase in oral cancer. The evidence on pancreatic cancer is disputed. There could be a slight increase, but it would still be less than for smokers, and possibly more than for non-smokers, although not all studies show that. It is much more likely to be related to nitrosamines than to nicotine. There is no sign of oral cancer from snus.

I can address the issue of the mental health effects of nicotine, if you want. There is a vague concern that nicotine does something mysterious to adolescent brains. That preoccupies our American colleagues a lot. They never quite specify what they mean by it, and in what sense. For instance, there are studies showing that smokers have lower cognitive performance than non-smokers, but that is because smoking is mostly linked to socioeconomic parameters.



I have collaborated with Chinese colleagues on some studies. They have a dataset there that shows a difference in cognitive performance in younger cohorts, but not in older cohorts. In China, everybody used to smoke—like here, much earlier—and there was no social class gradient until relatively recently. Before the social class gradient came, the cognitive performance of smokers and non-smokers was identical, but now it is starting to diverge. That suggests to me that it is nothing to do with nicotine or smoking; it is just self-selection of which groups in the population become smokers. I fully understand the instinct to protect children and to keep them away from addictive drugs, but in this case I think that is less of a concern.

As Riccardo has already said, e-cigarettes with nicotine are spectacularly unattractive to non-smokers. There is all this worry about kids who try e-cigarettes becoming hooked on nicotine, but that is absolutely not happening. I hinted at this nicotine mystery before. The same applies to nicotine replacement treatment. We have had nicotine chewing gum, lozenges and inhalators for 30 years. It is extremely difficult to find a non-smoker who has got hooked on those, because nicotine on its own—if you remove the other chemicals in tobacco and some other things behind it—is not really attractive or addictive.

A few people have tried to find non-smokers who got hooked on nicotine replacement treatment. They failed. One study that looked for them found two. That is the frequency of carrot addiction. It just does not exist. E-cigarettes are shaping up to be the same. We need to keep an eye on it, because somebody will figure out what you need to add to e-cigarettes to make them more addictive to non-smokers. At the moment, non-smokers do not progress to daily vaping; it is really difficult. If they do, they often vape nicotine free, just for some kind of flavour and behaviour. There would be a very legitimate concern if we saw large numbers of young people who have never smoked becoming daily vapers, but you would be hard pushed to find anybody.

Q30 Vicky Ford: So you think that the statement we have had from another person—“Nicotine disrupts the neurotransmitters in the brain, such as dopamine and serotonin and may influence mood disorders, such as depression, anxiety and schizophrenia”—is not important.

Professor Hajek: I am not aware of clear evidence on that. It is a concern and a worry, but I would like to see some data that show that it is actually the case.

Q31 Vicky Ford: You may already have answered my last question. What does the evidence show about the addictiveness of nicotine? How is its addictiveness linked to how it is consumed?

Professor Hajek: That is what I was talking about. It is highly addictive in cigarettes and tobacco generally. Animals readily self-administer cocaine or opiates, but you cannot get them to self-administer nicotine easily; you have to condition them or prime them. Even then, as soon as



you stop torturing them, they stop seeking nicotine. It is very different from other addictive drugs.

Q32 **Vicky Ford:** Is that because of the taste?

Professor Hajek: No. In animal models, it is injected. It just seems to work only when it is in tobacco. You can inject nicotine itself into people, so that there is fast nicotine delivery, but they will not enjoy that. It is a bit of a mystery.

Q33 **Chair:** It appears to be the combination of the nicotine with other ingredients of the cigarette.

Professor Hajek: Yes. Importantly, nicotine on its own is rewarding for people who are already primed for it. Smokers find nicotine replacement treatment helpful. Nicotine on its own becomes pleasurable if you add other sensory stimuli to it, but you have to be a smoker first.

Q34 **Carol Monaghan:** Can I follow up with a brief question about some of the evidence Vicky referred to, from the written submission by Dr Cope? In his written submission, Dr Cope recommends that e-cigarettes are not used by pregnant women. What are your thoughts on that? Is there evidence to suggest that they could cause harm to an unborn child?

Professor Hajek: The one chemical in e-cigarettes that is of concern here is nicotine itself. There are data from animal studies that suggest that nicotine damages the foetus, but in human studies it is not so clear. The largest study done was with pregnant women who were given nicotine patches or placebo patches. Actually, the women on nicotine patches had better outcomes than those on placebo patches, which could be because they smoked less. Human evidence of the risks of nicotine in pregnancy is not that strong. There is probably some, but what is most important is that we are talking about women who smoke. If you remove all the other risks of smoking and maintain nicotine, it is probably a good thing, but we do not know for sure.

At the moment, we are starting the first study of e-cigarettes with pregnant women. It is a large study, with over 1,000 women, in which the birth outcomes will be very carefully monitored. We will then get some answers to the question. Until the study has been done and we know that it is safe, I would not proactively recommend e-cigarettes to pregnant women, but I would not be against it either, if they are smokers anyway. We are not talking about non-smokers picking up vaping.

Q35 **Carol Monaghan:** It will be extremely interesting to see the results of that study, because it may be a possible option for smoking women who are pregnant.

Professor Hajek: That is the promise. We have a number of groups of smokers who find quitting very difficult. We have already discussed psychiatric patients. There may be lots of other reasons why pregnant women who are young and already hooked find quitting difficult. E-



cigarettes provide some of the experience and rewards of smoking, without as much risk, so it is a development we really need to look into.

- Q36 **Neil O'Brien:** I want to ask you about recent research on heat-not-burn tobacco products. Broadly, how dangerous are they? What do we know about them? In particular, I would like to know what claims are being made about these products and whether the claims are accurate. Do you think we need particular types of research on heat-not-burn? What kind of research would you like to see? Overall, what is your attitude to how we should regulate those kinds of products? Should we treat them just like normal tobacco, or should we treat them more like vaping-type products?

Professor Polosa: That is a very interesting question. Surprisingly, when you look at the literature, most of the good-quality data on emission and exposure reduction comes from heat-not-burn, not from electronic cigarettes. A vast amount of literature is being produced by tobacco companies, the reason being that they are trying to create portfolios and dossiers for the American agencies; that is their requirement. From what I can gather from those data, it seems that the emissions from heated tobacco products are vastly lower and that during switching experiments they lead to a reduction in exposure. However, they are not independent studies. The Government should consider sponsoring authorities like Cancer Research UK to do more independent replication studies.

At Catania University, we have run perhaps the first clinical trial on heated tobacco products, comparing at least two heated tobacco products with people's own brand. There were four switched, in an acute experiment. The experimental outcome there was carbon monoxide. Why carbon monoxide? Because carbon monoxide is a marker of combustion, and the companies claim that these products are not generating combustion or combustion toxicants. When we completed the study, there was no evidence of carbon monoxide in the exhaled breath of people using product No. 1 and product No. 2, compared with tobacco combustibles. They do not burn.

- Q37 **Chair:** These are heat-not-burn products.

Professor Polosa: Heat-not-burn. Heat-not-burn has no carbon monoxide, which is a good sign of no combustion. That does not mean that the products are 100% safe or that there is no risk, because there are other chemical events that may be attached to their use, such as pyrolysis, which can generate aldehydes. You have heard a lot from your media that aldehydes can contribute to cancer risk in electronic cigarettes as well as in the new heated tobacco products.

Allow me to provide some evidence that I thought about this morning. If you use a toaster properly, this is what you get—nice, golden, crispy toast that everybody will like; quintessential toast for a quintessential English breakfast, and this is a very good one. If you use the same



toaster for five minutes instead of 120 seconds, this is what you get—burnt toast full of nasty chemicals, including carcinogenic acrylamide. This is something that has been used by English media many times to scare potential smokers from switching. What happens is that a lot of scientists all around the world do not know these products very well. They own the good science and they know how to run cell and molecular biology analytics, but they do not know how to generate aerosol properly, so they use the toaster and overburn the e-liquid. That is exactly what happens; you get a lot of nasty chemicals.

Vicky, you asked about the cancerogenic potential of these products. Yes, they may be cancerogenic, if you end up overburning the toast. It is very important that we redesign position papers and white papers for all the scientists around the world so that they know how to use lab standards to produce proper science that can be compared across labs.

Q38 **Chair:** What is the relevance of the toast to heat-not-burn?

Professor Polosa: It is the same thing. The heat-not-burn can overheat, if not used properly. Obviously, there is technology. Temp control or temp limitation in the new products can minimise the problems. Let us imagine a toaster with a temp limitation. I am a bit forgetful, so I leave my slice of bread in the toaster and go to the bathroom to shave. It takes me hours to shave my beard; it is very hard. I would love to see in my toaster something that limited the time or the temperature, so that my toast did not go from this to this.

Q39 **Chair:** It is about product development. You can control that.

Professor Polosa: You can. It smells, so you would not eat it anyway.

Q40 **Neil O'Brien:** This leaves a question in my mind, which is about both heat-not-burn and vaping. What proportion of the products out there are metaphorically burning the toast? You made a point about science and said that it was important to replicate real vaping, rather than to overburn the liquid, but I am struck by the diversity and the cheapness of a lot of the different vaping products. I imagine that a lot of them are burning the toast and producing more toxic results than are perhaps intended. Do we know anything about that?

Professor Hajek: There is a built-in safety valve. When you get to the production of carbonyl compounds, you get an acrid, unpleasant taste.

Q41 **Neil O'Brien:** Always?

Professor Hajek: We do not know whether it is always the case, but generally vapers detect what they call dry puffs. A colleague in Greece has a number of studies on that. When you detect these compounds in the vapour at a certain setting and then ask vapers to vape at that setting, they say, "Ugh! I wouldn't vape it." When the setting is acceptable to them, you do not detect aldehydes in vapour. That is reassuring for me.



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Q42 **Neil O'Brien:** That is interesting. Can I pursue the original point? In one of its recent reports, the Royal College of Physicians said that it thought that vaping was roughly 5% as dangerous as smoking. If you were forced now to put a percentage on heat-not-burn, as compared with smoking, what would it be? Would it be 5%, like vaping, or 50%? Roughly how bad is it compared with regular smoking?

Professor Hajek: I know a little about heat-not-burn. We will start to test the IQOS product in our laboratory next month, but that is just to see the user reaction, effects on the user and their speed of nicotine intake. On safety, from the papers I have seen, I would say that the risk of heat-not-burn would be somewhere between the risk of smoking and that of e-cigarettes, but closer to e-cigarettes than to cigarettes.

Q43 **Neil O'Brien:** Would it be something like 10% or 20%?

Professor Hajek: I would not dare to try to say.

Professor Polosa: For the reason that I explained before, there is very little way of comparing all these experiments directly. I agree with Peter that it is reasonable to say that the level of harm and risk of heat-not-burn will be much closer to that of electronic cigarettes than to that of combustibles.

Q44 **Chair:** My understanding is that, as a product, it has taken off quite a lot in Japan. Is that correct?

Professor Polosa: It is.

Q45 **Chair:** I have heard a claim made that there is a higher conversion rate of smokers to heat-not-burn than to e-cigarettes. Can we establish whether or not that is accurate?

Professor Hajek: It is not accurate. In Japan, e-cigarettes are banned.

Q46 **Chair:** We cannot establish the conversion rate of one compared with the other.

Professor Hajek: No. Remember that I talked about the addictiveness of nicotine and how it is addictive in tobacco, but not outside tobacco. I expect that heat-not-burn products will be addictive. That may make them more effective for smokers, but the risk that non-smokers will start using them may also be a bit higher. That is one issue to bear in mind. The Japanese experience is heavily influenced by the fact that they do not have e-cigarettes, so we do not know who would win in a competition between heat-not-burn and e-cigarettes. My guess is that it would be e-cigarettes, but I would not put my house on it.

Professor Polosa: Can I offer a clinical experience? What we really need to do is to provide our smokers with a diversified portfolio. Not all smokers will love vaping. Some of our smokers who fail with vaping products just love the heat-not-burn products. That is the trick. It is about personalised medicine, if you like to call it that. You provide as



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many options as possible that reduce risk. There needs to be reduced risk, so we need that confirmation, but at the end of the day the smoker will have to decide which product fits his lifestyle.

- Q47 **Stephen Metcalfe:** I have a brief question about the research on heat-not-burn. You said that the majority of the literature at the moment has been produced by tobacco companies. What percentage is from the tobacco companies, and what percentage of research has been done outside that? Peter, you said that you are starting to look at IQOS. Can you put a number on it? As part of this inquiry, who should we talk to as the authority on the research for heat-not-burn? I am not discriminating against you, but it sounds like you are not the authority on this.

Professor Polosa: That is a great question. I was reviewing an exchange of emails in our nicotine policy groups. There was some criticism that the panels were made up just of men. I said, "The committee will certainly make up a female panel next time." However, this is not about men and women; it is about stakeholders. You are right; you are nailing it there. You really need an expert in the area of heat-not-burn to come here to answer your question. At the moment, that expert is not me, Peter or anybody from this community. We have very limited experience. The stakeholders are tobacco companies. You probably need to talk to them if you want more information about these products.

- Q48 **Stephen Metcalfe:** Okay. I asked about the percentages, but I think that you have answered the question.

Professor Polosa: The percentages are 99% versus 1%.

- Q49 **Graham Stringer:** Professor Hajek, can I take you back to the answer you gave Vicky? You said that it was a mystery why non-smokers did not seem to get addicted to nicotine. Can one draw the conclusion that the addiction is psychological, not physiological?

Professor Hajek: That does not necessarily follow. There is definitely an involvement of chemicals and drugs, with social and psychological elements as well.

- Q50 **Graham Stringer:** What have the studies shown about whether e-cigarettes are renormalising smoking? How reliable is the evidence on that?

Professor Hajek: Professor Conner may have something to say about that. I would be very happy to add something at the end.

Professor Conner: These are the data on adolescents. The evidence is really mixed. If you look at the rates of smoking and e-cigarette use in adolescents, you find that the rates of smoking are going down and the rates of e-cigarette use are going up. That suggests that they are not directly linked. However, a few studies have looked at the rates at which adolescents who use only e-cigarettes progress to normal cigarettes. There are 10 US studies and about two UK studies. You are about three



to six times as likely to start smoking if you have tried e-cigarettes as an adolescent than if you have not tried e-cigarettes. That suggests that e-cigarettes may be associated with progressing to smoking.

Q51 **Chair:** Is it right to say that only a tiny number of people who take up e-cigarettes have not smoked?

Professor Hajek: This is about trying one.

Professor Conner: If we are talking about regular use, you are right. Very few adolescents regularly use e-cigarettes without smoking, but you might get 20% or so who try e-cigarettes. That is the group these studies have looked at. It is a real weakness. They are looking at very low levels of e-cigarette use, and just at initiation of smoking.

The one bit of evidence that I think is slightly worrying is that you also get a moderation effect. If you try e-cigarettes, it is more likely that you will go on to smoke in groups that you would not normally expect to take up smoking—those who have few friends who smoke and those who have low intention to smoke. That may be an oddity of the data, but it is slightly worrying in that it is a group you would not normally expect to start smoking, but who at least initiate smoking when they are exposed to e-cigarettes.

Professor Hajek: The more likely explanation of the relationship is that, as my colleague Marcus Munafò says, kids who try stuff try stuff. You have young people who are interested in this type of thing, and if they try one product, they are also much more likely to try the other. All we are seeing here is that people who like red wine are more likely to try white wine than teetotallers are, who just do not do such things. The only question this is looking at is which product people tried first. It just depends on what is available around them. To my mind, that may possibly explain why people with more smoking friends are more likely to try a cigarette first, because that is what is around them. Sensation-seeking, risk-taking teenagers of that kind are more likely to start with e-cigarettes if they do not have smoking friends. That is all it shows.

Regarding the intention not to smoke, I think Mark's own study found that it was actually the other way around.

Professor Conner: Not as the moderator.

Professor Hajek: One of the American studies found that it could be a factor.

Professor Conner: I want to come back on that, on the friends finding. Our own study and a study in Scotland found a moderation effect. Those with few friends who smoke are most likely to respond by initiating smoking if they use e-cigarettes. That is open to interpretation. It is still the case that those who have lots of friends who smoke are most likely to initiate, but it is quite a big difference. If you have no friends who smoke, you are seven times as likely to go on to try smoking if you try e-



cigarettes. For those who have lots of friends, it is a ratio of seven or eight—seven if you do not use e-cigarettes, going up to eight if you do. That is where the big difference lies, but you would want to see it confirmed in other studies before putting too much reliance on it.

Q52 Graham Stringer: Are there any safeguards you would recommend to stop e-cigarettes becoming a new pathway to smoking, particularly for young people, but for adults as well?

Professor Conner: The regulations we have in this country are already pretty good. There has been quite a bit of discussion about flavoured e-cigarettes and whether they are particularly appealing to young people. There are some American vignette studies showing that adolescents say they would be more inclined to try e-cigarettes that are flavoured than ones that are cigarette flavoured.

Q53 Graham Stringer: It is a bit like alcopops.

Professor Conner: Yes.

Q54 Carol Monaghan: I am a teacher by profession. A few years ago, I had the great pleasure of removing an e-cigarette from someone who was vaping in my class. His response was, "It's not a cigarette. I'm just vaping." Have any studies been done on how these products are perceived by young people? Is there a perception by young people that they are something quite distinct from cigarettes and, therefore, do not carry the same risks?

Professor Conner: There is not a lot of good evidence. A number of studies now try to look at predictors of initiation of e-cigarettes and smoking. Generally, they show very similar predictors. Some studies show that lower socioeconomic status, gender and things like intentions to smoke are predictors. The predictors are very similar for smoking and e-cigarettes, so in that sense they appear to be seen similarly.

Professor Hajek: As Mark pointed out, the picture is very reassuring at the moment, because the increased experimentation with e-cigarettes among young people is accompanied by not a dramatic but an accelerated decrease in smoking. We have population-level evidence that this is not luring kids to smoke; if anything, it is deflecting them from smoking, which I think is a more likely explanation. The two phenomena may be totally independent, but it is also possible that if you are a young person looking to try one of these things, and you start with an e-cigarette which does not do anything for you, you may be less likely to try a normal cigarette as well, whereas if you start with a normal cigarette, you have about a 60% chance of becoming a daily smoker at least for a period of time. It could be preventing the uptake of smoking rather than accelerating it. I am not saying we know that, but we certainly know that it is not luring children to smoke at a population level.

Q55 Carol Monaghan: I am talking specifically about how they are perceived by young people. Are they perceived as distinct or the same in terms of



the risk involved?

Professor Conner: There is a general perception that they are less risky, and that is a predictor of actual use. If you perceive that e-cigarettes are less risky, you are more likely to try them.

Professor Polosa: We really need to keep our eyes on the prize. The prize is the rate of smoking initiation in a country like the UK where there has been liberalisation of vaping. The indicators clearly show that the rate of initiation of smoking in this country since 2010, which was 12%, is now down to 7%, so for me the gateway-in theory is closed.

Q56 **Chair:** But there are lots of different factors at play, aren't there? We have had legislation banning it from public places; we have had legislation to stop smoking in cars with children; we have had legislation on plain packaging and so forth. Surely, it is hard to differentiate what is having the impact.

Professor Polosa: It has been the strongest acceleration in decline in years, and those policies had already been put in place. What I am saying is that we really need surveillance, because these are highly dynamic behaviours at the moment. In addition, as heated tobacco products kick in, another ecosystem will be generated among those people, so we need good surveillance, but at the moment the prospect looks very positive.

Q57 **Vicky Ford:** I want to make sure I really understand the numbers you have given us. I think you said that in the group of adolescents who do not have lots of friends who smoke they are seven times more likely to pick up an e-cigarette than a cigarette.

Professor Conner: No. They are all non-smokers, and about 20% have used e-cigarettes and 80% have not. It is the difference between those groups in terms of the proportion who go on to try normal cigarettes.

Q58 **Vicky Ford:** You said that in that proportion they were three to six times more likely to try real cigarettes.

Professor Conner: That is the overall figure.

Q59 **Vicky Ford:** You also said something about the likelihood of picking up an e-cigarette as your first taste.

Professor Conner: If I did, I did not mean to say so. There are relatively few studies looking at predictors of starting to use e-cigarettes. Most of them are cross-sectional, and there are now a few longitudinal studies.

Q60 **Vicky Ford:** Is it your view that, especially among young people who have never smoked before and do not have a lot of peers who smoke, there is potential for e-cigarettes to be a route to encourage some of them to become smokers?

Professor Conner: This is where we need to be really careful. The data say that you are more likely to try cigarettes. The data on whether you



are more likely to become a regular smoker are just not there; the numbers are really small.

Professor Polosa: This point is a bit technical, but it is very important. There is a base rate issue. If 1% of kids with non-smoking friends later try a cigarette, and those who try e-cigarettes go to 6%, you have five times as many, but it is only a 5% difference. Among people with smoking friends who are more likely to try both as well, you may get 10% or 15%, so it is exactly the same, but for one of them you say there is only half the chance and the other has five times the chance. That is what you get when you use other ratios, and you have to be careful about interpreting them. This is a soundbite which sounds alarming, but if you look at the data, they show there is nothing in it.

Professor Conner: The numbers in our data do not quite match that. You are talking of a difference between, say, 5% and 34% initiating smoking. That is in the group who do not have friends who are smoking. I do not think the really low base rate is the explanation of those data.

Q61 **Vicky Ford:** It is a significant proportion but it is still quite a small number.

Professor Conner: Yes. We need to be really clear that it is trying cigarettes. The numbers who go on to become regular smokers are very low.

Q62 **Bill Grant:** I am hearing a lot of positive things: 95% harm reduction; little or no risk from second-hand vapour; the risk being the same as walking the streets of the UK and so on. I also heard the comment that it would be illogical to ban or restrict e-cigarettes. These are all positive things, and there is almost a change for the better in respiratory health. Can I narrow the field a wee bit and go to the flavouring that goes into these systems? What research has been done into the risks from flavouring? How much research has been conducted on the toxicity of the various flavourings? Could somebody tinker or tamper with the flavourings and alter them? Have you researched flavourings that are positive and flavourings that are negative? What is your general feeling about ingredients that may or may not present that 5% of risk?

Professor Polosa: In relation to flavouring, there has been quite a large debate over the last couple of years, mainly because flavours are considered safe according to the GRAS, but only when ingested, not when inhaled. This is a grey area where more research is needed.

To take an archetypal ingredient, let us talk about diacetyl, which is the element that gives a buttery aroma to many e-liquids. It has also been shown to cause popcorn lung disease in factory workers involved in the microwave oven industry. However, those workers were exposed to massive levels of diacetyl. Let us not forget that it is the dose that makes the poison, not the presence of a certain chemical that is of concern, so at this stage we need to try to understand the concentration and the



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threshold. More work needs to be done in that area, in particular on the unknown unknowns, because now we are just talking about the absolute risk of these products. As a medic running a smoking cessation clinic, to me that is marginal, because all I am doing at the moment is switching smokers already exposed to heat and very dangerous products, including diacetyl, at high levels, and I do not see popcorn lung disease in any smokers. A lot of this discussion is theoretical, and we need to start to set up with the authorities good protocols to try to answer these questions sensibly.

- Q63 **Bill Grant:** Basically, there is a weakness in our knowledge about the content of flavourings. Do we fully understand how the various ingredients of the chemicals contained within flavourings interact with others?

Professor Polosa: Yes.

- Q64 **Bill Grant:** Is that a weakness?

Professor Polosa: The reason why tobacco smoke is so dangerous is that it is a cocktail of 7,000 chemicals that are not in isolation; they interact between themselves. Our body is fantastic; it is phenomenal. It is equipped with scavenging and detox systems that can handle the deadly toxicants coming from tobacco combustibles, but only until a certain point. When ageing sets in, all the scavenging systems and detoxicants become less efficient, and that is when we develop cancer, cardiovascular disease and respiratory disease.

We certainly need to understand more about the interaction of the ingredients, but at the moment the priority is to have as many smokers as possible switching to less harmful products. Today, we know they are not 100% risk free, but because they are novelty products, by knowing the chemicals that may be of concern it will be very easy to get rid of them in the next two or three years just by changing the diluent or setting the temperature control.

The problem with tobacco combustibles is that people have been familiarised to the product for decades. With e-liquids, you change them every month, or every year, so you are not stuck with the same product long enough to develop any of these diseases. However, my opinion is that the precautionary principle suggests that anything that is more than 5% aroma in an e-liquid should not be recommended.

- Q65 **Bill Grant:** I have two further questions, one that sticks to the area of vapers and one that is off the wall. What part does flavour play in taking a smoker, or a non-smoker, into vaping? What part does it play in making it attractive, or is it just a side issue?

Professor Polosa: I do not think it is a side issue. I would like to use the best data and the best flavour that will force a smoker to switch to a reduced-risk product, so flavours have an ethical role. Obviously, you do



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not want to use ingredients or aromas that may cause more damage than a combustible cigarette, but that is very unlikely.

Q66 **Chair:** Restrictions in the range of flavours could have the unintended consequence of fewer people switching from cigarette smoking to vaping.

Professor Polosa: There could be unintended consequences that might be serious.

Q67 **Bill Grant:** My final question is about the hookahs, hubble-bubbles and shisha pipes that I imagine have been with us for centuries. They are certainly not as portable as a vaping machine. Is there a correlation with, or read-across to, that type of recreational vaping, whereby the user could be exposed for 20 minutes or even an hour? Has anybody looked at the risks or consequences of that type of vaping? As a lay person, in my mind's eye I see a similarity. Is there any Arabic evidence? I have seen them only in Paris. Is there a connection?

Professor Hajek: It is a very marginal phenomenon compared with vaping. The use of water pipes is limited to certain groups and is not very widespread. It is more a fashion or fad, which may well pass.

Q68 **Chair:** But what about the risk?

Professor Hajek: It is much more risky.

Q69 **Stephen Metcalfe:** Riccardo, you mentioned popcorn lung, which has caught the public's imagination in the papers. You said that in factories workers who had contracted popcorn lung were exposed to massive levels. What do you mean by massive levels? Is that 10, 100 or a million times greater than vaping?

Professor Polosa: It is 100 to 1,000 times the dose that you measure in e-vapour under normal conditions.

Q70 **Stephen Metcalfe:** It is an overstated risk.

Professor Polosa: Not only that. Not all people who work in those factories develop popcorn lung disease. There is a susceptibility that kicks in, and do not forget that they are exposed continuously for up to eight hours, five days a week. That is a big difference. On average, a vaper vapes in total for 20 to 30 minutes a day, and that is not even continuous; it is in bouts. Your body is already establishing defensive systems.

Q71 **Stephen Metcalfe:** It is an overstated risk. I have a final question, Chair, which I think is quite important. Is the risk overstated because it sells newspapers and grabs headlines, or is it overstated because someone somewhere has a vested interest in discrediting e-cigarettes and vaping?

Professor Polosa: What do you want me to say?

Q72 **Stephen Metcalfe:** The answer.



Professor Polosa: I hope not, because that would be immoral and fraudulent. It is understandable that papers look to hype for their headlines, but the people who read them are not that stupid. They now know that 80% of the information provided by newspapers is fake.

Chair: I think we are moving on to other issues. Thank you all very much indeed. It has been massively informative and very helpful. In particular, Riccardo, thank you for coming over from Italy; it is appreciated.

Examination of witnesses

Witnesses: Dr Shahab, Dr Brown and Professor Aveyard.

Q73 **Chair:** Welcome, all of you. Thank you very much for being here. You probably heard the instruction earlier. I am not sure how much it sank in, but try to keep your answers brief, and don't feel all of you have to answer every question. Could you introduce yourselves?

Professor Aveyard: I am Paul Aveyard. I am here partly because I am the co-ordinating editor of a thing called the Cochrane Collaboration, an international collaboration known for the systematic, rigorous collection of evidence and for producing reviews that are useful to people. Independently of that, I am a tobacco control researcher at the University of Oxford.

Dr Brown: I am Jamie Brown, principal research fellow and deputy director of the Tobacco and Alcohol Research Group at UCL. Among other activities, we provide monthly updates on the use of cigarettes, quitting, e-cigarettes in England, and have done since 2006. That work is funded primarily by Cancer Research UK. I am very grateful to be here to answer your questions.

Dr Shahab: I am Dr Lion Shahab and I am a senior lecturer and an associate professor in health psychology at University College London. I have been working on tobacco control for about a decade and have published a couple of papers, but clearly many fewer than Riccardo, on cigarette safety.

Q74 **Chair:** Vicky asked the first panel a question about whether any of them had done work for tobacco companies. Can each of you answer that question?

Dr Brown: No.

Professor Aveyard: No.

Q75 **Chair:** Or any other interest.

Dr Brown: I have received funding from the pharmaceutical industry relating to the study of smoking cessation trends.

Q76 **Chair:** Any others?



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Professor Aveyard: Prior to 2012, I did occasional bits of work with the pharmaceutical industry.

Dr Shahab: I have also done work for a pharmaceutical company, but nothing with the tobacco industry or e-cigarette industry.

Q77 **Chair:** As with the first panel, bear in mind that there is no need for us to hear the same issues repeated, but do any of you want to add anything about the difference in the public health harm issue between conventional cigarette smoking and e-cigarettes? Does anyone want to comment further on that issue?

Dr Shahab: A priori, it is important to point out some very important differences between tobacco smoking and e-cigarettes. The first one is that tobacco contains about 600 compounds, of which about 70 are carcinogenic, and the big problem is combustion. You burn tobacco, which then leads to the production of about 7,000 chemicals. E-cigarettes and e-liquid primarily contain nicotine and propylene glycol, vegetable glycerine, and some flavourings, so there are many fewer compounds. What is very important is that there is no combustion. E-liquids are just warm; they are heated to about 200 degrees Celsius versus 800 degrees Celsius, so a priori you would assume they would be much safer than smoking tobacco.

Q78 **Chair:** Presumably, the same would apply to heat-not-burn.

Dr Shahab: Heat-not-burn is somewhat different in so far as it uses tobacco products. They use tobacco sticks that tend to be heated to about 350 degrees Celsius as opposed to about 200 degrees Celsius, so it is heated to a greater degree than e-cigarettes.

Q79 **Chair:** But you said that the key point is combustion.

Dr Shahab: Yes.

Q80 **Chair:** Ultimately, does the same point apply? Because there is no combustion, one assumes there is likely to be less risk.

Dr Shahab: Indeed. Yes.

Q81 **Chair:** Are there any other contributions?

Professor Aveyard: There is very little doubt that, if you smoke and you switch, you are better off. There is almost no doubt about that. A lot of people who do that use the e-cigarette as people use NRT; only a certain proportion of them go on using it for a long time. We must not think that people switch and then become lifetime users of e-cigarettes, because it is not always the case.

Q82 **Chair:** One imagines that there is likely to be a declining market for e-cigarettes if the only cohort of people generally using them are smokers. If the proportion of people who smoke is going down, presumably the likely number of people who vape will also go down in time. Is that a reasonable assumption?



Professor Aveyard: It would be reasonable, yes.

Q83 **Chair:** Can the UCL witnesses tell us more about the research you are doing on long-term effects?

Dr Shahab: We published a paper last year that tried to compare the risk of exposure to various harmful substances. It looked at people who were long-term users of e-cigarettes compared with people who were long-term users of cigarettes and users of nicotine replacement therapy. The problem in terms of establishing the long-term effects of e-cigarettes is that most of the health effects, certainly for tobacco use, tend to take about 20 to 40 years to materialise. There is a long time lag. The other problem is that a lot of people who used e-cigarettes prior to that are currently still using tobacco, and a lot of the health effects of tobacco are irreversible. One of the ways of getting around the problem is to look at biomarkers that have a much shorter turn-around time, so they are eliminated from the body, but are crucially linked to long-term health outcomes.

In our study we looked at different users—long-term e-cigarette users and people who had been smoking cigarettes—and compared them in terms of exposure to various carcinogens that we know are related to long-term health outcomes. We found that for some of the best characterised, one of which is nitrosamine, there were reductions of about 95% compared with cigarette smokers. For other compounds that we looked at, the reduction is 60% to 80%, but there may be sources other than tobacco that cause an increase in those levels.

The important thing to remember is the interaction between the user and the product they use. That is why it is not enough to look at just the aerosol a machine generates, because people may use it differently. It is more important to look at the body's actual exposure to these carcinogens.

Q84 **Chair:** Do you want to add anything, Jamie?

Dr Brown: Only to clarify whether the question is also about effects in terms of cessation or just health. Is it about cessation as well?

Chair: Yes.

Dr Brown: We have been doing work in which we looked at trends in the use of e-cigarettes in 2006, and how far that was associated with population-level quit success rates and quit attempts, and also the use of other treatments. In that study, which looked at quarterly trends, we found that increases in the use of e-cigarettes were associated with increases in population-level quitting success. Although the length of outcome was short to medium, in terms of how long smokers were abstinent, it was conducted between 2006 and 2015 and so represents relatively robust observational evidence. There is also a study that came out of the US that found a similar finding.



Q85 Chair: As e-cigarettes vary in design and composition, does that also affect their relative harmfulness to varying degrees? Is there a difference in the range of products available?

Dr Shahab: In our study, we were not able to look at the different types of products because the range was quite vast, but one would assume that there would be an impact. A lot of the concerns about e-cigarettes are that, depending on the materials used, there may be degradation, in particular degradation of the metals used in the products, that could be potentially harmful.

Another issue touched upon earlier was about flavourings. Certain flavourings may be found in e-liquids. Two that might be particularly important are diacetyl, which may or may not be linked to popcorn lung, and a cinnamon flavour, which leads to cinnamaldehyde, which is a carbonyl that is highly toxic, so that is a concern.

Some of the early devices were very simple; you could not modify them at all. Some of the newer devices you can modify, which is positive in so far as it allows the user much more control over how they use the device, but it may be negative if it is used incorrectly and leads to overheating and so on, which could lead to the production of toxic compounds.

Q86 Chair: In UCL's submission, you state that research reports and press releases on the harmful effects of e-cigarettes are being overplayed. Could you elaborate on that?

Dr Shahab: I think it is partly due to the fact that a lot of the papers, while written quite correctly, in the press release overstate what has been found. This may be partly because often the papers look at acute and not at chronic effects, and effects that are not very well linked to long-term health outcomes. One of them is arterial stiffness on which a paper was published recently. That was then linked to the fact that e-cigarettes cause heart disease. The very same authors also published a paper that showed that, for instance, exercise increased arterial stiffness, so it is very difficult to link that particular marker to long-term health outcomes. That is one of the problems.

Another is that often people use unrealistic use conditions. A study looked at the formation of formaldehyde, which is very toxic. This came up in earlier discussion. Basically, it is produced only at levels where it becomes really unpleasant to use. It is an acrid taste called dry puffing, which is unlikely to occur in real-life conditions.

Lastly, often the models used to investigate the effects of e-cigarettes are not really relevant to humans—for example, mice models. One big problem is that mice are much more sensitive to nicotine than humans, and often the effects observed in animal studies may just reflect nicotine poisoning rather than the effects of any of the other potentially harmful substances.

Q87 Stephen Metcalfe: You talk about trying to estimate the long-term



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effects of vaping and e-cigarettes, but it might be useful to expand on the fact that we are not beginning from the same place as we were when we started to realise there was harm in smoking tobacco, in that the analytical technology that is available is able to identify much earlier where potential risks might lie. Is that true? Can you explain how that works? We originally started with animal tests with cigarettes, and we have now moved way past that, I hope. We are not in the same position; we do not have to wait 40 years to find out the risks associated with this.

Professor Aveyard: When we discovered that smoking was bad for you, it was because people had smoked for many years and, therefore, were getting diseases caused by smoking. It required a study of people and then you could go back and unpick the mechanisms by various animal tests and so on. Undoubtedly, the unpicking the mechanism stuff has improved considerably, but what we do not have is a cohort of people who have been using e-cigarettes for a long time, in order to realise whether there is a true risk in humans. Everything we say is either extrapolation or speculation. There is not a technological fix around that problem; we just do not have people who have used them for 30 or 40 years.

Q88 **Stephen Metcalfe:** The point I was trying to make was that 40 years ago we did not know there were 7,000 chemicals in a cigarette; we do now, because we have the ability to analyse that, hence we can analyse the vapour that comes from e-liquids, and identify the chemicals, flavours and so on at a much earlier stage than waiting that time, presumably.

Professor Aveyard: Yes, but the question is what is the effect on human health? The answer is that we can do studies in labs where you drop liquids on to cells and that kind of thing, and then make extrapolations. What many of us are worried about is that some of the extrapolations seem to be over-claimed, based on people's prior conceptions that e-cigarettes are bad.

Q89 **Chair:** The risks are over-claimed.

Professor Aveyard: The implication that vaping is going to be a cause of heart disease and so forth is. We do not know, but it looks like an overstatement in many cases.

Q90 **Chair:** Paul, can you say more about the work Cochrane is doing on e-cigarettes and what key conclusions have been produced so far? I was going to ask about the over-claiming, but I think you said you agree with the UCL concern over that. Tell us more about the work you are doing.

Professor Aveyard: What we have done is to summarise studies in humans. There are just shy of 2,000 people involved in these studies. As you heard previously, they are people who used to smoke and now have switched, so we are always in that context. Riccardo's group has looked at people with chronic lung disease, asthma or high blood pressure who have switched. They have looked at the effects on blood pressure control and so on, but we see no signal there. Among those 2,000 people,



investigators were unable to find what we call serious adverse effects—things that take you into hospital or death, for example—in the group of people who were switching to e-cigarettes. While there could be risks, the signals coming from real-life studies and real human beings are reassuring at this stage, but by no means can we say that that means, therefore, there is no risk; it is just that thus far there is no signal of a risk.

Dr Brown: On the point about long-term data, it is also worth thinking about the context in which we are talking about making those sorts of reassurances, and remembering that any perceived risk associated with offering reassurance before we have the long-term data must be balanced against the risk associated with the opportunity cost of failing to inform the millions of people who are currently smoking uniquely dangerous products that e-cigarettes are safer when they believe they are not.

Dr Shahab: Generally, the point to remember is that it is very difficult to produce a product that is more dangerous than smoking tobacco.

Chair: Very good.

Q91 **Martin Whitfield:** I want to look at the role e-cigarettes play in smoking cessation. I presume from what we have heard today that everyone is in agreement that they are safer than smoking. What role do e-cigarettes play in cessation programmes generally, to give a setting to it?

Dr Brown: I do not think there is much evidence yet directly in terms of comparing what sort of effect they have on cessation when offered in that context. There is some monitoring data from PHE that show that they seem to produce quite high success rates. I think Peter—who is still here—is currently conducting studies along those lines to look at the effects in those contexts. In the meantime, I certainly support PHE's and NCSCT's recommendation that it is wise for those sorts of services to support smokers who are interested in using e-cigarettes and being friendly towards them.

Q92 **Martin Whitfield:** What is the evidence about the relative effectiveness of e-cigarettes over the more established systems—the gums, patches and things?

Professor Aveyard: It is something we address in the Cochrane review. Obviously, we can only review the evidence that is published. Essentially, there were two trials where people came along and said, "Help me quit, please," and then there were what we call randomised, where they were randomly split into trying an e-cigarette, trying NRT or just trying. What we see there is that, roughly speaking, e-cigarettes seem to double the chances of a quit attempt being successful, but there is wide uncertainty around that. It could be more than that, or it could be less. It is somewhat consonant with the type of data Jamie has from populations just using them. It is not a miracle cure; it is about the same as you get



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with NRT, or possibly slightly less effective than Varenicline and other available medications. By no means do they look like, "Wow. This is it," but they are tremendously popular with people who smoke, and that is where the difference lies.

Q93 **Martin Whitfield:** Their value really lies in their popularity.

Professor Aveyard: Because of the population impact. Suddenly a group of people will use a cessation aid, whereas they might just have given it a go without that.

Q94 **Martin Whitfield:** Do you think that with the popularity of e-cigarettes there is a danger that some of the other systems for cessation will drop by the wayside and lose their funding and that, as we discussed in the first session, the idea of individual choice will become limited?

Dr Brown: In the study I mentioned, we looked not just at the association with quit success but also at how far changes in the prevalence of e-cigarette use seem to be associated with changes in other quitting aids. We did not find, after adjusting for secular and seasonal trends and other tobacco control activity, including funding, that they were directly associated with the declines we have seen in the use of services and all other prescription medications. We saw a small decline in the use of prescription NRT. It is not exactly clear to us why that would be the case; it may be related to health professionals having a conversation with people who have already tried others and therefore they recommend e-cigarettes, or something along those lines.

Funding is a separate issue obviously. It is very important to reiterate what Paul said about the evidence base for the services. It remains incredibly strong; it is one of the most cost-effective healthcare treatments available. While e-cigarettes appeal to a wide variety of smokers, there are also smokers who need the additional help the services can provide. In a review of the performance of the services over their first 10 years, my colleague Robert West found that they were very successful in reaching the most disadvantaged smokers, with about half eligible for free prescriptions.

Q95 **Martin Whitfield:** Flowing from that, would any of you like to comment on the earlier discussion about the potential for renormalisation of smoking with e-cigarettes?

Dr Shahab: Looking at the toolkit data, as we have done, we assumed that if there was renormalisation we would expect to see certain trends since they have become popular, one of which would be, for instance, that there is a greater relapse rate among long-term ex-smokers. We do not see that. Another thing would be that smoking prevalence rates in the UK would not decrease to the same degree as they did before e-cigarettes became popular, and we do not see that. Most of the indicators we can think of suggest that they have not led to renormalisation of smoked tobacco products.



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With regard to funding, Brexit was mentioned earlier. The UK is exemplary when it comes to tobacco control. I am German. Germany is very much down the list if we look at these indicators. Bar Scandinavian countries, where snus is very popular, the UK has the lowest smoking prevalence rates in the whole of the European Union. It is doing very well, and it is due in part to the fact there are exemplary stop smoking services and other forms of support.

Dr Brown: It is worth noting that a lot of the positive evidence—certainly the observational evidence—on e-cigarettes in the UK has been collected in a context in which there are all these other tobacco control measures and initiatives in place, and there is a lot of advertising and support for smokers wanting to stop, encouraging them to do so. It is at least possible that we would not necessarily have observed the same effects if those things were not also in place. I think there is one paper from the ITC that shows that at the individual level, the association between the use of e-cigarettes and cessation outcomes depends upon the regulatory context in which e-cigarettes are available.

Q96 **Chair:** Would you be seeking to change the regulatory framework, as and when we are able to after leaving the EU, in terms of the biggest impact on public health?

Dr Brown: Pass. There are certain opportunities, which I think Peter mentioned. The point I was making was more about the wider tobacco regulatory context than specifically about e-cigarettes. It is worth noting that in some ways it is possible to perceive e-cigarettes as being regulated more strictly. There are other ways in which they are regulated less strictly; they are not subject to the same levels of advertising restrictions as traditional tobacco. There is currently consultation, or it has recently ended, on whether additional health effect claims might be able to be made around e-cigarettes. They are allowed to include characterising flavours.

Q97 **Chair:** Do you think the regulatory framework is about right, or is there scope for changing the framework to increase the incentive to get people to shift from smoking to e-cigarettes?

Dr Brown: There are certain opportunities, but I do not think there is evidence as yet that the TPD has been having a significantly negative effect on the use of e-cigarettes.

Dr Shahab: In general, one of the biggest drivers of downward smoking prevalence is taxation. By the way, this is different for e-cigarettes and heat-not-burn products. Heat-not-burn products are produced by the tobacco industry and they are quite expensive, so that will not really provide an additional benefit to somebody who wants to switch over and save money, whereas, if e-cigarettes are taxed at the right level, people can be encouraged to use a safer and arguably cheaper product, so that should be considered as well in this context.



Q98 Martin Whitfield: We heard before that the socioeconomic level of the smoker tends to be lower than other people. Are you aware of any research that proves that statement about smoking levels by socioeconomic group? If that is the case, does one of the ways to promote the move away from smoking to e-smoking lie with taxation?

Dr Shahab: There is plenty of evidence to suggest there is a very steep gradient in terms of smoking prevalence by socioeconomic group. If you look at the data going back over the past 30 or 40 years, you can see a huge decrease in the prevalence in social group AB1. Smoking prevalence has remained relatively steady in the lower socioeconomic groups. I guess that taxation is one of the levers you can use to help people switch over. There is some evidence on e-cigarettes in relation to that.

Dr Brown: In the study I mentioned, we checked data on e-cigarette use and socioeconomic background. The answer is slightly nuanced, but since we have been monitoring them over the entire period there has been a social gradient, such that the greatest proportion of high-income smokers have used e-cigarettes. However, as with most new innovations, there has been some diffusion. If you look at 2017, there is no longer a social gradient across use and it seems to have diffused into lower income groups. I imagine that affordability and the very different taxation schemes applied to cigarettes and e-cigarettes may have played a role in that. A further point of mitigation against that initial gradient is that the highest proportion of smokers exists in low-income groups. If you look at just adults across income groups, the highest e-cigarette use is among low-income groups because there are so many smokers.

Q99 Martin Whitfield: Are you aware of any research about the level of harm of e-cigarettes as compared with other cessation strategies like gum, patches and things like that?

Dr Shahab: In the study I mentioned earlier, we compared the long-term use of e-cigarettes with long-term use of NRT. To be precise and concise, the short answer is that there is no difference on the measures we looked at.

Professor Aveyard: In the trials that randomised people to two groups, there was no real difference in the occurrence of minor adverse effects. It is just an irritant at the site of exposure to nicotine. If you put on a patch, it irritates your skin; if you inhale it through an e-cigarette it is the same sort of thing.

Q100 Chair: The Public Health England report on e-cigarettes says, "Some health trusts and prisons have banned the use of EC which may disproportionately affect more disadvantaged smokers." Do any of you see any basis for NHS mental health trusts banning the use of e-cigarettes, given that smoking rates among people with mental ill health are significantly higher than in the rest of the population and, therefore, the health consequences are significantly greater for that cohort of people? Is there any sense in mental health trusts banning the



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use of e-cigarettes?

Professor Aveyard: I cannot see any justification for it on health grounds. With cigarette smoking, there is a risk to prison staff, for example, but there appears to be negligible or no known risk of exposure to vaping.

Q101 **Chair:** You mean a secondary smoking risk.

Professor Aveyard: Yes, second-hand vaping, as it were. On health grounds at least, you would not ban it, and you certainly would not ban it wholesale. That does not make sense to me.

Q102 **Chair:** Presumably, alternatively there is a case for making a significant effort to encourage people with mental ill health to switch.

Professor Aveyard: Indeed, but for all sorts of social reasons you may not want people vaping just everywhere in, say, a prison, a restaurant or whatever setting you happen to be in. There are all sorts of reasons, but they are not particularly health related.

Q103 **Chair:** There are reasons for restrictions on where you do it, but not to ban it.

Professor Aveyard: Yes.

Q104 **Chair:** Do you all agree on that?

Dr Brown: Yes.

Dr Shahab: Yes.

Q105 **Bill Grant:** It is quite clear as we progress that a lot more knowledge has been gathered about e-cigarettes and vaping. Where is the knowledge gap? What is the weakest area in that knowledge? Are there any areas on which we should focus? Where is the weakest link in the knowledge about vaping?

Professor Aveyard: Jamie will have the figures, but if you ask the population, roughly speaking half of people who smoke think that e-cigarettes are as harmful as smoking. That is a terrible misrepresentation of what we know already. What they are asking for is more reassurance about safety, I think, and health professionals feel the same thing. Like everybody else, they read the papers; that is where they get their information, so we probably need to know more about the safety issue. Of course, we need more randomised trials in different contexts, but those are under way and the data will come through in due course.

Dr Shahab: It is probably very important to look at effect modifiers. We do not really know how different types of e-cigarette affect health outcomes, or even some of the markers I was talking about. More research on that would be very helpful, given that there is constant innovation in the e-cigarette industry.



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Dr Brown: To follow up Paul's point about harm perceptions, that is about right. If anything, it has been going the wrong way for the past two to three years despite the improving evidence base.

I would be interested to see more research on the long-term relapse rates associated with e-cigarettes. People have speculated that they may go one of two ways, and we do not really have good data on that as yet. When we have made calculations as a consequence, we have just assumed a priori that it will be similar to other routes to quitting, but evidence on long-term relapse, which may well be lower than for other treatments, would be very interesting.

Q106 **Bill Grant:** It seems that collectively you suggest that the health boards, or those tasked with smoking cessation, should be encouraging conventional smokers to drift to the use of e-cigarettes.

Dr Shahab: There are other very effective forms. It is not a panacea for smoking cessation. There are very effective means of stopping smoking, including behavioural support and other pharmacotherapy, including Varenicline, bupropion or NRT, so it is not one deal for all smokers. Smokers are a very heterogeneous group, and, for some, e-cigarettes may be more helpful than for others.

Q107 **Bill Grant:** We heard earlier today, and from yourselves, that there is little or no risk from second-hand vaping. It was suggested earlier this morning that there was greater risk in walking the city streets in the UK. Would you agree that that is a true statement?

Professor Aveyard: I am not an expert, but from what I understand that is my perception.

Dr Brown: My answer is very similar. The point Peter made about the lack of sidestream smoke is a very important thing that a lot of people forget. With cigarette smoking, one source of toxicants is the sidestream smoke that comes off the cigarette, whereas with e-cigarettes the only output, essentially, is the vapour breathed out, the person having already inhaled it, so that is an important point.

Q108 **Bill Grant:** What safeguards or regulations, if any, would you like to see to minimise the uptake of e-cigarettes among non-smokers, or young people?

Professor Aveyard: The problem with any safeguard is that you can deter people. If you smoke, you are better off switching, if that is the only thing you are prepared to do. Any safeguards always risk the perception that it makes e-cigarettes seem dangerous and so on. I feel we are in the right sort of zone in Britain at the moment. If you are a young person, you cannot buy them. That seems a reasonable sort of thing, because they have an inherent attractiveness over and above, say, nicotine gum, which I suspect does not seem quite so interesting and fun to a teenager. That is probably a reasonable regulation, but I would not want to see that much more regulation.



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Dr Brown: I agree. There are also the current advertising restrictions, which are probably appropriate, in terms of what they can say to appeal to young people. It would probably be helpful for advertising to be able to offer more messages to adult smokers about the relative safety.

Q109 **Bill Grant:** Of vaping.

Dr Brown: Yes.

Dr Shahab: If you look at the epidemiology, there is not a big problem. Only 0.1% of kids who have never smoked have used e-cigarettes regularly. I think the latest ASH survey data also suggest that, if anything, there is a decline in the use of e-cigarettes among kids. It seems that we are getting it right at the moment.

Q110 **Bill Grant:** Would you see vaping as a stepping stone from conventional smoking, rather than a stepping stone from a non-smoker to a conventional smoker? Is it a two-way street?

Professor Aveyard: I think it is mostly the other way; it is mostly away from smoking and towards non-smoking. Hardly any people are going in the opposite direction so far as we can tell.

Q111 **Bill Grant:** We sense collectively that vaping is not a stepping stone on a journey from being a non-smoker to a conventional smoker.

Professor Aveyard: Yes, at any scale. That is not to say you could not find cases of it, but at any scale the traffic is massively one way, and there is hardly any the other way.

Dr Shahab: A good way to estimate it in the context of the UK is to look at smoking prevalence rates in youth. In a country like the UK, e-cigarettes had quite light touch regulation early on and were quite prevalent compared with the tobacco use rates in countries where nicotine e-cigarettes were banned—for instance, New Zealand. What we see over the same period is that the decline in smoking prevalence is very similar in those two countries. If there were a strong gateway effect, we would expect to see that in this kind of data, which we do not see. I also agree that it is primarily in one direction.

Q112 **Chair:** How many countries currently ban vaping?

Dr Brown: A surprisingly large number.

Dr Shahab: At least one.

Dr Brown: Certainly 10s. There are people behind us who could answer that.

Q113 **Stephen Metcalfe:** Do we know why they banned e-cigarettes when the evidence we have heard today seems pretty solid that there is harm reduction and a reduction in the prevalence of smoking?

Dr Shahab: Not all policy decisions are informed by evidence.



Dr Brown: The evidence base has changed significantly over the past two, three or four years and some people decided to act on a precautionary principle that may have been unwise then. A lot of people have been looking to England and the UK as a natural experiment, and the positive results coming out of this country may be giving others pause for thought. I know that Australia has had a review recently of their current regulations; Canada has also looked at it.

Q114 **Chair:** Australia, New Zealand and Canada all ban vaping.

Dr Shahab: They ban nicotine and there is nicotine in e-cigarettes. I do not know whether they have banned vaping as such, but it is not possible to get nicotine e-liquids there. I think they are reconsidering it. [Interruption.]

Chair: Anyone who wants to send in a written submission can do so. That is probably the best way of dealing with it.

Q115 **Martin Whitfield:** What is the evidence base with regard to people who both smoke and vape at the same time? Do we have any evidence of mixed use and, if so, what proportion mix use?

Dr Brown: The proportion we find in our study has been changing over time and has been reducing, presumably as a greater number of vapers quit successfully and become exclusive users. Over the time we have been tracking it, it has been declining towards about half e-cigarette users. Other studies give other estimates, but one thing about this kind of dual use issue, which has not often been raised with e-cigarettes, is that we also track the same figure with NRT and it is not radically different. Attention is not often drawn to that.

Q116 **Chair:** Are there health benefits for people who are simply reducing the use of cigarettes, even if they are not giving up at all, because they are vaping?

Dr Shahab: It is a rather tricky question to answer because so-called dual use is manifold. You can have a dual user who smokes 30 cigarettes a day and vapes once a month, and identify them as such, or vice versa. Depending on the type of dual use, you would expect to see health benefits or not. The study we published also looked at dual use with NRT and e-cigarettes, and we did not really find any benefit for the kind of dual use we observed, but others have published data that suggest that, if people sufficiently replace cigarettes with e-cigarettes, you can expect to see some reduction in various biomarkers of harm, and some health benefits.

Professor Aveyard: Prior to the advent of e-cigarettes, or frequent use of nicotine alongside smoking, there were studies of people who cut down their smoking and were followed up 20, 30 or 40 years later to see whether smoking-related illnesses occurred. They suggest some degree of reduction but some uncertainty about that. As a public message, we would normally say that there is no certain benefit of reduction, and



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stopping is your only way. That might partly be offset by the use of a nicotine device, because one of the things that happens when you cut down the number of times you smoke is that you tend to smoke more intensively, whereas concurrent use of an e-cigarette or nicotine replacement might prevent that happening, and does so to an extent.

Q117 **Chair:** And might, therefore, deliver a benefit.

Professor Aveyard: Yes. The second benefit is that we know from certain randomised trials that cutting down with the aid of nicotine replacement helps people to stop smoking, even though that was not the intent to start with.

Q118 **Chair:** It is a staging post.

Professor Aveyard: Yes. The same might well be true with e-cigarettes, but we do not have direct evidence that that is so.

Q119 **Darren Jones:** I have some questions on heat-not-burn products. I want to check that my understanding is right, because in the previous panel we spoke about heat-not-burn as a general product. My understanding is that some of them work slightly differently. IQOS and Glo are examples where an external heat device will heat up a specific type of cigarette that has nicotine in it and aerosolise it for the vaper, but you also have others like Ploom and PAX, which have a sealed heating chamber that aerosolises nicotine from tobacco leaves. When it comes to assessing the health consequences, specifically addiction, do we need to think about those products as distinct from each other, and, if so, is the research doing that?

Dr Shahab: I would say that we ought to. A question was asked about the addiction to nicotine. Nicotine per se may not be as addictive in, say, NRT or e-cigarettes as it is in cigarettes. Addiction is a function of the speed of delivery of nicotine to the brain. The quicker it gets there, the more reinforcing there is, and the more addictive it is. I assume that will be determined by the way nicotine is delivered using Ploom, the pharmacokinetics of which I assume might be slower than for a product like IQOS or Glo. For that alone, in terms of addictiveness it is important to think of those products as somewhat different.

Q120 **Darren Jones:** Is there a difference between the nicotine you breathe in from a designed cigarette and heating up tobacco leaf, or is it the same? Is it just about speed?

Dr Shahab: Are you comparing it with e-cigarettes?

Q121 **Darren Jones:** Those two different types of heat-not-burn.

Dr Shahab: I suspect there will be a difference as well, because, as far as I understand, with Ploom the aerosol is drawn through tobacco, whereas in Glo and IQOS you have a heating device directly on the tobacco to warm it up. I suspect it will be somewhat different, but I am not an expert on those particular devices.



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Q122 **Darren Jones:** You know of no research taking place at the moment that is looking at these questions.

Dr Shahab: We have a sample study looking at IQOS but not comparing it with Ploom. Comparing IQOS, a heat-not-burn product, with e-cigarettes, there is a reasonable assumption that because they work slightly differently, because one uses tobacco and one does not, the exposure profile in users will be somewhat different, but I do not know of any studies that have directly compared something like Ploom with Glo or IQOS.

Q123 **Darren Jones:** What is the tobacco industry saying about heat-not-burn, and what are the benefits that they claim it has over traditional smoking?

Dr Shahab: The benefit is that there is no combustion going on. I think Stephen Metcalfe asked earlier about the percentage one would put on it compared with cigarette smoking. One of the submissions to this Committee was by the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment. They put a percentage on it. They assumed that it would deliver 50% to 90% less of the potentially harmful compounds than conventional cigarettes. The problem is that the data are limited and virtually all the data currently available—about 99%—as Riccardo was saying, are based entirely on industry research. It is quite important to replicate those data by independent research.

Q124 **Chair:** It is definitely a priority for more research.

Dr Shahab: Definitely.

Q125 **Darren Jones:** The clear answer is that there is no research that can give us the answers to those types of questions on heat-not-burn at the moment.

Dr Shahab: The industry data are quite positive.

Q126 **Darren Jones:** Yes, but not independent.

Dr Shahab: No.

Q127 **Darren Jones:** I do not know whether you know the answer to my next question, so don't worry if not. I understand that some of the heat-not-burn products have Bluetooth chips in them that can connect them to a mobile device. Do you know what data they may be collecting when you use heat-not-burn, if that is the case? Do you have any experience of that?

Dr Shahab: It is not unique to heat-not-burn; it is also true of e-cigarettes.

Q128 **Darren Jones:** Do you know what data they collect when they are connected?

Dr Shahab: No.

Q129 **Darren Jones:** My last question is about flavouring. Do you think there is



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an opportunity for flavouring in heat-not-burn as well, if this is deemed to be something that may be fashionable in the e-cigarette sector?

Professor Aveyard: I do not know.

Dr Shahab: Primarily, there is menthol and non-menthol. There are different types. Certainly, for the heets, for IQOS there are currently three different flavours available, but that is not entirely unusual; it is also true for conventional cigarettes. Different flavours are still available. What was the question in relation to?

Q130 **Darren Jones:** It was specifically about flavouring, and it leads on to my last question. It seems evident that, as Cancer Research UK said, heat-not-burn products are a largely unknown entity because clearly there is not much to be said about them. If you were bidding for funding from independent sources, what specifically do you think we should be looking at in new research on heat-not-burn? What would be the areas of concern we should look into?

Dr Shahab: As I said, in our study, we have three main questions. What is the potential for addiction with this product? Is it higher or lower than for e-cigarettes and how does it compare with cigarettes? What is the level of acute exposure that immediately occurs in the use of these products? You can look at some health effects. What are the more chronic effects? For that reason, we are going to look at some biomarkers that we know are related to long-term health outcomes.

Professor Aveyard: I second that. We would also like to know whether people switch and then stay on the lower exposure products, or whether they go back and forth. Does it interrupt the process of quitting, or is it some kind of stepping stone to that? That is an obviously important question.

Q131 **Stephen Metcalfe:** Because this inquiry covers heat-not-burn and reduced harm products as well, who should we ask to answer those three questions, in the absence of any research that is yet to be undertaken, so that at least our report has some reference to finding those answers and is a complete analysis of what the Government, or whoever, should do next?

Dr Brown: What rules are you governed by in consulting the tobacco industry?

Stephen Metcalfe: If they have conducted research, I believe we are entitled to invite them here and ask them, as long as it is a scientist as opposed to the PR people.

Dr Shahab: British American Tobacco and Philip Morris International are the two companies that have done the most research in this area. There is very little independent research at the moment. If we come back in two years, hopefully, we will have completed our study.

Q132 **Stephen Metcalfe:** But you see no harm in asking them the questions.



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Dr Brown: It might be more productive to find—off the top of my head, I could not tell you who—an independent scientist who may be willing to review their evidence and offer you a view on the quality of their evidence.

Chair: We will continue the search. Thank you all very much indeed. The time you have spent with us is enormously appreciated.