HOUSE OF COMMONS

Science and Technology Committee
Health and Social Care Committee

Oral evidence: Coronavirus: lessons learnt, HC 877

Wednesday 21 October 2020

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Watch the meeting

Members present:

Science and Technology Committee: Greg Clark (Chair); Aaron Bell; Dawn Butler; Chris Clarkson; Mark Logan; Carol Monaghan; Graham Stringer.

Health and Social Care Committee: Jeremy Hunt; Paul Bristow; Rosie Cooper; Dr James Davies; Dr Luke Evans; Neale Hanvey; Barbara Keeley; Laura Trott.

Questions 110 - 222

Witnesses

I: Dr Max Roser, Director, Oxford Martin Programme on Global Development; and Professor David Heymann, Professor of Infectious Disease Epidemiology, London School of Hygiene and Tropical Medicine.

II: Professor Mark Woolhouse, Professor of Infectious Disease Epidemiology, University of Edinburgh; Professor John Edmunds, Professor of Infectious Disease Epidemiology, London School of Hygiene and Medicine; and Professor Sir Ian Diamond, National Statistician.

III: Dr Clare Gardiner, Director, Joint Biosecurity Centre; and Professor Axel Gandy, Chair in Statistics, Imperial College London.

Written evidence from witnesses:

– [Add names of witnesses and hyperlink to submissions]

Examination of witnesses

Witnesses: Dr Roser and Professor Heymann.

Q110 **Chair:** Welcome to a joint meeting of the Science and Technology and the Health and Social Care Select Committees. We are undertaking an inquiry to make sure that we learn whatever lessons we can from our response to the Covid pandemic, especially lessons that can be applied to help decisions that will need to be taken during the weeks and months ahead.

Today, we are considering the role of modelling and statistics. We will ask questions about the first few months of the pandemic, and about current issues in this area. Part of the purpose of these Select Committee hearings is to consider and question current pressing issues.

This morning, we have three panels of witnesses. The first will examine how we fare compared with other countries around the world and what lessons we can draw from that. The second will consider statistics and modelling at the UK level. Finally, we will consider what we know about the experience of local places within the UK.

Before we call the first witness, can I ask if any member of the Committee has relevant interests to declare?

I am delighted to welcome our first two witnesses in this session. Dr Max Roser is from the University of Oxford. He is the founder and editor of an online publication called ourworldindata.org. Professor David Heymann is professor of infection disease epidemiology at the London School of Hygiene and Tropical Medicine. He was previously the World Health Organisation's assistant director-general for health security. Welcome to our session. We are very grateful for the time that you have with us this morning.

Perhaps I could start with a question to Dr Roser. Could you summarise the current international situation with Covid? Which countries are displaying exponential growth, and which are not?

Dr Roser: Thank you very much; I am happy to speak about that. The pandemic had several waves in different world regions, starting very early in Asia and then moving to Europe in March and April. Over the summer months, the centre of the pandemic was clearly in the Americas. Now we are seeing a strong surge again in Europe.

The European number of confirmed cases per day now stands at 365,000. That is more than a million cases every three days. Half of that is in Europe. The surge in Europe is quite pronounced. Europe is the region where we are seeing this surge.

I am sorry; I misspoke: 365,000 is the global number and 140,000 is the European number. Within the last two weeks, the number of confirmed cases in Europe has doubled. At the same time, testing has, if anything, got a little worse. The positive rates that we are seeing across Europe

have increased over the last days. The true doubling number of the daily case count has actually increased faster than two weeks.

It is important to mention that we are seeing very large differences within Europe. The total number for Europe is 140,000. The UK currently stands at 260 cases per million. There are countries that saw the surge earlier. The Czech Republic and Belgium now stand at over 700 cases per million every day.

At the other end of the spectrum, Estonia and Norway have case counts that are 90% lower than the UK. Estonia is actually seeing a decline currently in cases. Those countries are testing better, so that the true difference between the UK and those countries is likely to be even larger.

Q111 **Chair:** Outside Europe, which countries are doing relatively well in this current phase of the pandemic, if I can call it that?

Dr Roser: There are several countries that are doing well even within Europe, as I mentioned. Estonia and Norway stand out. Several countries still have lower case counts. My own home country, Germany, is under a quarter of the UK case count at the moment. Countries that are doing well are countries that largely have done very well throughout the entire pandemic. That is one of the clearest lessons that we see from this pandemic. Some countries reacted fast very early on and remained very much in control of the pandemic.

If we look towards Asia, we see several countries in which the total death rate—the cumulative death rate over the last months—is still below 10 deaths per million. The UK stands at 644 deaths per million at the moment. Countries that have very low death counts are Taiwan, Vietnam, Thailand, Sri Lanka, South Korea and Malaysia. Japan is only slightly higher at 13 deaths per million.

Q112 **Chair:** Professor Heymann, based on your studies and your experience, are there reasons that can be ascribed for these differences, especially the current differences in this phase?

Professor Heymann: Thank you very much for inviting me. As you may know, I chair the technical advisory group at the World Health Organisation. It is working with the emergencies programme on the response to the pandemic. In that role I participated, earlier this morning, in a seminar in Asia, where they were talking about how they were going to open up their travel within Asia. That is only possible because they have done such an extremely good job, as we heard earlier from Dr Roser, in stemming the outbreaks that have occurred.

They understood early on that this does not transmit like flu. It transmits in outbreaks. The outbreaks can be traced back to a source many times, and that source is shut down temporarily until rectification is done. They can be traced forwards, so that you can isolate contacts and prevent transmission in the community.

Each country in Asia that participated in the seminar—Australia, New Zealand, Singapore, Japan and South Korea—had begun that activity very early and are now in a position where they are ready to look at beginning travel where there is equal risk of transmission and equal response capacity. For example, Singapore is opening up travel with Hong Kong and with New Zealand. That is all because there is transparency in the data that is being provided.

Chair: I am grateful for that. You are a little quiet in terms of volume. Perhaps you could keep the microphone closer to your mouth; that would be helpful.

Q113 **Jeremy Hunt:** Dr Roser, you have just mentioned how successful places like South Korea, Taiwan, Vietnam and Sri Lanka were. It is very striking that Taiwan, with a population of 24 million—so not a small city state—has had just seven deaths. From your standpoint, why has there been that dramatic difference between what happened in those Asian countries and north America and western Europe?

Dr Roser: One aspect that stands out is the importance of testing and the quick capacity increase of testing in those countries. It is only when people are aware that they are sick that they can decide to self-isolate. The Government can monitor the situation and respond appropriately if the data is clear, so testing is our window on what is happening in the pandemic. Asian countries stand out, as do several European countries and Uruguay, a country in south America. It is not just the Asian countries that have achieved it. Those countries expanded their capacity whenever there was a surge in cases, and they were able to monitor it very closely. There were contact tracing operations in place that were very successful. Several countries have given patients the option to isolate outside the household to prevent transmission within the household.

Another aspect that is very much emphasised, and I believe is right, is the role of mask wearing. That was understood very early in several of those countries and was advocated by the Government.

Q114 **Jeremy Hunt:** Professor Heymann, you headed the global response to SARS for the WHO in 2002-03. Many people say the reason that Asia has been more successful is their experience with SARS, which led them to have earlier border controls, local lockdowns and more test and trace, as Dr Roser was saying. We see what is going on in Asia here in Europe and in America. Why didn't we model and implement that approach in Europe and north America?

Professor Heymann: One of the issues in Asia, as you said, was that they had SARS and also a MERS coronavirus outbreak in South Korea, which killed 38 people from one importation of disease. They were well prepared. They learnt lessons and they applied those lessons between the current pandemic and SARS. They developed excess beds for hospitalisation and isolation. In all of those countries, those rooms have

renal dialysis capacity and ventilation capacity. They learned and applied the lessons. By 20 January, they were already detecting cases and responding to outbreaks that were occurring.

There were some misunderstandings early on that this disease spread like influenza, but actually they showed early on that it did not. It spread in outbreaks, and you could fully contain those outbreaks. Even if there were massive outbreaks, such as occurred in churches in Singapore and in South Korea, they were able to trace people, get them isolated and shut down the sites where transmission was occurring until they could rectify those sites. Yes, they learned from SARS and from the MERS coronavirus. They were ahead.

Why other countries were not is not clear. The virus landed in those countries at approximately the same time as it landed in Asian countries, in Europe and in north America, yet the detection systems did not trigger the alarms as they did in South Asia. Why that occurred, I cannot answer.

Q115 **Mark Logan:** Linked to what Jeremy was asking on SARS, Professor Heymann, do you feel from your area of specialism that looking back to January/February time, when I remember hearing a lot about the UK having the world's leading scientific capability, we had not factored in the potential for a global pandemic hitting us in the UK?

Professor Heymann: I cannot answer that question. I was at one time chair of Public Health England. I left that position two years ago. At that time, Public Health England had scaled up its activities to be ready to face outbreaks. During the pandemic, it did quite a good job in dealing with the pandemic.

I cannot answer about what has happened since then; I do not know. You would have to ask someone who is much closer than I am, but I agree with you that the United Kingdom has some of the best public health and scientific experts in the world. Those people are speaking up during the current pandemic.

Q116 **Mark Logan:** Looking again to Asia, Dr Roser, I have been looking through ourworldindata. The image I am looking at does not include China. Is there a reason for that? What is your evaluation of what has been happening in China in recent months in the pandemic's development?

Dr Roser: We include the data from China. There are several statistics that we report from different sources. The main metrics we present are obviously the confirmed cases and the confirmed deaths. That data is aggregated from the European CDC, and includes China.

Where we do not have data on China as a whole is in testing. Several of the metrics you might see on our site that rely on testing data, for example—the positive rate of tests—do not include China because China is not publishing aggregate figures for testing in the country.

Q117 **Mark Logan:** Looking back to the outset of the pandemic, to what extent do you feel that the more severe type of lockdown that was used in China was successful in the long run? Which other factors are important in controlling the pandemic, as for example testing, which was mentioned earlier?

Dr Roser: It has always been clear that the pandemic should not be controlled by lockdowns. Lockdowns are the bluntest weapon that we have, and it is only once every other public health intervention has failed that countries should consider a lockdown. The discussion should be about what we can do to control the pandemic, as Professor Heymann has repeatedly made clear. How can we identify outbreaks at local level and react quickly? The crucial point is to monitor very closely and to act on a local level.

I think that is something the UK can do better. Lots of crucial data is not available at local level, but I guess that will be picked up in the following sessions. It is about avoiding the situation where there has to be a discussion of whether we should have a nationwide lockdown or not. The very early lockdown in Wuhan that was making the headlines earlier this year is an example where the country was able to avoid a lockdown of more than 1 billion people by having a local lockdown in the city where the virus broke out.

Q118 **Chair:** Professor Heymann, do you have a view on that? Do you have a response to Mark's question?

Professor Heymann: What is happening in Asia is that they are learning to live with the pandemic. That is very important because, at present, it appears that the infection may become endemic in human populations like four previous coronaviruses.

The technical advisory group that I chair put out an article in *The Lancet* 10 days ago on living with the pandemic, using the tools we have at present and not waiting for a vaccine that might not come or might not be what we are anticipating, or a therapeutic. That is what the Asian countries have done. They have been able to keep transmission at low levels. They had glitches at times but have kept it at fairly low levels. At the same time, they have had decreased mortality compared with other countries.

As Dr Roser said, they do not just lock down bluntly. They do a surgical lockdown. They do good epidemiological tracing where transmission is occurring and shut those areas down; plus they mitigate by making sure that mass gatherings do not occur in places where people congregate.

Q119 **Chair:** Learning to live with the pandemic is the approach that is being taken, you say, in the leading Asian countries. Is that advice that you would give generally to countries around the world?

Professor Heymann: The reason they can do that in Asia is that they started early with contact tracing and making sure that they stopped the

outbreaks that occurred. Therefore, they decreased transmission to communities. As Dr Roser knows, Germany has continued with contact tracing from the very first imported cases from China. They have continued to do that, with massive numbers of contact tracers and Covid taxis that take people around. They have shown that it can be done in European countries as well. That is a very important lesson that we can all learn. By finding discrete outbreaks where you can, and decreasing transmission from those outbreaks, you can in fact control the outbreaks in a very good way using surgical shutdowns when you need to—for example, in night spots or areas where the outbreak is shown to be concentrated.

Q120 **Laura Trott:** Dr Roser, can you explain to the Committee the differences between data gathering methods in different countries from the UK, and whether those differences have any impact on how useful international comparisons are?

Dr Roser: That is a very large question. I will make a couple of key points. One limitation in understanding cross-country differences is differences in testing. That is very clear. Several countries are not testing widely. It is always the case that confirmed cases are only a fraction of total cases. In countries where testing is not happening on a large scale it might be a very small fraction, so that we are actually unaware of most of the cases in those countries.

The fault does not only lie with other countries. It is often the fault of the UK itself that we cannot compare the UK clearly with other countries. The UK for a long time only published cumulative test figures. It was not publishing that data as a daily rate, as it was publishing the case counts, so we could not understand how cases and testing related to each other. It still does not publish testing data at a local level. The data exists and Public Health England has the data disaggregated at local level, but it has not been published.

There is no testing data broken down by age, sex or race that would allow us to understand more clearly where the differences are between the UK and other countries, and to learn more clearly. For example, we do not know whether increasing case counts might be due to a shift of test allocation to younger cohorts.

Another central figure to discuss is deaths. That is often relied on as the central metric for making comparisons. There are several limitations. Again, testing is one of the key ones. Several countries only count a death as a Covid death if the patient had been positively tested beforehand. Other countries do not do that and rely on a clinician's judgment as to whether Covid might have been involved in the death of the patient. Those are so-called probable deaths. For example, Belgium is a country that is known for having that wider definition of the death counts, and it is also one of the countries that stands out with the highest death rate.

One last point on deaths is the setting where the deaths occur. That was perhaps more of a problem in tracking the number of deaths over time. Several countries initially only counted deaths that occurred in hospitals. Then they widened the definition to deaths that occurred in care homes. Only later did they increase the death definition to count deaths that occurred at home and outside hospitals.

Q121 **Laura Trott:** Would the recommendation, particularly for the UK, be to try to break down the data a little bit more, make it more local and make sure we have data on age and sex available more widely?

Dr Roser: Yes, that would be key information. Another key metric that is missing for the UK is the number of people that are tested. The UK is one of the countries that does not make that data available. It publishes the number of tests that are performed rather than the people who are tested. Of course, since we are counting cases at a people level, we should know the number of people who are tested in the UK. That data should be available to understand the situation here and to make comparisons with other countries.

Q122 **Chris Clarkson:** Dr Roser, you have probably already touched on this a bit in your response to my colleague. I want to understand what the key issues are in comparing international data on deaths. You talked about how different countries record deaths differently, how they look at excess deaths differently and how they break down that data. What are the key challenges in comparing that data? How have you overcome the inconsistencies?

Dr Roser: I have spoken about the question of probable death and the setting of the death. There is another, third, aspect which is the time cut-off. There was obviously a discussion here in the UK. Scotland had the definition that a death only counted as a Covid death if it happened within 28 days of a positive test. It is more widely a problem that we do not know what a Covid death is and how it relates to a prior diagnosis that would impact the death counts.

The second aspect is the question of excess mortality, which is a second way of getting a perspective on the death counts within countries. The basic idea is that we compare weekly death counts in previous years with weekly death counts this year. We can get a measure of the excess deaths that are happening beyond what we would normally expect, and thereby get a mortality estimate of the pandemic. The crucial thing to know there is of course that it is agnostic to the causes of death. It would be naive to think that the excess deaths are a more accurate count, or even a count, of the Covid deaths. It just offers a second perspective.

The fundamental problem is a long lag in reporting in many countries. Those vital registries tend to be slow, so it is more a metric with which we can understand the damage done, rather than monitoring the outbreak as it happens. It is of course very hard to understand what comes from the outbreak of the Covid pandemic and what is due to

changes in the country more broadly. There are several countries, for example, where Covid deaths are higher than the number of excess mortalities. That can happen because of the impact of the pandemic, with people staying at home more. Injuries from car accidents or falls, which are often a relatively high share of deaths, or crime might drop during the pandemic, so it is very hard to understand from the excess deaths what is really a death due to the infection.

Q123 **Chris Clarkson:** Thank you; that is very interesting. What do we know about direct and indirect deaths across the world? We are talking about how the data is recorded and what we class as a Covid death; for example you touched on the fact that Scotland says that after 28 days it is no longer a direct Covid death. What do we understand about the way that is being recorded and how that affects the comparison internationally?

Dr Roser: The honest answer is that we do not yet have a good understanding of the indirect death count from the pandemic. Of course, there is a second aspect to excess mortality. Deaths due to other causes might have increased. People who had strokes or were suffering from other conditions, and were afraid to go to the doctor because the health system was overstretched, did not receive the care that they would usually receive. That would increase indirect deaths in the previous months, but it might also lead to indirect deaths in the years ahead.

Some of the deaths due to the pandemic might not have happened yet. A key aspect is that people who may have concerns about a cancer do not seek diagnosis, and therefore are diagnosed at a later stage, so that their survival chances in the years ahead might decrease. There is a paper in *The Lancet* that looked at that for the UK for four types of cancer. They estimated that over the coming five years they expect an addition of 3,000 cancer deaths in the UK because of the impact of late diagnosis and overstretched health systems.

Q124 **Chair:** On the question of the definition of a Covid death in the UK as being someone who has died within 28 days of a positive test, Professor Heymann, is that the right cut-off? You obviously have to define these things somehow. In your experience around the world, do people who die of Covid tend to die within 28 days of having a test, or having the symptoms that give rise to a test?

Professor Heymann: The answer to that is that it depends on the skill of the medical community and the availability of equipment to keep people on life support in countries. The levels of mortality that actually occur in people who become infected with Covid depend on many different things.

What is lacking, as Dr Roser said earlier, is standardised reporting. It does not really matter what countries report as long as they all report the same thing, and they are not doing that at present. We know that. In many countries, they report very late or not at all. What is necessary is

not looking at what is happening today but urging countries to report the standard definition that is provided by international norms and standards groups such as the World Health Organisation. The WHO is working on frameworks to make sure that is available to countries. Once that occurs, we will be able to compare countries better.

From the experience that I have had in many different countries, and from listening to the presentations of those at the WHO committee, I can say that in fact there is a difference in the definition of when deaths occur related to Covid. Some countries do not report it at all, as Dr Roser said. They just report deaths going forward. Others report deaths that are specifically a number of days after infection began. Standardisation is the goal, and that is what needs to happen for comparisons to be made. There will be excess mortality, clearly, in the present year, as has already been shown in many states and countries, and in addition in the long term going forward, as Dr Roser said.

Q125 **Chair:** I do not know whether Dr Roser has some reflections on the question of the 28 days. Dr Roser, in your comparisons of countries we have talked about the number of deaths, but are you noticing anything different in the likelihood of people dying from Covid during this phase of the pandemic? Is there a change that you are picking up in your international comparisons?

Dr Roser: We would need better international data to pick that up. From what I understand from colleagues, the chances of survival have increased, so the infection fatality rate might have declined. To understand cross-country differences, we need much more detailed data, which we do not have. A crucial aspect would be the age of the people infected.

It is a blind spot in the international data. Obviously, countries have data on the age breakdown of cases. They have the age breakdown of deaths and perhaps even on hospitalisations, but the data is not aggregated by international organisations, so we lack the data to understand cross-country differences.

Q126 **Dr Evans:** My question is to Professor Heymann. I am particularly concerned about the risk factors that a country might have on a national level. If I think back to my days as a medical student, we used a surgical sieve approach. That means stratifying all the different reasons why that might happen.

What evidence is there for why certain countries have fared better, be it around obesity levels, population density or airports—those kinds of factors—and whether there is a way of stratifying countries as we learn for the future?

Professor Heymann: That is a very important question. Until there is reporting by morbidity in countries, it is going to be very difficult to understand *[Inaudible.].* What is clear, though, from studies already

[Inaudible.] middle east and in Asia *[Inaudible.]* very low levels of comorbidities *[Inaudible.]* people who are working overseas.

There is beginning to be an understanding of what is going on. As Dr Roser said, it is very important. If younger people are getting infected, presumably there will be fewer cases showing up in hospitals because there will be less severe illness and at the same time fewer deaths when they develop infection. All of those things are important. We just need to be more certain of what is being reported and getting countries to report more precise data.

Q127 **Dr Evans:** Thank you very much. I have the same question for Dr Roser. Is there the data to support that there is differentiation between, say, population density, airport numbers and make-up of the population in terms of ethnicity or job descriptions that seems to make a difference? We have already touched on the fact that testing capacity and culture, particularly around Hong Kong, Singapore and Taiwan, had a big impact. Is there any data to suggest how you can tease that out so that we can learn for the future?

Dr Roser: I think Professor Heymann was correct on that. The crucial point is how countries react and the public health measures that they put in place. Yes, the age breakdown of a country matters, but there is only so much we can do about that. We have the populations that we have, and we have to react appropriately for our current situation. The public health measures are much more important, and we can actually change them to react appropriately.

If we look bluntly across countries, we do not see a clear correlation, or any correlation, between, for example, population density and death rates. The claim is often made, but it is not there in the data. I emphasise that what is important are good public health measures to manage the pandemic and keep outbreaks very small, and focusing our attention on those aspects.

Q128 **Carol Monaghan:** Dr Roser, could I ask a wee bit more about that? I saw evidence—I'm sorry I cannot remember who was presenting it—looking at the way in which people lived, not necessarily population density. It used Belgium as an example, and we know that rates have been high in Belgium. It was looking at how many people lived within a 10-metre area. Even in the country, where population density might be low, it seemed that people still lived in fairly close contact whenever they were in groups of people. Can you say any more about that? Do you know anything about it? Is it something we should be looking at?

Dr Roser: I am not aware of the latest evidence on that. It was very much a discussion early in the European surge of the pandemic. Southern European countries often have larger household sizes, and the outbreaks in Italy and Spain were sometimes explained by larger household sizes, but there was also research early on showing that within Spain and Italy

the correlation between household size and severity of the outbreak in the region was actually the opposite of what you would expect.

It is also true that some countries that have particularly small households, where not many people live in the same space, have very severe outbreaks. Sweden, for example, is the country in the OECD that has the smallest household size. It is obviously one of the countries in the world that has the highest death toll. I do not think that those demographic differences matter very much, although I am not on top of the latest evidence. We cannot change anything about that anyway, so we should focus on what we can change and where we can learn from other countries, and react as well as we can now and going forward.

Q129 **Chair:** I have a couple of final questions. Dr Roser, you mentioned that the countries that had done well had high levels of testing. In your review of European countries, you mentioned that Germany was doing comparatively well, but it is the case, is it not, that now the UK is doing much more testing than it did in the first wave? By comparison with other European countries, both absolutely and per capita, we are doing a lot of testing. How does that observation tally with the current comparative performance, if I can put it that way, of countries in this wave?

Dr Roser: The first point to make is that, yes, every country has learnt and is doing better than in the first surge. Testing capacities have increased. The UK is testing much more. Almost all the industrialised countries in the world are doing better in that regard.

Looking back at the first surge, it is very clear that Germany was increasing testing much faster. By mid-March, Germany was testing 50,000 people per day. The UK, which had a much larger outbreak, as you know, only reached that capacity one and a half months later than Germany. It was very late.

More importantly, it is not just about the number of tests that we are doing. I think that was a mistake in the public discussion in the UK, which was very much focused on the number of tests and whether we reached the goal of 100,000 tests or not. It is testing in relation to the size of the outbreak. A country that has a very small outbreak—for example, Korea or Estonia right now—does not need to test very much to stay on top of the outbreak. A country that has a massive outbreak, like the US or several of the European countries, needs testing on a much larger scale. It is the relation between the testing that is done and the cases in the country.

The way to see that is the positive rate—the share of tests that confirm a case. There again, it is the same situation right now. The positive rate in the UK now stands at 6.2%; the WHO recommends a level below 5%, ideally below 3%, so it is a high positive rate. The latest data shows a positive rate for Germany of 2%. It is that metric that we should focus on—the relation between testing and the size of the outbreak. The UK

was not doing well in the first surge, and it is not doing very well right now.

Q130 **Chair:** That positive test rate—the proportion—you are advocating is a good measure to compare whether the right steps are being taken in policy terms to control the pandemic. Is that right?

Dr Roser: Yes. I believe it is a better measure than the pure number of tests that are done in a country.

Q131 **Chair:** Professor Heymann, we have heard that some of the Asian countries that did well in the first wave are doing comparatively well in this wave. Is it the case that the right strategy for where we are now is to do what was right the first time round? In other words, is it a continuation of the approach that was taken by those countries, or is a new strategy required? We have talked about the notion of living with the virus. Is there any change to the strategy that should be taken by our country and other countries this autumn and winter?

Professor Heymann: There are a couple of things that are extremely important in living with this pandemic. One is the population's solidarity and understanding of how to protect oneself and others. That is extremely important and was in the culture of Asians for many, many years before pandemics. When they have a respiratory infection, they wear a mask to protect others. Something that is indispensable in moving forward is that people in countries understand that the way they can prevent themselves from getting infected is by physically distancing and washing hands, and that by wearing a mask they protect others.

They also need to understand that it is communities and local areas that have the best chance of doing activities such as contact tracing because that is where there is trust. That is where face to face is very important. You cannot do contact tracing from a central point; it must be done with the full involvement of communities, as it is done for tuberculosis, sexually transmitted infections and HIV. These are techniques that are understood in countries like the UK, and they should be used. It should be a method of making sure that there is trust and community involvement. If you can get that base for the response, the other things become much easier to do, such as protecting the elderly and protecting those who have comorbidities, at the same time as making sure there is a decrease in entry to hospitals.

If the Asians did one thing differently from European countries, it was that they understood early that this does not occur in waves; it occurs in surges and re-surges. That means that it does not come into a country and immediately spread into communities. It comes into countries in outbreaks, and those outbreaks can be contained with proper attention and the cost that goes along with it.

Chair: Thank you very much indeed. I am very grateful to you, Professor Heymann, and to Dr Roser, for your evidence this morning. You have

kicked us off very well in taking our perspective to the global level. We are now going to drill down into some of the more UK specifics, but thank you very much for your evidence today.

Examination of witnesses

Witnesses: Professor Woolhouse, Professor Edmunds and Professor Sir Ian Diamond.

Q132 **Chair:** I am very pleased to welcome our next three witnesses. They are Professor Sir Ian Diamond, who is the UK national statistician and chief executive of the UK Statistics Authority, which includes the Office for National Statistics, which has been doing such important work during this pandemic. Professor Mark Woolhouse is professor of infectious disease epidemiology at the University of Edinburgh. Professor John Edmunds is the dean of the Faculty of Epidemiology and Public Health at the London School of Hygiene and Tropical Medicine. Sir Ian and Professor Edmunds are both participants in SAGE. Professor Edmunds and Professor Woolhouse are members of the modelling sub-group of SAGE, SPI-M. Thank you for joining us today.

I will start with some questions to Professor Edmunds. One of the things that we are trying to do in this inquiry is to understand and learn from the initial response that we had, as well as looking at some current issues, as you will have seen from the previous session. Starting with the initial weeks of the pandemic, in its meeting on 13 March, SAGE concluded: "SAGE was unanimous that measures seeking to completely suppress spread of Covid-19 will cause a second peak. SAGE advises that it is a near certainty that countries such as China, where heavy suppression is under way, will experience a second peak once measures are relaxed."

The implication is that not to completely suppress but to spread the infection in a managed way was the strategy that was being advocated from the beginning. Is that correct?

Professor Edmunds: No, I do not think that is quite correct. That minute does not say that, does it? That minute says that, if you go in and completely suppress and then relax, you will get the epidemic back, which you will. China was the only country that had adopted that very stringent measure at that time, but they have not completely relaxed. Their borders are not open. If they were open, they would get Covid back very rapidly. That elimination strategy is not something that you can do and maintain in a cost-free manner. That is all we were saying at that point.

Q133 **Chair:** What I read out is literally the minute from the SAGE meeting on 13 March, point 24. That was the description; SAGE was unanimous in that. I am trying to understand what the advice was behind the approach we adopted initially, and what were the grounds for changing it.

Professor Edmunds: The approach we were adopting initially was the flattening of the curve. If you remember, I think there were four phases; I cannot remember exactly how they were termed. There was trying to keep the infection out, and then moving to a flattening of the curve-type approach. That was then reversed around the middle of March, when we went into lockdown. It was quite clear that the strain on the health service was such that we could not run that approach and keep the health service running. The health service would not be able to cope, and we would have ended up with very large numbers of deaths. That was reversed in mid-March, and we went to a much more stringent approach going into lockdown.

Q134 **Chair:** Why was it thought that, from what the minute says, an attempt to completely suppress the spread would cause a second peak? Why would it cause a second peak?

Professor Edmunds: It does not cause a second peak. That may be poor wording on behalf of the officials who wrote the minute. It does not cause a second peak; it is the relaxation of the measures afterwards that would then lead to a second peak.

Q135 **Chair:** But the implication of that advice was that our strategy should be to allow a manageable proportion of the population to get Covid, was it not?

Professor Edmunds: No, I do not think that follows from it at all. All that point is saying is that, if we go into a lockdown and then relax it, we will get a second peak.

Q136 **Chair:** The Imperial College paper of 16 March said that "the more successful a strategy is at temporary suppression, the larger the later epidemic is predicted to be in the absence of vaccination, due to lesser build-up of herd immunity." As you know, Patrick Vallance, on 12 March, said: "Our aim is not to stop everyone getting it, you can't do that…it's not desirable, because you want to get some immunity in the population. We need to have immunity to protect ourselves from this in the future."

I understand that the policy moved on because of a number of things. We can discuss whether it is to protect the NHS from being overloaded—a perfectly reasonable objective—or the deaths, but in those early days it was the consensus, to quote the SAGE minutes, that it was wrong to try to suppress it completely, but that it should be managed, as it were. That is a fair reflection, is it not?

Professor Edmunds: I think you are misunderstanding the role of SAGE. We do not set the policy. That is set by the Government. The policy at that time was a kind of managed epidemic, I agree. What we were doing at the time as modellers was trying to make that policy work. Could we make the policy work so that it did not overwhelm the NHS and did not result in hundreds of thousands of deaths? The answer was no, we could not make that policy work, so I am very glad that the policy was changed shortly after that.

Q137 **Chair:** That is what I am trying to understand. You are absolutely right; we know that SAGE does not make policy. It gives advice on policy, but the Science and Technology Committee has taken evidence that, in every material respect, during those early days the Government followed the advice of SAGE.

Finally, to pin down this point, was the change of the policy because of the view that the NHS could not cope with the likely demands that would follow from that policy, or was it that the number of deaths that were implied by the modelling was unacceptable?

Professor Edmunds: I don't know. You would have to ask the policymakers about that. I assume it would be both.

Q138 **Chair:** Did SAGE ever consider what was the reason for changing the policy? Was it a concern about the NHS or the number of deaths?

Professor Edmunds: Yes, we were concerned about the NHS. There was no way that we could see that the NHS would not become overwhelmed pretty quickly, and we were very concerned about the numbers of deaths. There was no way that we could see that we would not get very large numbers of deaths pretty quickly. Both of those are true.

Q139 **Chair:** We heard in the last session, which I think you observed, some discussion about whether a policy of learning to live with the virus might be something that informs the decisions that countries take. This Committee will take evidence on the progress towards a vaccine and more effective treatments, but if we do not live up to what we all hope for on that, what is the way forward for living with the virus?

Professor Edmunds: We are going to have to live with this virus for ever more. There is very little chance that it is going to be eradicated. We will have to live with it. There is so much investment in vaccines of very different types—a huge array of different vaccines are being developed—that it is almost certain that we will have vaccines that will help us to manage this epidemic in the not-too-distant future. In fact, it is very important to understand that vaccines are not potentially that far away. That changes what we should do now. If vaccines are just round the corner, in my view we should try to keep the incidence as low as we can now because we will be able to use vaccines in the not-too-distant future.

Q140 **Chair:** That is very important. We all want a bit of hope in these times. You participate in SAGE and you see the papers that are submitted across the board. In your estimation, you are optimistic that there will be a useful vaccine. Within this winter?

Professor Edmunds: I'm not sure. Towards the end of the winter, yes, it is certainly possible. These things are moving at pace. Of course, it is not just one vaccine that is being developed but many, many different vaccines across the world. The likelihood is that some of them will become available in the not-too-distant future.

The UK has played a clever game and invested in very many of them, and in different technologies. I think that is the right thing to do. Here in the UK, if we are thinking colloquially, we will be in a reasonable position in months, to start—I do not think we are going to be vaccinating everybody, but to start with the highest-risk people, healthcare workers and so on.

Chair: We will have a session on that question in a few weeks' time.

Q141 **Jeremy Hunt:** Professor Edmunds, I would like to follow up on the paper that was done by Imperial for SAGE on 16 March that you were just talking about to Greg Clark. The paper modelled two approaches: mitigation and suppression. You explained why we moved from the mitigation strategy to the suppression strategy, to protect the NHS. Why did you not model test and trace at that point, and give that as an option to Ministers as well?

Professor Edmunds: We had modelled test and trace. We published a paper on test and trace very early in the epidemic.

Q142 **Jeremy Hunt:** But test and trace was not actually modelled as a national strategy for tackling the pandemic until the end of April. If you look at that Imperial paper, basically the two options that were modelled for Ministers were the gradual allowing of people to catch the virus, as Greg talked about, or total lockdown. We veered from one to the other, but the middle way, the South Korean test and trace, was not actually modelled as an option for Ministers until the end of April. It was not in the Imperial paper, was it?

Professor Edmunds: You are just looking at one paper. We had published before that on test and trace. There was a paper in *The Lancet Public Health* by Jon Halliwell and others. You are just looking at one paper and asking whether all the modelling work that was done by all groups around the country was contained in that one paper. No, it wasn't, but there were plenty of pieces of work—

Q143 **Jeremy Hunt:** Sorry to interrupt, but that paper was the paper that was published by the Government to explain why they were changing strategy from one approach to another. There isn't any modelling that was done by SAGE and no advice, for example, given by SAGE to Ministers to massively ramp up the testing as part of a South Korean-style strategy. The reason for ramping up the testing in April was initially to protect the NHS. I am just trying to understand. Ministers obviously have to make the decisions. Why weren't you modelling South Korean test and trace and giving that to Ministers as an option right from the outset?

Professor Edmunds: I disagree, because we had modelled those different things, but let's just leave that aside because you are refusing to listen to me on that.

At that time, when we were having perhaps 100,000 to 200,000 infections a day at the peak in March, there was no way that anybody

could test and trace their way out of that. Test and trace works when you get infections right down, and you can have enough contact tracers to keep the infections at bay. That is one of the reasons why in September, when we offered the advice about what to do in the SAGE paper of 21 September, we were suggesting that a circuit breaker might be put in place, and other stringent measures, in order to put the epidemic clock back to a time in, say, August when the test and trace capabilities were such and the cases were low enough that you could be reasonably confident that you might be able to stamp out cases and not overwhelm your test and trace system.

Q144 **Jeremy Hunt:** I understand that. Perhaps you could clear this up by sending us the SAGE papers and modelling on test and trace, where you modelled for Ministers how adopting test and trace early would work as a strategy to control the virus, because I am not aware of those. Could you send them to us?

Professor Edmunds: I will certainly send you a couple of papers that we did on testing and tracing in the early stages, and whether you can keep an epidemic at bay in the early stages as it comes into the country.

Q145 **Jeremy Hunt:** I want to ask you one other thing. How comfortable are you with the phrase "following the science"?

Professor Edmunds: Pretty uncomfortable. It can hide a lot of things. It is pretty apparent that there is not one scientific view anyway. It never has been the case that it is just following the science. Of course, the Government have to weigh these things up against other things—the impact on the economy being one of the other very important aspects. Of course, they have to weigh that. They have been weighing it all along. There is nothing wrong with that. They should perhaps be a little more honest and say, "Look, we are doing this." I think maybe they are being a bit more honest about that now.

Q146 **Jeremy Hunt:** What do you think the proper division is between scientists and politicians in a pandemic?

Professor Edmunds: It has always been clear. It is that old phrase: "Advisers advise and Ministers decide." There is nothing different in a pandemic. Advisers advise and Ministers decide.

Q147 **Graham Stringer:** Following up that last point, Dr Edmunds, do you think sufficient work has been done on understanding the impact of the Government's policies on the reduction of health services and the deaths that have been caused by that, and the impact on the economy and the health impacts that follow that? Cancer is the obvious one, but there are many other areas. There is always a caveat in scientific advice. Of course, there is collateral damage elsewhere, but do you think that sufficient work has been done in that area to enable us to get an overall picture of what is happening?

Professor Edmunds: It is difficult to do that. I think we have tried to do it. I am sure that Ian Diamond will answer the question better, so it is probably better put to him. We have attempted to do that. We have models that attempted to take into account the indirect effect of different measures like lockdown on health and on deaths. Of course, ONS has measured the impact over the first wave of direct impact on deaths from Covid and deaths from other causes. We have some information.

To minimise the impact of increases in deaths due to cancers, strokes and so on, the best way is not to have your health service overwhelmed with Covid cases. If we keep the cases low, we will also keep the indirect health impacts low.

Q148 **Graham Stringer:** Following that up—Sir Ian might want to answer this—we are aware of a paper on 8 April that attempted to quantify the number of deaths because of the withdrawal of health services and the economic impacts. Are there any other papers that have been produced since then that attempt to analyse the same issues?

Professor Edmunds: I think Ian would answer this better; ONS has certainly done more work on that. I will let Ian answer it.

Professor Sir Ian Diamond: Would it be helpful if I responded, Graham?

Graham Stringer: Yes, please.

Professor Sir Ian Diamond: The ONS, together with the Government Actuary's Department, DHSC and the economists in the Home Office, produced two papers. One was relatively early in the pandemic, and that may be the one to which you are referring, Graham. I cannot remember precisely the date of that one. In both, we start with what is modelled to be the reasonable worst case of deaths, and then we make actuarial adjustments to that to address the question of the extent to which the people who sadly die would likely have died fairly soon anyway.

Secondly, we look at some models of the numbers of people who might die as a result, in the short term, of reprioritisation in the health service. Thirdly, we look at potential deaths in the next two to five years, again as a result of reprioritisation of the health service—for example, postponement of chemotherapy, lack of cancer testing and other such issues. Fourthly, we look at both the short-term and long-term impact of a sustained recession. The short-term impact of a short recession can actually be seen to have positive effects; you have fewer road accidents, for example.

In the first of those papers, we simply looked at mortality. In the second, we also took into account the classic WHO quality-adjusted life year. We were then able to look at mortality and morbidity, again for those four categories.

In the modelling that we did, because the health service was not overwhelmed in the first wave, the second basket of deaths, as a result of reprioritisation of the health service in the short case, went to zero. Further conversations with colleagues in the NHS suggested that we needed to rethink that. We are now into a third study of that work, and I am very happy, Graham, to let you have that paper. I warn you that the second one is almost 200 pages long. It is very detailed and gives all the data you asked for.

Q149 **Graham Stringer:** Professor Woolhouse, given the failures of epidemiological models when it came to predictions of how many people would die from BSE—the Imperial model was the least accurate of the three models used for foot and mouth disease in 2001—were the Government right to rely so heavily on epidemiological models in coming to their conclusions?

Professor Woolhouse: I would not want to be a Government responding to an event like this who did not have access to models. Let's give the obvious caveat: models should be one of the lines of evidence that goes into Government decision making; they should not decide it under any circumstances. That is why SPI-M was set up. You want a range of modelling inputs because not all models behave exactly the same.

The alternative to not having models is that you have to make some very difficult quantitative decisions, like whether to invest in test and trace, whether to close your borders or whether to go into lockdown; and you are going to have to make them on the basis of what then will come down simply to expert judgment.

One of the huge advantages of mathematical models, and the mathematical modelling approach, is that all the assumptions, inputs and the way you understand it—the system behaviour—are all laid out, crystal clear. They can be inspected, criticised and changed, and they have been. One of the advantages of modelling—although many people, who don't do mathematics, don't look at it this way—is that actually it is very transparent. You can see the basis for your decision making. If you do not like it, you can change it. I would not want to be responding to an event like this without access to modelling expertise.

Q150 **Graham Stringer:** With the information we have now, how accurate and useful have those models been?

Professor Woolhouse: Accurate is a very interesting word. In my group we have been very careful—

Q151 **Graham Stringer:** It is a useful word.

Professor Woolhouse: An interesting word. In my group, we have been very careful not to describe our modelling work as predictions. What we are doing is modelling different scenarios. It is exactly what I said. If you make this set of assumptions and put in this set of inputs, this is what

might happen. When you are doing that, what you want to do is model a range of scenarios. In one particular aspect of the epidemic that we were modelling, we looked at a million different scenarios—literally a million different variations on the inputs and the assumptions—in order to understand the range of behaviours we might expect over the coming weeks.

There are two reasons why I do not think you can predict this epidemic, and we are not in a position to do that even now. One of them is the question of herd immunity and what role it plays. Actually, in the early stages that you are discussing it was fairly minor; herd immunity was not having a significant impact on the way the early stage of the epidemic unfolded. We can put that aside for the immediate question.

The other thing you are being asked to predict is human behaviour, because the transmission of this virus is intimately linked to some very fine details of human behaviour. If you cannot predict how that is going to change, both in response to the epidemic unfolding before people's eyes and of course in response to the various regulations, restrictions and laws that are implemented to alter people's behaviour, you cannot predict what is going to happen in the long term. Predicting people's behaviour in an unprecedented crisis is extremely difficult, if not impossible.

Q152 **Graham Stringer:** Can I finish with a very unfair question? Do you think that the Government understand the subtleties of your answer?

Professor Woolhouse: I would be very disappointed if they did not, because I and John and many colleagues have been working on all these points for over two decades. I have written good practice guides on how modellers should communicate to Government. That went through DEFRA in that particular case. There has been a lot of discussion among science advisory groups that I have been on for DEFRA and for the Food Standards Agency on how you communicate it. It is very much there in the Government machine. I am very aware that all the Government scientific advisers with expertise in this field, and there are several of them, are very aware of these issues.

Q153 **Chair:** Professor Woolhouse, are the models that we have been using in this country specific to the UK? They are models of a global infection, but are they just usable in the UK? Do they have domestic aspects that confine them to us?

Professor Woolhouse: There is a range. The ones that are probably most useful to Ministers are very detailed and parameterised for the UK. It is the demographics, the contact behaviour and how people mix with other people—the work that John and other colleagues have been doing. That is all in there, so, yes, they are specific for the UK in that sense.

The problem in the very early stages of this epidemic was that the disease parameters—how fast it spreads and under what circumstances—all came from China, which was essentially the only place from which we

had inputs. That is inevitable. There is no way round that. We all re-parameterised our models as quickly as we could when the UK data became available, though of course ultimately we would have wished it had not become available. But it did, and we were able to estimate the relevant parameters from that.

Professor Edmunds: The structure of the models is common across different countries. It is the parameters that are specific to a locality. We fit our models to what we have now, which, as Mark rightly pointed out, is a huge amount of data in the UK. They are fitted to the whole epidemic curve and what is happening in the most recent data. There is a whole stream of different datasets, whether they are deaths, hospitalisations or testing results. They are tied to the data in the UK very intimately now.

Q154 **Chair:** Are the common aspects shared in the models that other countries use?

Professor Edmunds: Yes. We use our UK model. It is the same model structure that we use for looking at a huge range of different countries. We change the parameters. We change the demographic parameters. We change other parameters. We fit them to local data.

Q155 **Chair:** Has SAGE conducted a comparison of how other countries' adapted models have fared during the course of the pandemic?

Professor Edmunds: Not that I am aware of, no.

Q156 **Aaron Bell:** If I could, I will follow up on a few of the answers that you gentlemen have already given. Thank you all for your time.

Professor Woolhouse, you were just speaking about the behavioural impacts and the way people respond to these things. The Science and Technology Committee heard some evidence early on in the pandemic about the possibility of fatigue. It was acknowledged at the time that it was very uncertain, but the feeling was that fatigue would be there.

To what extent did we have good modelling about how long we thought people would put up with restrictions? Following from that, was the relaxation that happened over the summer necessary in that context, or was it potentially unwise?

Professor Woolhouse: The answer to the first question is no. We did not have a mechanism, as far as I know, of predicting exactly when fatigue would set in, or if it would set in. Everyone in SPI-M, over much of March and beyond, was modelling lockdowns of different lengths, and indeed different severities. We were saying that you could have a short, sharp lockdown—a phrase much used at the moment—or you could have a long, gentle lockdown, and what would be the costs and benefits of doing that? But we have to take advice from SPI-B, which is responsible for the behavioural science inputs to the Government on what the appropriate length or the strictness of a lockdown might be.

Q157 **Aaron Bell:** Looking forward, do we now have better information being

fed into SPI-M based on the observed data? Obviously, there was the recent King's pre-print suggesting that adherence to elements of self-isolation was very low.

Professor Woolhouse: This is a crucial question. John and Ian have already alluded to the data flows being much better and the data availability being much better at this stage, but it is still the case—just as I said it was back in March—that, if we want to predict what happens next with any degree of authority at all, we are going to have to understand how people are likely to behave. That has been much discussed.

I am very reluctant to call it a weakness because it is clearly extraordinarily difficult to do, but I would like to see more behavioural studies going on and inputting into the process than there have been. That is difficult to set up in the short term. Setting up studies of behavioural cohorts and things is absolutely not trivial, but as a lesson learnt it might be very important to try to understand the behavioural feedbacks and the dynamics of the epidemic.

Q158 **Aaron Bell:** Could Professor Diamond comment on that? Also, when we had Baroness Harding and Lord Bethell in front of us to talk about Test and Trace, we did not seem to have data available on how many people were obeying self-isolation. We were not following up on that, and we were not getting data about how many people who were asked to self-isolate subsequently developed Covid. It seems that we are missing an awful lot of statistics that might be quite germane to how we handle this going forward. Professor Diamond, could you comment?

Professor Sir Ian Diamond: Thank you very much for that question. It enables me to tell you a little bit about some of the work we have been doing in that area. Very early in the pandemic, we set up a weekly opinions and lifestyle survey, which has been going since March on a weekly basis. That has information, albeit on a relatively small group in the population, on self-isolation. We also ask questions about self-isolation in some of our other work.

It shows that a significant number of people who start to self-isolate do not complete self-isolation. We have a large amount of behavioural data from that source, and we have been working to make sure that the questions we ask on our large prevalence survey include the kinds of behavioural data that people need.

Having said that, I completely agree with Mark that we need detailed behavioural work. Indeed, in some of the work we are about to do at the moment we are bringing qualitative as well as quantitative work into our data collection.

Q159 **Aaron Bell:** Thank you, Professor Diamond. I would love to ask more, but time is short. I would like to follow up with Professor Edmunds on the vaccine. You mentioned that earlier. We are obviously all very hopeful.

Do the models need to have some parameter for a percentage chance of a vaccine by a certain date for us to decide what the right strategy is? To put that another way, was the circuit-breaker advice that SAGE gave predicated on the idea that it was probable that we would have a vaccine by a certain date, or would the advice have been the same regardless?

Professor Edmunds: It wasn't predicated on that, although I think, if you have a vaccine around the corner of course, it changes your decisions now or could potentially change your decisions now.

Q160 **Aaron Bell:** Are you including the probability of a vaccine anywhere in your models, or is it an extraneous white swan that you are hoping for?

Professor Edmunds: I don't think it is a white or a black swan. Obviously, it is something we are hoping for, but there is a reasonable chance that we will have our first vaccines in the coming few months. It would be very gloomy to assume that all of those vaccines will fail in the near future.

Q161 **Neale Hanvey:** Talking of swans, I want to talk about forced viability and the fundamental basis of some of the modelling that took place. The phrase "guided by the science" puts a lot of emphasis on scientific proof in the minds of the public, but the other actor in this crisis—the virus—is something whose behaviour we do not yet understand to a large degree. That information is still leaking out as we move through the crisis. In terms of the science, would you consider the modelling to be an unforced viable hypothesis or a forecast, or is it, as it says, modelling?

Professor Edmunds: There is not one model, and they are not used for one purpose. There are models that are used for forecasting. Some of them are the same models that we use for scenarios and some of them are not; they are completely different, more statistical models. Throughout the epidemic, SPI-M have been doing short-term forecasts that are helpful for planning, and that the NHS can plan against. Now we have stopped doing the shorter-term forecasts, which are two or three weeks ahead, and we are doing them medium term. We cannot really call them forecasts when they are medium term if they are four to six weeks ahead; they are projections. They are what might happen if things stay the same, but it is hard to say that things will stay the same over a four to six-week period. They are less certain, but we do them.

In order that you understand the process that we go through, there is a number of different groups around the country that do them. We come together and thrash it out. We examine each other's forecasts or projections every week in some detail. We scrutinise them in a friendly but nevertheless pretty rigorous way, and look at outliers and examine why this group has got that result and so on. We then come to a consensus view, and they are formally combined into a consensus forecast or projection. It is a pretty rigorous process.

We also go back to see how well we have done. We compare those forecasts or projections with what happened. We are learning as we go along and improving our methods and techniques as we go forward.

Q162 **Neale Hanvey:** On that note, back in June there was a bit of an issue around a comment made by yourself that delaying lockdown had unfortunately cost a lot of lives. I know from the SAGE minutes that Government decided to hold out for a few weeks before they put the lockdown measures in place.

In terms of the arguments about whether some form of herd immunity would be useful in that context, what is your reflection on that now that we understand that immunity from Covid may only last for two to three months, and that there are growing numbers of people who have had a second infection of Covid?

Professor Edmunds: It is still quite a small number of people with a second infection of Covid. Given that we have had millions and millions of infections, the number of known people with secondary infections is still a handful. I am sure there are many more that we do not know about, but I still think there is pretty strong evidence that immunity lasts for some time. I think the three months that you quoted is a bit gloomy.

It is undoubtedly the case that that is one of the bigger uncertainties that we have. I agree entirely with Mark's assessment; probably the most difficult thing is to predict people's behaviour. I actually think the most difficult thing to predict is Government behaviour. I am serious. Most of the time, people's behaviour is governed by the Government. Saying you can or cannot do this or that is the biggest determinant of individuals' behaviour. At the moment, it is difficult to say what Government will do.

However, the other big biological unknown is the duration and the nature of immunity, and whether it is due to natural infection or a vaccine-induced infection. All of those are big unknowns, and they will remain uncertain for some considerable period of time. If it takes on average five years for you to lose immunity, it will take us five years to know that.

Q163 **Neale Hanvey:** In that context of uncertainty, do you think that the current policies are cautious or relaxed, or do you think the messaging should be more pessimistic or more optimistic?

Professor Edmunds: Could you be a bit more specific?

Q164 **Neale Hanvey:** Is the approach sufficiently cautious or should we be relaxed? Over the summer, we saw a quite rapid relaxation of some of the lockdown measures and, as predicted, a second wave as a result. How cautious should we be and are we getting the balance right?

Professor Edmunds: We are not being as cautious as I would like us to be. It is pretty clear that cases have been going up quite fast. What worries me a little bit is where the strategy leads at the moment. If you

think it through, the targeted strategy—the tiered strategy—leads to a high level of incidence everywhere.

Let's say that tier 3 works and keeps the reproduction number at about 1. I do not think anybody really thinks it will reduce it to less than 1. Let's assume that it manages to get the reproduction number to about 1. That means that in Liverpool, Manchester and the north-west, we will keep the incidence at that high level, which is putting hospitals under strain and causing significant numbers of deaths. We are going to keep it at that high level for the foreseeable future.

A few weeks later, the midlands goes into tier 3, so we then keep the midlands at a high level of incidence for the foreseeable future. London is shortly thereafter, and we keep London there. The logical extension of this means that we all end up at a high level of incidence, where hospitals are really under strain and we have large numbers of deaths. For me, that is the logical conclusion of the strategy we are following. I would not follow that strategy.

Q165 **Neale Hanvey:** In that situation, would you argue that a short, sharp circuit break would help suppress the virus and give testing and tracing a greater purpose in controlling the virus in the future?

Professor Edmunds: Yes. That is the purpose of it. You put measures in place so that incidence stays roughly the same, so the longer-term measures are there to hold the reproduction number, let's say, at about 1. If you go through a circuit breaker first, that would reduce incidence for a few weeks. If you did a very stringent one, maybe you could halve the incidence. Instead of holding the incidence at a high level where hospitals are under strain, you hold it at a lower level where they are not under such strain. That is one option. Or you move to tier 3 everywhere now, so that where places have not got to the point that hospitals are under strain, you keep them at that level now to stop them getting there.

Chair: Let me turn to James Davies and to Carol Monaghan. We need to be brief.

Q166 **Dr Davies:** Professor Woolhouse, I am interested in transmission settings in particular. I have seen a number of studies, whether through Test and Trace data or through self-reported settings, about where people have been in the previous week and where they think they have contracted Covid. They are somewhat conflicting. Clearly, there is strong evidence for indoor transmission—we all know that—but when it comes to hospitality there seem to be wildly different views. Also, non-essential retail, gyms and travel, for instance, have all been banned in Wales, but the evidence does not seem to point in the direction of those being particularly relevant. What are your thoughts as to the quality of the evidence and where we stand on these factors?

Professor Woolhouse: The evidence is as you described it. The problem is that a decision has to be made. Another way of putting what John was just saying is that, at the current time, we have to reduce levels of

transmission. We could discuss, maybe another day, whether social distancing lockdown-type measures are the best way of doing that in a sustainable fashion, but we have to do it. Something has to give. We are not reducing contacts through schools, which many people would agree with, and the hospitality industry has taken the brunt.

I had a meeting with a representative of the Scottish hospitality industry the other day. She was hoping for some comfort that I could not give her. She said what you said: the evidence is not crystal clear. The evidence that we have all seen is suggestive that hospitality is making a significant contribution. More to the point, it is almost a race to the bottom. The evidence is stronger for hospitality than it is for many other non-home settings. It is very strong for homes and household transmission. You have to do something. If it wasn't hospitality, it would be something else, and the evidence for that would be of very similar quality to what we have for hospitality. Given that we have to do something, it is a reasonable decision by Government to go on that route, though, obviously, I am as aware as everyone else of the difficulties that that causes the industry.

Q167 **Dr Davies:** Fair enough. Thank you. I have one additional question in relation to potential immunity. What is your latest understanding of what seroprevalence studies of antibody levels across the population show? In terms of T-cell mediated immunity, for instance, what is your latest understanding of the role that that might play? In other words, what proportion of the population might have some protection at this point?

Professor Woolhouse: That is an excellent question. The theme of this discussion has been that in the long run herd immunity is going to play a key role in how the dynamics of this plays out, as we have all made clear for a long time. I don't think it is yet possible to know what the impact of T-cell immunity will be. At the moment, we are looking at antibodies and antibody responses decaying over time, which they do in response to any virus infection. That in itself is not a surprise. It is what goes underneath that, whether it is T cell responses or whatever in the longer term. That is crucial.

The big thing that we are using the antibody testing for at the moment is as a marker for how many people have been exposed. The minimum number of people who have been exposed are the ones who test antibody positive. If it is decaying rapidly, we may be underestimating, to some extent, the number of people exposed.

Professor Sir Ian Diamond: Could I add a supplementary answer?

Chair: Very briefly, Sir Ian, if you wouldn't mind.

Professor Sir Ian Diamond: It is just on simple numbers. Our most recent data shows that 6.2% of the population of England are testing positive for antibodies, but there are regional variations, ranging from 3.1% in the south-west to a high of 11.6% in London.

Chair: Thank you very much, Sir Ian.

Q168 **Carol Monaghan:** Sir Ian, back in March when we looked at how infections, the cases, were increasing, the trajectory pretty much followed what we expected in terms of the modelling. Is that the case at the moment?

Professor Sir Ian Diamond: Yes. What we are seeing at the moment is a significant increase. It certainly follows some of the expectations of the models. It has also, importantly, lagged against France and Spain, been following very similarly the second waves in those countries. They are ahead of us, but I do not think we should be surprised about the course of the pandemic at the moment.

Q169 **Carol Monaghan:** You said earlier in one of your responses that you were using behavioural information as well to predict the growth rate of infection. What sort of behavioural evidence are you using? Is it giving us the models that we would expect?

Professor Sir Ian Diamond: The behavioural data we get comes in a number of ways. I have already indicated our weekly survey. We also ask questions of people we collect samples from. We have tried to link to some of the other behavioural data—Professor Edmunds has been running an extremely good survey—to ask similar questions, so that we are able to get extra and more powerful data.

The behavioural data do not do modelling, but they provide input to models. We have been very careful to have close relationships with the mathematical modelling groups to make sure that we are doing everything we can to provide the information that is needed—an example being the need for inter-local authority mobility data, which is something we have been working very hard to be able to provide for the modelling team in Lancaster, and hope very soon to do so.

Q170 **Carol Monaghan:** A month ago today, Sir Patrick Vallance said in a media briefing that by the middle of October, if we were following the current rate, we would be at 50,000 cases per day. Was that realistic? Was it taking into account the types of information that you are talking about?

Professor Sir Ian Diamond: That is not an unrealistic position. Our most recent data said 27,900 new infections per day. We will publish some new data on Friday. It is too early to say what those numbers will be, but in recent weeks we have only been going in one direction.

Q171 **Carol Monaghan:** Should we be as worried as we were in March?

Professor Sir Ian Diamond: Without a doubt. The one thing I would say, Carol, is that we have much, much better knowledge than we had previously. I use the word knowledge, because we have much better data on all kinds of areas. For example, some work we have been doing has been showing that the highest prevalence in September was among the

wealthier areas. We do not know whether that was the case at the beginning of the pandemic because we simply did not have the data.

We have much better data now, which has enabled the kinds of modelling that Mark Woolhouse and John Edmunds do to be ever more precise in providing better information. The knowledge that our medical leaders and medics right across the country have on how to manage people with severe illness is much better. We should be absolutely worried, but we can be worried in the context of better information. We also need to be worried about long Covid. That is something that ONS, along with other parties, is working on at the moment. Thank you for the opportunity to say that.

Q172 **Dr Evans:** This leads on quite nicely from what the professor was saying. Professor Edmunds, I am particularly interested in risk factors this time in terms of the modelling around vulnerable areas and vulnerable people. We heard from Professor Woolhouse that it is hard to do the socioeconomic side, but the biological side may be more so. What assumptions do you make about age, sex and ethnicity in the modelling?

Professor Edmunds: In most of the standard models that are used for evaluating policy—not just my model used at the school but others—they tend to be split by age groups, some of them also by sex, because the severity of the illness is so different in different age groups.

Q173 **Dr Evans:** Does it drive policy because, as we heard, we know a lot more? We know that for older men, for example, it is much more likely and riskier. Does that change the policy? From the biological point of view—take out the politics of doing it—does that make a difference?

Professor Edmunds: Yes, of course it would change your results. If you have a model that does not have age and sex in it, for instance, you might come to rather different conclusions about what to do, such as which age groups you might target for interventions and so on. Yes, it makes a very big difference.

Q174 **Dr Evans:** A review analysis was done by *The Lancet* in June looking at ethnicity and the factors affecting ethnicity. What evidence have you seen of factors around diabetes, blood pressure and ACE2 receptors? How much do they factor into what is going on versus the socioeconomic side? Are you able to pass comment on that at the moment?

Professor Edmunds: It is very hard to tell. Are you asking if there is something genetic?

Q175 **Dr Evans:** Absolutely. We know, for example, that the number of ACE2 receptors may be different, and that seems to be the focus point for the virus getting in. We know that south Asians are more predisposed to diabetes, and diabetes is a risk factor. There is a lot of confusion in the media and the public about what really counts and where the debate should be. How much evidence have you seen to back it up, or do we not have that evidence yet?

The Lancet review said that there might be something there, but more work needs to be done on it. The Government have said that they will look into it. As we are modelling for the future, that is important, given what we know, because the first 10 deaths were of BAME people in the health service. I am intrigued as to how that fits into what we are trying to prevent for the future.

Professor Edmunds: There are multiple things. Ethnicity is related not just to the severity of the disease if you acquire Covid; it is mainly because of other co-existing conditions. It is also related to your probability of acquiring it in the first place, exposure, mainly because of different occupations that people might be working in, such as in the health service. Many people working in the health service are of ethnic minorities; therefore, they have higher exposure to the virus than people who are not working in those situations. There are multiple factors that lead to higher risk in certain groups in the population.

Q176 **Dr Evans:** Is there enough evidence yet on whether we should be doing policy based on the factors of age, sex and ethnicity? I take out the political aspects of what that might or might not mean, but in trying to draw a strategy forward, purely from a scientific point of view, is there an evidence base yet to produce that?

Professor Edmunds: I think it is already factoring into policy, to be perfectly honest, and has done for some time. I don't think there is any change there. Clearly, if individuals are at higher risk, we need to take that into account and factor it into any policy we might come up with. It is also true that some of the interventions affect those very same people more. There is a balance between the effect of Covid itself and the interventions.

Q177 **Chair:** I have one final question. Professor Edmunds, given what you said about the work that is being done and the comparison of forecasts to form a consensus view, based on the current measures, what is the trajectory looking like in terms of the number of cases, pressure on the NHS and, ultimately, deaths?

Professor Edmunds: Quite gloomy.

Q178 **Chair:** Could you give us some more detail? At the beginning of the pandemic, some forecasts were made that the capacity of the NHS would be just about contained. Where are we on a comparative basis?

Professor Edmunds: It is very regional at the moment. In Liverpool, I believe, elective operations are already being cancelled, so we are already at the stage where they are under strain. Elsewhere, in the north-west in particular, in the north and Yorkshire, it is not very far behind. We are already at the point, or getting close to the point, where the health service in much of the north will be under strain in the next few weeks.

As you probably know, even if we stop things now, cases and hospitalisations will continue to go up for the next 10 days or two weeks because they are already baked into the system. They have already been infected, but they will take some time to be hospitalised. The same goes for deaths. If you look at where we are, there is no way we can come out of this wave now without counting our deaths in the tens of thousands.

Q179 **Chair:** When do you expect the peak to be, based on the projections?

Professor Edmunds: If we don't take any additional measures, if we just leave it as it is, we will see peaks in the north-west probably in the next four to six weeks. The rest of the country is weeks behind. We will see peaks around Christmas and the new year. There will be very severe numbers of cases throughout the UK.

It is slower and lower in the south-west and the south-east, but in the more urban centres of the UK we will be looking at very large numbers of cases, with hundreds of deaths a day occurring. I do not think it is quite going to reach the heights of the epidemic in March and April, but in many parts it may already be similar to the heights. Already in Liverpool, they have more people hospitalised now than they ever did in March and April. We are looking at quite a bleak situation unless we take action. I do not think we should be taking action specifically in the highest-risk areas, but we need to take action everywhere else to stop them getting into that rather perilous position.

Q180 **Chair:** Has SAGE modelled the impact of the measures that it has recommended in terms of the cases, hospitalisations and deaths?

Professor Edmunds: When you say SAGE, there are different groups around the country. My own group has looked at, and is looking at the moment, at different options for non-pharmaceutical interventions for the coming winter. Matt Keeling did some nice work at Warwick on the impact of circuit breakers some time ago. That was published or released a couple of weeks ago.

Q181 **Chair:** Has SAGE considered these different studies to form a consensus view?

Professor Edmunds: We have not been specifically asked to look at different policies, quite honestly. Nobody is asking us, "What should we do here?" These are things that we have taken on ourselves and decided to look at ourselves.

Chair: Thank you. I am very grateful to all three witnesses. You have given us a very thorough insight both into the early days of the pandemic and into some more recent topical issues. All of you are engaged in extremely important work. We are very grateful for that and grateful for the time you have spent with the Committee today. Thank you.

Witnesses: Dr Gardiner and Professor Gandy.

Q182 **Chair:** We move now to our final panel. I am very pleased to welcome two witnesses; Dr Clare Gardiner, who is director-general at the Joint Biosecurity Centre, and Professor Axel Gandy, who is professor of statistics at Imperial College London. Welcome both, and thank you very much for coming.

Perhaps I could start with a couple of questions to Dr Gardiner. You are the inaugural director-general of the Joint Biosecurity Centre. Would you give us a bit of an insight into who runs the JBC? Is it you? I think Dido Harding is the chair, is she not? How is it run?

Dr Gardiner: Thank you very much, Chair, and Committee members for inviting me to join the conversation today. As you said, I am the head of the Joint Biosecurity Centre. I am quite keen, if I may, to lay out a little bit of context in answer to your question on who we are, what we seek to do and, importantly, as you say, where we sit within the Government machinery.

The JBC is an analytical unit within NHS Test and Trace, staffed by civil servants and accountable, ultimately, to the Secretary of State for Health and Social Care. In some ways, we are not dissimilar from many of the other analytical groups across Government who provide or seek to provide evidence-based information and support to Ministers as they make what are, in this particular case, some difficult decisions.

Broadly, the JBC aims to do two things. One is to provide, as I said, local and national decision-makers with the best information available on the spread of Covid. The second is to support local colleagues, in particular as they seek to make use of the levers available to them to manage outbreaks.

We have a very different role from the role of SAGE. Clearly, the previous panel included a number of important SAGE members. That is a committee of independent scientists. Ours is, as I said, an analytical group within the Department of Health and Social Care. The JBC has no remit or authority to take or direct operational decisions in response to outbreaks, either nationally or locally. Those decisions are made according to the framework that is laid out in the contain framework, which is online. Ultimately, decisions rest, rightly, with Ministers.

Chair: Could we pause there for a second because some of my colleagues have questions for you, and they have to be in the Chamber of the House of Commons shortly? Let me go, briefly, to Chris Clarkson, and then we will come back to some of those issues.

Q183 **Chris Clarkson:** I am sorry for cutting you off mid-flow, Dr Gardiner. It is quite important for a few of us with the recent developments in Greater Manchester. There are a few of us on this call who represent people in that region. We want to understand what types of data are being collected at local level, how it is being shared with local authorities and

how the data is being used to inform the decisions that are being made about restrictions. I know it is a lot in one go.

Dr Gardiner: Absolutely, Mr Clarkson. A whole range of data is being collected to inform decisions both at local and national level. The vast majority of that data is available online. Since the beginning of June, Test and Trace is one of the key data sources. There is data on individuals who have been tested for coronavirus and, importantly, those who have tested positive, which part of the country they live in and key demographic indicators and age information.

Local authorities receive detailed record-level data under appropriate sharing agreements with the directors of public health. From 20 July, fully identifiable test, case and contact-tracing data has been shared with directors of public health locally to support outbreak investigation. It has been enormously important for colleagues locally to have that record-level data. That has been sent to them since June.

Chair: Thank you, Dr Gardiner. Please try to keep your answers as crisp as possible because some colleagues have to get to the Chamber.

Q184 **Chris Clarkson:** We are now going into tier 3 restrictions. We have seen from previous restrictions—I have seen the effect in my patch of tier 2 since May—that it has not done much to arrest the rate of infection. In fact, it has gone up fairly steeply in my patch. I want to understand better how long it takes for us to see the benefits of some of these measures. Now we are looking at a 28-day period. When should we expect to see it work or not work?

Dr Gardiner: We would expect to see indications in the data coming through within two to three weeks of interventions being established. The sorts of data that we look at are case rates and positivity—the number of people who have tested positive—in different age groups. We are seeing quite a variation in the rate of change of infection across different ages. We are also looking keenly at the number of people being admitted to hospital. We are particularly concerned about, and will be looking closely at, case rates in the over-60s, and watching carefully the information around outbreaks in care homes and so on. We are looking to be able to protect the vulnerable. The incubation period for people who are infected now is about 10 days, and that is why there is a lag on some of the indicators.

Q185 **Chris Clarkson:** We will probably only know whether the tier 3 measures are being effective halfway through. Is that so?

Dr Gardiner: At least halfway through. From experience of interventions taken over the summer, it is at least two to three weeks, if not more, before we start to see evidence in the data. We will be working jointly with local colleagues looking at some of the proxy or lead indicators, which is key. For example, we will be looking at openly available mobility data. As we do now, we will benefit enormously from intelligence on the ground, from the local directors of public health, who have extraordinary

capable teams. They have really good knowledge of what is happening on the ground. All of that information feeds into both local and national decision making.

It is important to note that we need to be looking for reductions in transmission rates. We might still see rates climbing, but they might be climbing at a slightly slower level, or we might see, in certain age groups, as in some parts of the north of England among 17 to 21-year-olds, a flattening of the curve. We are not seeing the same flattening at the moment in the over-60s. That is causing us concern.

Q186 **Mark Logan:** Dr Gardiner, I represent a constituency in Bolton. Since severe restrictions were put in place at the beginning of September, what have we learnt from the experience in Bolton that can help us nationally in the next few months?

Dr Gardiner: Enhanced restrictions have been in place in Bolton since the beginning of September. I would pull two things out in terms of lessons learnt. One is developing a tailored package for Bolton. As I said, the decisions were ultimately made by Ministers, but members of the test and trace team and Public Health England were very closely involved with your directors of public health in thinking about how the epidemic was spreading in Bolton and, therefore, what local interventions might be most effective.

That led to the decision to restrict hospitality to takeaway only, for example. I think that Bolton, at the time, was the only part of the country that had that restriction. Some of the early analysis that we have been doing and that we are keen to publish suggests that the package of those measures combined—it is difficult to disentangle any one of the measures from the others—led to a reduction in the rates of transmission in Bolton. Therefore, although case rates are regrettably still rising, our assessment is that they are rising at a lower level.

Q187 **Graham Stringer:** Dr Gardiner, why do we need a centralised system as opposed to a decentralised system? There have been some huge mistakes with the centralised system; the notifiable disease not being notified to local public health authorities and, recently, the loss of 16,000 positive tests. Would it not be much more effective, quicker and efficient if it was done at a local level?

Dr Gardiner: We have a system that is national and very much relies both on national support but also, as you say, on local action. I recognise that your question was also looking to cover aspects of testing and contact tracing, which are outwith my particular responsibility, although colleagues across both testing and tracing work closely with local colleagues to ensure that we make the best possible use of all the capacity and capability we have.

From a JBC-specific perspective, we have rich relationships with our local colleagues, alongside Public Health England with whom we work hand in

glove. The information sharing, both up and down, is incredibly important. What the JBC brings from a centralised perspective, and what we aim to bring, is enhanced data science capability and capacity, so that we are able to provide a unique insight into some of the trends and risk factors in the transmission of disease, which we can then provide to local colleagues to help paint a broader picture.

It is that increased capacity in terms of data science that we bring, essentially, as well as our relationships by default with the academic community. In the previous panel, you heard from Professor John Edmunds and Sir Ian Diamond, both of whom are close collaborators and supporters of the JBC. We benefit enormously from those collaborations.

Q188 **Graham Stringer:** I would like to follow up with two questions in one. On the second point, you are operating in the dark, aren't you? The membership of your organisation is not known, the research you are talking about is not immediately available and the minutes are not immediately available. That is one point I would like you to respond to.

On the first point about good relationships with local public health people, that has not been the case. You, Public Health England and Test and Trace have not passed on information on every occasion. There have been huge delays in the system that would not have happened had it been based locally. I am asking you to make the case for centralisation, not to say that sometimes the relationships are good and recognising that sometimes they are poor. Wouldn't it be better dealt with at a local level?

Dr Gardiner: I will take the questions, if I may, in two parts. The first question was about transparency. From a JBC perspective, we are not like SAGE. We are not an independent scientific body that has members per se. We are part of the civil service. We are staffed by civil servants and we report directly to the Secretary of State for Health and Social Care.

We are committed to being as transparent as we can be about the work we are doing. The vast majority of the data that the JBC analyses is in the public domain. You mentioned some of the delays in getting information to local authorities. Test and Trace colleagues and Public Health England colleagues have been working incredibly hard over the summer, particularly since May and June, to get as much data in as timely a fashion as they can to local colleagues.

Quite a bit of the JBC's work is already in the public domain, but because we are part of Test and Trace it is branded as such. I recognise that that might have caused a little confusion. Colleagues and Members may well be aware of the weekly watchlist, which is published jointly with Public Health England and identifies areas across the country where we have some concern about the epidemiological picture. Alongside the watchlist, we publish on a weekly basis quite detailed data—for example, LSOA level maps that show case rates. We also publish epidemiological data

broken down by age and by positivity, which is an incredibly important indicator and is the number of people who test positive per week.

As a final example, there are the many briefings that you have seen from the chief medical officer and his deputies over recent weeks. Those charts and graphs are based on Joint Biosecurity Centre and Public Health England data. There is quite a bit in the public domain, although I recognise that, because it does not have a JBC badge on it per se, it is not immediately obvious that it comes from the organisation. We are committed to putting as much as we possibly can into the public domain. In the coming weeks, I hope we will be able to put even more out there.

Q189 **Aaron Bell:** Could I bring in Professor Gandy briefly to discuss modelling? Then I have a couple of questions for Dr Gardiner about the process of advising on restrictions.

Professor Gandy, could you explain what your team does using regional data and how, in particular, you look at the boundaries between regions that are in different tiers, and the modelling that goes into that to assess the likely spread from one region to another?

Professor Gandy: It is a pleasure to be here and to answer these questions.

First of all, with some colleagues of mine, I am running some local projections for local authorities. We project forward the likely evolution of the epidemic over the next two or three weeks. We take in public data, in this case provided by the JBC as mentioned, particularly on cases and deaths. From that, we estimate the number of infections that must be there, together with other studies like the DiRECT study or surveys from the ONS. We use that to say where the trend will be going over the next two or three weeks.

If I may, I could say, roughly, what the current picture is.

Aaron Bell: Yes, please.

Professor Gandy: Overall, over the last few weeks we are seeing increases in many regions. In fact, our model at the moment says that, in 94% of the regions, the number of new infections is increasing. We are seeing more and more infections in most parts of the country. Even among the 6% that we are looking at, where it might be decreasing, there are cases where, since we do not use age-specific data for our model, we will see some epidemics in the younger populations coming towards an end, but the overall picture may still be rising. For example, that could be the case in Manchester.

In terms of the overall extent, at least half of the country has more than 100 weekly cases per 100,000 of the population. That number is going to increase unless some action is taken. These rises have not come as a surprise. Over the last month, it was quite evident that cases were rising. Now it comes down to the question of what kind of action will be taken.

Actions are being taken and, as Dr Gardiner rightly said, it will take at least two weeks for the results to filter through. That is not just because of the incubation period but because none of the interventions affects transmission within households. You will still have transmission through households.

Q190 **Aaron Bell:** Thank you, Professor Gandy. The second part was about diffusion from one region to the other. There are a lot of regional outbreaks at the moment. What data do you have about how likely it is to spread from one area to another? Neighbouring areas can have very strong links if they are part of the same urban agglomeration, or they can have relatively weak links. Do you have that kind of data available, and can you model the spread of regional outbreaks around the country?

Professor Gandy: We deliberately decided not to include it in our model. We wanted to see which areas on their own saw an increase in cases. The worrying thing is that, without even taking strongly into account the effect in neighbouring regions, we see increases.

On the question of whether we have the data, yes, the data, in principle, would be available in private form to us, but I do not think it is publicly available data.

Q191 **Aaron Bell:** It is not part of your model. Thank you for the clarity.

Dr Gardiner, can you talk us through the process of advising on restrictions? I understand it is largely on a weekly review basis, although it is obviously dependent on individual circumstances. Do you start with the data? Is it the absolute level? Professor Gandy mentioned the 100 figure, which seems to be a bit of a rule of thumb that has been going around, or is it the rate of change that matters more to you? Where does it come? Do you start with the data, and what do you do with it?

Dr Gardiner: We use a basket of measures and indicators because there is no one lens through which to look at the problem. The issue is incredibly complex, as you know. The basket of measures includes the sorts of indicators that Professor Gandy has just articulated. It involves looking at case rates, looking at the rate of change of those case rates and, importantly, looking at positivity—those testing positive within a given week. They are also broken down by age. We see across England quite a lot of regional variation, which the previous panel members also noted. For all the indicators, we are looking keenly at local authority level, going down to quite small geographical levels, to understand the picture.

From a JBC perspective, our role is to try to put all the information together, and that includes input from our modelling colleagues. It includes, importantly, input from local colleagues, who, as I said, have an important role to play and have a good, deep and rigorous understanding of what is happening on the ground. Our role is to pull all of that together to provide the best possible evidence base and information picture that we can.

As you say, there is a weekly rhythm. That information, in the first instance, feeds into a meeting chaired by the chief medical officer, where he brings together all the public health expertise across the community, to try to understand from a public health perspective what is happening with the virus, where there are areas of concern, where it looks like things are improving and what we can learn from that. Then the CMO will, ultimately, make recommendations to Ministers for decisions about where further action can be taken.

In some cases, particularly over the summer, when we had relatively low levels of infection and then outbreaks, the vast majority of action could be taken locally without recourse to national support. Now that we are in a situation where we have epidemic rises and real concern, particularly in some parts of the country, where national action is required, decisions are, rightly, made by Ministers. They will of course be playing out not just the public health advice that is coming through the system I have just articulated, but a range of other important information, particularly associated with economic and societal factors. I don't doubt—

Chair: Sorry, Dr Gardiner; we have to keep the answers short, if you wouldn't mind, otherwise we are going to run out of time.

Q192 **Aaron Bell:** Can I focus again on the numbers? In the summer, about 20 was seen as the threshold for being worried. Now it seems to be 100. Will it keep going up because it is in relation to the national average, or is 100 going to stay as the rule of thumb as far as you are concerned? You mentioned rate of change as well. Briefly, will the number keep going up on where the tier 1 and tier 2 boundary comes in?

Dr Gardiner: We need to keep it under close review. From my perspective and that of Public Health colleagues, there is no single, hard threshold, so we are looking to develop—it is very much a live conversation with local colleagues at the moment—a set of soft trigger points, one of which is case rate, and something in the region of 100 to 150 might be the most reasonable piece.

Positivity at 7.5% and above is another area where one might want to start looking more deeply at what is happening, as well as understanding rates of change, particularly in the over-60s. Looking at the full suite of measures as soft indicators or triggers to start a conversation about the potential necessity for further action is the way to think about it, rather than hard thresholds and a mechanistic approach that says, "If this, then that," because the situation across the country is so nuanced.

Q193 **Dr Davies:** To what extent has the modelling of other negative impacts arising from lockdown, on mental health, other medical problems and mass unemployment, influenced the guidance offered by the Joint Biosecurity Centre so far?

Dr Gardiner: Our role is specifically to provide public health guidance. That is what we will be doing, but the ministerial decisions that are made are based on a range of inputs, which include inputs from other bodies,

like the Biosecurity Centre, operating under the auspices, for example, of the Treasury, which is looking at modelling some of the economic impacts. As Professor Ian Diamond said previously, ONS has done some fantastic work on non-Covid health impacts of Covid. All of those things are being brought together to inform decisions.

Q194 **Dr Davies:** What does the JBC believe in terms of the concept of circuit breakers, the regional approach, the balance between the two and how long any circuit breaker would need to be to be effective?

Dr Gardiner: We do not have a responsibility for devising or determining the policy. That is very much a question for Ministers. We will be providing the best possible advice and information we can on the progression of the disease, both regionally and locally, and seeking to learn, as interventions are put in place, about their effectiveness to ensure that we are modelling and tracking closely whether the particular interventions that have been put in place are starting to bite. We are starting to see contacts reduce and case rates slow down in terms of increase of transmission, and potentially and ideally reducing. All the interventions have one aim, which is to reduce the number of contacts. We will be looking keenly at all information from across Government, the local level and academia to see whether the interventions are biting.

Professor Gandy: Overall, cases are rising across the board, so some intervention will have to happen almost everywhere at some point. Once we have managed to deal with the current outbreak, we need to move towards a more proactive strategy in trying to determine how we bridge the time until, hopefully, perhaps in half a year, a vaccine comes along.

If you want a local strategy, to a certain extent, not completely mechanistically but roughly, you have to pre-define the kind of measures that you will take at certain levels. That would be far more transparent for everyone and you would not need to negotiate things when you reached that point. You can be far nimbler at doing things. To be able to be at that point, one needs first to get the infection rate down a little bit, as Professor Edmunds said earlier.

Q195 **Dr Davies:** Dr Gardiner, your work with the devolved Administrations is of interest to me. I represent a constituency in north Wales, where there is a clear extension of the north-west England outbreak. You will have seen the unilateral measures taken by the Welsh Government recently. To what degree is the data being studied on a cross-border basis?

Dr Gardiner: With Public Health England colleagues, we have a daily meeting every morning with colleagues from across the devolved Administrations to take stock of the data from the previous day. We also have, on a weekly basis, the opportunity for a more in-depth conversation to look at trends so that we are able to share insights. That meeting looks particularly at border issues because, as you say, it is important to understand exactly what is happening on either side of a border as well as understanding movement across the border, and being

in a position where consistent advice can be provided to all national Governments.

Q196 **Chair:** I thank our witnesses for going straight into some of the specifics for my colleagues who had to attend the Chamber. I would like now to come back to some of the overall aspects.

Obviously, the role of the JBC is very important and influential. We understand that it is Ministers who take decisions, but the analysis and advice that comes from the JBC is important. It has big implications for local people, as we have been seeing.

The Mayor of Greater Manchester said: "We do not believe we should be put into Tier 3 for two reasons. First, the evidence does not currently support it. The rate of Covid infection in Greater Manchester is much lower… compared to Liverpool City region…Plus our hospital admission rate is much lower" than in that region. He makes a comparison there. His view, at the time he made that point earlier in the week, was that Greater Manchester should not be in the higher tier. What is your assessment of the reasons for the decision that was made?

Dr Gardiner: Ultimately, the decision was one for Ministers. I can comment, if helpful, on the data, particularly what the data is telling us in Greater Manchester. In the last few weeks we have seen, as colleagues will be well aware, rising case rates across large parts of the UK, particularly in the north-west, Greater Manchester and Merseyside.

In terms of particular data, the Manchester positivity at the moment—one of the key things we look at—is 15%, which is considerably above our worry threshold of 7.5%. Previous witnesses articulated that the WHO has a 5% threshold.

Q197 **Chair:** But it is a key metric. Let's just be clear about that. The positivity rate carries a lot of weight in your organisation.

Dr Gardiner: It is one of the basket of metrics. Case rates in Greater Manchester are relatively high. Case rates in the over-60s in particular, which is a point of concern, are 294 per 100,000. To put that into context, in the summer, across the UK, case rates were in the region of between 207 and 212 per 100,000. That is quite a high number, particularly among the over-60s. As we know, sadly, from a Covid perspective, age is the strongest determinant of difficult health outcomes. The rate of 294 in the over-60s that we are seeing now was 79 on 23 September, so there has been quite a sharp increase. As I said, we look at a basket of measures: case rates, positivity, the number of people going into hospital and how NHS capacity might evolve in the coming weeks. What is difficult is not the number of admissions or number of beds occupied today but what will be the projection for beds and admissions in three or four weeks' time. There is quite a lot of nuance and uncertainty.

Q198 **Chair:** Your advice was that Greater Manchester should be put into the

higher tier.

Dr Gardiner: Our advice was to the chief medical officer, who then put that forward. Remember, it is not just JBC advice. It was the full public health advice, including Public Health England and others.

Q199 **Chair:** Obviously, you are only responsible for JBC. The advice of JBC was that it should go into the higher tier.

Dr Gardiner: Further intervention was needed in Manchester.

Q200 **Chair:** What are the criteria for moving, in this case, from tier 2 to tier 3?

Dr Gardiner: As I said to your colleague previously, we are working with colleagues across the public health system to make sure that we have the right flags, trigger points or criteria. None of these things can be hard metrics because each area is different. We are looking, as I said, at case rates and case rates in the over-60s. We are interested in making sure that we track carefully the number of people being admitted to hospital. We are making sure that we work with NHS colleagues to track carefully capacity. We are also concerned about outbreaks in care homes. There is a whole range of information. We have to look at the whole picture.

Q201 **Chair:** There is a range of things. You are working with colleagues. Is it your intention to publish what will be the criteria for moving from one tier to another?

Dr Gardiner: I would certainly be very supportive of putting those criteria into the public domain; yes, absolutely, once they have been agreed with local colleagues.

Q202 **Chair:** Are they there at the moment and just not in the public domain, or are they still being worked on before they are settled?

Dr Gardiner: It is very much a live conversation at the moment. With JBC being part of the civil service, what ultimately goes into the public domain is not entirely within our gift, but I would certainly be very supportive, once agreed—some proposals are out for review—that those sub-thresholds are put in the public domain.

There are a number of reasons why one may want to move up the tiers. Preventive or prophylactic action is one reason. Some of our local and regional directors of public health, in consultation with council leaders and MPs, are choosing and proposing to move from a preventive perspective, even if they may not have met some of the soft triggers that are under review.

Q203 **Chair:** I want to understand this clearly. Are the criteria in place or are they still being developed?

Dr Gardiner: I wonder whether it might be helpful for me to write to the Committee. I am more than happy to write laying out where—

Q204 **Chair:** It would be more useful to hear from you now. This is very live

and no doubt we will have questions in Parliament this afternoon.

Dr Gardiner: We have a qualitative process in place—

Q205 **Chair:** Are there criteria for moving from one tier to another, or is it a question of sitting down and deciding subjectively on a case-by-case basis?

Dr Gardiner: Professional judgment is ultimately where we are, informed by a set of key indicators and data sources, which I have described. Ultimately, this is why the meetings that happen on a weekly basis, particularly that chaired by the chief medical officer, are so important. That is his opportunity to bring his public health community together, of which the JBC is but one part, in order to look in the round at the information and data associated with a particular area or region, and then make a professional judgment decision and a recommendation. The sorts of soft thresholds that we have been talking about are helpful to have in our minds, but they are not the mechanistic reason and the only reason why an area may be recommended to move up into a different tier. Remember, the ultimate decision is for Ministers after consultation with local areas.

Q206 **Chair:** We understand that, but members of the public in those places, and the Mayor of Greater Manchester, were in a state of some confusion as to why it was proposed to put Greater Manchester into the higher tier. It is only reasonable for members of the public, whose livelihoods are going to be affected, to know what the criteria are. Would you mind running through the key criteria that cause the trigger for an area to be moved from tier 2 to tier 3?

Dr Gardiner: As I said, they are currently out for review for comment with the local DPHs. At the moment, the proposals are to consider overall case rates, and case rates in the over-60s, because that is, regrettably, an important lead indicator for the number of people who may have more severe health impacts. We are also looking—

Q207 **Chair:** Overall case rates and case rates in the over-60s. What is the next one?

Dr Gardiner: Positivity and rates of change in all those three indicators, because it is important to understand whether they are rising rapidly or whether we are seeing more gradual increases. The trends are important. NHS data from NHS colleagues is incredibly important. We heard in the last session the importance of understanding hospital capacity, to ensure that important routine operations and other healthcare provision can be maintained.

Q208 **Chair:** The measure is the capacity of the NHS against the demands on it.

Dr Gardiner: Yes, exactly so. The final point, Chair, which is really important, is local intelligence. The information that not just the JBC but the CMO more broadly gets from regional directors of public health and

from local directors of public health is incredibly important. The chief medical officer will consider all of that information in the round before making his recommendations.

Q209 **Chair:** That is very helpful. There are five key metrics, plus a local intelligence basket, if I can call it that. On the rates of change, earlier I think you referred to the rates of change in some places having moderated but not falling. Is it necessary, thinking of the next stage, for a place to come out of a higher tier for the rates to be falling, or is it sufficient for the rate of increase to be moderate or flat?

Dr Gardiner: That is very much a discussion that we will need to have with local colleagues. Let me take a step back. Quite an interesting picture is developing in parts of the country where we see some case rates falling—for example, in younger age groups—while case rates are still rising in the over-60s. There is quite a nuanced picture to disentangle. It will be important to see a stabilisation of case rates ideally, before deciding to come out of a tier. There is a four-week review period that needs to be considered.

Q210 **Chair:** It is stabilisation rather than necessarily falling. We have identified the criteria by which places may be put into a higher tier. Can I take it that they are the same criteria in reverse to come out of it, or is there a separate set of criteria for that?

Dr Gardiner: This is a personal view. The decisions around coming out will need to be much more qualitative. They will need to be formed around a rich conversation between public health officials, local leaders and others to determine the most appropriate course of action.

Q211 **Chair:** Why would they need to be more qualitative and subjective coming out than going in?

Dr Gardiner: It goes back to the point about trying to set hard thresholds. A lot of professional judgment needs to be brought to bear. As you said, Chair, looking at those key indicators and trying to ascertain whether there is a stabilisation or, at the very least, a marked slowing in growth of case rates, such that NHS colleagues feel more comfortable about their ability to retain key services, would be an important part of the discussion.

Q212 **Chair:** Of course. That is part of the criteria you mentioned. I think you will accept that, for people suffering from measures that are imposed by going into a higher tier, it is very important that they should be able to see some light at the end of the tunnel, or at least to know that there is the possibility of release. Therefore, I imagine you can see the importance of having criteria that everyone can have in mind locally.

Dr Gardiner: I completely agree, Chair. None of us is under any illusion about how difficult this is for the parts of the country subject to restrictions. My point was more that, in four weeks, it is going to be unrealistic to see a sustained and defined drop in case rates. I would

suggest that it is incredibly unlikely that cases would drop sufficiently, such that they go below the thresholds or the soft thresholds that we were just talking about.

Q213 **Chair:** To be clear about the implication of that, are you saying that it is incredibly unlikely that places that have gone into the higher tier will be able to come out of the higher tier within four weeks?

Dr Gardiner: No, no, not at all. That is exactly what I am not saying. What I am saying is that, if one sets an arbitrary threshold of 150 cases per 100,000 and an area is currently at more than 500 cases per 100,000, it is very unlikely that in four weeks they will cross that lower threshold. That is why one should be looking at the relative stabilisation of rates as opposed to setting specific thresholds. Apologies, Chair. I don't know whether that is clear.

Chair: It is, but I think what you have described is a different set of criteria for coming out than going in. It is about the rate of change, perhaps, rather than the level. It would still be useful to have that set out. Let me go to Graham Stringer, my colleague, who has been patient.

Q214 **Graham Stringer:** How do I distinguish between unpublished criteria, professional judgments for making recommendations to go into tier 3, and arbitrary government?

Dr Gardiner: I cannot comment on the final point. As I said to the Chair, I am really supportive and keen to see as much of this information in the public domain as possible. It is a very live conversation with policymakers. Once policymakers have reached conclusions, it would be important to ensure that it is in the public domain. The rate of change is relevant on the way up and down. The chief medical officer's role, as key adviser to the Government on public health issues, is to consider this in the round.

Q215 **Graham Stringer:** You can understand that it is not very reassuring for people who are going to have their lives and livelihoods restricted for we don't know long if the person in charge of a large part of the health system and making recommendations on this is talking about having a lively conversation about it. It does not seem very professional to me.

Dr Gardiner: Apologies if it is coming across in that way. The reality of what is happening is a set of well-informed conversations across the public health community, both nationally and locally, that are coming together to make a recommendation that the CMO makes to Ministers. I agree that it is important that the basis for that recommendation is in the public domain. Most of the epidemiological data already is. That is the data that the JBC, as part of that system, is seeking to use. We do not have any decision-making or directive powers. Our role, as part of the civil service, is to ensure that we are helping to pull together and provide the full range of information to national decision-makers and to ensure that that information is also available locally. That is what we seek to do.

Q216 **Chair:** When can we expect these criteria to be put into the public domain?

Dr Gardiner: That would be a matter for Ministers.

Q217 **Chair:** Is your feeling from discussions that they are close to the point of publication—you are experienced enough to know the gestation period of these things—or are we early in the life of it?

Dr Gardiner: We absolutely need to be in a position where they are in the public domain as soon as possible. That is a decision for Ministers.

Q218 **Chair:** We note that your personal view is that they should be put into the public domain, which leads me to my final point. When SAGE considered the JBC, it was told that the organisation "should pursue a reputation as an organisation that the public can trust. This will require them to be an exemplar in terms of openness, honesty, competence and independence." Consistent with that, you will be independent and open in pressing for the publication of the criteria as to when people go into higher tiers and when they come out, as soon as possible.

Dr Gardiner: I will be making that case; yes.

Q219 **Chair:** Thank you. Your organisation is still relatively new. You have made that commitment to openness and independence. You are very important in the system. You have a steering board, a technical board and a data science advisory board. You have made a commitment on your website to publish details of the membership of those boards. Have you done that since I last checked, or when can we expect it?

Dr Gardiner: Membership will be published almost immediately.

Q220 **Chair:** Today? Do I interpret almost immediately as today?

Dr Gardiner: Certainly, the membership of the data science board is on the internet. Can I explain what the different boards are?

They are governance boards. The ministerial board and the steering board are specifically boards for our devolved Administration colleagues to make sure that colleagues in Scotland, Northern Ireland and Wales have sufficient oversight of the work, capability, development and overall strategic direction of the Joint Biosecurity Centre, particularly as we move forward towards the National Institute for Health Protection.

We then have an important technical board, which comprises the four chief medical officers from the four nations of the UK and their deputies. That board provides important oversight of the methodology that we use and signs off that methodology. For example, information from some of the conversations that we have just been having about appropriate triggers has gone to our chief medical officers across the four nations in order to provide appropriate scientific advice.

The final board, which is the one you articulated, Chair, is the data science board. That is because I am keen to ensure that we are learning

from the best that UK academia and the private sector has to offer. We open ourselves up to appropriate peer support and challenge. That board, which is currently in interim format, has people sitting on it from Oxford University, UCL, the Bioinformatics Institute, the London School of Hygiene and Tropical Medicine, and UK Research and Innovation. We announced this morning a partnership with the Alan Turing Institute and the Royal Statistical Society, which is hugely exciting. As we provide what colleagues have described, and I rightly accept, as important advice and information to Government, we are pulling on the very best that UK academia has to offer.

Q221 **Chair:** Thank you. We look forward to seeing the publication of the names of that board. To be clear, the technical board, which you have described, has taken a paper on the criteria for moving up and down tiers.

Dr Gardiner: As part of the review, absolutely, we have sought views from the same mix.

Q222 **Chair:** Will you be able to supply the Committee with that paper?

Dr Gardiner: As I said, being part of the civil service, unfortunately, the timing and publication of things like that are a matter for Ministers and the appropriate approvals process. As I said, I will be making the case, as I know a number of colleagues will be, for early publication once there has been an opportunity to review.

Chair: We are very grateful for your evidence today. I thank both witnesses. We had a lot of ground to cover. We have a better understanding of some of the factors that determine local decision making. We are grateful for the work you are doing and the evidence you have given to the Committee today. That concludes this meeting of the Committee.