HOUSE OF LORDS

Science and Technology Committee

Uncorrected oral evidence: Innovation in the NHS: Personalised Medicine and AI

Tuesday 9 June 2026

11.30 am

Watch the meeting

Members present: Lord Mair (The Chair); Lord Berkeley; Lord Booth; Lord Drayson; Lord Duncan of Springbank; Baroness Jones of Whitchurch; Baroness Nicholson of Winterbourne; Lord Patel; Lord Ranger of Northwood; Lord Stern of Brentford; Lord Willis of Knaresborough; Baroness Willis of Summertown; Lord Winston.

Evidence Session No. 15 Heard in Public Questions 168 - 180

Witnesses

I: Professor Andrew Beggs, Professor of Cancer Genetics and Surgery, Department of Cancer and Genomic Sciences, University of Birmingham; Professor Mikael Sodergren, Clinical Associate Professor, Imperial College London.

Examination of witnesses

Professor Andrew Beggs and Professor Mikael Sodergren.

Q168 **The Chair:** Welcome to our second session today. We are pleased to have as our witnesses Professor Mikael Sodergren, who is a clinical associate professor at Imperial College London, and Professor Andrew Beggs, who is a professor of cancer genetics and surgery in the Department of Cancer and Genomic Sciences at the University of Birmingham. We are very pleased to have you both here. By way of introduction, can you each briefly set out for us your backgrounds as clinical academics and the innovations that you have introduced, or tried to introduce, into the NHS? What do you think could be realised for patients if your technologies were adopted more widely?

Professor Andrew Beggs: Thank you very much for inviting me. I am from Birmingham, as you have heard, but I started in London: I went to medical school and trained as a junior doctor here. I then left half way through my junior doctor training to become an academic in Birmingham, after having done a PhD in Oxford in what is now the Crick Institute. I moved to Birmingham because, at the time, there were no suitable jobs for me as a scientific lab-based academic clinical lecturer in surgery. I was very fortunate to be in the right place there. I was lucky to get a couple of fellowships from the Wellcome Trust, Cancer Research UK and, most latterly, the MRC to sustain my salary.

I have set up my own independent research laboratory in cancer genetics and surgery at the University of Birmingham. There are two main things that we have introduced that have been of benefit. First, during the Covid pandemic, our laboratory was seconded to the Department of Health and Social Care, and we started academic testing for the Covid virus, both PCR and sequencing. We were the first lab in the UK to do that and get accredited. As part of that, we helped the Department of Health and Social Care lead on a project to develop an AI reader, using your smartphone, of Covid lateral flow devices. That increased its accuracy by 30% for a cost of around £1 per read on top of the lateral flow device.

On the other project, which we did more recently, one of the exciting technologies that is happening in the UK at the moment is liquid biopsy. Thanks to funding, we developed a liquid biopsy test for children's cancer that is more accurate than anything else on the market but is 1/40th of the price. We are currently developing that into a test that will be used; it is being used at the moment, on NHS patients, but we are getting it spun out into a company where we will be able to license it on a larger scale and, I hope, transform the use of these tests in the NHS.

The Chair: Can you describe what you mean by a liquid biopsy?

Professor Andrew Beggs: A liquid biopsy is when you take a sample of blood from a patient with cancer—it does not have to be cancer; you can use it for other conditions, such as for pre-implantation genetic diagnosis and pregnancy—and you spin the blood down. The plasma is the yellow

fluid in the blood. If you have cancer, you shed DNA from that cancer into the plasma at very low levels—around one hundred millionth of a gram—which can be detected by sensitive sequencing technology.

Up to this point, one of the problems has been that the technology is very expensive. Several commercial companies in the United States charge upwards of £3,500 per test, whereas our assay uses a technology developed in the UK, Oxford Nanopore, and that works out to around £60 to £70 per test for equivalent sensitivity and specificity.

Professor Mikael Sodergren: Good morning, everyone. I am a clinical academic at Imperial College where, clinically speaking, I am a consultant HPB surgeon; I operate on liver and pancreatic cancer. I am also an associate professor at Imperial, where I have been interested in AI and machine learning since long before AI became a buzzword. I did my PhD in machine learning in 2008, as it applied to healthcare, and I have had an interest in the applications of it in healthcare since then.

I have taken inventions from bench to patent before but what we have focused on more recently in the Imperial spinout that we built, Prelego, is, in essence, a tool to predict preventable hospital harms. We have been able to do that more recently simply because the data has matured to a point where we can train AI algorithms to be useful. To give you some context around that, at Imperial, we were one the first to embrace electronic healthcare records rather than written notes. We only started in earnest in 2015 so we have around a decade's-worth of data; that is about what you need to train these models to predict preventable harms.

The way that we selected the first problem we have solved was by trying to identify the one with the greatest socioeconomic impact. That was pressure ulcers, pressure injuries or, more colloquially, bedsores. They are injuries on patients who are not well and are in bed, developing these ulcers over time, which lead to a lot of complications. They are extremely problematic across the western world. The NHS spends about 4% of its budget treating the effects of pressure ulcers, and they are up to 95% preventable. We thought that this was one of the most worthwhile applications for machine learning, so we trained machine learning tools on these big datasets to prevent these preventable harms happening.

The results are much better than anything we use in clinical practice. In addition to the performance of the tool being better than anything we use in clinical practice, it removes what is present in all prediction layers: subjective input from a clinician. These prediction tools do not need the opinion or clinical evaluation of a doctor, nurse or healthcare professional. That is important because, if it can keep performance higher or very high without them, we remove the heterogeneity of training, people being busy on wards and so on. We can generate these predictions quickly and to a very high standard.

We have spun out from Imperial and are in shadow deployment at Imperial, which means that all of the patients who have come in through

Imperial are having this algorithm read their data. We are looking at ways in which we can apply this to the NHS more widely.

Q169 **Lord Stern of Brentford:** I thank you both very much for coming. My question is about clinical academic careers in relation to innovation. In the past, this committee has recognised that clinical academic careers are becoming more difficult to pursue. What is your assessment of the decline of the academic career story on innovation? Has it had a direct effect?

Professor Mikael Sodergren: I met Andrew 20 years ago on a clinical academic pathway here in south-west London, so we have both seen the trajectory of this. The first thing that it is important to state is that clinical academics are the bridge between innovation and patient benefits. Without them, it is difficult to see how you have a group of people who can identify what the problem is, come up with a solution then test it in clinical practice. That is the role of clinical academics.

You are right in the observation that the population of clinical academics has possibly decreased over time. That is multifactorial. One of the more important reasons for that is that clinical academic outputs are measured by a specific set of criteria, including impact, but that impact is measured by the grants you bring into hospitals and by publications—that is, how many people read your publications. It is not necessarily about how many innovations you can develop to help X number of patients. There is a mismatch here; that is very important.

The clinical academic pathways are sometimes difficult to navigate. There is no well-understood route. You can do it in many different ways, as a clinical academic. There are the NIHR fellowships, of which we both took advantage and which are beneficial, but you can become an academic in many different ways. The key problem for clinical academics is the pressure on time, which takes you away from academia and innovation and pulls you into the NHS for clinical service delivery. This is undoubtedly a problem that has escalated over time.

Professor Andrew Beggs: The best way of illustrating this is that I now supervise 27 clinical PhD students—doctors who have come out of their training to do PhDs before they go back into training. I have managed to get one to take a lecturer's post. On the reason why, they said, "Andrew, I see what you do. I see what your life and job are like, and I don't want to do that. It seems like a lot of work and not very much fun". Two or three people have said that. It did make me laugh—it is funny—but the problem is that it is a sad reflection of what is going on with clinical academia.

I was more of an accidental academic. I ended up doing a PhD because I could not get a job. There was something called the MTAS problem in 2007, where people could not get training posts. I could not get a training post so I ended up going into a clinic academic post. I liked it and proceeded, and it has led to all of this. There needs to be more of a role for the accidental academic. Not everybody comes in on the career

pathway that has been set up. People come in at later stages. The recent academic training report that I read—I did not necessarily agree with all of it—will go some way to allowing multiple entry points here.

On innovation—Mike touched on this—we all get assessed by something called the REF, which is the Research Excellence Framework. There is nothing in there for innovation. It is basically about impact, facilities and environment. The joke is that they keep saying, "Oh well, it's not about how many five-star *Nature* papers you have", but it actually is about how many four-star or five-star *Nature* papers you have.

Impact cases are very subjective. It depends on the reviewer. You could put innovation as an impact case, but it is never specifically done. People are too wary to do it. That is what causes problems in making academics do it. As I say, I enjoy my job; I love my job as an academic. It is just difficult to persuade people. There is a lot of evidence showing that you end up losing out, cash-wise and salary-wise, because your career progression is delayed. In craft specialties such as ours, you end up getting split between two worlds: surgery and academia. If your university and hospital are not based on the same site, like mine and Mike's are, it is very difficult to make that work.

With the lab now, we are up to almost 50 people. It feels like I have 50 children, in a pleasant way, but nobody teaches you as a clinical academic how to manage that number of people. There are certainly not many other environments where you would have that.

Lord Stern of Brentford: I must confess that your answers are very close to home because, 10 years ago, Jo Johnson, when he was the Higher Education Minister, asked me, as the president of the British Academy, to review the Research Excellence Framework. I said something very similar to what you have just said. Part of the fault is on the university side. You have focused more on the report and the way in which the university side and research assessments work. Do you think that part of the fault could be on the way in which the NHS, research funders and the Government are behaving?

Professor Andrew Beggs: How do I say yes or no without it coming up in one of my grant reviews in future? It is. They have changed the way in which the Medical Research Council works now, but I used to sit on the Molecular and Cellular Medicine Board, so we would see a lot of grants come in. Although the criteria are quite strict, it was always just, "What are their papers like? Are they relevant? Are they high-impact?" The science was preferred over the innovation because it is sometimes difficult to define innovation in a scientific grant. You can label it, but it is difficult to put your finger on exactly what they need to do, from a governmental and societal point of view, to fund this type of research better.

Lord Stern of Brentford: Do you have a recommendation for us to offer that is more than just, "This is a big problem"?

Professor Andrew Beggs: Yes. Innovation needs to be part of the REF. Impact cases need to be about not just, "I wrote a paper about chemotherapy and now it is standard of care", but, "I've made this device"—as Professor Sodergren is talking about—"which has led to this benefit in the NHS". They should be prioritised if we are going to drive innovation. Do not get me wrong, it is great to have *Nature* papers, but, on the other hand, innovation is of more benefit to the NHS.

Q170 **Lord Patel:** Andrew, I am surprised that your PhD students do not follow your career path, because you are an enthusiastic and fascinating person; I would have thought that they would be delighted to do what you do, but that is by the by. I read what you have both written with interest. In your submissions, you were concerned that patients are not benefiting from innovations in the NHS, particularly when our focus is on AI, genomics and personalised medicine. What are the barriers that stop patients benefiting from innovations in practice?

Professor Mikael Sodergren: You can divide this into two main issues. One is the translation of the innovation itself. Then, once you have translated an innovation, it is about diffusing that—going to market, as it were—to ensure that the NHS population can benefit from it. The problem we have, particularly now with AI, is that we have had an issue with being able to translate innovation effectively in the NHS for a long time. That is common to many western healthcare systems but, particularly with AI, the technology is now moving so quickly that we need to find a way to adapt how we embrace these innovations and diffuse them across the NHS in a different way to what we have done.

Let me give you some examples of the problems that we have had. I should start by saying that the NHS is a fantastic place to innovate. The infrastructure and potentially rich data sources that we have available to us are almost unparallelled, so we should be able to have a very rich environment to do this. On the problems that we have faced, there is no national framework for this kind of translation. There is no road map to take an innovation in a university and make it into a commercial product.

What does that mean? It means that each individual site, or each individual innovation, possibly goes through the same steps in many different places across the country. If they were homogenised and standardised, it would lead to a much quicker process. For example, we had to have dialogues with NHS trusts as data providers, but the decision-maker in the NHS trust was a clinician who was too busy to be able to reply within a week or two. That dialogue to understand the role of the NHS trust, as a data provider, in this innovation took six months. A standard recommendation on how it should look could simplify things a lot further.

The second bit is going to market. The procurement challenges across the NHS are well understood. There are good measures that are trying to address the supply side. The value-based procurement is excellent; that has all been piloted and will, I hope, become more widespread. For digital innovation, there is the concept of a DTAC passport, where, at the

moment, you need to show certain aspects of your product to ensure that it is safe for integration into an NHS trust. That should be something you can passport and make available to all NHS trusts. All of these small initiatives that are happening in parallel should be combined to ensure that we can do this at scale and very quickly.

The third thing is supply and demand. At the moment, for what we are interested in—preventive medicine—the person who is in charge of that line of P&L for a hospital is not the person who necessarily sees the benefit of the prevention. For therapeutics, which we sadly do more than prevention in medicine, this is very straightforward: we are treating a problem. Preventing a problem is less straightforward to sell economically, and that should change.

The easiest way to do that is to measure it. In the same way as you have cancer waiting lists, put preventable harms right up there in terms of things that we need to publish nationally. How many patients in each hospital are experiencing these preventable harms? That will provide the incentive to prevent them.

Professor Andrew Beggs: From my perspective, there are a couple of things. There is the local problem and then the national problem. The local problem, in my experience—not just in Covid but generally in molecular diagnostics and genomic medicine—is that, whenever you take an innovation into the NHS, the first answer is always no. The reason why is because people are inherently cautious. That is completely understandable when you are dealing with patients, healthcare and lifestyle, but it is to the extreme: "No, we don't want to use this new test. Is it any better than the old one?"

The baton then gets passed on to NICE to approve it. NICE fulfils an important role—we have to be able to afford what we do—but some of the commissioning criteria have not kept up with modern-world diagnostics, testing and drugs. There are a lot of things I could speak about around drug therapies and innovations in the UK.

This means that the process is quite long, and, when it gets to the end, a company or an innovator may not have their process approved by NICE. They then end up selling that test abroad, for great profit, and the NHS does not benefit from a test that the rest of the world does benefit from. That is frustrating for innovators. You just think, "What's the point?"

Those two things together—slowness of adoption and the understandable risk aversion, along with the approvals process and the MHRA—slow things down to the extent where people lose interest. Innovators tend to be type A. They are quite energetic, but they tend to lose interest rapidly when they come against all these structural barriers.

The Chair: We will come on to regulation, the MHRA and NICE a little later.

Q171 **Baroness Willis of Summertown:** This leads on from both of your

replies, but I want to take things up a level. From the NHS down, rather than up, who determines which innovative technologies are prioritised? Where does that happen in the process? In a devolved ecosystem such as ours, how does that work? How does that enable things, such as the Nanopore technology you mentioned, to be spread across the ecosystem?

Professor Andrew Beggs: It is easy to say that it is complex, but it is. I will use cancer as an example of genomics. I know that you met Dame Sue Hill in a previous committee. She is the decision-maker in genomics for NHS England. There are similar people in place in the devolved nations. She understandably devolves that to civil servants working in the genomics unit; that applies to all kinds of molecular testing and diagnostic testing.

The issue is that they are quite technical briefs. The civil servants are excellent but they do not always have, or ask for, the subject matter expertise. What ends up happening is that, sometimes, the person who speaks the loudest gets commissioned—as has happened with some diagnostic testing or drugs—or somebody who gives a superficially attractive test or presentation to the Government is prioritised over one that may be better value for money or easier to use. I should say that I am biased because I always want my tests to be used, but this is a problem.

This means that we need strict criteria on how we adopt these types of innovations in the NHS—not so strict that they stop it happening but strict enough that they allow diversity of innovation and prioritise UK innovators, which they do not necessarily do at the moment. It is easy to listen to a big American company give a glossy presentation about the thousands of patients it has treated, but it has not done it in our healthcare system. We have a great healthcare system that works across the whole population, not for a few.

Baroness Willis of Summertown: We have been hearing that pockets of innovation are coming through in some parts of the healthcare system or the NHS devolved structures, but not in others. How does that movement or translation occur?

Professor Andrew Beggs: You cannot break it out because, unfortunately, it all comes down to rivalry. If I produce a test, colleagues at other hospitals, although we are colleagues, will say that they might be able to do it better. It is difficult. You cannot enforce, "You must use Andrew's test because that's the one we decided on". It has to be a decision where we bring everybody along. There is a gap where local practice can struggle to scale up nationally.

One of the things we are doing in Birmingham—it was signed off just yesterday—is integrating all pathology and molecular diagnostics into one big lab in our life sciences innovation park. The whole idea behind that is to have one front door for all samples. They all come in and everybody works together, not just from the diagnostic point of view but from the

innovation point of view as well. I know that other people want to copy that, but our model may not work for others.

Baroness Willis of Summertown: You talked about prevention. Where do innovation and prevention come into this ecosystem?

Professor Mikael Sodergren: The original question was also about how to determine what the research priorities are, nationally speaking, and how that comes down to research teams. Obviously, there are a number of different ways in which it can be done. One is through the NIHR; you can have commissioned funding for particular areas of interest. In AI, the Sovereign AI Fund is an example of that where there will be more direct investment into commercial. Those are ways of doing it, but, from the ground up, in the NHS, where you have the ability to carry out this research is often linked to academic centres.

What is obvious is that NHS sites that are not linked academic centres do not have the same track record. Why would they? Academic centres have their different priorities, which do not necessarily align with the national priorities at the time. There are surrogate measures and indirect ways of doing it but there are no real, direct ways of directing the national priorities in biomedical or life science research to what happens here on the ground.

Baroness Willis of Summertown: So there are no direct links, not even through the Medical Research Council?

Professor Mikael Sodergren: It can do the same and commission grant funding, but the problem right now with these types of grant cycle, particularly when it comes to AI, is that these fields are moving so fast. In traditional research, where you do a bit of in vitro research then go to animal, it takes a long time. That is fine, but these technologies are so fast-moving.

We just applied for an NIHR grant for NICE approval for our product. We calculated that, if we apply now, the grant funding will start in Q4 of next year. You have to triangulate where you think your technology will be in a year and a half. That is almost impossible to do. How do you then articulate that in a grant? How do you say, "I'd like funding to be able to do this in a year and a half"? The grant funding mechanism is ill suited for the kind of technological implementation that we are seeing now.

Q172 **Lord Winston:** Mind you, Imperial College does that triangulation quite well, to be fair. I thank you both for coming. I have so many questions to ask you but I have been allotted a particular question that I have to ask you. Before I do so, can you comment on one of the tensions that we have in innovation? The scientists we work with read *Nature* and the clinicians we work with read the *PMJ*. Neither side really understands how to connect those two things up. It is a very difficult issue. Can you comment on that? There is still a difficulty around basic science and good clinical research in terms of innovation, which is a long way down the line.

Professor Andrew Beggs: You are right. We see similar tensions all the time. I would suggest, perhaps rather arrogantly, that clinical academics will be the ones to do that—especially the ones who do scientific-based research—because we are the ones who sit on both sides. A famous surgeon said, "We are rubbish at both, but we have a foot in both camps". We can help.

For example, there is something called arginine methylation. It is an obscure change for a protein, but it turns out that it is very important in pancreatic cancer. One of my colleagues in Birmingham works on that. They invented at AstraZeneca in Cambridge a class of drugs that treats and works on that. It was a chance conversation that helped put these people together with our institution: the person doing the basic science plus the scientist who is interested in using the drug and in working out why is there no resistance.

Once again, flying the flag for the university, we need to fund well these clinical academic collisions and collaborations across the whole level. It cannot just be that you sit a load of basic scientists in one institute and a load of clinician scientists in another. They have to work together. I am going to be quite critical now. One of the problems we have, for instance, is that a lot of institutes funded by the MRC tend to be pure basic scientists, rather than a mixture with clinician scientists. Part of the reason is that there are not enough clinician scientists but, on the other hand, we enrich each other; all my pure science colleagues would acknowledge that. We help each other work out where the priorities are, where we should be directing funding and how we should be taking it further.

Professor Mikael Sodergren: I agree completely. Clinical academics are the key component. They are the glue between these two journals. The basic scientists who do the research that you translate into clinical benefit but then must be trialled and proven to be beneficial to patients by clinicians are the clinical academics and clinician scientists. We spoke about why there have been challenges, but there could be more to bridge these two groups together. There has to be a group of people in the middle who understand both research problems and can offer a different perspective.

Q173 **Lord Winston:** We ought to come on to the issue that you have been dealing with: bedsores. The Imperial College Trust is a huge collection of hospitals. Does every hospital adopt your protocols for the treatment or prevention of bedsores?

Professor Mikael Sodergren: Yes. Imperial College has just changed them. Two or three have been used globally. They are all paper-based systems that have been developed into small datasets with limited validation. Imperial uses something called PURPOSE-T, which was developed in Leeds and is used among all Imperial hospitals. The protocols are supposed to be standardised and to align with the NICE guidance.

Let me give you an example. An assessment for every patient that comes into hospital must be made within six hours. That is a guideline. It is a target that is not surfaced but which we should meet. We have ordered this. Imperial is probably like every other hospital in the UK. We are very bad. Around 60% of patients actually get this kind of assessment. These digital tools will guarantee that 100% of patients get this assessment, because it pulls from the electronic healthcare record to give a prediction. You do not need a human to see the patient to do the assessment.

Lord Winston: I was an in-patient in a competing trust not far from Imperial College—you might decide which one—where it was clear that the protocol for bedsores was less than adequate. What is preventing us adopting these standards across the National Health Service in a much wider capacity?

Professor Mikael Sodergren: The short answer is nothing, apart from the fact that interoperability between electronic healthcare systems is a problem that needs to be solved in some trusts. There are two good things here. One is that most healthcare trusts operate one of two big electronical healthcare record providers, so getting integration with those is relatively straightforward. Although the FDP is extremely controversial, politically speaking, that kind of environment is excellent for disseminating these technologies because, once you integrate with the FDP, you can deploy across all hospitals in the NHS that have this technology.

Lord Winston: What are the barriers to implementing innovations across the NHS?

Professor Mikael Sodergren: In this particular example, it is procurement. There is no way, at the moment, for there to be a national recommendation for an AI tool such as the one we are developing, or a health technology, to be implemented across all of the NHS. It is going to specific NHS trusts. Understanding who has an interest, which may be financial or clinical, then going through one of an incredibly large number of different procurement pathways—everything from accessing a quality improvement budget in a department to a national procurement pathway—takes a lot of time.

To give you an example, we are talking with the Oxford NHS Trust about implementing this specific solution. The person who is in charge of that, the chief digital information officer, is also an anaesthetist. The first conversation we need to have is with him and the chief nursing officer but, because they are so busy clinically, it is impossible to sync diaries to meet them within two or three months. That is across the NHS.

Q174 **Lord Winston:** Professor Beggs, may I ask you another question? There seems to be a big difference between the procurement of mechanical and engineering aspects of medical practice and the things we do on cell biology, which obviously involve this committee much more. One of the issues is that, when you come to tools and so on, individual doctors or

surgeons decide that that is the piece of equipment they want, irrespective of anything else, whereas they do not necessarily want to use somebody else's innovation. How do we deal with that experience of innovation better? Do we allow that in our procurement in the health service, because it is a big financial problem?

Professor Andrew Beggs: Speaking for my own hospital, University Hospitals Birmingham covers the entire population of Birmingham and wider: 5 or 6 million people. For surgical staplers and surgical devices, we were just told, "We've awarded the procurement contract to this company based on a free tender, so these are the ones you're going to use now". You can imagine surgeons being like small children—I am a surgeon so I can say that—and stamping their feet and saying, "I'm not going to use this device because I don't not like it", but they are told, "There's no other way. You have to use it. It's what we have agreed with the procurement".

That is what has happened. We probably need to be slightly brutal like that. There will be people who use devices that they are used to. There are ways to do it in a kinder fashion, but it may just take a bit of top-down talk: "You're going to use this system or this innovation and make it work", because that will save the NHS money in the longer term. It is our boss, at the end of the day. We are surgeons. We can speak into the procurement process—and we do—but, at the end of the day, we have to try to get the best value for money for the NHS.

Q175 **Lord Winston:** I have one last question, if I may. We have heard that the two great advances are imaging and, on the other hand, cell-based things such as genetics. It took ages to get endoscopy established effectively in the health service. It has been a very long time, and people are often still worried about using endoscopes; they refuse to do so.

Professor Andrew Beggs: I notice this a lot from having a foot in two camps. The NHS is capital poor but ongoing money rich, whereas the university sector is capital rich and ongoing money poor.

The issue is that a lot of these pieces of equipment and technologies come with capital costs. Your standard big genome sequence was around £1 million, which is ironic given that they were all invented in the UK but have mostly been sold to US companies; we end up paying a lot of money for them. The NHS struggles to get that kind of capital investment because there are rules with which I have become familiar—such as CDEL, the capital investment rules—and which mean that it is difficult for the NHS to say, "We want to buy this piece of equipment that comes with a capital cost", and cover the service contract.

Companies make all their money off the service contract. It is the razor and razor blade model, which a lot of places are familiar with. That is why the NHS struggles with innovation: it does not have the capital investment to afford these innovations. If it is an ongoing cost, such as with a machine learning model or a drug that you give for a period of

time, it is a bit different because you can stretch the budget out over time. The NHS struggles to deliver when it is a big upfront cost.

Professor Mikael Sodergren: The fundamental issue, which you have alluded to, is that procurement across the NHS has been financially driven. The staplers are a great example. We had the same tender at Imperial. You may be familiar with the tender that we had a while ago for surgical gloves. One day, all of a sudden, we had gloves that were worse than those you wash your dishes with; that was because a tender process had taken place and they were obviously the cheapest option.

The underlying problem is that it is not the cheapest product that will add the most value. Value-based procurement will go some way to solving that if it is done correctly. It may be that these gloves are actually okay, but it may also be that surgeons make more mistakes and there are complications. Those things are more costly than paying the couple of pence extra for the better-quality gloves, but that calculus is not present in the majority of NHS tenders in procurement at the moment.

This goes to the heart of these preventive measures. You are spending money to prevent something happening, so you cannot see it on your P&L because it does not happen. However, if you model it out to what you actually see, it becomes very apparent that it is money well spent.

Lord Winston: That is helpful; thank you very much indeed, gentlemen.

Q176 **Lord Patel:** My question relates mainly to clinical trials, regulations and the role of the regulators. We are all aware that the UK is not doing so well in clinical trials these days. The ambition is that this 10-year plan and the proposals in it, plus innovations in AI, genomics and personalised medicine, will make us the world leaders in clinical trials—so we are told. The MHRA in particular has plans for improving the UK's role in clinical trials.

Professor Sodergren, can you comment on AI regulation and the role of the regulators, particularly in clinical trials using AI? Professor Beggs, you commented in your written evidence that you feel quite strongly about why the UK is so weak and so far down the ranks in clinical trials. Can you comment with your views on how clinical trials could be done better in the United Kingdom?

Professor Mikael Sodergren: To start, we have a unique opportunity with the MHRA to be world leaders in regulation and advance the way in which clinical trials are carried out. By doing so, we will get medicines to patients quicker and get new technologies to patients faster, with less cost. The key thing is that some things must remain of paramount importance—patient confidentiality, robustness of evidence and so on—on which we should not negotiate, of course. However, we have a unique opportunity to be leaders in this space.

To give you an example, I presume that all of you have asked ChatGPT or another large language model something. If you ask a healthcare

question, it will give you a pretty good answer these days. There is no doubt that these technologies will play a role in healthcare in the contexts I mentioned: confidentiality, privacy and so on. However, it is entirely unclear at the moment how the regulators will approach them—particularly AI black boxes, where you have no way of understanding the output from the input. There is the problem.

It is crystal-clear, though, that they will be part of the solution. How do you marry these things up? A good example—again, I refer to what we are doing—is that we are looking at preventive medicine pulling data continuously to assess risk in patients. That is very different to what has been regulated by the MHRA, which is, in essence, "I'll show you a picture and you tell me whether or not it's cancer". It is static.

There are innovative ways in which you can build in regulatory bundles so that we are allowed to change how the model behaves, within boundaries, without having to go back to the regulators. There are many examples of this, in terms of how you innovate in regulation to ensure that you can get these products to market as quickly as possible but also safely.

Lord Patel: Professor Beggs, can you include in your answer the role of the new Health Data Research Service? It is promised that, when that gets going, clinical trials in the UK will become much easier.

Professor Andrew Beggs: Yes, I will. As you said, I have quite strong views on the clinical trial landscape in the UK. It is not because of the clinical trials units, which are run by great people. The issue is the regulatory burden that we face in getting drugs and technologies assessed; that is important in a well-controlled trial, but it is massive. I mentioned in my evidence one trial that we recently had funded by the NIHR. It is for the experimental and mechanistic efficacy stream. That should be a bit of science, not just the trial, but we are spending 80% of the money on the costs of doing the trial and 8% to 9% on the science to work out why the intervention works.

The number of people we need—data managers, data programmers, oversight officers and people funding the clinical trial users—means that clinical trials in the UK are ruinously, ludicrously expensive. If I work with US drug firms, or even UK ones, and I tell them how much it costs, they look at it and say, "We're not going to do that. We'll go to China, the US or Europe because they can do these things cheaper than you. They are also more efficient: they are quick, and your set-up times are too slow".

The reason is because, to be honest, British society is addicted to the most risk-averse attitude when it comes to sets of regulations. To give you an example, when clinical trial samples are analysed, they have to be analysed according to a set of regulations and according to good clinical practice. It is important that we follow them. When I have been audited in the past, one of the things I failed on was the fact that I could not demonstrate cleaning rotas for my laboratory for the past four years,

including the name of who cleaned it and when. That is not vital when it comes to assessing the accuracy of a biomarker. It is important to have a clean lab, obviously, but it is not important to know who cleaned my lab four years ago, yet I was stopped from doing biomarker work until I fixed that. These kinds of obstacle get thrown up regularly by well-intentioned people who interpret the rules in the most risk-averse way possible.

That brings us on to the Health Data Research Service. It sounds like a good idea. My worry is that, having been involved in the 100,000 Genomes Project, it will not end up like that. The datasets and samples for the 100,000 Genomes Project were excellent when we started. We were all promised that we would have unrestricted access to data: "It'll be really easy. You'll log into the research environment and it'll all be there". Nothing could have been further from the truth. It is really difficult to use. Until it changed recently, it was very difficult to do analysis on the research environment. My worry is that, when we go over to the HDRS, we will be repeating the mistakes of the past.

One of the other reasons for that is things like data security. Although data security is important, the unfortunate things that happened with the UK Biobank—I would like to point out that they did not happen in the UK; they happened overseas—mean that the landscape is now even more difficult to look at, especially in genomic medicine. It makes it incredibly difficult to do anything. Academics are used to getting data, analysing it themselves then coming up with an outcome, but it is almost impossible to do that at the moment. One of the other reasons is that all of these secure data environments charge a lot of money. Academia is not rich.

The final point I want to make is that one of my colleagues wanted to get some test results out of a secure data environment in the NHS; it was 2,000 paper and electronic reports on a certain pathology type. They were going to mine them for a keyword. For those 2,000 reports, it was going to cost £20,000. I could probably have paid somebody less to do it by just sitting at a computer and doing it, but it cost that much. It makes academics not want to use it.

All of these problems stack up and completely disincentivise us from doing research. That sounds very moany, I know. It can work; it just needs access to people who use these tools every day and listening to the difficulties that they face with them.

Lord Patel: This is slightly away from the main question but, on the comment you just made about a researcher's ability to access data and the cost of it, it is probably related that the data is held in the cloud and the NHS has no cloud-based NHS service. Do you think that the NHS, as big as it is and given the amount of data that it is likely to generate and collect, should have its own cloud-based capacity?

Professor Mikael Sodergren: It is a resounding yes from me, and not just for storing this kind of research data. More importantly, the electronic healthcare records of the population are now stored in

disparate on-prem servers, and partially in the cloud, across the country in different ways. One of the ways of leveraging the real benefit of having the NHS as a healthcare service is saying, "Yes, the unified records are great, but being able to access all those electronic healthcare records through one cloud-based solution will make it demonstrably easier to research, apply solutions and so on".

Professor Andrew Beggs: A cloud-based computer is actually pretty cheap. We have our own high-performance computing infrastructure—we have one of the national supercomputer clusters—so it is frustrating that we then have to use the cloud and pay for it. We have the secure infrastructure to host data; we are just not allowed to transfer it now.

Even with that, there is a disparity between what is charged to researchers. We know what cloud computing costs because we use it. It is not their fault because they have to recover the staffing costs and the other costs, which are prohibitive for new research. I can apply for a grant but, if you are a new lecturer or a post-duty of care starting out, getting access to that kind of money to access that data is prohibitive. It is never going to happen. This is where attention needs to be focused: how can we get the bright young minds of the future access to this data so that they can do stuff to it free of charge, in essence? At the moment, that just does not happen.

The Chair: Lord Ranger, we have already moved on to access to health data, so perhaps you could make your question a bit briefer.

Q177 **Lord Ranger of Northwood:** We have covered mine so I am happy to go on to Lord Duncan's question. We have covered the challenges and you have described, quite clearly, some of your frustrations with the access issues. The only point I would make is about interoperability because there is that fragmentation, which you had just started to highlight, with a commercial charge and then the fragmentation of different systems using it. Is there an approach to saying how we standardise that in terms of data housing and interoperability between usage?

Professor Andrew Beggs: We are quite lucky in genomic medicine because the precision measures' formats are pretty standardised. It is relatively easy to do. When you go into clinical data and population-level datasets, that is when the problem emerges more. There are lots of international standards for precision medicine data exchange, which we use, so that is less of a problem for us; it is more of a problem for people like Mikael.

Professor Mikael Sodergren: It is a problem. One of the useful research tools that is being widely rolled out across the NHS are the SDE environments, where clinical data is used for secondary purposes, research and so on.

The issue we face here is that we have trained on a certain dataset, which was curated from a certain healthcare record provider. We have

trained an algorithm on that. We wanted recently to take our algorithm and use it to evaluate the patients who have been seen in Cambridge over the past 10 years. Our algorithm does not speak to that secure data environment, although it is a secure data environment like the one we have at Imperial, just because this issue of interoperability has not been considered. They have stood up an SDE because that is something valuable, but the level above that—can all SDEs be pooled?—has not been addressed at all.

The fundamental thing here, in investing in this infrastructure, is that it should be a given that all this data speaks the same language. That is crucial for the NHS and should be the starting point of us leveraging it for its potential use, but, sadly, that is not the case at the moment.

The Chair: Lord Duncan, some of your question has been covered.

Q178 **Lord Duncan of Springbank:** I think that all of it has been covered. The Health Data Research Service is currently being set up to help, I suppose. Will it help? How might it be improved for your usability?

Professor Andrew Beggs: Once again, we had this issue with the 100,000 Genomes project, and things have changed at Genomics England. One of the major problems that academic researchers have is in bringing their own tools to the data. You can do that with the cloud. You can now bring your own virtual environment, as it is called, to the data with the new version of Genomics England. In the past, if you wanted to add a new tool to the system, you had to go through software tool statistical analysis. It was quite a bureaucratic process to get it in; it could last weeks or months, by which time you had lost interest.

It is about allowing flexibility of access to the data, including bringing your own tools to it. I understand the need for security. The HDRS is not necessarily a completely bad idea, but it will be a bad idea unless researchers can bring their own toolkits and mount them on to the data in a read-only fashion, rather than saying, "You're on a secure data environment so you can only use tools X, Y and Z". A lot of these researchers will have written their own tools that they want to bring in and use on the data. If they cannot do that, it is not going to be a success.

Lord Duncan of Springbank: I am concerned that, as there are more data breaches, the prospect of it becoming easier to do that probably diminishes or goes the other way. The restrictions placed on you in bringing in innovative tools will then be more, not less, bureaucratic.

Professor Andrew Beggs: That will be a problem. I read the Biobank report so I understand how it happened. It happened for a couple of reasons, including the allowance of external data transfer. Most of the SDEs that we have used do not allow that any more. You just cannot do that; it is sandboxed. Even if you bring tools on to it, you still cannot export the data without using a sandbox. Data will be very secure in the

way it is at the moment, so that will be very difficult to do, but it needs to be not so secure that it stifles innovation. There needs to be a balance.

Lord Duncan of Springbank: Is there a way of striking that balance?

Professor Andrew Beggs: Ask the researchers who use it, not a minority. What happens generally is that they ask their friends—the people who run these services—and, although they are collaborating, they tell them, "Do it like this". They do not necessarily consult with the entire landscape.

Professor Mikael Sodergren: Just to add to that, there are practical solutions. I can give you a live example of how this has been a problem for us. We have trained a model on pressure ulcers, but we have also trained models to predict surgical site infections from the same dataset. We cannot copy and paste the code from pressure ulcers in the surgical site infection research project, although they are within the same SDE. Somebody has to sit there and write these hundreds of lines of code again.

There is a balance between having secure environment, which is obviously paramount, and allowing researchers to take maximum advantage of it. Professor Beggs is correct to say that researchers should guide that in many ways.

Q179 **Lord Duncan of Springbank:** Lord Patel helpfully pointed his finger at the thing I ought to have asked earlier. How acute is this problem of interoperability across the NHS in terms of the data? Do you want to comment on that?

Professor Mikael Sodergren: Yes. I alluded to it in my previous answer, but the only way in which we can leverage this incredible resource of NHS data is for it to be one, unified data source that you can access—preferably at a single point, rather than the 200 different ways of accessing it at the moment. There are standard languages. You may have heard of FHIR, which is the standard way of communicating clinical data between two different systems. So there are ways of doing it. There has been a lot of effort put into curating and developing these SDEs, which is commendable. The next effort should be in how they can communicate with each other.

Professor Andrew Beggs: The other issue around data interoperability is regulatory. Birmingham Women and Children's Hospital is 500 metres from Queen Elizabeth Hospital Birmingham. If I want to send genetic data to them, for every project, it has to be subject to a data privacy impact assessment—a DPIA—which can take a year or two years to sign. Once again, by that stage, people have moved on.

There is a whole set of things that need to happen. You can have the data but, because you have to do these impact assessments, it adds that extra level of complexity. Then, it only takes one person saying, "I don't think you should transfer that data item because it might identify the

patient", to keep the cycle going. If we can standardise those kinds of data transfer agreement across the NHS and make them project non-specific, that will help with interoperability.

Lord Duncan of Springbank: Is that because one person, or a committee of people, is responsible for assessing each individual approach?

Professor Andrew Beggs: That is the problem. It only takes one person to say no for the whole process to grind to a halt.

The Chair: Lord Willis will ask the last question.

Q180 **Lord Willis of Knaresborough:** The problems you are raising are so complicated that I wonder what we are going to write in our report to try to resolve them. Our inquiry will ultimately make conclusions and recommendations to the Government on reforms. One thing the committee wants to do is have a set of positive recommendations that can be taken and discussed by the Government. What would be your top three recommendations for the Government to improve patient access to these innovations? We can guarantee that they might go in the paper.

Professor Mikael Sodergren: Wonderful. The first thing is standardisation. We need a standardised, national, commercial procurement protocol for innovation, with a particular emphasis on these new AI technologies. It should be centrally determined whether a product has a benefit across the population, like NICE does for therapeutics. It should then be rolled out at the population level. That is number one.

The same goes for regulation. There needs to be a clearly defined regulatory pathway for these products, particularly in terms of how you go from something that is regulated to something that is deployed in a live clinical setting.

The third thing is making preventable harms visible. It is a no-brainer. The NHS can save a lot of money there. Report all the preventable harms; that will allow for an incentive for them to be prevented.

Professor Andrew Beggs: Despite all my doom and gloom, we are really fortunate in that we are probably in the most powerful position as a healthcare system in the world, because we have a static population that can be studied to improve healthcare.

The three things I would suggest are, first, that we need to reform the clinical trials regulations we have in order to make them more dynamic and responsive and to reduce barriers to innovation, allowing us to become leaders in rolling out clinical trials. That is number one. Number two is, as regards the use of innovation and rewarding innovation, we need to change the REF so that innovation is basically rewarded, full stop.

Rather controversially, my last one is that we should make health data access free for researchers in the NHS and academia. It should be free of charge. We should not be charged for access to a secure data

environment or healthcare data. Yes, a profit share could be worked out if any innovation comes out of it—that could be part of a contract—but the single biggest thing that will drive innovation is making health data access free for any users who are going to do research in the UK.

The Chair: Professor Beggs and Professor Sodergren, thank you very much. You have answered a whole lot of questions. It has been very informative for us. Many thanks for coming to this session; it has been very useful, and we appreciate it. We will now conclude this session.