HOUSE OF COMMONS

Public Accounts Committee

Oral evidence: Antimicrobial resistance: addressing the risks, HC 646

Thursday 27 March 2025

Ordered by the House of Commons to be published on 27 March 2025.

Watch the meeting

Members present: Sir Geoffrey Clifton-Brown (Chair); Mr Clive Betts; Nesil Caliskan; Anna Dixon; Peter Fortune; Rebecca Paul.

Gareth Davies, Comptroller and Auditor General, National Audit Office, Paul Wright-Anderson, Senior Audit Manager, National Audit Office, and David Fairbrother, Treasury Officer of Accounts, HM Treasury, were in attendance.

Questions 1 - 102

Witnesses

I: Lord O'Neill of Gatley, author of the Government review of AMR in 2014; Dr David Partridge, consultant microbiologist and infection control doctor, Sheffield Teaching Hospitals NHS Foundation Trust.

II: Professor Sir Chris Whitty, Interim Permanent Secretary and Chief Medical Officer, Department of Health and Social Care; Professor Sir Stephen Powis, National Medical Director, NHS England; Professor Susan Hopkins, Chief Medical Adviser, UK Health Security Agency; Abigail Seager, Chief Executive Officer, Veterinary Medicines Directorate, Department for Environment, Food and Rural Affairs.

HOUSE OF COMMONS

Report by the Comptroller and Auditor General

Investigation into how government is addressing antimicrobial resistance (HC 690)

Examination of witnesses

Witnesses: Lord O'Neill of Gatley and Dr David Partridge.

Q1 **Chair:** Welcome to the Public Accounts Committee on Thursday 27 March 2025. Antimicrobial resistance—AMR, as we are going to call it from now on—occurs when pathogens become resistant to antimicrobial medicines such as antibiotics, antivirals, antifungals, antiparasitics and antiseptics. This is a major public concern, with antimicrobial-resistant infections causing an estimated 1.3 million deaths globally each year and rising, and leading to the failure of antibiotics in treating human illness. This poses a huge threat to population health, communities and the wider economy, and has been driven by the misuse and overuse of antimicrobials.

Today we are very fortunate to have with us a panel of witnesses with huge knowledge and experience of working on this critical issue, ahead of questioning of Government officials in the later hearing. We hope to hear from them how serious a threat antimicrobial resistance is and what more they think the Government could be doing to address this emerging crisis.

We are very pleased to welcome Lord O'Neill of Gatley, chair of the review on antimicrobial resistance set up in 2014. From 2014 to 2016 you chaired the AMR review, which was commissioned by the UK Government and Wellcome Trust. You have also written a book, of which I have read most but not all.

Lord O'Neill: That is very impressive.

Chair: Time eluded me. We are also very pleased to welcome Dr David Partridge, president of the British Infection Association and consultant microbiologist and infection control doctor at Sheffield teaching hospitals.

Without any further ado, let me go straight in and ask both of you, as an entry question, how serious a threat AMR is globally and to the UK specifically.

Dr Partridge: It is a huge and increasing threat. In my day job as a microbiologist, I am frequently encountering more and more resistant pathogens, with fewer and fewer antibiotic treatment options, including some pathogens that we are struggling to come up with any active combination to treat.

If we look at the data from the annual ESPAUR report, we see that a particular threat to the NHS are the highly resistant gram-negative

carbapenemase-producing organisms. Those have continued to increase year on year, but we are also seeing a shift in the types of carbapenemase producer to more metallo-beta-lactamase producers, which are associated with greater mortality. There was a large Italian study a couple of years ago that demonstrated that there is an over 30% attributable mortality associated with those organisms. That is probably largely because of even fewer treatment options for them. Those are now really increasing in the UK and are going to cause us great difficulties moving forwards, as they already are.

Q2 **Chair:** We can put all the measures in place that we are going to talk about this morning, but we cannot act in isolation, can we, particularly with huge international travel? To what extent is the fusing of populations and people contributing to the problem? What more could we do internationally to promulgate AMR measures?

Dr Partridge: You are absolutely correct. It is a global phenomenon and we cannot act in isolation in any respect. We can be strong advocates and set an example with respect to our antimicrobial stewardship initiatives. We can lead on the science and research, specifically in the areas of treatment and diagnostics, but also with respect to infection prevention and control, which has a global impact.

We need to bear in mind the economic constraints that much of the global south lives under and the restrictions that that places on access to effective healthcare and diagnostics. We need to drive the development of cheaper diagnostics that require minimal healthcare access and prove to be an appropriate alternative to buying antibiotics over the counter.

Q3 **Chair:** I am slightly darting all over the place, but this is what happens. I am going to bring you in, Lord O'Neill, in a minute. We were having a conversation about diagnostics earlier. Are they getting quicker, better and more broad-spectrum? When a clinician prescribes an antibiotic, there are protocols that they are supposed to go through in diagnostics. In my experience, they will look at your symptoms, but the actual sending-off of samples or whatever is relatively limited—or am I wrong?

Dr Partridge: You are right and wrong, but, yes, they are getting quicker. They are getting better. We are talking about not just pathogen-specific diagnostics, but host diagnostics, so host biomarkers—things in the host that demonstrate the host has a bacterial infection that requires antibiotics. It is really a synthesis of those two, which is what happens in clinical practice, alongside that assessment from history and examination.

We are seeing vast improvements in turnaround times and the ability, therefore, to move testing to the point of care, rather than it being laboratory-based. With some of the newer molecular-based assays, a much broader range of pathogens can be detected accurately. That is moving into the eventual aim, which is rapid detection of antimicrobial resistance itself.

At the moment, those technologies are probably not in the near future going to be an option in low and middle-income countries. We need to find diagnostic technology, probably more on the biomarker side, along with clinical decision support led through the developments in artificial intelligence that we are seeing in all aspects of life. That can help us within the NHS in a high-income country, but, tailored to the availability of whatever diagnostics can be delivered, can also be of assistance in low and middle-income countries.

Q4 **Chair:** Thank you for those opening remarks. Lord O'Neill, I know from your book you have lots of ideas on all these aspects. Let us start with the basic question: how serious a threat is AMR to us? It is one of the chronic threats in this country, so give us a picture on that, please.

Lord O'Neill: I never knew about it at all until I was asked to do it. As I have often said, it is probably the most intellectually interesting thing I have ever done in my life, for many reasons, but partly because it is so complex. It is truly global. I would have it in the same bucket as climate change. I have often said that it does not distinguish between Sunni and Shi'ite, black and white, or men and women.

In that context, not to repeat but to emphasise, we can do the best we can. I hugely welcome the NAO Report, by the way. The fact that these guys did it was a positive surprise for me. The UK officialdom system has done a pretty decent job compared with its peers around the world. As we will come on to, there are areas in which it could do more, especially diagnostics. If the rest of the world is not trying to do it, we are going to be affected by that.

Q5 **Chair:** You may or may not know that the Committee went to Denmark. We looked in some detail at their health system.

Lord O'Neill: We used it as an example in agriculture.

Chair: Exactly. As you saw, we have in the Report, at figure 2 on page 17, a table of comparator countries throughout the world, of which Denmark is the lowest. What is it about Denmark? We have been there, but what is it specifically about Denmark? Would you like to enunciate what it is about Denmark and why it is in that enviable position of being the best in this field?

Lord O'Neill: I do not know. I am an economist, a finance person and an evidence-based person, and the data showed that it was the best. I guess that it is because agriculture is so important to its economy, among developed economies. That is probably at the heart of it.

As I am sure you focused on and talked about, it epitomises the global connectivity of it. As we found when writing our report, there is a famous piece of research that discovered that colistin, which is pretty important for last-in-line antibiotics for humans, had been found to be a real issue in animals imported from China. That sums it up. Denmark is the best—

or was—on agricultural reduction, and yet it is still being influenced by things completely outside its control.

Chair: That is very interesting.

Q6 **Mr Betts:** We had the review back in 2016. Have things got better or worse since then?

Lord O'Neill: Gosh. I do not know whether it is completely finished or published yet, but there is an extremely detailed data analysis being done by—I forget the exact name. It has come around the last decade. It is a health data institute funded by Gates that I think has done a seven-year study looking back over decades at the incidence of AMR all over the world in a much deeper way. We did our stuff in 18 months. To my slight surprise, it actually seems to portray a picture that, in the so-called advanced world, across the board, the growth of AMR seriousness was reasonably stable. That was contrary to what I thought before—and, when I hear evidence like Dr Partridge has just provided, that still seems to be the case—but this is a lot of data. However—surprise, surprise—like so many other things, in the emerging world it is deteriorating dramatically, which is pretty evident from anecdotal stuff.

In the context of that question—I could spend hours on it—I often ponder whether, in a bizarre way, covid was helpful or harmful to the AMR case. At the core of many of the dilemmas as to why we cannot deal better with it is the fact that, as I often say, it is never on the 10 o'clock news. Obviously, we had that rather significantly with covid. On one level, the fact that everybody has witnessed that these global infectious things can happen is probably net good, but how much can human beings take of never-ending warnings of doom and gloom around the corner? It is a delicate balance.

Relating that to specifics, and linked to something you have already raised and maybe we are going to come back to, I want to emphasise again that the UK civil service system, as it relates to health, from what I have observed, has done a pretty decent job on some key parts of it. The area that gets mentioned but has not really progressed is diagnostics. Looking at it as an economist and financier, we did the whole of our review in the context that there is a whole series of things that affect the demand and a whole series of things that affect the supply. If you want to permanently improve the situation, you have to shift the permanent demand curve lower. In this age of never-ending focus on technology, and now with AI, the inability of diagnostics to be embedded into many countries' health systems, including ours, seems to be a bottleneck of considerable progress, in my opinion.

Q7 **Chair:** You heard what Dr Partridge said about analytics just a minute ago. I do not want to put words in your mouth, Dr Partridge, but you were saying that there are scientific tests coming along, but they are not quite there yet. Are we on the verge of a significant improvement in these diagnostics? That is to the pair of you. I hear what you say, Lord

O'Neill, but I wonder what it is that we should be doing more of. You were in mid-flight. What is it that we should be doing more of in diagnostics, in your view?

Lord O'Neill: I deliberately wanted to say it in this context because there are broader ramifications. Partly because of this background, I was on the *Times* health commission's review of the health system. It was a fascinating thing to go through, because we took endless evidence from people inside, as well as expert people outside. It is a data issue and there are aspects of how the NHS and its related partners have developed. There are data systems all over the place that do not necessarily connect properly.

My suspicion as an economist is that, if diagnostics could be embedded more across the whole system, it would also help on the equally if not more important ambitions of improving the productivity of the whole health system, lowering costs and making a lot of things work better. As a part of it, it would allow for some of these technologies, many of which I am reasonably familiar with, to be put into the relevant part of the system where they should be. If it is not done against the background of a much more collectively focused data system that can connect, I am not sure how you can do it.

Coincidentally—it is uncanny, in a way—I am aware that, in the past couple of months, there has been a number of people around the space who want to develop new groups focusing on accelerating diagnostics, in which I probably will have some direct involvement. That is quite a healthy sign that there is more focus on it than there has been for quite some time.

Q8 **Mr Betts:** You were talking about demand being the driver for this and how you could deal with demand. I have been talking to one of my local GPs, Dr Andrew McGinty, who led a group of GPs in Sheffield, where they are trying to get GPs to understand the importance of not overprescribing antibiotics. They had quite a bit of success, I understand. Dr McGinty said to me that the NHS is far too focused on secondary care. Most prescribing is done at GP level and they often are not linked into the thoughts about how you deal with this.

We talked about complicated diagnostic tests. It is right that we look at how we can improve those, but Dr McGinty said that there are some very cheap point-of-care CRP tests for about £15 a time, which the Scandinavians have used for a long time, but we still are not using in this country. Is that not something we ought to think about as well?

Dr Partridge: Yes, moving diagnostics, including biomarker-based diagnostics such as CRP, to the point of care is definitely something that we should be aiming to achieve. There is a slight caveat to some of the pathogen-based and rapid diagnostic testing that it can occasionally lead to treatment that you would not otherwise give.

For example, over the last few years we have introduced a PCR test for diarrhoea and gastroenteritis samples. Most cases of gastroenteritis are self-limiting. The old culture-based tests took 48 to 72 hours to report and quite often patients would have recovered by the time the report was delivered. With a PCR-based test, we can deliver a report potentially the same day if the sample hits us just before the run. The patient will not have recovered and is more likely to receive antibiotics that they would not otherwise. That probably applies to some other tests as well, so there is a slight caveat there.

On the point of moving things to point of care and getting results more rapidly in primary care, but also in secondary care when it comes to diagnosis of sepsis in emergency departments, for example, yes, absolutely, but with appropriate clinical decision support. That, coming back to the AI thing, is where I hope that we will see some significant improvement. If you can integrate that clinical evaluation of the patient with CRP or some later-generation multiple biomarker test that is similarly economically achievable, we could really see some inroads.

Q9 **Anna Dixon:** Good morning and thank you for coming. Before I get into my questions, I will declare that I worked as a civil servant in the Department of Health from 2013 to 2015, when Dame Sally Davies was the chief medical officer. All credit to her for championing both nationally and globally this very important issue at that time, as she has done since.

You have talked a little bit already about some of the barriers to tackling AMR, both globally and domestically here in the UK. Of the many complex drivers of AMR, you have focused quite a lot on some of the clinical ones; you have just had a conversation about embedding diagnostics. I wonder, given the many other drivers, what else you would point to as a major barrier to tackling this issue.

Lord O'Neill: I am going to use that question as an opportunity to raise something. It partly answers your question, but I want to put this in your minds because it also relates to my broader life. We are having this discussion at a time when we have a Government who have introduced a new framework for fiscal policy. All the focus today is on the first part of the rule. I think that the reason they changed it is primarily the second part, which is about investing more in the infrastructure of the UK and allowing themselves to borrow to invest.

Without sticking on diagnostics—but for now I will—it seems to me that one way of trying to help jump-start and dramatically accelerate some of the things that are needed is to try to get the research people in the system and the persuasive voices to get the National Infrastructure Commission, or NISTA as it is going to be in its new design, to focus on preventive health investments as part of infrastructure. I say that because, coincidentally, last summer—I do not what drove it to do this, but it was very useful—the OBR, in its long-term debt sustainability report, which is probably the most important thing it does every year, highlighted what could happen to long-term debt if we had correctly

focused preventive health investments. The conclusion was that it would have four times the impact of investing the same on doing everything right for climate change, in terms of lowering long-term debt.

That is the way to focus on a lot of these things. You need to have a mental shift in thinking, whether it be in embedding diagnostics or in funnelling things for, as it links to covid for example, ongoing new vaccine development. That is a whole separate area, particularly as it relates to animals. During our review and since, I have never quite understood why, if you had a proper focus on vaccines for infection in animals, virtually any antibiotics would be needed. It is still quite easy to circumnavigate and use them for growth promotion. Take Patrick Vallance and the financing of the 100-days idea for vaccines: unless you keep a pipeline going, the big guys in pharma are just going to come and go as always, and then the next crisis happens and there are no vaccines around. The way to deal with it is under this long-term infrastructure.

Q10 **Anna Dixon:** That is music to certainly my ears, as someone who is from a public health background. Hopefully the Treasury is listening to your interesting comments on preventive health as an investment. Certainly, the numbers we see in the Report about the economic impact if we do not get AMR under control are quite significant.

You would like to come in, Dr Partridge. I am really keen to try to unpack what these barriers are. What is getting in the way? Is there anything else you would like to add to that?

Dr Partridge: NHS estate.

Anna Dixon: Great. I was going to come on to that.

Dr Partridge: In many hospitals, we have an estate that is not ideal for preventing the transmission of organisms between patients. We have patients who are very close together and sharing toilets in facilities that are difficult to clean. We have health building notes that apply specifically to new build facilities. We have demonstrated locally that, in our newer ward blocks, we see lower rates of transmission of infective pathogens than in some of the older estate that we have. It works, but we do not know which elements of it work particularly effectively.

The problem is that we cannot just go and build an entire new NHS estate, so we rely on refurbishment. Refurbishment of existing estate is probably the bigger area of opportunity with respect to limiting transmission. Refurbishment is more complex because you are limited by maintaining the structural integrity of the building and the ward footprint and its operational capacity. We need greater knowledge of the elements of the estate and its fittings, particularly water fittings when it comes to gram-negatives. We know that water fittings are really important with respect to transmission of these organisms. Knowledge of which of those elements are most important would be really useful when it comes to us advising on refurbishment schemes within individual trusts.

Q11 **Anna Dixon:** We are about to make large investments in the new hospital programme. You would say you are more confident that the designs that are being looked at there build in sufficient safeguards in terms of reducing infection, but you are saying it is more challenging in refurb.

Dr Partridge: Yes. We refurbished a ward a few years ago and were constrained by the fact that, like many hospitals, it is a multi-storey building and there are support columns that limit how big you can make a bay area, and therefore limit how big you can make bed spacing. Obviously you need the services, particularly the plumbing, to put the desired number of toilets, shower facilities and so on in the ward.

Q12 **Anna Dixon:** You mentioned cleanability—I do not know whether that is a word. We have received some written evidence stressing hygiene—not just personal hygiene, which we all got good at during covid, but cleaning regimes, whether specifically in healthcare settings or more generally in public areas. How much do you think it is behavioural as opposed to hard design?

Dr Partridge: It is a combination. Human factors dictate that, if you make something easier to do, it is more likely to get done. The problem with ageing estate is not just cleaning frequency or adherence to cleaning regimes; it is the cleanability of the surface itself. If the surfaces start to deteriorate, you are not going to be able to clean them.

Anna Dixon: Lord O'Neill, do you want to add anything?

Lord O'Neill: I do not feel expert enough on the state of the buildings to offer anything.

Anna Dixon: That is fine. Thank you. That has been useful questioning.

Q13 **Chair:** Dr Partridge, to back up what you are saying, as I have already said, this Committee, or its predecessor Committee, went to Denmark. Denmark is at the bottom of the league, as we see from the NAO table. We discovered that it has virtually demolished all its old hospitals and built nine new hospitals. I am wondering whether that is part of the solution to what you are saying. If it is, should we be doing more research into what it is about refurbishment? You are quite right that we cannot build all new hospitals. The country is too big and complex. Should we be doing more research into what it is we need to do when we are refurbishing hospitals?

Dr Partridge: Yes, we should. UKHSA recently built a modular ward at Porton Down. I am hoping that we will get some results from studies performed there that will guide that, but yes, definitely.

Q14 **Mr Betts:** How successful was the 2019 to 2024 national action plan for AMR? What lessons could we learn to make sure we get it better next time?

Lord O'Neill: As I have already said, the general drive and persistence on it by the civil service machine that is relevant for AMR is pretty good, in my opinion. I want to say in that regard that I admire the ability to stay focused on it, despite, let us just say, some rather volatile things going on above it, which I have not raised yet. That is where there is quite a dilemma for the UK globally. By and large, with the important exception of diagnostics, the broad thrust of where they went with that and where they are going is generally, within the constraints of this being a global thing, pretty good.

We have not yet touched on what has become known as the Netflix model. NICE's leadership on the reimbursement system is leading that area globally. There is never-ending talk about incentives for new drugs, many of them based on the ideas we had in our review, including the so-called Pasteur model in Washington, but nothing ever happens elsewhere and the UK has introduced that. That is to the system's enormous credit.

Part of the dilemma, which is probably pertinent for the system, because, at the end of the day, it has to take its instructions and priorities from the elected Government, is linked to the turmoil we have had since the days of the review. The UK got AMR on the G20 agenda in a pretty serious way, and it has vanished. It is not easy. Even if we had elected officials who deemed it of sufficient importance and wanted to bring it back, I can imagine some pretty interesting reactions from leaders in other parts of the world: "How come it is suddenly important again when it was not for the past nine years?" The subtlety of how that interplays with the support that elected leadership gives the system is, I imagine, an interesting challenge. Despite all that, the system has done a pretty good job, except for this thing where diagnostics could have a much bigger impact.

Q15 **Mr Betts:** You mentioned the subscription model. It obviously has potential. This is potential that is not being realised.

Lord O'Neill: No. I was going to bring this up in response to the earlier questions about what more could happen. It is still against the background where it seems to me that big pharma will not get out of bed and get excited about dealing with AMR. As for the UK approach to it on the reimbursement model, if there was an ability to take that to the G20 stage—of course, I am saying that against the background of a dysfunctional G20, but ignoring that rather important issue for a second—if we could resurrect it and you had a GDP-proportional contribution to the same thing, you would be getting a global amount of money that probably would get big pharma out of bed and get it to think there are incentives for it to devote fresh resources to the space.

The UK is doing a pretty good job on that. You should quiz the officials who will follow us today, who are involved in it. As far as I know, there is some interest from some other countries in trying to join up and collaborate on that. For it to have a significant amount of money, you have to get the big countries in the world involved.

Mr Betts: Dr Partridge, you were nodding away there.

Dr Partridge: I entirely agree with that. It is really important. I have a bit of a conflict of interest because I was on the NICE panel that was convened to develop the model. It was a really important initiative and hopefully the other countries will follow it so it generates that critical economic mass to deliver the results that we would like to see.

Q16 **Mr Betts:** You mentioned the dysfunctional G20. Are events in the United States making all that more dysfunctional and making it more difficult to address these issues?

Lord O'Neill: Yes, just a little. Definitely, without a doubt—there is no way of sugarcoating it.

I have two other quick things to raise, if I may. It will be interesting to see, as part of the seeming ongoing efforts to have a trade deal with the US, how aggressive the US is about issues on food standards, which could have consequences for the successes we have had on agricultural control. From an AMR perspective, you would want to see the trade deal not weakening those.

The other thing again relates to the international environment and the mood of the era. The Fleming Fund has had some successes in the emerging world, linked to the fact that there is fresh focus from people who want to make progress globally on these things. In a world where support for Fleming-type things and the health aspects of what was DFID remained, some version of the reimbursement model as it applied to diagnostics—of neonatal sepsis in the emerging world, to pick one important example—would be quite an interesting thing on which the UK probably could show leadership, given how the Fleming Fund was quite pioneering on a global basis.

Q17 **Chair:** Dr Partridge, to follow up Clive Betts's question on the subscription model, it is not cheap. We are putting £1.9 billion into this. Is there anything more we can do to link that? Basically, we are saying to the pharma companies, "We will buy a capacity of an antibiotic, but we actually want to try to minimise the use." I wonder whether we could link that with encouraging big pharma, as Lord O'Neill calls it, to put more research into antibiotic development. I know that antibiotics are cheap compared with, say, cancer drugs, but is there more we could do to encourage big pharma to invest in development of new antibiotics, or is that not the answer, even?

Dr Partridge: It is certainly part of the answer. I am going to come back to AI, because that is another area where, as yet, we have not seen the benefit of AI. AI to facilitate the development and screening of compounds with antimicrobial activity is a significant opportunity for drug companies to develop agents in a more cost-effective manner than has been the case historically.

The challenge, and the reason for the subscription model, was that a company develops a drug, we try our best not to use it and, when we use it, we use it for as short a time as possible. This is entirely clinically appropriate, but it is not the model they have for anti-cholesterol drugs or anti-hypertensives. The incentivisation from a purely market perspective is not there, which is exactly what the subscription model aimed to achieve. Could that be linked to specific antibiotic investment in R&D? I do not know. That is outside my scope, probably.

Chair: Some of us will probably want to follow that up with the main panel. Thank you for that candid answer.

Q18 **Nesil Caliskan:** I want to ask a little more about the national action plan. You may have already addressed this, but it would be helpful to get a bit more of a sense of your assessment of how well the UK has made progress on human health alongside animal health, food and the environment as a whole. Clive Betts asked earlier whether we are in a better space than we were. To what extent has the national action plan assisted with that? Are there any lessons to learn as we look to the next iteration of the national action plan?

Dr Partridge: I will duck animal health because it is not my domain. It is very important, but it is not my domain. In human health, the previous national action plan made significant strides forward. Even from a simple data perspective, making carbapenemase-producing organisms notifiable via laboratories was an important step. Introduction of the national infection prevention and control manual was another important step. So is learning about the role of targets. Part of the national action plan was the human health targets.

Q19 **Nesil Caliskan:** Do you mean the targets to reduce AMR?

Dr Partridge: Yes, and gram-negative bacteraemia. There has been a recognition that we did not have the knowledge or tools to make those targets in the 2019 to 2024 plan—particularly the gram-negative bacteraemia target—achievable. The problem with a target that is not achievable is that it does not get prioritised. The ideal target is one where, if you really put your mind to it and push the boat out, you can make it there and achieve it. We all have a large number of priorities and there is a risk that people prioritise other things and deprioritise a target that seems unachievable at local level.

Q20 **Nesil Caliskan:** My understanding, but correct me because I may be entirely incorrect, is that those targets derive from WHO and UN guidance. They are targets derived from what those two organisations are saying when it comes to the agenda. Therefore, if the Department of Health and Social Care, for example, or the NHS changes the targets, I am trying to understand the justification for that change when it might be the WHO that is saying, "This is our assessment." It may not be a question for you to answer. It may be for our subsequent panel.

Dr Partridge: I am not aware that the gram-negative bacteraemia target is a WHO target. If it is, I apologise.

Nesil Caliskan: It is not. I am saying that it derives from the WHO's understanding of what the picture may be.

Dr Partridge: It is important. We clearly want to reduce gram-negative bacteraemia. Some of those gram-negative bacteraemias are resistant and the antibiotic use that goes into treating them generates more resistance, so it is clearly important. It is important that there is some form of target down to local trust level, but it has to be achievable.

Something else that I may come on to later is the workforce challenge that we have in the antimicrobial stewardship space. We are in a position where 20% of funded consultant microbiology posts across the UK, and 10% of funded consultant infectious diseases posts, are unfilled. I do not know about the situation with antimicrobial pharmacists, who are another key part of this, but those unfilled posts represent a significant opportunity cost. A lot of the initiative and strategic development at local level in this space comes within that headroom. That shortage is another thing that needs to be addressed.

Q21 **Nesil Caliskan:** My initial question was about your view of whether we have made good progress. The targets that we have just had a brief discussion about have been reduced, perhaps because they were not achievable or perhaps because they did not relate to the challenges that we have. Whatever the reason, they have been reduced.

I am trying to get a bit more of a sense of whether the targets have been reduced because we have made adequate progress, and therefore we should feel comfortable with the level of risk in this area, or whether the risk is so great and the targets are so difficult to achieve that we are reducing them. Sometimes this Committee looks at money that is being spent and whether there is good value for money; in the case of this hearing, we are trying to get a sense of whether the risk that exists is being managed appropriately.

I am trying, in my very convoluted way, to understand whether we have made enough progress that we should all feel comfortable that the risk is being adequately managed, and therefore the reduction in the targets is not something we should feel concerned about, or whether the risk remains so high that we have no choice but to reduce the targets, because we would never meet them anyway.

Lord O'Neill: I do not know the answer to your question, but my suspicions include the following two views. On the first, I will come back to boring you about the importance of diagnostics. It is something to quiz the experts on afterwards—and David might have a view on this. I personally think that, if you do not treat diagnostics more seriously, having too aggressive targets for reduction of antibiotics could quite easily mean that, sometimes, people who really need them are not going

to get them. It is an access issue, not an excess issue. That might be related to issues about it.

The second thing relates more to the agricultural issue, and I say it with a smile on my face. We were both surprised and impressed when the UK Government effectively adopted our recommendation on agricultural reduction, which was taking the Danish case, and they achieved it pretty quickly, so I thought maybe it was not tough enough. I do not know the answer, but I often have suspicions that that is the case.

I say that because I would like, in some areas, the latest plan to be more ambitious. I have touched on it already. I do not quite get why certain really important antibiotics for humans are not just banned for use in agriculture. I think one or two countries elsewhere in the world have, at least in principle, banned the use of colistin. I am not sure what the current situation is, but I do not really get why there is not more. The agricultural lobbying crowd go crazy when they hear me say things like that, but that might be because it tests their model of how they do things. I do not know, but I would like to see that tested a bit more myself. You have to be careful just having numerical targets for reducing antibiotic prescription unless it is done in the broader context of state-of-the-art, affordable diagnostics.

Chair: Anna, is there anything else that you want to cover?

Q22 **Anna Dixon:** Lord O'Neill has just suggested that it could be more ambitious. That is fine. That was the question—whether we are pushing hard enough in the latest plan. I do not know whether Dr Partridge wants to comment on whether the new plan goes far enough.

Dr Partridge: With respect to the targets embedded within it, I support them. The inclusion, which is WHO-based but goes beyond it, of the access group antibiotics as a proportion of the total is a very positive step. That will hopefully push the diagnostics agenda, but also push another very important component of this, which is penicillin allergy de-labelling. That is also mentioned in the NAP and will help us to reduce use of some of the more broad-spectrum agents.

I would like to see some more deliverables in some areas of the action plan, to be honest. I have already mentioned NHS estate and I would have liked to see some deliverables related to the estate. I just talked about penicillin allergy de-labelling. I would like to have seen some deliverables with respect to penicillin allergy de-labelling, because that is, as I say, a really important tool that we have at our disposal. I welcome the greater emphasis on social care. I welcome the emphasis on the impact of deprivation, and the association of deprivation with both AMR and antibiotic use. They are obviously linked. Trying to interrogate why that is and how we can tackle that is really positive.

Q23 **Nesil Caliskan:** Do you have a view on why that is?

Dr Partridge: It is a little bit chicken and egg, in that chronic illness will potentially lead to deprivation and will lead to increased antibiotic use. It is almost certainly multifaceted and that is only one component of it.

Q24 **Nesil Caliskan:** The use of antibiotics is more prevalent in those communities because of illness. Is that what you are saying?

Dr Partridge: Yes, but that is probably only a small part of the picture. There are likely other reasons related to health-seeking behaviour and the route via which healthcare is sought that are also important, as well as knowledge of antimicrobial resistance and antibiotic utility, which may be lower in more deprived groups than it is in less deprived groups.

Nesil Caliskan: I am not sure I know what all that means.

Dr Partridge: Sorry.

Nesil Caliskan: That is quite all right. Somebody in this room will, and will be able to explain to me later, I am sure.

Q25 **Chair:** It falls to the Chair to ask one or two tidying-up questions. Dr Partridge, I do not know whether you are familiar with the work of PIRU, the policy innovation and evaluation research unit, an independent unit set up by NIHR, but it backs up what you are saying about data and the need for joined-up thinking within the NHS. In particular, there has been an evaluation that was particularly critical of the UK's management of wastewater, finding a dearth of baseline data on AMR and how wastewater impacts other water sources. I do not know whether that is within your speciality or not.

Dr Partridge: It is not really within my speciality, but it is something that I feel quite strongly about. Contaminating our freshwater systems with wastewater with pharmaceutical by-products is going to generate resistance. I am not an environmental microbiologist, but it is clearly something that we would expect to generate resistance. That is probably something where it would be nice to see more deliverables within that.

Q26 **Chair:** Bacteriophages may be more in your field. Do they offer any useful solution in the future?

Dr Partridge: I am quite an advocate. I have to declare that I have some collaborations with a team at the University of Sheffield that is investigating bacteriophages and, in particular, their use in diabetic foot infection, which is a really important issue. They hold great promise. There are numerous current barriers to their further development and translation to healthcare use within the NHS. They were the subject of a Science and Technology Committee review a year or so ago, were they not? It would be desirable to make inroads into those barriers.

I know that UKHSA is at the beginning stages of setting up a phage unit at Porton Down. We need work in numerous areas, and hopefully with some alacrity, to optimise the utility of phages in the NHS. We need to drive the development of good manufacturing practice-compliant

manufacturing facilities in the UK, which do not currently exist. We can import phage from a foreign provider that does not manufacture it to the GMP standard and use it, but we cannot use UK-manufactured phage because we do not have a GMP-compliant facility. There is a bit of a logic gap there.

We need to better develop our phage susceptibility testing ability in the UK. Most of all, we need to incentivise and design clinical trials that confirm the utility of these agents, in conjunction or not in conjunction with antibiotics, to drive that further development. To make a GMP-compliant phage manufacturing facility costs money, so we need to justify that. We need to look at having good-quality clinical trial data in the very near future.

Q27 **Chair:** We will follow that up with our next panel. For those who are following these proceedings, this is mentioned at paragraph 3.13 on page 40 of the NAO Report.

Lord O'Neill, my deputies raised a lot of cross-country initiatives. We were one of the first to get this on the real agenda in the United Nations. In 2024, as is mentioned on page 21, figure 4 of the Report, the UN General Assembly, no less, held its second high-level meeting on AMR. Notwithstanding Trump, it seems to me from all our discussion, particularly at the beginning, that we cannot tackle this on our own. Is this a useful avenue that we should be pursuing through the United Nations?

Lord O'Neill: Goodness me. I had quite an active role in the 2016 one. I remember in the earliest days talking to Sally about it being a goal and it seemed like an extremely ambitious goal. The fact we achieved it made us feel that we had reached the Holy Land, but that did not lead to x, y and z, for naive people unaware of the complexity of the UN—it did not lead to the promised land.

It is exceptionally useful but, as I started to become aware of the complexity of the UN, I personally thought, in so far as all these things are relevant and my own role in it all, that getting it focused on the G20 agenda was more important than the UN. There, you have a smaller group of people representing 85% of global GDP and those who can action the things that really are important, including for everybody else. That seems an impossibility as we sit here today with the current status quo and what seems to be coming.

It is so relevant for other areas too. In the UK's way of thinking about its role in the world, trying to be at the forefront of getting the right actors, regardless of whether they share our philosophies on really major global issues, is something that the UK, despite ourselves in the past decade, still has a real edge on. It is really important that we should continue to try to lead those things.

Q28 **Chair:** That is very helpful. Dr Partridge, do you have any last-minute

remarks that you want to make on areas that you think are useful but we have not covered? We have you and Lord O'Neill here and would like to get the best of your knowledge.

Dr Partridge: I do not think so. The discussion has been quite broad-ranging and has covered most of the areas that I highlighted from my review of the plan and the subsequent report. I have nothing else to add.

Q29 **Chair:** Can I zero in on one thing that you said and ask you what is being done about it? You mentioned the shortage of relevant staff in the NHS—microbiologists and so on. Are you aware of any measures that are being taken to fill those gaps?

Dr Partridge: With my British Infection Association hat on, we are currently in discussion with the Royal College of Physicians and the Royal College of Pathologists with respect to identifying the barriers and then developing a plan for lobbying for more trainees within those two specialties. Clearly, other parties are key there. We can lobby, but we do need those training posts to be funded. The other challenge there is that this is a five-year plan. Training microbiologists and infectious diseases doctors takes longer than five years.

Chair: If we do not start, we will not get there.

Dr Partridge: Yes, exactly.

Q30 **Chair:** Lord O'Neill, do you have anything that we have not covered?

Lord O'Neill: It is quite remarkable how much has been raised in the time that we have had. One of our biggest frustrations during the review was the whole public awareness thing about how "antibiotics aren't sweets". Collectively, those who are aware of the issues need to find a better way of growing public awareness. When I see occasional surveys of it, many people still do not have the slightest idea what antibiotics are right for. It is quite remarkable, in many ways, given how important they are.

Chair: That is really interesting. It was on my mind to ask you about that. We have some samples of previous publicity campaigns that have not been terribly successful.

Can I thank you both hugely? The Committee has benefited greatly from your knowledge. I know you are busy people, so it is really kind of you to turn up this morning and give us the benefit of that.

Examination of witnesses

Professor Sir Chris Whitty, Professor Sir Stephen Powis, Professor Susan Hopkins and Abigail Seager.

Q31 **Chair:** We now move on to our main hearing. We have just heard from an excellent panel of witnesses. Antimicrobial resistance poses a threat to

public health both in the UK and across the world. AMR, as I will call it from now on, contributes to an estimated 35,200 deaths in the UK each year, and costs NHS England an estimated £180 million a year.

Since 2013, the UK has put in place three five-year action plans to address AMR. The 2019 to 2024 national action plan set five quantified domestic targets relating to infections in humans, antimicrobial use in both humans and animals, and diagnostics. However, it met only one of these targets. It therefore remains to be seen whether the latest national action plan—NAP24-29, published in May last year—will be enough to effectively reduce the threat of AMR.

Unless measurable change to reduce the spread of antimicrobial resistance is achieved, there will remain a serious threat to human life and society as we know it—and, I might add, healthcare treatment. Today, therefore, we will be questioning officials on the UK's resilience against antimicrobial resistance and whether the current national action plan sufficiently addresses this ever-evolving danger.

We are very pleased to have our witnesses with us today. Professor Sir Chris Whitty is the chief medical officer and interim Permanent Secretary at DHSC, pending the appointment of a new Permanent Secretary, although I cannot think of anybody better qualified to be here than you, Sir Chris.

Professor Sir Stephen Powis has been the national medical director at NHS England since 2018. I would like to thank him for his seven years of dedicated service, in which he expertly steered the NHS through the crisis of the covid-19 pandemic. I wish you all the very best for the future, Sir Stephen.

Professor Susan Hopkins is the chief medical adviser at the UK Health Security Agency and leads UKHSA's clinical and public health group, whose objective is to provide professional health security, clinical and public health leadership.

Last, but by no means least, we have Abigail Seager, who has been chief executive officer of the Veterinary Medicines Directorate since 2021. An especially warm welcome to you, as this is your first time appearing before the Committee.

Welcome, all of you, and let us launch into our questioning. Sir Chris, I have a similar question to the one that I started with for the previous panel, just to get your overall view. How worried should we be about antimicrobial resistance?

Professor Sir Chris Whitty: Thank you, Chair. We are all delighted that you and the NAO chose this as a topic, because it is a very serious issue. We agree with all the points in the NAO Report and with those that were made by the previous panel, which goes to the thrust of your question. It is and will continue to be a very serious problem, because it evolves around whatever we do. Antibiotics are evolving to try to spread

themselves and we are trying to prevent them, and the two are, essentially, always in battle against one another.

The threat overall, particularly to people who are very vulnerable—people with immunosuppression, elderly patients, or people in intensive care—is very significant. At a global level, the threat is, as you say, substantial. The numbers are large and, if we do nothing about it, they will go in only one direction: up.

We need to accept that this is not a situation that you can just fix and then walk away from. It is like painting the Forth bridge; you have to keep on going at it. There are many things that we can do and, if I may, I will lay out a couple of framing points.

I would divide antimicrobial resistance broadly into three groups: in the community, for example what you would go to a GP with; in hospital in general; and then in intensive and specialist care, for example haematology units. They have different sets of problems and different ranges of antibiotic resistance. It is probably worth bearing that in mind, because you cannot do one thing that will fix all of those simultaneously.

In addition, there is constantly the reality of importation of antimicrobial-resistant organisms from Europe and elsewhere in the world, and so, even if we got everything absolutely perfect in the UK—perfection is not an achievable goal, but you need to get as close as possible—the importation would continue.

Q32 **Chair:** It is currently classified as a chronic risk, which means that we have to continue to take action. What is the danger of it becoming an acute risk and, therefore, us having to take emergency action?

Professor Sir Chris Whitty: There is a small risk that we get a wave of a significant antimicrobial-resistant organism going around the world, and it turns from a grumbling problem that is gradually increasing to suddenly something that we need to do something about. There are some examples where there definitely is an up wave, and not just in bacteria. We have talked about bacteria principally, but Candida auris, which is a kind of fungus, is increasing everywhere and is, therefore, a new problem for intensive care and haematology units.

For most of the time, because it is increasing imperceptibly, it is the boiled frog risk: that we just do not spot the fact that every year is marginally worse than the last. Often, chronic risks are harder to deal with. When you see a sudden risk, as we saw during the covid pandemic, all state resources and public interest are focused on that risk; it is very visible and very front of mind. Something that is in the background and just increasing very gradually requires a lot more work to get people to understand its seriousness. My distinguished predecessor, Dame Sally Davies, did an extremely good job, when she was chief medical officer, of trying to raise the profile, but there is a continual need to do it. It is not something that you can let go of at any point.

Q33 **Mr Betts:** As I understand it, there is a vision for antimicrobial resistance to be effectively contained, controlled and mitigated by 2040. Is a vision an ambition or a target? What is it?

Professor Sir Chris Whitty: Like many visions, I consider it an ambition. Many things will have changed between now and 2040, but the need for us to take action across a range of areas is really clear. All of us would agree on where we are trying to get to by 2040, which is that the threat is, ideally, receding for most organisms, and certainly no worse than it is at the moment.

To achieve that, we will have to run very quickly, because we have two things heading against us: the fact that antimicrobial resistance is constantly evolving and new things are happening the whole time; and the fact that an older population is at higher risk of infection. That is just a biological reality. As our population ages, therefore, the risks are going to go up.

On our side are things that we can do to reduce the risk of infection at all. I will take a historic example and a current one. The big changes that happened in the 19th century were to do with improvements in drinking water and sewerage. That had an enormous impact on the reduction of infections, probably bigger than even the impact of antibiotics themselves. Then there is something that happened just yesterday, for which I would like to say a huge thanks to Members of Parliament. The generational smoking ban will have, in the long run, a very big impact, because smoking leads to a significant increase in chronic obstructive airway disease. Almost all of it is caused by that, and people get repeated courses of antibiotics, with an increased risk of pneumonia and various other risk factors.

Actions like reducing that, reducing air pollution and dealing with sewage in water are fundamental. In a sense, they are upstream—literally, in the case of water—of the problem. If we can reduce infection, we can go a very long way to meeting the goals of no infection and no antibiotics.

The second thing that we can do is to reduce the severity of the infections. Here, vaccination is extremely important. Vaccinations not only prevent infections but reduce the severity. When the three of us who are doctors were in training, very large numbers of children who came in with a sepsis syndrome would go on to get meningitis. That is now very rare, because we have vaccinations against Haemophilus influenzae B, meningococcus and pneumococcus. That has shifted the risk that someone really needs antibiotics, and right now, because vaccinations have derisked the infection.

There are a lot of things that we can do that are not just about the antibiotics, which I know we will concentrate on in this session, but are about reducing the risk of any infection and, if you have an infection, the severity of it.

Q34 **Mr Betts:** That is a really helpful and forward-looking view of the situation. How do you communicate that to the public? Most of the public would not connect being told that they cannot drive petrol or diesel cars into certain areas because of the pollution threats with dealing with AMR in the long term, even if they knew what AMR was. How do you get the message across?

Professor Sir Chris Whitty: That is absolutely as you say. In a sense, this is a joint responsibility for lots of different groups. Clearly, professionals like those of us on this panel have a strong responsibility to lay out the scientific facts of it, and to make sure that those are accurate and that we are not over-calling it, but simply stating, "These are the links and how they work."

Political leaders have an incredibly powerful role in this. Many of the big societal changes have happened when political leaders have chosen to raise an issue and put it into the public domain. It is an expertise combined with a platform. In my view, that is a shared responsibility between us and you.

Q35 **Mr Betts:** You now have social media to contend with, parts of which often have a completely different view of the world.

Professor Sir Chris Whitty: Social media can be a vehicle for information as well as misinformation, and we should be really clear about that. What is striking to me is that people are always worried that the public will not be interested in this. The public are very interested in this. If you take the Tobacco and Vapes Bill, there is very widespread public support for it across the political spectrum, across all ages and both genders, and all across the country. Once people understand the logic, people do want Government to do things to protect them and their children, and to make sure that future health threats are smaller than those facing the current generation.

Q36 **Mr Betts:** I have some specific questions for Sir Stephen and Professor Hopkins. A vision is great, and we are looking ahead and have ideas about what we need to do to deliver the vision, but four of the five targets in the 2019 to 2024 action plan were missed. If we are going to get to a vision, we need to hit targets in the meantime, but we are not doing it.

Professor Sir Stephen Powis: You touched on that with the previous panel. Those targets that were set for the last action plan were set in good faith, but, in retrospect, we would all agree that they were rather overambitious.

Why was that? Because the evidence base around the particular group of infections that those targets focused on—for instance, gram-negative bacteraemias—was limited and perhaps overly based on experience with other infections, and specifically MRSA, where the spread is a bit different. They are skin organisms rather than gut organisms. A number of academic studies during the period of the last action plan have refined

our thinking about the ways in which we can deliver those ambitions that we have around antimicrobial resistance.

You heard from the last panel that progress has been made. We have reduced the number of prescriptions, although not to where we wanted it to be. The pandemic is the elephant in the room in this. You can see in the NAO Report the impact that the pandemic had: the data shifts that were hard to interpret; the post-pandemic resurgence of a whole group of infections. You will remember the group A streptococcus surge a couple of winters ago that led to different prescribing patterns. Of course, the counterfactual is always, as Sir Chris has said, an increasingly ageing population that is more at risk of infection.

My assessment would be that we have made progress. Clearly, we did not hit all of the targets, but the counterfactual has a number of headwinds, and the next plan is more realistic. I am sure that we will come on to the ambition for the next five years, and I am sure Susan will want to add to that.

Professor Hopkins: You talked a bit about diagnostics with the previous panel. Diagnostics for sepsis and blood cultures have increased by more than 30% over the last 10 years. The more diagnostics we do, the more infections we will find. That is a good thing, because people get the right treatment, but it also means that, when you are trying to reduce infections, you are, in a way, trying to pull against it. We definitely do not want people not to do diagnostics. The more we push diagnostics, the more we will find, and then we will have a different target. Our ageing population and its comorbidity profile is definitely part of that effect as well.

That is not an excuse, though. While we were able to really reduce other infections in the past—I come back to what Professor Powis said—these gram-negative bacteria live in our gut. Therefore, they often start by causing a urinary tract infection, or are related to other procedures that people may have. One of the things that we have been trying to work on is going upstream to ensure that the prescribing for urinary tract infections is easy to access—Pharmacy First will help that—that people get the right treatment, and that we optimise the treatments for it. Again, as new diagnostics come in for urinary tract infections, that may help us to make sure that people get the right treatment and do not progress to sepsis or bloodstream infections.

Q37 **Mr Betts:** So targets are going to be more achievable in future because you are going to reduce them. Is that what we are being told?

Professor Sir Stephen Powis: No. The targets are more realistic and more evidence-based, and take into account the changing demographics. In the last panel, you talked, quite rightly, about having targets that are unachievable. That does not provide an incentive for people to try to get to them. It is a careful balance of setting targets that are realistic, sufficiently stretching and ambitious. As you discussed previously, the

new targets are based within the range of World Health Organisation targets, and some are more ambitious. The target for the use of drugs from the access list is more ambitious than that set by the WHO. It is a realistic plan that will allow us to continue to make progress.

Q38 **Mr Betts:** Professor Hopkins, in terms of reducing antimicrobial use in humans, why are you measuring only antibiotic use and not use of other antimicrobials? Is that not a very self-selecting target?

Professor Hopkins: There are two reasons. First, internally, we look at other antimicrobials as well. However, when we talk to the public, antibiotics are what are most commonly received. Antifungals and antivirals are very rarely received by the general public, with the exception of some for flu in winter, for example, and others for specific treatments such as HIV and hepatitis C, which are always based on a diagnostic and on what treatment will work for those individuals.

Antibiotics is where the greatest challenge is. The vast majority of antibiotics are given for a clinical syndrome. It is the area where we see the greatest challenge in developing new antibiotics, where there is a trade-off between providing a narrow-spectrum antibiotic that may not work versus a broad-spectrum antibiotic that may drive more resistance. The balance between using antibiotics and talking to people about them is easier. People understand that term better, which is one of the reasons why we have focused on it.

Q39 **Mr Betts:** It is purely about public understanding, is it?

Professor Hopkins: It is partly about public understanding, and partly because more than 90% of what we prescribe in primary care is an antibiotic. Therefore, focusing on that is important.

Mr Betts: I will probably come back to prescribing and diagnostics later.

Q40 **Nesil Caliskan:** Thank you to the panel. I have a question about prescribing, but we may build on it later. Does it worry you that 20% of antibiotics prescribed in primary healthcare are inappropriate? I do not know what "inappropriate" means. Does it mean it is wrong? Is there a clinical consequence to that inappropriateness, or is it an impact on the broader system of resistance?

Professor Sir Stephen Powis: Of course it is of concern. Worldwide, there are various estimates of the number of antibiotics that might not be used appropriately. That is why one of the focuses of the last action plan, and the next, is ensuring that prescriptions are issued only where necessary. If you dig under that, there are a number of components to it. We could talk about the role of point-of-care testing and other diagnostics to ensure that there is a bacteria to treat, rather than, for instance, a virus. A chest infection would be a good example of that.

Progress is being made. I will give the example of the pandemic, where there was, as you know, widespread use of a point-of-care test. The

entire public were using lateral flow tests to determine a covid infection. I am a bit more optimistic about diagnostics than perhaps Lord O'Neill was, because there is an explosion in those sorts of point-of-care tests coming, and there will be a very bright future once the evidence base is there, in terms of how we use them.

Clearly, we need to ensure that we engage with GPs, and Mr Betts gave a good example of that. We have education programmes in partnership with various academic partners that are targeted at general practice. Of course, there are a range of prescribers. It is not just doctors who prescribe. We talked about Pharmacy First, which is a great scheme that provides rapid access to the public for a range of minor illnesses and infections. It is very protocol-based. Early evidence is that those pharmacists are following those protocols. We are not seeing any increase in the use of antibiotics. In fact, we are seeing the use of antibiotic-sparing treatments in some of those conditions. There are multiple ways to address the issue of potential overprescribing, not just one, and we are taking all of them.

Q41 **Nesil Caliskan:** My point was not about overprescribing, which I know is an issue in itself, but about the inappropriate prescription of an antibiotic, which, from my basic understanding, is also a problem, not least for the individual patient, because they are not getting the treatment that they need. To me, 20% seems quite a high figure, but I take your point that there seems to be a focus on trying to address that, and there is an acknowledgment that 20% is not a space that we want to be in.

Professor Sir Stephen Powis: I was essentially using "overprescribing" to describe inappropriate prescribing. The other point that I would make is that it is not just about when antibiotics are prescribed, but about the length of prescribing. One of our focuses has been ensuring that prescriptions are for shorter periods, where appropriate, and that prescriptions are stopped. For instance, it is about making sure that electronic prescribing systems have flags in place so that there is a reminder to stop a course, because it is the totality of the antibiotic usage, not just the individual occasions on which it is used.

Q42 **Nesil Caliskan:** I also want to ask about the sufficiency of resources. The NAO Report talks about the amount of money that has been allocated by Government directly for AMR programmes. It is just over £500 million. In cash terms, that has increased over four years, but the value remains broadly stable. I understand there are other pots of money that have got through the system, so it is a sizeable amount of money. With that in mind, Professor Whitty, given the risks posed to the UK and expected further healthcare costs, are you confident about the level of spend and the level of risk? Are we prepared?

Professor Sir Chris Whitty: I will paint first a glass-half-full picture and then a glass-half-empty picture. In reality, the great majority of what we spend on AMR is not captured in those numbers. All the people who are doing testing or involved in hygiene—cleaners in hospitals, for example,

although they may not think of it this way—are, in fact, involved in reducing the risk of antimicrobial resistance. If you added all of that together, the sum would be very considerably greater, and the actual amount spent on it will always be much higher in the NHS.

What all of us want to do is shift the spend on to preventing the problem rather than having to pay very large sums to try to rescue people with antimicrobial resistance who have become very unwell and need very expensive drugs for prolonged periods. That is absolutely what we should be doing.

Q43 **Nesil Caliskan:** Is that why a lot of the spending is on research rather than treatment?

Professor Sir Chris Whitty: I will come on to the stuff that is very AMR-specific, but I do not think that we should underestimate how much of the battle against AMR is really basic things. It is about more than just encouraging, but about mandating people to wash their hands between patients, cleaning the environment properly, and designing hospitals in such a way that they can be cleaned. These are old-fashioned things that Florence Nightingale would have recognised. They are still absolutely fundamental. We should not always get down into the newest things without getting the basics, which we know work, right.

You are absolutely right: one of the bits that has been and will continue to be very important is the spend on research. Some of that is on novel antimicrobials, antibiotics and others, and the fundamental science behind them. Some will be on diagnostics, which we may want to come back to. Some is on other mechanisms of making environments cleaner from a microbiological point of view.

To be clear about where things are likely to go, one of the largest AMR-specific bits is the Fleming Fund, along with the work that we have done on international development using official development assistance money—ODA. I do not know what effect the recent changes announced by the Chancellor on ODA spend will have on this at this point, but it is unlikely to be good—let us put it that way—so we should be realistic. Our international development footprint in this is likely, in absolute terms, to be under pressure as a result of the changes. That is just a reality.

Q44 **Nesil Caliskan:** My second question was going to be about what impact that might have, but it is not a helpful direction.

Professor Sir Chris Whitty: Well, it is certainly not going to help.

Q45 **Nesil Caliskan:** I do not want to be provocative in what I am about to say, but I think it is an important point to make. It goes back to your previous point, Professor Whitty, about the need for the basics to be done better in the healthcare system and the NHS in order to be able to tackle the AMR challenge. Things like beds in corridors; not having paper records, with doctors walking around the hospital having to treat patients in such a way; staff under pressure, and cleaning staff being cut, are

basics, are they not?

Professor Sir Chris Whitty: Yes, even if AMR did not exist, none of us would want to see corridor care. In a sense—I do not want to confuse the different issues—

Nesil Caliskan: I am not trying to be provocative. I am just trying to get a sense of how those things not being in place helps this area.

Professor Sir Chris Whitty: In broad terms, hospitals being run efficiently and effectively, and people being able to have proper bed spacing, all contributes to an overall downward pressure on the transmission of infections in hospital. A lot of antimicrobial resistance is spread through transmission in hospital.

Q46 **Chair:** I just wonder whether, within the medical profession, the sorts of very basic things that Nesil Caliskan has been talking about have been slightly forgotten. We are seeing upticks in things like MRSA. The things that Nesil was talking about—hospital cleanliness, or aspects of hospital design—may well be mandated, as you said at the beginning, Professor Whitty, but have they been slightly forgotten and are they not upheld as much as they might be?

Professor Sir Chris Whitty: Basically, we have to constantly say this to people, and it is not just doctors and nurses. For example, someone who is handing around teas has to do exactly the same thing, and so on. It is about getting these issues right, and a lot of that depends on explaining to people that, by doing this, they are not just going through a routine but leading to a reduction in both an immediate and a long-term threat. When people realise that, they understand it.

In some areas, we have gone slightly backwards as a result of covid. In others, we went forwards. People were much better, for example, at decontaminating their hands, but they have tended to swap over to alcohol gel, which is fine for some infections, but does not help you at all with norovirus, for example. The same is true for some of the things for which antimicrobial resistance will be relevant.

We just need to get people back to some basic procedures. You are absolutely right that some of the successes that we have had, which really were very significant, were based on very basic things, such as washing hands and changing gloves between patients, and really quite simple measures, such as the proper cleaning of hospitals. They led to a reduction in some of the highest-risk infections that are transmitted in the healthcare setting.

Q47 **Nesil Caliskan:** My final question is on the UK's preparedness for AMR becoming an acute emergency. The Report details that the Cabinet Office currently distinguishes between acute and chronic risks, so will you say a bit about that? The Report also identifies that AMR is one of 26 chronic risk drivers. There is a potential that, although it is classified as chronic, it could very easily become acute. With that in mind, are you able to give

us a sense of how prepared the UK is, should it become an acute emergency, and to what extent we can compare it to covid, for example?

Professor Sir Chris Whitty: As I said in a previous answer, which I will slightly expand, it is very important that we keep it on the risk register. Dame Sally got it on to the risk register, and that was completely correct. "Acute" usually implies that things come in waves, essentially. Most of the time, AMR is at a high level, but it is not coming in waves. It is there the whole time. In a sense, that is the reason to call it chronic rather than acute, but it must be front of mind.

I have not been involved in this until much more recently, but successive UK Governments have taken AMR seriously really since about 2000. The key to that is integrating all the different components—the food elements, the animal side, the hospital side, and work in the community. We need to keep up the pressure to continue to do that, which is why it is very important that it is there.

If there was a sudden wave of antimicrobial resistance on a particular organism, it would very much depend on what it is. The UK's science base is outstanding, and we saw that in covid. UKHSA has very strong capacity. The question, though, as we saw in covid—and we have seen it in other emergencies, to be honest—is about our ability to scale up. Our initial science and understanding of the problem will be good. If there were a problem that required a very large scale-up, we would probably face greater pressure. That is just a practical reality, not just for this, but for many other threats that we face.

Q48 **Nesil Caliskan:** How do you test how prepared the UK is? There might be indicators that the Department is looking at as part of the process of putting it on a risk register and then managing that risk. Could you give the Committee a bit more of an understanding of how you test the UK's preparedness for a scenario in which something moves from being chronic to acute?

Professor Sir Chris Whitty: I will have a first go at this, and Professor Hopkins will then probably want to add to it, because she has done a lot. The first thing that you need is an overall structure that has multiple components to it—the research, the basics, all the components that we have talked about so far—and is monitored. The various mechanisms that are laid out in the NAO Report are very important for that: "What are the Government as a whole trying to do about this? What are the building blocks?" We have always scored quite well when people look at our plans, and that is mentioned in the NAO Report. I am always a bit nervous about this, because it can lead to a sense of complacency. We scored very well on our pandemic preparedness plans.

Q49 **Nesil Caliskan:** Are those the local resilience plans?

Professor Sir Chris Whitty: No, this is more widely.

People internationally look at the plans and score them and say, "The UK has a very good plan and all the basic blocks in place." That is good. We have a plan; it is a logical one and it meets international norms. The question then is, "What can we do about that? Can we do the scaling up?" That really depends on a whole bunch of different capacities, some of which are in UKHSA, some in the NHS and, in particular, some in agriculture. It depends on whether it is an agricultural risk.

In terms of the specifics, we clearly always need to be scanning the horizon for human infections, but also for animal infections, because many of the big risks, not just in pandemics but also from AMR, tend to come as a jump from animal areas. For example, something in the UK called the HAIRS group combines veterinary and public health expertise to look around the world and ask, "What are the things that are coming up, and are we ready for those?"

It is very important that we constantly look out for new threats, because the probability is that something of the wave sort, as opposed to the chronic background problem, is statistically much more likely to come from another country than from the UK, just because it has to arise somewhere, and then it spreads internationally. Susan, do you want to add to that?

Professor Hopkins: I would just highlight that, when we talk about antimicrobial resistance, we put all bugs and all resistance together into one big barrel, then think about the systems that we need. Actually, if you were thinking about acute, it is likely that it would arise on a particular organism with a particular resistance, where we did not have a treatment. As an example, if we suddenly started seeing really rising rates of gonorrhoea, we would be treating that as an acute risk and managing it as an acute problem, in terms of what we would need to do about it.

Another example is a pathogen, such as campylobacter, that interacts between the human and animal interface, where we are more likely to get it from the food that we eat, or from interaction with animals. Again, if we saw that we were unable to treat it when we needed to, we would be acting on that as an acute risk. We are constantly horizon scanning across all the pathogens and where they live across the world.

Secondly, we are exercising, which is really important. Many of the exercises that we do to look at how prepared we are would include an element of antimicrobial resistance. We may be exercising for flu, and we would think about antimicrobial resistance in flu, or we may be exercising on gastrointestinal salmonella and thinking about resistance in that.

From our point of view, we have to think about it in each of the modes of transmission and in each of the pathogens that are there for an acute risk, as we would for others. From the point of view of a chronic risk, it is much more about the systematic and systemic structures that we need to have in place to mitigate.

Q50 **Nesil Caliskan:** That is really helpful, because one of my sub-questions was about the decision to move something from chronic to acute, and to what extent it is about the prevalence of the disease, if you like, versus its severity on an individual. Millions of people might have something, but that in itself does not give it an acute categorisation, because it might not result in death, whereas something with lower numbers might do. Is that a fair understanding?

Professor Hopkins: We think about it in terms of the risk and the impact. What is the likelihood of a risk occurring? What is the impact on the population? As an example of antibiotic resistance, take Staphylococcus aureus. They are pretty much all resistant to penicillin, but we have lots of other antibiotics that we use to treat it, so we do not worry about that risk that emerged within months of its first being treated with penicillin. That is one of the things that we are always fighting with, and one of the reasons why we need new drugs and vaccines, because those are ways to mitigate the impact of antimicrobial resistance, not just trying to be in the inevitable war against the bugs themselves, which will mutate to whatever they are faced with.

Q51 **Nesil Caliskan:** You have answered this, but just for absolute clarity, the Report talks about workshops that were held in 2024 for local resilience forums post some of the covid inquiry work that had been done. We know that the local resilience forums were so important during the covid pandemic, but the exercises that were held in 2024 did not incorporate an AMR dimension.

From your answers, I gauged that you are not concerned that they did not specifically incorporate it. The Cabinet Office has since said that it is confident that there is preparedness, but I just want to confirm that there is not an element of questioning that we are missing. Is there something that we should consider further, given that they were not specifically included in those workshops?

Professor Hopkins: Again, wherever we are exercising, we consider whether we could add antimicrobial resistance to the exercise. Sometimes it is suitable, and sometimes not. During covid, we had no antibiotics or antivirals at all at the start, and needed to develop new ones. That is a scenario that we may face for any new pathogen that arises.

Professor Sir Chris Whitty: Just to take another real example, we anticipate that if we have a major flu epidemic or pandemic, it would evolve resistance to the flu antivirals probably quite early on in the wave, and you would then be left without an antiviral at all. It is not just bacteria, although most of the conversation is about bacteria; it is also true for viruses, parasites and fungi.

Chair: Your remarks on animals, Professor Whitty, segue us nicely into Peter Fortune.

Q52 **Peter Fortune:** I very much enjoyed Sir Chris answering a question with

a glass half full and half empty simultaneously. I am going to use a Schrodinger's glass answer in the future.

Let me turn to Abigail. Over the last five years—this is glass half full, I suppose—the targets have been hit, broadly, so what have you done? What has been your approach to achieve that?

Abigail Seager: You are quite right that the target that was hit in NAP19-24 was achieved on the animal side, that being a 25% reduction in use, which we hit in 2021. That continued reduction has meant that we are now at a stage where we have the lowest ever use, with a 59% reduction since 2014. Additionally, the sales of the highest-priority critically important antibiotics have reduced by 82% since 2014, which means that they are protected for use in humans at the stage at which we need them to be used.

Much of that has been achieved through stewardship and the work that we do with vets and farmers, who have really embraced the understanding of the problem statement that we have, and the way in which they can face into looking at both prescribing and use. That has been a major part of the success, as has all the work that we have been doing in surveillance to understand the prevalence of the diseases and the risk of resistance. We have focused specifically in pigs and poultry from a risk point of view, but we are gathering more data across the species, especially working with RUMA, which is assisting in the sector-specific species groups.

Q53 **Peter Fortune:** What was the thinking behind focusing on pigs and poultry?

Abigail Seager: It was based on the risk of disease brought by those specific species and the way in which they were farmed at the time—this was a historical decision—being quite intensive, which would, in itself, without additional biosecurity, mean that there is an additional risk factor. It was quite a Europe-wide decision, taken by many countries, to focus on pigs and poultry.

Q54 **Peter Fortune:** You touched on it briefly, but what are the risks of limiting surveillance to those species?

Abigail Seager: Of course, we need as much data as we can get across all the species. The risk-based approach meant that we were focusing on the information that we felt was most important, the target being to increase surveillance across many species, including companion animals, equines and ruminants. We are looking to do that through our work with the species sector groups. Increased data will help us to understand prevalence and to achieve increased targets as we move forward.

Peter Fortune: Sir Geoffrey, we were talking about pedigree animals. Remind me of what you were saying.

Q55 **Chair:** I do not know whether you were present for the previous panel, but Lord O'Neill said that, for certain antibiotics that are really sensitive,

he could not see any use in animals at all. I wonder whether there is a bit of a compromise here. We could use them, say, for the most valuable pedigree animals, but not for those animals that are in normal commercial use. Within your profession, is there something in that?

Abigail Seager: I did hear the comments specifically about colistin in the previous evidence. Our work has been focused on stewardship rather than banning the use of certain antibiotics. That is really because, if we push prescribing into a selective state, we could end up utilising the wrong antibiotics to a greater extent than we had intended to.

What is really pleasing with the stewardship approach is that we know that, for the third year in a row, there has been no colistin sold for use in animals at all, and we have almost never detected colistin resistance in UK livestock. The approach that we have means that we do reserve the right to use colistin when needed. I do not know whether pedigree is the right group—maybe everyone will have their own preference—but we do reserve our ability to utilise the antibiotics in that environment. At the minute, we have not had to, because of the engagement that we have had in the stewardship space.

Q56 **Chair:** We talked in the pre-panel, but have not yet got to it in this hearing, about diagnostics. How is diagnostics in animals progressing? Clearly, we want to make sure that the right antimicrobial is prescribed for the right disease. Is that improving in animals?

Abigail Seager: From a diagnostic point of view, the veterinary profession is a private industry and does not have the value of the NHS. Diagnostics are used a lot by the veterinary profession. I do not have any information about issues to do with access to them or about problem statements that would arise from a lack of diagnostics. It is not something that we focus on in terms of the regulation of medicines.

Professor Sir Chris Whitty: I am going to back up something that Lord O'Neill implied, which is that, bluntly, at international level, the relationship between public health approaches in humans and in animals has often been at cross purposes, and you get stand-up rows between the human health experts and the vets. That has not happened in the UK. We have benefited hugely from a very close relationship with the vets here, and I am very grateful to them from a human health perspective, but this is a big issue internationally.

Colistin is one of our last-line-of-resort antibiotics. Our view would certainly be that you would not want to be using that except under incredibly restricted circumstances for particular infections in very specific animals. You do not want to have widespread use, because, inevitably, that is going to lead to spread over the wider environment.

Q57 **Chair:** Sir Chris, just as the UK led the world in getting this on to the agenda at the UN, what more can we do to address that problem? Clearly, if there is a lacuna in worldwide prescribing in animals, that is a

danger to all of us.

Professor Sir Chris Whitty: The simplest answer to that goes exactly back over what Abigail just said. The livestock industry is an industry. If the expectation of the public who are buying, of the supermarkets that are buying, and of trade regulations is, "You cannot use antibiotics except under very restricted circumstances," use will go down. If that is not in place, use will go up, because it leads to animals getting fatter more quickly, to simplify it somewhat. It is important that we concentrate on these issues of trade, because it is through trade, rather than through other mechanisms, that the pressure comes.

Q58 **Chair:** That is a really important question. When it comes to negotiating a trade deal—the one with the United States was mentioned this morning—how much of an input do you, on the health side, have in advising on those matters?

Professor Sir Chris Whitty: We can advise.

Chair: Perhaps we will leave it there. Anna, who may be more of an expert on this, will come in in a minute, but we will leave that answer hanging, because it is really important.

Q59 **Peter Fortune:** Abigail, I started with the glass half full, so I will switch to the other side, but I am not being mean. Congratulations on hitting the targets, but let me ask gently: were the targets challenging enough? Could they be stretched?

Abigail Seager: It is a massive success that we reached those targets and, of course, went beyond them in terms of reduction. They were quick wins, if I am honest. We anticipate those reductions in use to plateau, and we have seen that. We publish an annual sales report, and we have seen that usage has plateaued somewhat and, in some areas, increased because of disease issues that we face in specific species.

The targets for the next year, as we have heard across the panel, have to be specific to what we can achieve, and realistic, so that we do not face a situation in five years' time where we are looking back and saying, "We have not achieved and have not moved forward." I do not think that we should be setting ourselves the same targets again.

The RUMA targets taskforce is working with all the species sectors so that, by the end of this year, we should publish specific sector targets that will take us all the way through to 2029, which will be realistic to the species group that we are referring to and can build on what we have achieved, while understanding that we had those quick wins and we expect further progress to follow not quite as strict a trajectory.

Peter Fortune: I love an answer with a specific timeframe. Thank you very much.

Q60 **Anna Dixon:** Before I move on to human health, I want to press this point. I was very taken with what you said, Sir Chris, about the fact that

some of this resistance can jump from animal to human. As we have seen in some of the diagrams, one of the pathways is via food. Having left the European Union, what are we doing to ensure that our food standards are not being diluted by some of the trade agreements, thus increasing our risk of exactly this point of resistant things coming into the UK via imported foods?

Professor Sir Chris Whitty: The UK starts very much from a position of wishing to minimise the risk of antibiotic contamination of food, and antimicrobial-resistant organisms on food, entering the UK market. I am not a trade negotiation expert, but, to make an obvious point, people bargain in all sorts of ways. That will always be an aim of ours. There are very strong phytosanitary standards across much of Europe and many of our trading partners already. Nevertheless, as a public health person, I would wish to make sure that those are pretty central to the way we view things—but, clearly, in a trading negotiation, everything is on the table.

Q61 **Anna Dixon:** Would you like to add anything, Ms Seager, in relation to animals?

Abigail Seager: I heard mention in the previous session of the use of antibiotics for growth promotion. Just to be clear, in the UK and anywhere in Europe, antibiotics are not used for growth promotion in animals. That is not the case throughout the globe. It is important that we have residues plans in place when we are trading. It is not my area of expertise, as Professor Whitty has also mentioned, so I will not go into the details of what should go into a trade agreement, but it is important for us to know what the situation is in the countries with which we are trading.

Q62 **Anna Dixon:** Yes, indeed. It speaks for itself. So there is a higher risk as we move outside and start to import food from places other than the European Union, where we can be confident of that type of biosecurity and standards, and from countries that have lower standards than the UK. In your view, that situation is likely to increase our risk here in the UK.

Professor Sir Chris Whitty: Inevitably, if we are trading, as we will and do, with countries that use a lot more antibiotics in farming, we need to take measures to mitigate the risk to the UK public.

Q63 **Chair:** I agree with you. In a trade negotiation, it is give and take, but the one thing that ought not to be given is any idea that we are going to weaken our health and AMR vigilance and effectiveness. Really, your advice ought to be paramount in this.

Professor Sir Chris Whitty: As a public health person, I am unlikely to disagree with you, Chair, but it is a political decision. Those of you on that side of the table possibly have more influence over this in some areas than people in the technical trade.

Q64 **Anna Dixon:** We should note that there is a risk and it is not currently

being factored into some of our trade deals.

I want to come back to human health and international comparisons. We have talked about animals, in which there are certain countries that are making much higher use. The league table on human use of antibiotics probably does not look that different, with the US topping out at some 24.5% in average resistance to antibiotics, compared with 10.8% here in the UK. We are doing better than some places, although, as we heard earlier, Denmark and the Netherlands are at 5.7% and 7.3% respectively. I am referring to figure 2 of the NAO Report. In terms of relative preparedness, do we really understand why resistance levels are lower in Denmark and the Netherlands? What can we learn from them?

Professor Hopkins: First of all, when we look across Europe, there is an east-west, north-south divide that you can see in antimicrobial resistance. The further north you are, the lower the antibiotic use and antibiotic resistance. That has been in place for a very long time and is not something that happened overnight. There are reasons for that that we can unpick. The further south and east you go, the higher the rates of antibiotic use and antibiotic resistance. They are related. The relationship is not something that you can change in a single year, which is why you need multi-year plans. In our comparisons with Europe—and we were very involved in looking at it in Europe—we sat in the top 25%. We were not in the best group, which was very much the very northern countries, but we sat in the upper groups to the middle.

I would highlight that, in the Nordic countries, there are differences in the underlying health of the population, vaccination uptake is high across all groups, and underlying social determinants are narrower. There are different health outcomes in general. All those things drive antibiotic use. If you smoke less, you will have less antibiotic use. If you have fewer respiratory conditions and better air quality, coming back to some of the conversations earlier, you will have less antibiotic use and, therefore, drive less resistance.

There is also a component around migration and travel. Countries such as the UK have a very large migrant population, inward and outward, and a travel-associated population. That will allow us to have ongoing incursions from the rest of the world. That is an important part.

My view is that, looking very carefully at the EU, which has set new targets, we are very close to meeting or have met a number of them. We are much better on MRSA, because of 20 years of work on it—it is not a single year—we are at the target for resistant E. coli, and we are at only a tenth of the EU target is for resistant Klebsiella.

For some cases, we are much better than the overall targets, but I still think that, if you look at the northern European countries, we have to learn about how they have used electronic prescribing, how they have linked electronic health records really well so that they understand the risks better, and how they have optimised the general health of the

population to drive down antibiotic use. We will need to continue to use all of those system measures to keep our antibiotic use as low as possible and, where possible, reduce it.

Q65 **Anna Dixon:** We will come on to inequalities, but I am guessing that you have given some of the answers there around underlying social determinants and better health. On the specifics of migration, is that an issue for broader biosecurity? Are there any measures that can be taken to mitigate our higher risk?

Professor Hopkins: The first thing that I would say is that, clearly, inward migration adds a lot of value. Many people migrate to provide health and social care to this country and to other sectors, so we need inward migration if we are to be able to provide the health and care that we need.

However, we need to ensure that, as people arrive, we get them up to date with vaccines, provide them with GPs and make them aware of the different practices that we have here compared with some other countries—for example, not having over-the-counter antibiotics, and not having an expectation for an antibiotic when you are ill with illnesses that are prevalent in other parts of the world. Those sorts of healthy components of life are really important, as is ensuring that they have access to healthcare when they need it, so that they get the right treatment at the moment that they need it, rather than waiting, as they may do in other countries. All those aspects are important. That is the constant challenge that we have, and this is why AMR is a global issue rather than a local one. We have to work globally to reduce the impact of antimicrobial resistance globally in order to reduce the impact here.

Q66 **Anna Dixon:** I am glad that you said what you said. We have an excellent primary care practice called Bevan Healthcare, which is specifically set up to provide specialised primary health and medical care both to asylum seekers in hotels and to recently arrived refugees, so that they can better help meet the needs of people coming in and, as you say, make sure that they are getting that proactive and preventive healthcare on arrival.

I want to go back to some of the issues that we heard about in our pre-panel around the NHS. We have heard that it is challenging at the moment, with some of our rather outdated estate, to maintain the sorts of hygiene standards that would help to keep infection low, particularly in hospital settings. That would extend, I am guessing, to some of our community facilities as well. How reassured can we be that sufficient capital investment and the way that the new hospital programme is designed will deliver a higher level of infection control?

Professor Sir Stephen Powis: You will not be surprised if I vehemently agree with you that our estate is, in many cases, not fit for purpose for a whole range of things, including infection prevention and control. You heard that from the pre-panel. That goes from our ability to clean

effectively through to water and wastewater management, and to an excessive need to move patients around from ward to ward, which increases the risk of infection.

Lord Darzi said, "The NHS has been starved of capital and the capital budget was repeatedly raided" to cover day-to-day expenses. We have not invested in the hospital estate in the way that we should. There is an issue with backlog maintenance, which I know this Committee has discussed before, and there is, of course, a need to replace estate with new hospitals.

What are we doing about it? Our infection prevention and control teams have been working closely with the new hospital programme to ensure that the ability to have effective IPC measures is at the heart of development work around the standardised Hospital 2.0 that you have heard about. You will have heard me champion—I am pretty sure to this Committee, but certainly to the Health and Social Care Committee—the need for a move to single rooms, which allow much better infection prevention and control. They reduce the need to move patients from one area to another. When you cohort because of infectious diseases, you are moving people around. With single rooms, you do not need to do that. Of course, there are privacy and dignity aspects as well.

There is a whole range of measures that we can take when we design new hospitals, some of which we can also take in terms of backlog maintenance, but not as much, as you heard. I can absolutely assure you that we are working closely with the new hospital team in particular to ensure that those principles are embedded in future builds.

Q67 **Anna Dixon:** Does that factor in human behaviours in terms of the basics that we were talking about, such as hand hygiene, with accessibility to sinks?

Professor Sir Stephen Powis: Yes, all those things. Everything from cleaning to inappropriately placed columns that are difficult to clean will add to the totality of the difficulty of maintaining the highest IPC standards, which has the consequence of hospital-acquired infections increasing.

Q68 **Anna Dixon:** As hospitals' budgets have been squeezed, has there been any concern that there has not been the appropriate level of cleaning, particularly with outsourcing? Is there any evidence of a difference between insourced and outsourced cleaning?

Professor Sir Stephen Powis: I do not have that evidence. As Sir Chris has said, there is a clear understanding, particularly but not just in hospital settings, of the importance of infection prevention and control. You heard mention previously of the national infection prevention and control manual, which has been a real step forward in terms of standardising the basics of IPC practice, but also layering on top infection-specific or microbial-specific actions that need to be taken.

Clearly, there are challenges in the estate at the moment and, until we have a fit-for-purpose estate, those challenges are going to continue.

Q69 **Anna Dixon:** We received evidence from the Royal College of Pathologists, and it was reiterated in our pre-panel, that there is a workforce problem here too, with a 20% shortfall in consultant medical microbiologists and a 14% shortfall in consultant virologists. Taken together with the problems that we have just talked about with the estate, how is that being further worsened by the shortage in the medical workforce?

Professor Sir Stephen Powis: As you know, the NHS has a long-term workforce plan, which is an important step forward in securing the workforce that we need in the future. You will know that that is being discussed with the new Government in the context of the 10-year plan that is being developed, so that is an important step on workforce overall.

On medical training in particular, which you heard about from Dr Partridge, we are aware of issues in terms of training pathways, which is the reason that Chris and I are currently undertaking a major review of postgraduate medical training. It has been 15 or 20 years since we last did that, and things have moved on, so we need to ensure that we have training pathways that mean that there are people going into those specialties, for the reasons that you have heard, although microbiology is not the only specialty that you might hear those concerns from.

Q70 **Anna Dixon:** I did not realise that it was necessary to declare this, but my husband works for the London School of Hygiene and Tropical Medicine, which does postgraduate training in some of these subjects, so I probably should put that on the record. I have not really thought of it being relevant, but I suppose it is.

Addressing those workforce shortages seems critical. Can you give us an idea of what sorts of things they do? We have heard a lot about all the prescribers needing to know what to do. That is about general medical and pharmacy training. What do these very specific doctors do?

Professor Sir Chris Whitty: Steve has a problem here, because both of us are—

Professor Sir Stephen Powis: Yes, I was about to make that point. I will take the question, but I am very aware that I am a mere renal doctor and I have two infectious diseases doctors sitting next to me, so the ball will be passed at some point.

The first point that you made is the important one, which is that most prescribing is undertaken not by specialists in infectious diseases or microbiology, but in general practice by general physicians, and by people like me—kidney doctors. This is something that everybody needs to know about, not just those who are in infectious diseases or microbiology.

Having said that, of course, there is a huge requirement for expertise in those areas. In microbiology, virology and infectious diseases, that expertise exists, and it is really important, but to discuss the range of what they do, I am going to hand over to the people who do it.

Q71 **Anna Dixon:** Let me flip the question. Why is a shortage of these particular specialists a threat to us achieving what we need to on AMR? Let us make it really specific.

Professor Hopkins: The first thing is that these people are the curators and leaders in antimicrobial stewardship and infection control in hospitals. In a particular way, they help ensure that the national guidelines are translated into something that can be locally usable. They walk around the wards and ensure that anyone who is having trouble figuring out what to prescribe to an individual has immediate availability of advice from an expert who knows what is happening.

They also act as the interface between what is happening in the laboratory and in the clinical space, so are able to ensure that the right diagnostic tests are available and that the results from those diagnostic tests are applied in the right way to give the right treatment to the right individual.

They provide input into infection control to the built environment. Any builds that are happening will have input from the infection control doctor, the microbiologist and the virologist in terms of how that might impact and affect infection control.

They train people on every aspect of infection control and antimicrobial stewardship in hospitals, as well as outside in the wider community and the wider population. Their role is really as the focus and nexus of specialist input to all the generalists in primary and secondary care.

Q72 **Anna Dixon:** Some of that could be replaced. We have talked about other countries having e-prescribing and EPRs. We are talking about AI decision support. Are there better and more efficient ways in which we can make sure that every generalist has, at their fingertips, the right sort of decision support in terms of ensuring greater adherence with the guidelines?

Professor Sir Stephen Powis: Yes, which goes back to my point that most management of infectious diseases is not undertaken by specialist ID doctors or supported by microbiologists, but by general physicians or physicians in other specialties. One of the advantages of having electronic records is that you can embed the decision support—guidelines, essentially—into those systems. I absolutely agree with you, and I am sure that Susan and Chris would too.

Q73 **Anna Dixon:** I would like to come now to the issue that has been highlighted about those who are more at risk of antimicrobial-resistant infections: babies, the elderly and those with compromised immune systems. We have also touched on this in terms of deprivation and

ethnicity. There are various theories about why this might be and how we might deal with it.

We talked about the focus in the new plan on social care, but there are also people with quite complex health needs and high levels of disability. I have a constituent who is caring for a daughter who has a tracheostomy and finds it incredibly difficult now, when she has a concern about an infection, to get an immediate response in terms of confirmation of an infection—we talked earlier about point-of-care diagnostics. As a result, the only thing that she can do is go to A&E every time, so she is taking this already vulnerable child with a tracheostomy to A&E when she is concerned about infection. It is delaying the response in terms of getting the right care, while increasing the risks of things like sepsis.

That is just an example of where healthcare is not working at the moment for people who at higher risk. What more do we need to be doing to protect these groups from resistant infection?

Professor Hopkins: You have touched on a number of things. The first is pathways to care. It is really important to ensure that, when somebody has complex medical needs, they know how to access care and, if there is a scenario like this, they know what to do if there is a problem and how to access it.

The second is to ensure that they know what diagnostic tests are available to them and how to access those. In some cases—perhaps not the one you mentioned—such as cystic fibrosis, they may have emergency back-up antibiotics that are decided by the hospital, based on their previous infection. In some cases, that also happens in those who are immunocompromised, such as haematology patients.

The biggest things are that there is a pathway for care, that there is access, that they know how to contact people, and that there is a treatment plan in place for episodes of infection. That is what makes the biggest difference for individuals.

Q74 **Anna Dixon:** Given that that is clearly not in place for my constituent, what is the expectation on the NHS that it should be doing those things?

Professor Sir Stephen Powis: There is an expectation. For instance, in recent years, we have been putting more support into care homes, where urinary tract infections are a particular problem with respect to AMR. I mentioned Pharmacy First, which completed 4.4 million consultations as of the end of last year. Of those, 1.7 million were for clinical pathways and 1.1 million for minor ailment consultations. That is giving the public alternative access points into the treatment of minor illnesses, including common infections.

GPs are under a lot of pressure at the moment—you know that—due to the demographics of the population and the headwinds we talked about in terms of increasing complexity and multiple conditions. It is important that we provide more than one access point to manage infections, and

that the public are aware of that. Chris and I have been absolutely clear that, in introducing those additional access points, we need to be sure to minimise any potential adverse impact on antimicrobial resistance, which is what we have done with Pharmacy First.

Q75 **Anna Dixon:** Is there anything you would like to add, Professor Whitty, on the social determinants?

Professor Sir Chris Whitty: People underestimate the degree to which almost every one of the risk factors that we think of—I am going to call them social determinants for the sake of argument—including smoking and obesity, increases the risk of infections. Crowding definitely does. At one level, it is not particularly surprising that people who live in areas of poverty and deprivation are more likely to get infections because they are in an environment where they tend to accumulate risks.

A very significant problem more widely is that people tend to get ill maybe a decade or more earlier than they do in areas of affluence. Once you get into the healthcare system, you are going to have, in addition, significantly increased risks of getting antibiotics and coming into contact with people who have antimicrobial resistance. People get into a situation where AMR is more likely, for several reasons, when they come from areas of deprivation. Many of those, sadly, are largely preventable. The fact is that that is the situation and that is what we need to try to address.

Going back to almost the first question that we dealt with, if you want to improve things in 2040, getting ahead of all these big risk factors is really the best way to do that, because it means people do not get infections and, therefore, you do not even start down that path.

Anna Dixon: Thank you for your clear answers.

Q76 **Chair:** We have had evidence from Dr Wendy Thompson that declining access to dentistry in the UK has emerged as a key driver of AMR. Is that something that is on your radar?

Professor Sir Chris Whitty: We had a whole session on dentistry. The need to preserve antibiotics for when you need them is as essential in dentistry, where, of course, people have serious infections and need antibiotics, but you need to make sure that they are restricted—and restricted to the narrowest spectrum possible, so those that do not cover multiple bugs at the same time—to achieve the aim of improving dental health.

Q77 **Mr Betts:** I have a number of questions on the 2024 to 2029 national action plan. Is it ambitious enough? We talked before about not being too ambitious, because you do not hit targets and everyone feels that it is not really quite worth while. On the other hand, you want to be ambitious enough to achieve everything that you can. Are the targets ambitious enough? There are not really any timelines, are there, for achieving them?

Professor Hopkins: All the targets that are in the current national action plan for now are there to be met by 2029. They are going to be met only by year-on-year reductions. We definitely will not make any of them if we wait until 2028 before taking action, so there is already work in place to look at those across all the components that are there.

In my view, the fact that we stay steady is a reduction compared with what you would expect to see with increased diagnostics, an ageing population, and increased healthcare demands. Any reduction is going to be challenging for us to achieve, and we need to recognise that.

If we are overachieving—and I hope that that is the case, but I do not think that it will be—we will review those targets, reset them and look at them again. If we hit our target in 2027, we would not sit back and say that we need to do nothing. We are in a place of wanting continuous improvement, and that is what we will look for.

Q78 **Mr Betts:** One of the targets that you have changed is on drug-resistant infections. Now it is to pursue no increase in infections, not a decrease.

Professor Hopkins: Again, coming back to what I said, no increase in the absolute number of infections, which is where it is coming from, is a decrease, given the population size increase, the ageing population, and the comorbidities of the population, if you took it and were able to adjust for all of those complex factors. What we are trying to do is give something simple to the public, so that they have a simple number that they can see and monitor, and we will, hopefully, be able to engage with them on why we are doing that, rather than trying to put out a very complex age, sex or comorbidity-adjusted number that we then have to have real complexity in explaining.

Q79 **Mr Betts:** But you are going to have to explain what it means to simply keep it level. You are saying that it is really an improvement, but you still have to do all of that.

Professor Hopkins: Yes, exactly. We have to do all of that, which is important, but everyone will be able to see and talk about a number that is not changing, rather than about an age, sex or comorbidity-adjusted number that would be more difficult for us to explain to people over time.

Q80 **Mr Betts:** The target for antibiotic usage in humans was a 15% reduction, but is now a 5% reduction.

Professor Hopkins: It is a 5% reduction over the next five years from 2019. Given the fact that we have had the changes in the pandemic, the aim is to have a year-on-year reduction from where we are now. Again, I would say that that 5% reduction will be challenging, given the ageing population that we have and increasing prescriptions for underlying conditions. However, if we can show that we are able to meet this and are achieving it, we can review it. If we set something out that people fail to go towards over the first year or two, we worry that they will decide

that there are other priorities to be met in other places, rather than continuing to focus on antibiotics.

Q81 **Mr Betts:** Is it really right that if you say to someone, "This is a really challenging target," they are less likely to meet it than if it is an easier target that they know they are going to hit?

Professor Hopkins: People disengage to some extent. We saw that when we looked at the previous targets, particularly for gram-negatives, where people said, "We cannot meet that. I have 10 other things that I need to meet in healthcare, and a lot of other competing demands. We will focus our attention on the areas that we will succeed in." It is about finding that balance, driving attention to the area and finding something that is achievable and measurable, versus doing something where people will say, "We are not going to be able to do this," and clinicians will feel that they are under pressure to not prescribe and will do harm.

Q82 **Mr Betts:** Abigail Seager, there are no targets in the plan for reducing antimicrobial usage in animals, are there? It is dealt with elsewhere. Why is it not incorporated into this plan?

Abigail Seager: As I said previously, the targets will be set by the end of this year and will be relevant through to 2029. Those will be set by the species sectors, because it is important that we have a target that is realistic per sector. As I said earlier, we anticipate that use will not decline to the same extent that it has done in the previous five years, because there was such a dramatic tail-off. However, it is important that the targets that are set are ambitious and realistic.

Q83 **Mr Betts:** But it is dealt with separately, and animals are not included in this plan.

Abigail Seager: The targets will be set as part of the overall programme that we will be monitoring.

Q84 **Mr Betts:** Let me move on to diagnostic tests. As we have mentioned, the way in which they are used in Scandinavian countries, in particular, is so much more developed. Is that simply a product of them having a much higher-tech health system that can deal with lots of data, and where the different parts of the system can talk to each other in a way that our health service does not?

Professor Hopkins: It is a scale issue. All the Scandinavian countries are much smaller than the UK. Within the Danish system, they are having to communicate with fewer hospitals and community services than we have in England. However, I would say that this is more than just diagnostics. In Scandinavia, in particular Denmark, they use similar levels of diagnostics to us in terms of blood cultures and urinary tests when you are received in hospital. They use, and have traditionally used, some more point-of-care diagnostics for things like sore throat, which have been assessed in this country as well but not routinely implemented.

Q85 **Mr Betts:** Point-of-care tests were mentioned before. They are available. Why do the Scandinavians use them so much more than we do?

Professor Sir Chris Whitty: To situate this, can I say a bit more about diagnostics? They were touched on in the last panel, but there is a danger of getting different things confused. There are diagnostics that are generically to find out if you are sick enough to need an antibiotic. You are not asking the question, "What is the infection?" That is what a CRP test would be like, for example.

There are diagnostics to rule in a particular infection, which is what we used with the covid test. It did not tell you anything except that you do or do not have covid. There are ones that are wider and tell you which infection you have. Blood cultures would be one of those. A bit later down the line, there are things that tell you which antibiotics you are resistant to. All of those are diagnostic tests.

On the later ones, such as blood cultures, we are very similar to Scandinavia and Holland, and various other areas; our use of those is pretty well identical. We use the severe infection ones probably less than some areas, and some of the point-of-care diagnostics.

The problem with the point-of-care diagnostics is that they tell you exactly what they are designed to tell you, and nothing more. If you do a test that tells you that you do not have covid, it does not tell you what you do have. All it tells you is that you do not have covid. Diagnostic tests are much better at ruling things in than ruling things out.

For antimicrobial resistance, what you really want is a test that tells you that you do not need to give an antibiotic or, if you do need to give an antibiotic, you need to give only this very narrow-spectrum antibiotic, not all the other ones. That is what is useful for AMR. There are wider uses that you can use them for.

In reality, the tests that we have at the moment are not really adequate to do that for many of the situations that GPs and non-specialist doctors in hospitals need to use them for. You cannot go to a GP and have them do a test and say, with confidence, "I can tell you that you do not need an antibiotic." It may be a helpful adjunct, but it is not really strong enough. That is the test that all of us would want, because then they can share it with the patient and say, "I have taken you seriously. I have done the test. The test tells me that you do not need the antibiotic," but we do not have tests that are that reliable.

What we do not want is to get to the point where we are disincentivising people to use antibiotics when they should be treated. For example, if you are dealing with someone in their mid-80s, I would be much more nervous about a GP not giving an antibiotic than I would if it was someone in their 30s, because there is a much higher probability that that will translate into a later sepsis and then into severe disease. On their own, diagnostics have to be seen in their pathway in terms of how

you use them in practice. The way that people use tests, and the way that people imagine them being used, are often quite a long way apart.

I am not going to go on a long diatribe on this. It was one of my areas of research interest in the days when I was a scientist, but the short answer is that doctors and patients do not use tests in the way that they are designed to be used. That is the reality. We are trying to make sure that people who need antibiotics get them, but only those that they need, and that people who do not need them do not get them, but the tests are not yet adequate to allow us to make that really clear differentiation.

Q86 **Nesil Caliskan:** How do you know that 20% of antibiotics being prescribed through primary healthcare is inappropriate?

Professor Sir Chris Whitty: In a sense, "inappropriate" means two things. The first is, "Should you be given an antibiotic at all?" and the second is, "Was the antibiotic that you were given the right one for this particular syndrome?"

On the first of those—and this is a classic example of where, speaking as a researcher, you can be wise after the event—you can do tests that will take a couple of days to come back from the lab. At the end of that, you will say to the GP, "I have not grown anything in the lab, so you gave the wrong antibiotic," but the GP did not have that information when they were sitting with the patient. It is not an accusation that 20% are wrong, but simply an observation that, despite the fact that, with best efforts, they are going with the syndrome that the patient in front of them has presented with, they have come to the wrong decisions, as it happens, but they could have been right.

Q87 **Chair:** In that specific example, what a GP would probably do is say, "I think you have this, and you need this antibiotic. I will do a test and, if it comes back and you need a different antibiotic, I will contact you."

Professor Sir Chris Whitty: That is true. GPs also do two other things, both of which are very good practice. One is that, if they are not sure, they will say, "Come back in a couple of days. If things get worse or you deteriorate, please present earlier than that." Particularly if it is difficult for someone to leave their home, some GPs—and there are good studies underlying this—will prescribe the antibiotic but say, "If you get worse, start the antibiotic, but I do not want you to start it now." That is good practice and there is a good evidence base behind it.

The question about which antibiotic is an even more complicated one, and GPs rightly have some difficulty on this, but what we would want them always to do, as with all doctors, including all of us, is to use the narrowest antibiotic for the infection that is in front of them, so that it has the lowest risk of inducing antimicrobial resistance for all the bugs that they have on their skin, in their gut, and so on.

Professor Sir Stephen Powis: Can I add to Sir Chris's answer on point-of-care testing? I said earlier that I was more optimistic than Lord O'Neill

on point-of-care testing. To paraphrase you, Sir Geoffrey, I think you asked him, "What is it that we should be doing better?" The reason I am more optimistic is that I see lots of innovators and SMEs, but also established companies, coming forward with new point-of-care diagnostics—for instance, lateral flow tests that diagnose more than one infectious agent—so I think there will be an explosion in these.

Chris is absolutely right that we need the evidence base before we deploy them, in particular the cost-effectiveness evidence base. There are risks in deploying them without that evidence base, but we will see more innovation and more applicability in these areas. In terms of what we need to do better, we need a stronger evidence base. When that evidence base is there, we need to be able to deploy them more quickly and more extensively.

Thirdly, on Mr Betts's point about data collection and why we have not done that—it was something that we did not achieve in the last plan—we need to continue on the journey of interoperability. The federated data platform will help extensively there. We need to finish the journey of getting electronic prescribing into all settings, particularly secondary care settings. We need to do some work on coding, because some of this is just the technicalities of how we code diagnostics and prescriptions. Then we will start to get to the point in the future where we can join all these things up.

Professor Sir Chris Whitty: I do want to pay tribute to our GP colleagues, because they do a very good job in the UK compared with many other countries in having the conversation with patients and saying, "You really do not need an antibiotic." That is often quite a difficult conversation to have.

Q88 **Mr Betts:** You say that tests are not yet available to provide that more accurate information for GPs. Is it that they do not exist anywhere, or that they are simply not available in this country? What more should we be doing to try to develop these tests?

Professor Sir Chris Whitty: My view is that none of the tests that are available are sufficiently accurate for us to say with confidence, as a GP or a frontline doctor in a hospital, "You do not need an antibiotic" based on the rule-in, rule-out test immediately in front of you. That does not mean that we will not get there. The CRP test, for example, which was being talked about earlier, is too crude. It will be negative in some people who subsequently turn out to have sepsis. It will be positive in people who have it for other reasons. It is not a perfect test and we should be realistic about how you can use them.

Q89 **Mr Betts:** Finally, on GPs, I mentioned Dr Andrew McGinty, whose Woodhouse practice is in my constituency in Sheffield. He has done the work and his view is that the NHS does not deal with GPs' concerns or involve them enough in these issues, and that there is not the work going on to get GPs to work together and discuss appropriate prescribing of

antibiotics. To the point you just made, which is absolutely right, he says that so many patients just walk into the surgery expecting a pill for everything that is wrong with them. What more can the NHS do to get the message across that this may not be the right thing to do?

Professor Sir Chris Whitty: Stephen and Susan may want to come in as well, but I would say that GPs do a better job of not prescribing when they do not need to prescribe than many hospital doctors do. Every time I am involved in discussing this issue with GPs, they have a very sophisticated understanding of the issue and work very hard on this.

One thing that was in the NAO Report is that a very high proportion of the general public believe that antibiotics work against viral infections, for example. Saying, "Yes, you have an infection. You are pretty unwell. You have flu. Antibiotics are not going to help you" is often quite a tense conversation to have. GPs are very good at this, and we should involve them in these decisions because, in my view, they are literally at the frontline of trying to deal with this often quite difficult conversation.

Professor Sir Stephen Powis: In the work that we have been doing at NHS England, we have had workstreams that are really focused on helping GPs. GPs are really good at this, but, equally, we can provide support. The TARGET—"treat antibiotics responsibly, guidance, education and tools"—training that we developed with Imperial College is a good example of that. We would always want to do more, but there is a lot of work going on to support general practitioners.

Professor Sir Chris Whitty: There are some GPs who prescribe more. When Dame Sally was CMO, she would occasionally write to GPs who were prescribing more and ask, "Should you be doing that?" She was quite a formidable person.

Nesil Caliskan: I bet they stopped after that.

Q90 **Mr Betts:** On a completely different point, we talked about the antibiotic subscription model. Is it good value for money when we are quite a small part of the global health industry? Is it really going to make much difference if nobody else is doing it as well?

Professor Sir Stephen Powis: It is early days yet. The challenge that we were set was to develop a subscription model, which we did. The UK was, if not the first, one of the first countries to do that. We started off with two products in a pilot. We are now extending that through procurement into a number of other products. It is not a competition. We do not know how many products will come. The £1.9 billion that you mentioned is an estimate of what we think it will cost over a number of years.

We need to continue to evaluate. That is a point that the NAO makes, and we would absolutely support that. The final point, which you have discussed previously, is that this is something that we cannot do on our own, and it is important that other countries think about this too. My

understanding—and I have the list here—is that Sweden and Japan have implemented schemes, Canada and Italy are about to, and Switzerland, Denmark, Australia and the USA have proposals. Most of those are based on a variant of the subscription model that we have introduced, but there are other models and approaches possible, and it is important that different countries look at different models. I know that the European Commission is thinking about the use of a scheme that would extend the patent life of antibiotics to give more certainty to pharmaceutical companies in terms of income.

There is a range of models and, in my view, it is good that we should test a number of them, but, as the NAO pointed out in its Report, while we have made good progress in establishing a world-leading model, it does require evaluation.

Q91 **Nesil Caliskan:** I want to ask about environmental factors that might impact AMR resistance. How worried are you about water companies dumping sewage?

Professor Sir Chris Whitty: I have done quite a lot of work on this, including with the Royal Academy of Engineering. In fact, we did a report, which, if they are interested, people might want to take a look at. Broadly, there are two different routes by which human gut organisms, many of which may have antimicrobial resistance, get into our waterways. One is via storm sewage overflows. Today, we had the report that all the storm overflows are now measuring, which is a good start, but they also demonstrate that there is a lot going in.

The second thing is that sewage works, in their ordinary use, are constantly releasing some level of micro-organisms from people's guts. There are ways in which we could reduce that, which is what the report goes through. In sunny weather, when the rivers are low and people tend to swim or kayak in them, that is arguably more important than the storm overflows, so those two need to be seen together.

There are engineering solutions to this, but they cost money. This is, essentially, an economic question as much as anything, but there is a lot that we could do to reduce the risk that AMR poses through this mechanism. Susan and I are both involved in this.

There are also risks from the animal sector, but they are rather different. I have much more of a concern about human pathogens, because they are exposed to the full range of antibiotics that humans get, and animals a much smaller range, by and large. They are also bugs that are optimised for humans and designed to infect us. This is an area that we really need to take very seriously.

One of the problems with this, in my view, is that water has been seen as an environmental issue for many decades. While the sewerage system used to be set up for a public health purpose, almost all the things

against which water companies are measured are environmental rather than public health targets.

I am on the water commission, which is meeting at this time, so unfortunately I am not there, but if I did not have the privilege of appearing in front of this Committee this is one of the points I would be making at that meeting. We really need to have public health goals in our water. This is what the system is set up for, and this is one of the ways in which we can manage down the risk of AMR in our waterways.

Q92 **Nesil Caliskan:** So sewage being dumped in our waterways, rivers, streams and other open water sources is a public health issue.

Professor Sir Chris Whitty: It is indeed.

Abigail Seager: From a DEFRA point of view—although the Veterinary Medicines Directorate is an arm's length body of DEFRA—I have something to say on that in terms of water. We really welcome the NAO's recognition that some of the investment that is planned in wastewater is relevant to AMR. That is a really important link to make, as we have just established.

There was a price review in 2024, which has recently been published, showing that £104 billion was invested across the water sector between 2025 and 2030, including to improve over 1,700 wastewater treatment works, and £12 billion to improve nearly 3,000 storm overflows, all of which contribute, as we have just heard, in terms of the environmental impacts. We also know that Sir Jon Cunliffe is leading an independent commission to reset the water industry, which will publish in the summer and will make some recommendations on how to tackle some of the systemic issues and transform the water sector.

All of that, together with the work that was undertaken in the 2019 to 2024 NAP under the PATH-SAFE programme, will enable us in the summer to put in place some specific targets for this next NAP. I know that it has been a theme of what we have discussed today, but they have to be realistic. The combination of all that information will help drive us putting in place, for the programme for the years ahead, something that can really tackle this element.

Q93 **Anna Dixon:** I want to come back to the issue of public education. You have given examples where GPs are faced with patients and having to do that education in the moment. As part of some of the earlier plans, there were wider public education campaigns. The Keep Antibiotics Working campaign in 2017 to 2019 seemed like it was fairly effective. Public education campaigns are generally quite weak, but that saw a 5% increase. Clearly, when you stop the campaign, it falls back, so it is not maintaining that.

What should we be doing, and are there any plans as part of this current NAP, to address the fact that, for example, 49% of the UK public thought that antibiotics might kill viruses? What more can we do to educate the

public about this?

Professor Hopkins: UKHSA runs a programme called e-Bug, which talks about education right from preschool children all the way through school. My first thing is that we need to ensure that this is embedded in education and in education principles, across everything to do with hand hygiene, food safety, antibiotics and your health. That is really important.

Secondly, as you have said, large public media campaigns—and I was involved in providing the clinical input to Keep Antibiotics Working—have short-term but not long-term effects. We need to think about novel ways of working with influencers and social media, so that there is a community of people out there helping spread the message for us.

Finally, I would say that the most important people—you can see this through any Ipsos or other survey—who impact on prescribing are doctors and nurses. Ensuring that they have the right information, and that they are confident in giving that right information throughout multiple other events where they may be meeting patients, will be important as well.

You cannot do this in one way; it has to be tackled in a multi-pronged way, but we have committed to measuring and doing regular public surveys and looking at the interventions that work in this NAP.

Q94 **Anna Dixon:** You mentioned hand hygiene. During covid, there was a lot of learning and teaching us all how to make sure that we were doing that frequent handwashing, so it is possible to change human behaviour, not through education programmes but with other types of interventions. Is there anything more that the NHS could be doing generally around hand hygiene as well as adherence to prescribed antibiotics?

Professor Sir Stephen Powis: Yes, I have mentioned a range of things in previous answers. We will continue to work with primary care on supporting primary care general practitioners in antibiotic stewardship and IPC. I have mentioned the national infection prevention and control manual and giving more standardised guidance, particularly to hospital settings, on IPC.

Q95 **Anna Dixon:** I am interested in the public, going beyond the professional.

Professor Sir Stephen Powis: This is one way we work in partnership with UKHSA. We run a number of campaigns, but, on public health issues, this would be one to do with UKHSA. There is always more that can be done, and there are always priorities in terms of how you run those campaigns.

Q96 **Anna Dixon:** I was thinking about your winter flu campaigns. I understand that the NHS runs public-facing campaigns; I just wondered why not on this.

Professor Sir Stephen Powis: Vaccinations is a good example of a campaign that we run and that, as Chris has said, has an impact on infections. It is not just campaigns directed at hand hygiene. There is a range of impacts. Clearly, it is something for us to take back and think about.

Professor Sir Chris Whitty: I would add, though, that this is a more complicated campaign than many of the others, because you are saying, "Do not do this unless you need to." That is very different from vaccines or handwashing, where, basically, you say, "Just do it." You do not want to disincentivise people who are moving towards sepsis from presenting to a doctor and then being prescribed an antibiotic, so you have to get the balance right, which is harder than a very binary yes/no.

Q97 **Anna Dixon:** Would you say that the emphasis for public education should be much more on infection reduction than on antibiotics?

Professor Sir Chris Whitty: We need to do both, because what you do not want is for someone to come to the GP already thinking that antibiotics is the answer to their problem, when that is not medically correct. We do need to do that. My view is that what we really need to do, from a public health point of view, is to reduce the risk of getting infection in the first place—no infection, no antibiotic, basically.

Q98 **Chair:** To reinforce that, Sir Chris—Professor Hopkins, you may wish to comment on this as well—there was an article published in the *Journal of Medicine and Public Health* reviewing the Keep Antibiotics Working campaign and awareness raising about antibiotic resistance in the UK, which was one of your initiatives. The review's findings revealed that "it was effective in conveying that antibiotics are not omnipotent but failed to adequately stress the severity of AMR". The paper concludes that "while awareness was raised, a more aggressive narrative-based approach may be needed to drive real behaviour change" in antibiotics usage in the UK.

Professor Sir Chris Whitty: I will have a first go at this. This illustrates part of the issue, which is that we have not adequately made the link between people not needing antibiotics and that being good for them and their family. To imply, as can sometimes happen, that you are at risk if you do not take the antibiotic, and we do not want to give you the antibiotic for the benefit of some future risk to society as a whole, is a very difficult message to give.

There are strong reasons why an individual should not take antibiotics unless they need them. It messes up the antimicrobials in their own gut. It has a number of other downsides. My view is that we should link it much more closely to, "These have downsides, unless you need them," but we do not want to disincentivise people from coming forward if they do have a significant infection. Getting that balance right has always been the challenge in this particular area in terms of communication.

Q99 **Chair:** This is a really important subject, but I think that sums it up. I now have a few sweeping questions. I do not mind who answers, but probably just one on each of the questions.

We have received some rather interesting evidence from B. Braun Medical Ltd to do with IV drips, and washing them out and getting the last 20%. They say that, very often, that is not done; it would be done with cancer drugs, but, because antibiotics are relatively cheap, they just put the drip on, think it is empty, and take it off again, and then it is just chucked away. That is summarising the evidence. Is this something that we should be worried about? The patient is not getting the full dose that they probably need. Could this be breeding AMR?

Professor Hopkins: First of all, the vast amount of antibiotics that we give are oral rather than in injection format, so it slightly different from some of the chemotherapy drugs.

Secondly, a lot of those are given in an injection format rather than by hanging a bag and leaving it there. When the bag is hung, in the vast majority of situations using a device, you are supposed to flush it out. Good practice is that you do flush out these devices after use, so you should get the full dose, because that is the reason you are getting it.

Clearly, if there are situations where that is being reported, we should look at and investigate it, but good practice is that people need the full dose. That is why we are giving it.

Q100 **Chair:** All of you heard the previous evidence. Just to go back to this business about phages and their licensing and regulation, there may be phages out there in the world, but we cannot use them because they are not licensed here. What can be done about that problem?

Professor Hopkins: First of all, there was a recent Science and Technology Committee report, and the Government have responded. The MHRA is writing guidance about this particular matter, which is extremely important. As was raised earlier, you can import a phage but you cannot grow or have a phage here, and we need to find a way through that.

More importantly, we also need to have a system in this country to be able to test phages to see which ones work, so that, whether we are importing them or not, we have a standardised system. We need to have better clinical trials and research, which is starting to develop, about how and when to use them, so that people are comfortable and that we know that they are effective.

It is highly likely, in the first instance, that these will be used in chronic and complex infections, where they will be used alongside antibiotics or where there is literally no antibiotic that works. At UKHSA, we are doing quite a bit of work to ensure that we have the laboratory capability to support the use of phages in the NHS, and we are working to look at industry collaborators to see what we can do about having good manufacturing plants and practice in the future in this country. There is a

great amount of interest in this, and we are taking steps forward and will continue to do that.

Q101 **Chair:** In some of the other spheres that we have not discussed too much today—antifungals, for example—are there more of these types of phages available?

Professor Hopkins: Not so much in antifungals. Phages have mainly acted in antibacterials, and that is where the majority of phage development is, but I have no doubt that they will be able to do development work, particularly in things like Candida auris, which is already a multi-drug-resistant fungus. We need to have a network of basic scientists and researchers to look at that and then to understand how they work in practice.

Q102 **Chair:** Sticking with you, Professor Hopkins, this is way outside my sphere, but there have been media reports recently about proteasome, a tiny structure that is found in every cell of the body. Its main role is to chop up old proteins into smaller chunks, so that they can be recycled to make new ones. Is this a promising area of research?

Professor Hopkins: It is a really exciting area where, basically, they were able to go into the cell and find discarded remnants where new antibiotics could be discovered. Anywhere that we can discover new antibiotics or find a source for discovery of new antibiotics is a really good thing. In actual fact, a lot of our older antibiotics came from plants or other bacteria producing them, so this is a new method. Clearly, it is early stages, but we should go at anything that shows promise.

Chair: Thank you very much. Does anybody want to add anything that we have not covered today? We have covered a big field, so I am really grateful to all of you. I am also grateful to my colleagues. It has been a really interesting hearing. Formally, thanks to our witnesses for attending. You are all busy people, and we really appreciate this. An uncorrected transcript of this hearing will be published on the Committee's website in the coming days. The Committee will consider the evidence provided and produce a report with recommendations in due course.