



Environment, Food and Rural Affairs Committee

Oral evidence: Air Quality, HC 468

Tuesday 8 September 2020

Ordered by the House of Commons to be published on 8 September 2020.

[Watch the meeting](#)

Members present: Neil Parish (Chair); Ian Byrne; Geraint Davies; Dave Doogan; Barry Gardiner; Dr Neil Hudson; Robbie Moore; Mrs Sheryll Murray; Derek Thomas.

Questions 1 - 42

Witnesses

I: Professor Alastair Lewis, Professor of Atmospheric Chemistry, University of York, and Science Director, National Centre for Atmospheric Science; Professor Eloise Scotford, Professor of Environmental Law, University College London.

II: Professor Anna Hansell, Professor of Environmental Epidemiology and Director of the Centre for Environmental Health and Sustainability, University of Leicester; Professor Sir Michael Marmot, Professor of Epidemiology and Director of the Institute of Health Equity, University College London.

Written evidence from witnesses:

- [National Centre for Atmospheric Science](#)
- [Professor Eloise Scotford](#)
- [University of Leicester](#)



Examination of witnesses

Witnesses: Alastair Lewis and Eloise Scotford.

Q1 Chair: Welcome to the Environment, Food and Rural Affairs Select Committee. Today we are looking into air quality and we are very lucky to be joined by Professor Lewis and Professor Scotford. Please introduce yourselves, starting with Professor Lewis, and then we will start asking questions straightaway.

Professor Lewis: I am Professor Alastair Lewis. I am from the National Centre for Atmospheric Science at the University of York. I am also currently chair of Defra's Air Quality Expert Group.

Professor Scotford: I am Professor Eloise Scotford. I am from University College London. I am a professor of environmental law at the Centre for Law and Environment at UCL.

Q2 Chair: Thank you very much. Welcome to both of you, and welcome to our other witnesses later on in the second panel. My first question is particularly to Professor Lewis, but, Professor Scotford, if you want to make an answer, please do. UK air pollution has fallen over the last 40 to 50 years. Where are the main areas of concern at the moment?

Professor Lewis: It is true that there are two ways that you can look at how it has changed over the last 40 years. You can look at how emissions have changed, so that is how much, on a national basis, we have emitted in terms of air pollution, measured in units of tonnes, or you can look at how concentrations have changed, so that is how much people are actually breathing in on average in the UK. You get slightly different answers to your question depending on whether you want to look at the units of emissions or the units of concentrations.

Generally, if you look at how emissions have changed—how much, as a country, we are emitting—that is the slightly more flattering statistic. That one shows, as you have implied, some quite steep drops, particularly from the mid-1990s onwards. From around 1990 through to perhaps 2010 or 2012, many of the main regulated air pollutants fell quite a lot, sometimes by factors of two or three. The notable ones that have not fallen in emission terms would be ammonia, which we might come back to later, which is largely from farming.

If you want to know where the problems lie in terms of what people breathe, which is slightly different, there we have seen reductions in some of the larger particles since around 2000, increases in some pollutants like nitrogen dioxides and then decreases from perhaps 2010 onwards. The picture is more complicated for concentrations, partly because reductions in emissions can occur in big hits when you do things like close down coal-fired power stations—that does not have much effect on what people breathe—and partly because the atmosphere does not work in linear ways,



HOUSE OF COMMONS

so sometimes you can do a lot of work to reduce emissions but the benefits that you get are rather small.

What we are left with at the moment is air pollution that has been broadly flat since perhaps 2015, both in terms of emissions and in terms of concentrations that people breathe. Which ones are the most important? PM2.5 is probably the one that gets the most attention in terms of health impacts. That has been largely flat over the last few years.

Q3 Chair: What is interesting is that, over the years, we emphasised going to diesel cars because they go further on a litre of fuel and the carbon was reduced, but of course the nitrous oxide particulates were increased. Have we seen any noticeable difference now in the pollution coming from diesel vehicles?

Professor Lewis: Yes. Diesel vehicles are obviously disproportionately important because they are doing their emissions where we live. If you look at how much of a contribution diesel vehicles make to the country's NOx emissions overall, it can appear relatively modest. Of course, bundled in there are also the emissions of things like power stations and so on, which we do not get particularly exposed to. They do have a disproportionate effect and they really have an important effect close to the roadside. It is an urban phenomenon.

Peak nitrogen dioxide probably occurred perhaps in 2012 or something around that time. That was probably the point when Euro 5 vehicles were at their peak, but we have seen, since around 2012, relatively steady declines, which is a consequence of better performing vehicles from the Euro 6 class entering the fleet. Of course, in the last couple of years, we have also started to see electric vehicles enter, so the high watermark for nitrogen dioxide was probably in the early 2010s and we have seen steady improvements in that in urban environments for certainly the last five or six years.

Q4 Chair: What is interesting about diesel vehicles is that, if you look at the new vehicles being registered, while there is quite a dramatic increase in electric vehicles, it is going from 2% to 4%, and so you are still seeing an awful lot of diesel vehicles even being registered. I accept they are cleaner, but are we actually doing enough to convert people to hybrid and electric? Especially in some of the areas perhaps where people are not so well-off, it is quite difficult for them to buy new vehicles, is it not?

Professor Lewis: Yes. Fleet turnover is inherently slow. You cannot buy everybody a new car overnight. One of the challenges here is that, for vehicles that you might buy brand new off a forecourt today, there is really still far too much variability between manufacturers. There are some internal combustion engine vehicles that are really very clean in terms of their tailpipe emissions. There are others within the same class that seem to perform much worse on the road.



It is very difficult to generalise on this because each model and each car seems to give rather different performance. It is certainly true, though, that it has been demonstrated that it is possible to make internal combustion vehicles with pretty low tailpipe emissions, but, of course, one senses that this is going to be overtaken by the ability to make affordable fully electric vehicles, which, of course, eliminates the tailpipe completely. They do not completely eliminate emissions, of course, because a surprisingly large fraction of a modern vehicle's emissions come from essentially friction associated with the vehicle, so that is tyre wear, brake wear, road wear and so on. Of course, they are not eliminated if you buy an all-electric car, but you certainly eliminate the nitrogen dioxide, which is a consequence of exhaust, and you also eliminate the fuel, which is a source of pollution in its own right.

Professor Scotford: While emission levels have been falling—Professor Lewis is the expert on that—our standards of what we understand are acceptable levels of air pollution have also been evolving over time and getting, by and large, more stringent. While we are thinking about compliance with WHO air pollution guidelines as they are, we are expecting them to be updated and to become more stringent. Yes, the levels have been falling but what we think is acceptable has also been going in the other direction.

Q5 **Geraint Davies:** Professor Lewis mentioned nitrogen oxides, but the big concern now is absolute particulates PM2.5 and smaller, and he will be aware that the manufacturers now have particulate filters that essentially smash together all the particulates and belch them out every 300 miles as smaller particulates that are much more damaging to the body. Would you not accept that the focus should really be on delivering World Health Organization PM2.5 and smaller levels in law to protect us all, because at the moment particulates are getting into unborn babies and the like.

Professor Lewis: I would not disagree with what you have said there about wanting to work towards better air quality standards; that is for sure. When we look at particulate matter and PM2.5—the small particles—it is important to reflect that road transport is only one of many contributors and, while you would want to see PM2.5 fall further, there is a risk that, if you over-focus on road transport as the means to achieving that, you might not get to the targets that we would all like to see. Overall, diesel particulate filters have been generally pretty effective in internal combustion engines and certainly more effective than NOx control measures have been.

It is absolutely true that we would want to drive down those and have very clear standards that made sure there were no unintended consequences of diesel particulate filters, but, if you look at how much additional particulate matter is generated at roadside—if you like, the bit that you could attribute to the cars—it is surprisingly small; it is perhaps measured as a few tens of per cent in most places. Most of the PM2.5 that we are inhaling is generated from this much broader and wider set of sources, so road



transport emissions absolutely have a role to play here, but we should not rely solely on vehicle emission controls to try to get to something like a WHO air quality limit.

Q6 Dave Doogan: Thank you very much, Professor Lewis, for your information. It is very helpful. In terms of the danger of lumping diesel vehicles together as a group, if you take a Euro 6 passenger car and compare it to a 13-year-old bus, there is a massive disparity there, is there not, in terms of pollution in urban environments? My second thing to raise is that I am very mindful of what you say about passenger transport. Is one of the biggest issues that we face the growth in small vans making deliveries to houses in urban areas? Do you have any advice on that particular thing?

Professor Lewis: You are quite right. It becomes slightly lazy to lump all things together as diesel vehicles. The age of the vehicle and the emissions control on the vehicle are absolutely crucial. Euro 6 and vehicles that meet the most modern standards, compared to some even just perhaps five or six years ago, are a lot better. You mentioned 13-year-old buses and so on. It is always worth just checking, though, whether the older bus that you see has been retrofitted for emissions control. Just because a bus is old, it does not necessarily mean that it really is excessively polluting. It could well have been retrofitted by the manufacturer, possibly at the insistence of the local authority.

There is then, of course, the question around the per-passenger emissions, which become significant as well. Inevitably, a very large heavy goods vehicle such as a bus might have higher emissions, but, if it was carrying 40 people, it may actually compare reasonably favourably. It is quite a complicated metric to calculate. Obviously, there is an economy of scale with large vehicles, and this is perhaps moving on to your second question about the growth in delivery vans.

One of the issues with putting an emissions control on the tailpipe of vehicles is that it is a very substantial part of the cost. Trying to fit an emissions control system on a car that might have a retail price of £12,000 does not give you much room for manoeuvre. As the vehicles get bigger and bigger—into the hundreds of thousands of pounds when you are dealing with heavy goods vehicles and so on—the cost-effectiveness of really good-quality emissions control improves. One might try to consider the vans within this class, which is that the business case for having good emissions control on those sorts of larger vehicle may mean that they end up with reasonable emissions.

It is a fair question around the growth of that particular sector and whether enough is being done to electrify that because, in terms of engine size, these are not so dissimilar to the size of engines that we are seeing in large four-wheel drives. While you can go and buy an electric four-wheel drive, it is much more difficult to go and find an electric van.

Q7 Derek Thomas: Professor Lewis, we want to know how lockdown has been



for you. It must have been a fascinating time. While all the stresses and strains were going on, I would guess that you were looking at how and why air pollution changed during lockdown, or whether it did. Please share a little bit about what you have learned over lockdown in terms of air pollution, and also about the extent to which we have returned to pre-pandemic levels so far.

Professor Lewis: If you are interested in real chapter and verse on this, there is a report published by Defra that was produced by the Air Quality Expert Group that looks into this in some detail. You are right. This has been an interesting time for anybody working in atmospheric science and air pollution science. We can look on what we have gone through in lockdown as a test case of what the future might hold for essentially the three pollutants that we think about most: nitrogen dioxide, particulate matter and ozone.

Not surprisingly, the one pollutant that has seen the largest change is nitrogen dioxide, because this is predominantly from road transport. There were some large drops in the UK as there were across Europe; there were perhaps reductions of 30% or 40% in urban NO₂. A colleague of mine, Stuart Grange, has done some calculations. A metric to consider to this by is that, basically, in the middle of lockdown, we were living in 2028 in terms of vehicle emissions for nitrogen dioxide; we were at the point of emissions that we were anticipating eight years from now. It gives you some positive encouragement that the NO₂ problem is likely to begin to disappear in terms of urban exceedances of air quality standards in the next few years. The atmosphere did respond as expected.

For particulate matter, which is obviously the one that really focuses the mind around the WHO limit, concentrations did not change by really dramatic amounts, and we actually would not have expected them to. As I mentioned earlier, far more of PM_{2.5} comes from things that are not related to road transport. Many industrial emissions continued. We still continued emitting from our central heating units, cooking, agriculture and so on.

There are some calculations that have been done to try to estimate how that changed relative to business as usual. They are the changes, perhaps, only of the order of one or two micrograms per cubic metre, so a beneficial improvement but not one that is so obvious that you could spot it with the naked eye. That really has told us that simply road transport alone is probably not going to deliver all that is going to be needed for PM_{2.5}, even with the really dramatic changes from covid.

Finally, the one other pollutant that does not get very much airtime is ozone, so this is surface ozone. One of the consequences of reducing nitrogen oxide emissions, which we saw in the peak of the lockdown, creating conditions that are more like 2028 or 2030, is that we saw a growth in urban ozone. This is one of the challenges with air pollution: sometimes the chemistry works against you. Here we are beginning to see an increase in one of the regulated air pollutants, particularly in urban



HOUSE OF COMMONS

settings as nitrogen dioxide begins to reduce. It is a mixed bag. There were very large changes in the right direction for some pollutants and small changes for others. Some pollutants moved slightly in the wrong direction in some places.

Q8 **Derek Thomas:** Have we just gone back since lockdown to where we were in February or March this year?

Professor Lewis: People ask me this fairly frequently and I am afraid my answer changes week by week, as lockdown lifts. It is certainly true that although transport volume, measured by how many car journeys people are taking, has returned to something like 95% of what it was before, nitrogen dioxide has not returned back to those levels. Now, this is a work in progress, but the working hypothesis on this is that, although people are taking car journeys, they are taking them at different times. We have certainly seen a change to rush hour, so we do not have very distinct peaks at 8.30 am and 5 pm. Car journeys are more spread out. The consequence is that you get less congestion, and it is the stop-start of congestion that is really the killer for releasing air pollutants.

In the next week or two, as schools go back and perhaps people are forced back into a more traditional nine-to-five commuting pattern, we may see pollution, in terms of NO₂, go back to where we were pre-covid, but we are not quite sure on that yet. It is certainly an illustration that it is not solely transport volume. It is also to do with when you actually use the transport.

Professor Scotford: I just have a very quick point on ozone. Professor Lewis is absolutely right to say that it does not get much attention despite the fact that we have no zones that are compliant with the long-term objective for ozone. One of the main reasons that it does not get the attention it probably deserves is that there is a much weaker legal obligation to achieve the long-term objective for ozone. All the attention on nitrogen dioxide is because there is a very binding legal obligation. That is just worth bearing in mind as we think about where standards might go in law in the future.

Q9 **Mrs Murray:** Professor Lewis, do you think any contributing factor is a result of schools closing over the past few months, and do you think that that could mean that we could see higher levels as the schools reopen again?

Professor Lewis: It is a good question and I do not have an answer for you just now. It is certainly true that commuting patterns changed when schools were not in. We just do not know yet. Schools have not been back long enough for us to know for sure how that will affect people's general commuting patterns, but it is a lesson that often it is congestion that is the problem—the focusing of journeys into very short periods of time—and it is the stop-start of the engine that increases NO_x emissions. Of course, it is the stop-start that increases wear from things like brakes and tyres, so



HOUSE OF COMMONS

free-flowing traffic is much better for pollution than stop-start traffic, even if the number of cars on the road is actually exactly the same.

Chair: It is a good argument for us all to get our bypasses when we need them, Sheryll.

Q10 **Mrs Murray:** Yes, absolutely. Moving on to the period before covid and the pandemic, what progress had the Government made on reducing the pollution and enforcing legal pollution limits before the pandemic, so in the period of time before the pandemic hit? Could you give us any indication as to what progress the Government had made?

Professor Lewis: I do not want to give you a really long answer here, because one of the problems is that there are many different sorts of pollutant and, depending on which pollutant I pick, I will give you a different answer. As I mentioned, nitrogen dioxide had been improving over the last five years, but there are still many locations in the UK that are above the legal limits. For most other pollutants, they are below the current air quality standards, but, for many of them, they have been on a plateau for the last few years. For a couple of pollutants, there is even some hint of some small increases in emissions.

I do not want to get into each of the different pollutants, but it is a mixed picture depending on which one you look at. I will pick one out that perhaps has not done very well and that would be ammonia, where emissions have been gradually creeping up the last few years, but there is no limit that is being exceeded. The UK is under its emissions obligations under the previous National Emissions Ceilings Directive. There is no particular enforcement that is being brought because there is no limit currently being breached, although it may be in the future.

Professor Scotford: In terms of progress to achieving legal obligations pre-pandemic, what you are referring to here partly is post the ClientEarth litigation and pre-pandemic. In a sense, there has been quite an interesting chapter in regulatory approaches to air pollution in England. We saw very singular regulatory focus on compliance with NO₂ limit values and roadside emissions, local authorities as the actors to deliver compliance, clean air zones and the use of ministerial directions as the regulatory tools.

There are lots of reasons why that bundle of very singular focus artificially reduces the complexity of the air pollution problem that Professor Lewis is pointing out, but, even in what it was trying to do, it was not working. You can see it was not working because we do not have a single clean air zone outside London yet operating and, if we think back to the 2015 air quality plan that was found to be unlawful in the ClientEarth (No.2) case, that was for clean air zones to be in place by 2020 and that has not even been achieved. In a sense, the regulatory strategy of the Government to try to achieve their obligations for NO₂, which have been the main focus because they are in breach on those in particular, is not yet successful.

Q11 **Mrs Murray:** Do you think more guidance should have been given to local



authorities? For instance, I know that my own local authority in Cornwall has been quite reticent; it is monitoring but it is not really taking any action. I do not know, but that may very well be replicated throughout the United Kingdom. Do you think the Government ought to take more action centrally in providing more guidance and setting targets for local authorities?

Professor Scotford: There are quite a few things that probably were not being done. I conducted an empirical research project with local authorities in 2018, which is getting a little bit out of date in terms of the challenges they are encountering now, but lots of the themes I spoke to them about still remain quite relevant.

Certainly, there is a big issue of resources, which is already in the joint Committee report from last time. Local authorities are very strapped in terms of the money and the personnel they have. They also have differences in the monitoring data that they have locally compared with nationally, so what they think are the priorities to deal with are not necessarily the national Government priorities; that creates challenges.

There remain very serious issues of policy co-ordination that can happen at the local authority level, so reconciling planning, public health, transport and environmental controls. Different local authorities deal with that better or worse, but they have different problems they are dealing with. There is certainly a problem of co-ordinating national and local action. To delegate wholesale compliance with NO₂ standards, even at the roadside, puts local authorities in a position where they are required to do things beyond their competence and beyond their control.

Q12 **Mrs Murray:** Chair, I am sorry to add so many supplementaries. Finally, do you think there is a difference between the way inner-city local authorities have dealt with this and the way those in the more rural areas have, where you may have, at certain times of the year, a build-up of traffic, such as when you have changeover days for tourist areas, for instance, and there are really congested areas? We know, as has been mentioned before, that it is often idling and slower build-up of traffic rather than that same amount of traffic travelling in a more consistent way that contributes to the NO₂.

Professor Scotford: There are a couple of points there. In a sense, having different kinds of problems in out-of-city, rural or inner-city areas is an argument for local action, knowledge and expertise. However, there is a challenge where people move and, if they move and the rules are different, you are not necessarily going to get very good compliance. If it is things like idling and if we are trying to set common behaviour standards across the country, they speak to national priorities to set those norms of behaviour or those norms of conduct centrally, but they need to be adjusted and applied in a way that is appropriate in a local context.

I would just add that the other advantage that inner cities have had is that they often have a more difficult air pollution problem, but, if you look at



London or Greater Manchester, there is the Greater London Authority or the Greater Manchester Combined Authority that actually provides a co-ordinating governance structure, which has been quite important for air pollution governance. That changes the context as well.

- Q13 **Dr Hudson:** Thank you to Professors Scotford and Lewis for being before us today. You have talked about the progress that the Government made prior to the pandemic on pollution and enforcing limits. I am keen to know whether we can draw some good from this dreadful crisis that we have been going through. Are there any particular lessons learned? You mentioned that vehicle usage is back up to 90% or 95%, but the NO₂ levels are not right up there, so are there lessons learned that Government at all levels can learn in terms of controlling and enforcing pollution moving forward? Can we draw some good take-home messages from this dreadful crisis?

Professor Lewis: There are some positives to take from it. Air pollution changes quite slowly and sometimes people can become a little bit disheartened; you introduce a measure and you do not see an instantaneous effect. You often have to wait several years before you see clear trends emerging. The reductions particularly in nitrogen dioxide that were seen during lockdown should give people a lot of confidence that the introduction of cleaner vehicles will solve this problem. It is a little bit of a window into the future around emissions.

It has also given us a bit more confidence around the attribution of particulate matter. We might come to this later, but, in the end, the Government have to implement their clean air strategy and that means controlling all sorts of different emissions. One of the assumptions in that is that a very large proportion of our PM_{2.5} is derived from secondary sources. Again, from what we have seen in terms of how the atmosphere has behaved during lockdown, it probably means we are going into that with a bit more confidence than we had before.

Ideally, of course, it will have changed some patterns of behaviour as well. We may see people commuting differently—more walking, more cycling and so on—so there are both the scientific and technical lessons learned, and we may also see longer-term changes as well that reduce emissions in city centres.

- Q14 **Dr Hudson:** That is really helpful. Professor Scotford, do you have anything to add to that? There are changes in the science and then the behaviour, but on the legal and legislative side, how can that help things?

Professor Scotford: I would have thought it would give us more confidence to think more structurally and fundamentally about air pollution through the planning system, because, if we think about the delivery vans example from before, what matters is how we move in cities, how we move around spaces and what our patterns of behaviour are. Now, it might be that we can worry about the delivery van that is zipping through the



HOUSE OF COMMONS

streets, but we can also think differently about how we move each day, where we procure our groceries and where we procure things.

Thinking at a very fundamental level, we know that behavioural patterns can change and that chasing the perfect clean air zone is not a structural solution to air pollution. A structural solution is not having the behaviours that generate the pollution in the first place. I am not an expert on this. Professor Lewis might know more about this than I do, but it might be that some of the boundaries set for clean air zones that have been planned no longer look right in light of people's changed movements through the pandemic. That might show that that is not necessarily the perfect answer and we might think about how, yes, we have better public transport, but how we actually move around the day, plan our cities and have confidence in planning our cities in a way that guides those movements that minimise pollution.

Dr Hudson: That is really helpful and thought-provoking moving forward, so thank you very much.

Q15 **Dave Doogan:** To both our witnesses, with regard to the 2019 clean air strategy, is it your assessment that the right measures are being pursued? If not, what would you do or what would you drop? Are the right resources in place to tackle the air quality crisis that we face in certain parts of the country?

Professor Lewis: The clean air strategy covers all the right bases. It takes a relatively holistic approach to air pollution, identifying that pollutants interact with one another, so you have to account for the whole system and not deal with it issue by issue. There is then a question about how you deliver it. It is not a delivery plan for clean air; it is a strategy. This is where it becomes really important to deliver on all elements of that in parallel.

Because so many pollutants in the atmosphere interact with one another, it does not afford you the luxury of picking off one pollutant at a time, making X the focus today and then dealing with Y in two years' time. If you take that approach, there is a risk that, in fact, pollution gets worse in some cases rather than better. It is a challenge to deliver because, essentially, progress is really defined by the progress of the slowest component of the strategy.

This perhaps comes to your second question around resources, which is that it may well be relatively straightforward to make reasonable progress on some pollutants but there may not be resources or necessarily a plan in place to deal with all of them in concert, and it is this dealing with them all in concert, trying to bring the volume down on all of the regulated pollutants together, that is the real challenge here. Rather than identifying what the pollutants are and what might be done, it is about how you deliver that strategy of bringing them all down together.

If I just pick out two, ammonia and volatile organic compounds are two classes of pollutant where, at the moment, the strategy says that they



need to be controlled, but there is still an awful lot of work to be done to actually implement workable strategies that are going to deliver the reductions. In some places, I have good confidence that emissions are going to continue to decline, particularly around nitrogen dioxide and sulphur dioxide. In others, although the strategy says we should be doing something with these, we do not yet really have plans in place that are going to reduce the emissions, so it is a bit of a mixed bag.

Professor Scotford: I agree with Professor Lewis that what is nice about the strategy is the holistic approach to air pollution. The attention on farming and agriculture is welcome. There are a lot of suggestions of regulatory change to come and we have not seen that come in yet, so, in a sense, the devil will be in the detail or the proof will be in the pudding when we see what that regulation looks like, whether it is the emissions permitting for non-road mobile machinery or extending the environmental permitting scheme to farming. We will only fully be able to appraise how that is going to work when we see legislation coming forward.

There are quite a few areas where, as Professor Lewis is suggesting, action is recommended without necessarily any measures behind it suggested in the strategy. You see that particularly in relation to indoor air quality. There are a few nice measures suggested but nothing very comprehensive, and that is certainly an area where a lot more regulatory attention is warranted. It is very complicated to think about the air quality particularly of private spaces. That is a lesson from covid: we might be spending more time in our own homes, and thinking about the air quality of that becomes particularly important, as hard as it is to think about regulation of private spaces.

In terms of the headline standards, there is a bit of disappointment in terms of the ambition of the strategy. The PM_{2.5} goal is a bit weak. We have various other standards where we are not also reaching WHO levels, which are likely to become stricter, and that includes ozone, PM₁₀, emerging pollutants and ultrafine particles. They are things where you might have expected to see a bit of ambition, particularly because it is a strategy, and there is nothing there.

To finish off, I might just mention a particular pet topic of mine: anti-idling legislation. This does not work and the strategy does not recommend that would be reformed, which is a really missed opportunity.

Q16 **Dave Doogan:** Reflecting again on the strategy, this is manifestly a difficult nut to crack and there is not a particularly clear map of anyone, in any country, that is managing to make great leaps forward. There is a balance between the UK's strategy and the way that it interacts with devolved Administrations in the UK and local government. Do they have the resources they need, and is that balance correct between central direction and local delivery?

Professor Lewis: It depends which pollutant you are talking about. As has been covered already, nitrogen dioxide is a pollutant that you can do



quite a bit about at a local level, because it is predominantly from local transport. The answer that you give on that is rather different to the answer that you would give for PM2.5, which is very significantly influenced by transboundary movement of pollution. That means not only transboundary within the UK, between devolved Administrations and across borders; it also means it is dependent on activity and action in mainland Europe, so they are the levers of control change. There it looks more and more inappropriate to place obligations on local authorities, or indeed, in some cases, to devolved Administrations, when a substantial fraction of the PM2.5 in particular that may be causing harm may be coming from across borders.

It is a difficult question to answer, because it depends on which of the pollutants you are talking about. I would not underestimate now, as we move into the mid-2020s and beyond, the significance of this transboundary issue and how one region affects another region in terms of air quality. It is going to become a growing issue.

Professor Scotford: The strategy is quite deliberate in saying that there need to be improvements in air quality governance. It makes a commitment to ensuring that responsibility for air quality standards sits at the correct level. Then it suggests a solution for that, about where the correct level of governance is, which is now coming through in the Environment Bill, which is having a wider group of public bodies involved at the local government level. It is keeping the governance at a very local level for air pollution generally.

There are real weaknesses in that approach because there are some issues that are transboundary. There are some issues that require national strategy and national investment. There is a problem built into the strategy and now it is getting baked into the Environment Bill, should that go through, of keeping the governance and responsibility for air pollution very local. Even for NO₂, it is right that roadside emissions are the main cause, but local authorities do not always have responsibility for the roads going through their areas. Even then you have a multi-level governance issue going on, even for a very localised form of pollution.

You cannot get away from the fact that air pollution is a multi-level governance problem that requires a structure for governance that coordinates levels of government, and that is national and local, and then requires an agreement at least between the devolved Administrations about pollutant effects between them. We have a good treaty in Europe, the Convention on Long-Range Transboundary Air Pollution. We have regularly revised protocols that should do some work and continue to do work for that international transboundary protocol.

Q17 **Dave Doogan:** In summary, Professor Scotford, the subsidiarity of responsibility is appropriate and desirable but, to some extent, ineffectual without the appropriate level of resource and cross-boundary working. Is that the space we are in just now?



Professor Scotford: There is a certainly a requirement for co-ordination.

Q18 **Robbie Moore:** This question follows on nicely and is to do with the clean air zones and timings predominantly. It is mainly to Professor Scotford. Clean air zones are obviously key to improving air quality, but they were held up at a national and local level before the pandemic. It seems that now they are going to be continually delayed. It is simply about how we can faster progress them being implemented.

Professor Scotford: I am not sure I have the magic answer, but I can see some of the problems. One of the problem is the real fragmentation in approach to clean air zones across the country. I understand the reason for that is that different areas have different problems, but it means that you are sending different signals to different parts of the country about investment in technology and around behaviour that is acceptable and not acceptable, and that creates real compliance challenges for people who might be moving between clean air zones and so on. One reason is that lots of different kinds of clean air zones have been dreamed up.

There is clearly political resistance in local authorities to implementing them, so there is a search for alternate measures to be introduced. There have been some technical challenges, in that the Government were supporting on the technology to actually make them work and there was some delay on that. There is a whole range of things.

There is another problem as well, and we know this from the second ClientEarth case. The legal obligation to achieve nitrogen dioxide was to take whatever measures to ensure compliance in as short a time as possible. That meant, yes, clean air zones, but other measures that might supplement them. There has been a challenge for local authorities to think about the measures that might supplement, the measures that might be possible instead, and then the clean air zones, and continually modelling them and getting them approved by the Government.

There is also an issue of money. There has been a limited pot. Local authorities are putting their plans forward and getting them approved. I would add that that process has not been very transparent.

Q19 **Robbie Moore:** Given the sporadic nature and the fragmentation between that national and local level, do you think there are better collaborative approaches that could be taken at that local authority level in terms of getting it actioned quicker? Do you see that as a challenge?

Professor Scotford: If local authorities were working together rather than competing for resources, you might come up with better solutions. There might be an argument for the efficiency of having some more simple and common solutions. There has been a lot of confusion in different local authorities about how to apply the clean air zone framework, especially when they think it is a short-term measure rather than something they are embedding for the long term. There are arguments every which way.



HOUSE OF COMMONS

There is this process of issuing direction after direction after direction, in terms of ministerial directions. If you count the number of directions, I think it is getting close to 100, maybe, of repeatedly telling authorities, "You must come up with a solution that will definitely produce compliance in the shortest possible time". The fact that no answer keeps coming back shows that local authorities cannot deliver that. They are being told repeatedly and it is either an issue of resourcing or of the fact that they do not have the levers to make that happen.

It must be national Government and local authorities working together and minimising competition between local authorities for resources. Probably, if there is a clean air zone framework, it is one framework, not many, many kinds.

Professor Lewis: Very briefly, if clean air zones that pay this particular attention to NO₂ are delayed for many more years, they will essentially be redundant because the NO₂ problem is gradually going away. If they had been introduced in 2015, the integrated benefits of that would have been significant. One does have to worry a little bit that introducing something in 2023 or 2025 is effectively fighting yesterday's battle. It may not be a good use of resources.

Chair: That is an interesting point.

Q20 **Geraint Davies:** Can I ask Professor Scotford about the Environment Bill? The EU currently has an enforcement mechanism of specific air quality limits. Do you feel that the Environment Bill has the powers in it and the measures necessary to provide a system of legal enforcement for air quality limits? Do you think it is fit for purpose? How, specifically, would you improve the Environment Bill to deliver better public health outcomes?

Professor Scotford: I have a longer answer in my written evidence. I note that your joint Committee report from last time recommended that there should be an enforcement mechanism that replaces the Commission, which is equivalent. In the Environment Bill, the enforcement mechanism is not equivalent to the function of the Commission. There are many reasons for that.

If you look at how the Bill defines what is a failure to comply with environmental law, which is a very strange thing to do—to define what a failure to comply with the law is—it effectively restricts the scope of things that will be caught by the Bill's compliance mechanism. Things like reaching outcome standards, like air quality standards, seem, on a reading of the Bill, to fall outside the enforcement mechanism. It defines failure to meet environmental law in judicial review terms: the local authority has unlawfully behaved in complying with its legal obligations. It does not capture actually achieving environmental outcomes, so that is one really big problem.

Equally, there is not actually a binding mechanism for compliance. There are decision notices and an environmental review process, but there is no



body that can actually say, "The Government are in breach of this obligation and here is the sanction". That kind of mechanism does not exist. It is more consonant with the British legal culture of guiding Government to comply with their legal obligations, rather than being an enforcement mechanism as such.

Q21 Geraint Davies: Do you feel therefore that there should be specific limits, for instance World Health Organization limits, of 10 micrograms per cubic metre of PM2.5 by 2030, for instance, and specific requirements for indoor air pollution perhaps, and planning law, et cetera, actually built into the Environment Bill, and indeed the Agriculture Bill, that are enforceable in law, to more robustly ensure we have better public health outcomes in a defined trajectory?

Professor Scotford: That is a good question. That is less about enforcement and more about who is subject to the obligations. On standards, the Bill provides a process for setting targets. In a sense, it is going to be as good as the Government that use that structure to set environmental targets. On the air quality front, there is a requirement to set a minimum of two targets, one generally on air quality and one on PM2.5; that is it. Obviously we have our retained EU law, which is our current air quality standards, so long as that is not amended or repealed.

In setting targets though, one of the problems—I go into great length in my evidence on this—is that there are not any guidelines about what should drive that target-setting process. There are no objectives. There are no requirements to take any particular considerations into account. If you compare, for example, with the Climate Change Act, where there is a very clear set of considerations that must be taken into account in devising carbon budgets, there is nothing like that in the Bill. It is a power. It is a bare power to set a target. That means we do not have any ambition built in.

There is some link to the environmental improvement plans that set a direction towards environmental improvement. That is good, but the target-setting process itself relies on the policy direction of the Government to build in the ambition for any targets that are set in law.

In terms of who has the duties or responsibilities placed on them, for air quality, if you look at Schedule 11 to the Bill, it is all about putting responsibility on local authorities and other public bodies, in collaboration or co-ordination with local authorities as the lead authorities, to achieve air quality standards. This is a misplaced drive to make local authorities the primary bodies responsible for achieving air quality standards. That requirement to achieve air quality standards is boosted in the Bill as a mandatory obligation on local authorities, putting them in quite a difficult position to achieve some air quality standards.

There is scope, which the Bill has not taken up yet, to put duties on public actors more broadly, to either work towards achieving the goals of the equality strategy or work towards air quality standards specifically.



HOUSE OF COMMONS

Considering that air quality is a classic co-ordination problem, it requires planning, transport, health and so on to work well. Your joint Committee report showed that very well in 2018. To have no legal obligation to try to force that co-ordination when it is very difficult to make happen in Government is also a missed opportunity.

Q22 Geraint Davies: Could you send us some specific recommendations for possible changes to the Environment Bill? I think it is coming out of the Lords. You have mapped out a lot of the problems, but if you would send some specific suggestions, I am sure the Committee would be very happy.

Professor Scotford: I have some suggested amendments in my evidence, but I am happy to send some follow-up as well.

Chair: If you send that to us in writing, that would be lovely, thank you.

Q23 Geraint Davies: Professor Lewis, do you have anything to add about how the Environment Bill could be improved to deliver better health outcomes, perhaps with responsibilities more widely for Government as well, and enforcement mechanisms for specific targets?

Professor Lewis: As has been described previously, it is a balancing act here. In terms of having strict limit values and strict targets, as we have seen with NO₂, they very much focus the mind. They catalyse change, but sometimes, if you like, they then dominate the narrative in an almost unhelpful way. It becomes the sole focus around meeting particular legal targets to avoid ending up in court and so on, rather than taking account of a more general view of benefits to public health. There is a tightrope to be walked here between having strict standards that can be enforced and not then driving perverse behaviours that do not actually have public health at their heart, which become legalistic solutions to the environment rather than ones that actually put people at the heart of that process.

This is not an argument to not have an ability to enforce, but there is a downside to having very well-articulated, very strict, pass/fail tests for air quality. As we have seen with NO₂, they can drive behaviours that do not necessarily always have the best outcomes.

Q24 Geraint Davies: What if the targets were in terms of deaths? For example, there are 7 million deaths globally related to air pollution. In Britain it is about 64,000 premature deaths a year. Would it be helpful to have targets in terms of deaths associated? We could then have a flexible approach to strategies and particular limits on particular chemicals and pollutants.

Professor Lewis: This is what is under discussion in the Bill in terms of the targets that are going to be set. It seems that there is enthusiasm for setting something called a population exposure reduction target. That is, rather than looking at point values at a few monitors, basically coming up with a metric for how the exposure for the UK as a whole has changed. That has a lot of value in this because it stops game-playing, it stops people focusing on a small number of hotspots and it focuses the mind on trying to come up with solutions that actually deliver benefits to everybody.



It is worth bearing in mind that, for both NO₂ and PM_{2.5}, the harm to health does not stop once you reach the limit value. The harm continues. There is a significant incentive to try to push down exposure for the population as a whole. With the current set of standards that we have, we do not have one very robustly around population exposure reduction. That is an opportunity for the Bill to introduce something that tries to measure the health benefits or sets some targets around health benefits for the population as a whole. That is a counterbalance from seeing people focus too much on a few roadside locations that were hotspots in excess of limit values.

Q25 Geraint Davies: We know that one microgram per cubic metre of PM_{2.5} can reduce covid deaths by between 8% and 15%, according to Harvard or the Netherlands, depending on which study you look at. It is surely worth having specific targets on, for example, PM_{2.5} because we have measurable death outcomes, have we not?

Professor Lewis: You are articulating exactly why a population exposure reduction target is valuable. That one-microgram reduction that you get in a location that is below a limit value is still of public health value. That is the risk with only limit-based values. If you live in a location that is one notch underneath the standard, you may get no attention paid to air quality in your city or your region at all. We want to see population exposure reduction even for people who happen to live just underneath the limit value. A population value helps drive that, because it means you have to work on increasing air quality right across the UK, not just in a small number of very highly polluted places in the south-east.

Chair: That is a really good point.

Professor Scotford: I would completely support that. The extent to which there is game-playing and polluting up to the NO₂ limits—the concentration-based limits—is a real problem with our current regime. Again, it comes back to this point about the singular focus being on achieving compliance with 40 micrograms having been quite a perverse challenge. The Environment Bill allows an alternate kind of standard to be designed. That should be encouraged, but some kind of public health goal guiding that in the legislation would send the law in that direction. At the moment, it is really down to the luck of the policymakers coming up with that as the plan.

Q26 Geraint Davies: If we know that there are very high concentrations in particular urban areas with poor people, which is what we are going to talk about later, is that something that could be built into the Environment Bill?

Professor Lewis: If you are working on exposure reduction across the UK, you have to think about everybody. You are right: people who live in the most polluted places are very often people from deprived communities. In essence, you would like them to have two protections. You would like them to have a limit value that says, "Pollution will not exceed this", but you would also like them to be caught up in widespread improvements that



are going to occur on a population basis as well. It is quite right to pay particular attention to those communities. While most of the UK lives underneath the 10-microgram-per-cubic-metre WHO limit, not everybody does. Limit values are potentially of significance to a substantial number of people in the UK for PM2.5, as they are for NO2 as well.

Q27 Dave Doogan: This is for Professor Lewis. In one of his answers to Mr Davies, he gave a reference to the broader role of Government Departments beyond Defra. This is a very difficult issue and there is no silver bullet. For amateurs like me, it is very tempting to think that just by outlawing, through, say, the road fund licence, diesel vehicles that are Euro 4 or lower, that will have a very significant and positive impact. Is that just hopelessly naive?

Professor Lewis: You could, for example, scrap and take all vehicles off the road of a particular Euro class. You could probably calculate the benefits of doing that. More broadly, this ability to think about air pollution as something that is integrated into the wider system of Government is absolutely crucial. If I could pick out one area, it is around the intersection of the ambitions around net zero, climate change and air quality. Those are, in many areas, very closely linked. The delivery of a net zero carbon budget in the UK has very substantial potential to improve air quality as well. We need to think a bit more about the combined costs and benefits of doing that.

At the moment there is a tendency to cost up an intervention, either thinking about air quality or thinking about climate change and dealing with them as separate issues. Sometimes the quantification of benefits changes if you also factor in the other effects. Obviously the delivery of net zero is something that runs through multiple areas of Government in a way that means air quality does as well. There is thinking going into this, but we will increasingly have to consider the two as tightly interlinked policy areas, and then there will be a small subsidiary of areas that will fall outside of that. Not all pollutants are solved by climate change actions, but a lot of them are.

Q28 Chair: Can I thank both Professor Lewis and Professor Scotford very much for your evidence this afternoon? You have explained to us quite succinctly that improving air quality across the whole global piece, across the whole country and working better with local authorities in delivering it all are really good things. Also, reducing the pollutants will benefit everybody, irrespective of whether you are in a hotspot or not. That is very interesting. It carries on very nicely from where our previous inquiry left off. We thank you both very much for that evidence this afternoon. If you have anything in writing, or any evidence you think of, please let us have it. Thank you very much.

Witnesses: Professor Anna Hansell and Sir Michael Marmot.

Q29 **Chair:** Professor Anna Hansell, would you like to introduce yourself first, and then Sir Michael Marmot after that, please?

Professor Hansell: Good afternoon, everybody. I am Professor Anna Hansell. I am a professor in environmental epidemiology at the University of Leicester. I am also director of the Centre for Environmental Health and Sustainability there and a national new Health Protection Research Unit in Environmental Exposures and Health at the University of Leicester, which is joint with Public Health England and the Health and Safety Executive. I am a member of the Committee on the Medical Effects of Air Pollutants, but I am here in a personal capacity today, rather than as a representative of COMEAP.

Chair: Thank you very much for that clarification.

Sir Michael Marmot: I am professor of epidemiology and public health at UCL and director of the Institute of Health Equity. Relevant to today's discussion, you might be familiar with the report I published in February, *Health Equity in England: The Marmot Review 10 Years On*, which was a re-look at the report that I did in 2010 on inequalities in health in England.

Q30 **Chair:** Both of you are very much welcome. My first question is to Anna, but if Sir Michael wants to add please do. How does air pollution affect people's health across their lifetime and what is the scale of ill health attributed to air pollution in the UK? We bandy around very large figures and I sometimes wonder how accurate they are. Are they guesstimates? Where is it?

Professor Hansell: There is a three-hour lecture on this, but you probably want a one-minute summary. As our previous panel witnesses have outlined, there are lots of different air pollutants that have different effects. We concentrate on the small particulates that get down into the lungs and affect the body. There are various ways they could affect health but a big component of that is likely to be through inflammation. Because they can penetrate very deep into the body, they affect most of the organ systems.

As well as giving you increased risk of death, increased risk of respiratory disease, increased risk of low birth weight in babies and may affect development in utero, there is a lot of work now going on looking at effects on dementia. Almost every body system you can look at is potentially affected by air pollution. It is one of a number of environmental risks and hazards. Part of the risks will be coming from people's occupation, part will be coming from their lifestyle, so it is an additional component to that.

There is a lot of debate as to what the right numbers are. You are right to pull that out and I have heard several numbers today already from the Committee. COMEAP put forward a number of between 26,000 and 38,000 deaths per year associated with particulate air pollution. The Royal College



HOUSE OF COMMONS

of Physicians has come up with a number of 40,000, which I think also includes nitrogen dioxide air pollution.

There are various estimates around of the impacts on morbidity. There was a very nice publication last year by Public Health England that looked by local authority and estimated the effects. I have the numbers here. A one-microgram-per-cubic-metre reduction in PM2.5 in England over an 18-year period would prevent around 50,000 cases of coronary heart disease, 16,500 strokes, 9,000 cases of asthma and 4,000 lung cancer cases. For quite a modest reduction in air pollution, you have quite a large impact on thousands of lives, so that is really crucial to bear in mind. Of course, we have a lot of current debate now about how air pollution might affect covid-19, which has also been referred to.

Q31 Chair: We have questions about that in a minute. Thank you for that clarification. You would be reasonably confident these figures, from 30,000 to 40,000, are reasonably accurate as far as you can estimate, basically.

Professor Hansell: As far as we can estimate. They come from looking at a range of studies that have been done, pulling together the best available evidence, and there has been a very careful consideration of them. There is uncertainty around them, partly because you are not dealing with an experimental situation. You cannot select half the population and put them in the air pollution and the other half not and see what the difference is. You are trying to have to account for all these other things going on in people's lives, but these are our best scientific estimates of what the likely scale of the impact of air pollution is, yes.

Q32 Chair: As we go through air pollution and air quality, over the years we have naturally changed. It was not so much nitrous oxide. It was not much particulates. There is a certain amount of, shall we say, scepticism in the population in some parts because the goalposts move a bit. I am not necessarily saying you have moved the goalposts. What do you say to people who feel that sometimes the goalposts get moved and when they are not quite certain who to believe?

Professor Hansell: There are a number of answers to that. The first thing to say is air pollution has improved over time. If you look back to the 50s and 60s, there is massive improvement. I have done analyses that look at air pollution back in the 1970s and you can still see an impact of that in mortality up to 40 years later. That is important to think about.

As time has moved on, we have been able to look at effects of air pollution at lower and lower levels. We actually see levels that have impacts on the various outcomes that are below the WHO guideline of 10 micrograms per metre cubed. There is work in Europe and Canada that has been going on recently, looking at how low you need to go before you cannot detect anything, and it really is down to extremely low levels. Actually, the exposure-response function is a bit steeper at those lower levels. You get this steep bit and then it starts to tail off once you get to the very high



levels. The good news about that is that the more you reduce it at those lower levels, the greater potential impacts on health you have.

Q33 **Chair:** Sir Michael, do you want to add anything to the answer?

Sir Michael Marmot: I have two things. First, if we look globally, the World Health Organisation estimates that 7 million deaths annually can be attributed to air pollution, about half external and half internal air pollution. Like most of these things, there will be discussion around the accuracy. Whatever the scale of air-pollution-associated mortality in the UK, look at New Delhi, Beijing, Mexico City and countries around the world where it is an order of magnitude worse than we are suffering.

The second thing was that Alastair made what I think is a most important point, and it is very close to what has just been said. It is tempting to look at hotspots and high levels of exposure. Geoffrey Rose, a generation ago, talked about the prevention paradox: that the total burden in the population will be bigger from the large number of people at small increases in risk than it will be from the small number of people at large increases. It is underlying that I am agreeing with his very important point that we need not just to get down to the acceptable limits; we need to get lower than that, because there will be continued benefit. It might well be that number we have just heard might be larger, but it is difficult to estimate it at the moment.

Chair: Thank you for that. That came over loud and clear from our first two witnesses, and I agree with you. It is probably something that has altered over the last year or two, where we were concentrating very much on the hotspots at one stage. We still need to remember them and do something about it, but we need to do something more on overall air quality and reduce pollution, so thank you for those answers.

Q34 **Ian Byrne:** This goes to both of you, and it is great to see you both here today. To what extent are people from disadvantaged communities more exposed to air pollution? What does that mean in terms of health inequalities? I will just define health inequalities for people watching. Public Health England defines them as "systematic, avoidable and unjust differences in health and wellbeing between different groups of people".

Professor Hansell: We did some analysis of this across the UK that was published in 2015 and found that the UK has higher air pollution levels, as you might expect, in the more deprived areas, but also in the areas with higher ethnic minority percentages. Those are independent of each other, so it is not just the deprived areas have the higher percentage of ethnic minorities. It was about 1.5 microgram per cubic metre higher on the PM2.5 and, for deprived areas and environments, three micrograms per cubic metre higher in the areas with more than 20% non-white population. There are big differences in people's exposure.

The concern is that the deprived areas and the areas with high levels of ethnic minorities also have clusters of other factors that might predispose



them to be more susceptible to air pollution. There is a strand of research in environmental inequalities that says that we should be looking at having even lower levels of air pollution in the most deprived or ethnically mixed areas because those populations are more vulnerable. I am not sure how you actually put that into legislation, but it is a really interesting principle to have in mind.

Sir Michael Marmot: In my *10 Years On* review, we reported PM10 exposure by level of deprivation. Looking at London, Liverpool, Birmingham, Bristol, Leeds and Sheffield, in each of these cities, those in the most deprived quintile had higher exposure to PM10 than those in the least deprived quintile.

Separately, I have cited a study of schools in London. It was a slightly odd analysis, but it looked at the proportion of children eligible for free school meals as the deprivation indicator. The higher the proportion of children eligible for free school meals, the higher the exposure to oxides of nitrogen. Given, Chair, your first question about the life course, that is the one that makes my hairs stand on end. The idea that we are exposing our children in deprived areas to high levels of air pollution is extremely concerning.

Q35 **Ian Byrne:** To follow on from what you have just said, Sir Michael, you mentioned before about the 7 million deaths. Even if we drill down to the deaths in this country attributable to air pollution, do we actually have the numbers based on income and deprivation indices on the number of deaths within these areas? Do we have the information to drill down into that detail?

Sir Michael Marmot: Anna would be better to answer it than me, but I think we would both say that, to get a precise answer, it is so difficult to disaggregate the air pollution effect from the other challenges to health of people linked to the level of deprivation.

Chair: Perhaps we could ask both witnesses to supply us some evidence in writing on that one. It is relatively complex, but it is a very good question of yours.

Q36 **Ian Byrne:** To follow up, Sir Michael, can you explain the triple jeopardy effect facing disadvantaged communities and how this relates to air pollution, please?

Sir Michael Marmot: The clearest evidence I saw was from the US six cities study. It showed that the more deprived the area, the bigger the air pollution effect on mortality. We are seeing that it is not just if you are more deprived you are more exposed. If you are more deprived, you are more exposed and the damage to health of air pollution appears to be greater.

The kinds of mechanisms that Anna talked about in her introduction will give a ready answer to why that might be the case. It is damaging various organ systems. It is damaging airways. We know that chronic obstructive pulmonary disease is among the diseases that show the steepest social



gradient. The more deprived you are, the higher the risk. That is not just due to air pollution. It is due to smoking, infection and so on. You can see that, if you are already at high risk from other factors linked to deprivation, air pollution could have a disproportionate effect, harmful to health.

Ian Byrne: Those were excellent answers.

Q37 **Geraint Davies:** I was going to ask whether there was a link also with covid as well. We have heard some data about the fact that there is a greater propensity for BAME communities to be affected by covid. I was wondering whether that was linked in.

Chair: That is question number 9, Geraint, so can I ask the witnesses to make a short answer to you and then we will move on to question 9?

Professor Hansell: The short answer is it is difficult to disentangle the ethnicity and deprivation effects. We need some more detailed individual-level studies. We just have area-level studies to look at at the moment.

Sir Michael Marmot: I will answer it when it comes back as question 9.

Q38 **Dr Hudson:** Thank you both for being before us today. It is very difficult, is it not, to disentangle the epidemiological links in a disease such as covid-19. Broadly, could you tell us what the evidence may suggest about a possible link between air pollution and people's susceptibility to covid-19? That is in terms of how severe the disease may be in those people and then potentially linked into mortality rates as well. I know it is a very complicated field, but are there any broad epidemiological links that can be made?

Sir Michael Marmot: Can I start with the deprivation and the BAME, and then we can talk about covid specifically? First, let me say how much I appreciate what ONS and Public Health England have been doing with the publications. ONS has been putting out a string of extremely useful publications on the impact of covid-19. When they look at deprivation, you see a very clear social gradient: the more deprived the area, the higher the mortality from covid-19. It looks very similar to the social gradient from all causes, which means the kinds of influences on inequalities in health that I reported in my February report are likely to apply to covid-19. You look at the gradient for all causes and you look at the gradient for covid-19. They are very similar, with one small, but potentially important, exception: that, in the most deprived two deciles, you see a higher mortality for covid-19 than the gradient for all causes. It is very interesting. Why might that be? I will come back to that in one moment.

Then you look at the BAME and that one is really interesting. You see higher mortality from covid-19 than I had been able to observe in my 2020 report. For black British, about half is accounted for by deprivation. For Pakistani and Bangladeshi, more than half is accounted for by deprivation, particularly for women. The part that is not deprivation may well be related to frontline occupations and living in multi-generational overcrowded households.



HOUSE OF COMMONS

We also know, though not from ONS's recent publications, that we see a social gradient in diabetes and in chronic obstructive pulmonary diseases, each of which make it more likely that covid-19 is fatal, related to the severity of the infection. That is also likely to relate to severity of infection in the BAME population. I do not think we have reliable incidence data because testing has not been routine. I look at what they publish on incidence and I say, "Yes, maybe", but I think the mortality data are reliable. It is likely that pre-existing conditions are contributing to that excess in covid-19. Those same pre-existing conditions are likely to make BAME and deprived groups more susceptible to the effects of air pollution.

That does not prove that it is the air pollution linking to covid-19 deaths. We are seeing a pattern here that links air pollution, covid-19 and inequalities in health more generally.

Dr Hudson: That is very helpful.

Professor Hansell: The starting point for me is that air pollution is associated with so many diseases. It is going to be really unlikely that it is not associated with covid. The issue I am concerned about is whether there is an interaction with the air pollution. You need to think about different ways the air pollution might be acting. The air pollution is going to increase your risks for the diabetes, the COPD, the heart disease, the hypertension that make you more prone to have a severe covid disease. If that is the mechanism going on, you would expect the same exposure-response coefficient that you see for those other diseases.

If you have some short-term impacts as well, you might see higher exposure-response coefficients. The possible mechanisms there are that air pollution is increasing a general inflammation, so that might increase the risk of more virus penetrating. There is a specific mechanism that air pollution seems to increase a particular receptor called the ACE2 receptor, which the SARS-CoV-2 virus enters the body by. That might be another mechanism. There are also some reports that particulates might be carriers of the virus in community settings. There are various ways in which short-term exposures might increase your risk of getting infected and/or having a more severe infection.

The problem as an epidemiologist is trying to drill down and say, as Sir Michael has really nicely elaborated on, in the deprived areas, in the black and Asian minority groups, there are various reasons why they already might be more susceptible to covid-19. Disentangling all those impacts is very tricky, particularly with the data we have at the moment. I agree that mortality data is reasonably reliable. The case data is really difficult to interpret because the thresholds and criteria for getting tested have changed over the time period.

I have been concentrating on looking at the mortality studies. We have five studies so far in the UK that are all area level. Four of those have looked at air pollution levels per se, but they have various flaws in them because of the way they were conducted, because the fine-grain data that you need



to get to the bottom of this is not readily available and it takes some time to gather it together. The estimates they are coming up with are somewhere between the 1% to 10% range, so they are compatible with what is coming out of the US, which are also area-level studies.

There is the Harvard Wu and Dominici study, which has seen an 8% increase in covid-19 mortality for every one microgram per cubic metre PM2.5. There is also a study from Emory University, which has a Harvard collaborator on it, and that has found a 2.3% increase. There is a reasonably big range, but those figures are actually an order of magnitude higher than the exposure response for general all-cause mortality. They throw up some hypotheses that mean you have to be doing individual-level careful studies to get to the bottom of it, but they are not definitive enough yet to say that we need to change public policy. That is the bottom line of it.

It is not just my view, because there was a recent editorial in the European Respiratory Society journal, which was saying, "Go fast to go slow". It was saying that we have had a lot of studies now saying that there is some sort of correlation between air pollution and covid-19 mortality, but now we need to do some really detailed scientific study to get into the fine-grain detail of that.

Q39 **Dr Hudson:** That was really helpful. It is very technical and complicated, and both of you articulated that really well, so thank you. It is very hard in this risk factor analysis to draw down on to one factor when those factors could be working in tandem with other particular risk factors as well. It is interesting you have mentioned the data associated with mortality but also potentially with susceptibility to contracting the disease and morbidity as well. You mentioned that more research needs to be done and perhaps there is not enough yet to influence policy. My follow-up question, which I think you have probably answered, is whether, if there is some potential link with air quality but perhaps it is not tight enough yet and there are no particular air quality measures that Government could be looking at in their initial response to covid-19, you felt that policy is not ready yet. I wondered what your thoughts were.

Professor Hansell: This issue around the short term and the long term is really important. If it is long term and it is increasing risk of chronic conditions, your policy response is to shield the people who have the chronic conditions or to look more carefully into their health or screen them more often or whatever. If it is a short-term impact, you have an imperative to try to bring down the air pollution levels in a short-term way. You may not get the epidemiology. You may have to look at some toxicological studies, and there are some going on at the moment, looking at cell cultures and responses. They are kept under review.

There is a covid subgroup within COMEAP that is keeping an eye on all the papers that are published. We have very consciously in mind that, should the evidence come out to say we need to be taking some short-term action, we will take those.



HOUSE OF COMMONS

I am a public health doctor by background, so the other way of looking at this is saying, "To get covid-19 you need to be in contact with someone who has the virus". If you have good public health control measures, maybe the air pollution side of this becomes less important. It is only when you have very high community prevalence that it becomes more important.

Q40 **Dr Hudson:** Sir Michael, do you have anything to add on that point?

Sir Michael Marmot: Yes. If we had had this discussion in September last year and you would have asked about policy, I would have said, "Yes, we have ample evidence to take action on the underlying causes of inequalities in health and we have ample evidence to take action on air quality". With the fact that covid-19 has come along, I would say that is still true. Both those answers are still true. We have ample evidence to take action on the determinants of inequalities in health and on improving air quality. I have been saying from the beginning of the pandemic that covid-19 has exposed the underlying inequalities in society and amplified them, so it gives more urgency for policy and to take action right now.

There is one particular one. Let me hold my hand up. I was criticised in my 2010 report for not saying enough about black, Asian and minority ethnic groups. We said more in my 2020 report but there are no routine mortality data for black, Asian and minority ethnic groups, so we said what we could. The pandemic has exposed the susceptibility of these groups to covid-19 and to ill health that we perhaps had not paid enough attention to before. As I say, I hold my hands up. We need to be dealing with structural racism. We have enough evidence to say we have to start dealing with that. It took the pandemic to make us realise. It took the pandemic and Black Lives Matter, but it took the pandemic to make us realise that. My answer to your question is yes, we have ample evidence to make policy right now.

Dr Hudson: Thank you very much for your thought-provoking answers on that. That brings us to take-home messages. As with previous inquiries, covid-19 has brought many of these issues into sharp relief, so this will give us food for thought, certainly, as we put our report together.

Q41 **Geraint Davies:** Clearly it is the case that all disadvantaged groups are more exposed to covid because they are more likely to be working as nurses, in taxis, in food production or whatever, rather than sitting at home on a Zoom call. Secondly, they are more likely to be in more congested environments with higher pollution. Therefore, as you said, they are a lot more likely to be weaker, so it is no real surprise that, if covid comes along, they are more susceptible.

Given that we found from these reports in Harvard, the Netherlands, et cetera, that there is a correlation between, for instance one microgram of PM2.5 per cubic metre and an extra 8% to 15% deaths, it is no surprise that those poorer groups are being hit harder. We have also heard from the professor that we know there is more likelihood of infection through the ACE2 receptor. Is it time to introduce specific measures now so that people can work from home more easily, there is less congestion, there



HOUSE OF COMMONS

are more masks, we take action now, rather than just talk about the data all the time and actually bring down air pollution to save the lives among these groups?

Professor Hansell: I would go back to Sir Michael Marmot's view that we have enough evidence to act on air pollution now. The issue of how much difference it is going to make to covid-19 mortality specifically if we implement the air pollution measures now is not clear, so that is what we are saying about the data, in terms of the actual scale of that benefit.

Q42 **Barry Gardiner:** Sir Michael, when you were talking about the susceptibility factors, in effect you described my borough of Brent in London. My constituency has multi-family households, multiple HMOs, high ethnicity, both black and south Asian populations, high incidence of free school meals, low income and of course we have the A406 and the A4(M). It was no wonder to us that we were the epicentre in London, at Northwick Park Hospital, of the covid crisis at the beginning.

Both of you agreed with our previous witnesses about the importance of not simply setting standards to be attained and dealing with hotspots. I suppose I want to fight for the hotspots. I think it was Professor Scotford who mentioned the problem of limited resource. The trouble is, if you have limited resource, and it always is limited from Government, having a generalised understanding that we should be lowering levels in all areas, which I absolutely agree with, can mean that there is no concentration and focus on areas like Brent, which I represent. If we are really going to tackle what you call the structural racism—I think you used that word—that areas like Brent experience and that structural inequality, surely we need to target our resources carefully at those areas of greatest deprivation.

Sir Michael Marmot: Chair, may I crave your indulgence if I use two rude words together? The two rude words are "proportionate universalism". I apologise for such bad language. In my 2010 report, I was trying to deal with exactly this issue. On the one hand, I have described for decades now the social gradient in health. Inequalities in health are not confined to poor health for the poor. The Geoffrey Rose principle is that the hotspots and the high risk are terribly important, but, in population health terms, they are less important than the other parts of the gradient. I was trying to deal with these two issues. Do we focus on the most at risk, or do we deal universally with the issue?

I came up with the classic British compromise of proportionate universalism. I said that the NHS is a universalist policy. It is there for everybody. My own view has been that, if I was bungee-jumping at aged 95 and the rope snapped and I plummeted to my death, I would not say, "Damn, I paid my taxes all these years and I never profited from the NHS". I would be pretty happy. On the other hand, if I had diabetes, peripheral vascular disease, ischaemic heart disease, glaucoma and other complications, I would be pretty pleased that the NHS was there to treat me with my renal disease and my hypertension and all those things. It is a universal service with effort proportionate to need.



HOUSE OF COMMONS

The way to deal with the gradient and the way to deal with the hotspots is precisely that. We want a universalist policy. We want cleaner air for everybody, but with effort proportionate to need. In Brent, there will need to be more effort to deal with the hotspot, but that does not mean that we should ignore the air quality in more salubrious, cleaner parts. We need proportionate universalism.

Professor Hansell: I am thinking about the Environment Bill and the idea of having an absolute as well as a relative reduction. That fits into that very nicely.

Chair: Can I thank both our witnesses again? Sir Michael, with your very good analysis, and Anna Hansell, it has been really good to get to grips with air quality. The evidence you have given has particularly highlighted deprived areas and how we can deal with general health and how that may well be connected to covid-19 as well. We really value your evidence this afternoon. If, when you finish this session, there are parts of the evidence that you feel that you could let us have in writing that you did not add to your excellent evidence this afternoon, we would be very happy to receive it.

We have had two very good panels today and it has launched our inquiry into air quality and the future of improving the quality of air for all in this country. It was very useful, so thank you both very much. I also thank the members very much for their questions and patience. I will allow you all now to return to your various jobs. I think we are about to vote here in Parliament. Thank you very much to both our witnesses.