Panel Discussion: Innovative Sectors Driving the Future of Healthcare

Moderator: Sarah Haywood, Advanced Oxford

Panelists:

- Rebecca Gans (Becks), Bluesky AI
- Dr. Jon Wilkinson, Institute of Cancer Research (ICR)
- Professor Rafael Carazo Salas, University of Bristol
- Javier Alvarez-Valle, Microsoft Research Cambridge

SARAH HAYWOOD: Welcome to my panel. I'm going to ask each of them to start by just saying very briefly who they are and what they do, and then we'll start to talk a little bit more about the different innovation activity that you're all involved in.

REBECCA GANS: My name is Rebecca Gans, everyone calls me Becks, I'm a portfolio non-exec across the public and private sector. What that means is I'm an NHS non-exec, so Bolton Foundation Trust. So that's an acute and community trust with 20 settings up in Greater Manchester. But on the other side of the coin, which is where I come from, early stage technology companies. So Bluesky AI in one liner, emotion AI, and also Patchwork Health among the advisory board there, their software as a service selling to over 60 NHS trusts.

DR. JON WILKINSON: John Wilkinson, I'm the director of business and innovation for the ICR, so our role is to help cement and support all of the collaborations in ICR, hundreds with companies and with other academic institutes, and not for profits. So our job is to stitch those together and make this happen. Part of that role as well is technology transfer. So that is identifying those innovations, trying to nurture them, trying to culture them, trying to drive them back, move them through into the market and then principally another aspect of business development. So trying to find partners to help forward our mission and drive impact.

PROFESSOR RAFAEL CARAZO SALAS: My name is Rafael Carazo Salas, I'm a professor in chair of medical sciences at the University of Bristol in the southwest of the UK. I've had my research group there for about seven and a half years before I was in Cambridge for many years, so I feel a connection also to the ecosystem still, and before that, Switzerland. I'm an academic and also repeat entrepreneur. I founded or helped co-found three companies until now, the latest of which is called Cell Oil Technologies, which is spin out of the University of Bristol that works at the intersection between artificial intelligence and cell therapy.

JAVIER ALVAREZ-VALLE: I'm Javier, senior director of biomedical imaging and Microsoft Research in Cambridge. I lead a team of researchers, engineers and clinicians, and we are working currently on multimodal AI for radiology. So we are trying to generate draft reports for radiologists to accelerate radiology and make it more efficient and precise. In the past, I worked in radiotherapy treatment as well. So we did a project with Addenbrooke's Hospital, where we helped them accelerate the radiotherapy treatment planning. So usually clinicians have to draw on medical images, and we created a model that basically took this task from hours to minutes, and it's now being used in Addenbrooke's for prostate and head and neck cancer. And now Addenbrooke's is training their own models. So we open-sourced the solution and they are trying to scale it with a commercial partner.

SARAH HAYWOOD: Javier, can I start with you? Because coming from Microsoft, everybody will think, well, of course, that's of course, what you're doing. You've talked a little bit in your introduction about how some of the technology is driving productivity, in terms of radiotherapy planning, in terms of reducing clinicians' time from hours to minutes between tools in their hands. So could you tell us a little bit more about how you set about solving that problem and then really importantly, how you're trying to get it actually deployed into the NHS?

JAVIER ALVAREZ-VALLE: So the way we work is like working very closely with the NHS, partnering with clinicians at Addenbrooke's. So for us, it's very important to design the solution with them. So, yeah, we have to do many trips to Addenbrooke's. So my lab is by the Cambridge train station, and yeah, we'll have to go there many times to design the solution. I think another important thing is to have the right data to work on these problems and have quality data. So in the case of radiotherapy planning, Addenbrooke's already had a dataset for a clinical trial that was also annotated. So that was really helpful and then, yeah, figure out how do we deploy it.

So the way we did this is, in this case was to open source the solution, because as Microsoft, we didn't want to create a medical device, but we wanted to empower the NHS to create their own AI solutions. So, yeah, using the cloud was super important because these type of models, they need to run on high-end GPUs, yet then getting the feedback from the clinicians is super important.

SARAH HAYWOOD: Given that model that you've described about collaboration using data but open source, so that clinicians effectively create the solution, can you talk a little bit about how then that can be scaled? Because obviously Addenbrooke's have been part of that kind of co-production process. How do you then take a product into other NHS settings?

JAVIER ALVAREZ-VALLE: Yeah, so at the moment, this is, how do we scale the solution? So one of the things that Addenbrooke's did is to create a quality management system and to validate and evaluate that the solution was safe for deployment. So one of the challenges in the NHS is that they don't have the resources to run this type of quality management system, so what they did was to outsource it to a commercial partner and now they are trying to scale it across all the hospitals. This is still challenging because the governance across many different trusts is different and there is also fragmentation in terms of cloud infrastructure that is required to run these AI models. But, yeah, I think we're making progress on some of the initiatives, like the NHS AI lab. I think they are important to be able to scale these solutions.

SARAH HAYWOOD: John, tell us a little bit about some of the solutions to the productivity and therapeutic challenges that Kristen Allen was outlining to us earlier and where the academic and NHS innovation can help.

DR. JON WILKINSON: Yeah, absolutely, I think so. ICR, the partnership of the Royal Marsden Hospital, we're co-located at two different sites, and it's a sort of cliche, but it's true in our case, to sort of bench to bedside and back again is absolutely critical. So we've had some fantastic innovations that involve that sort of co-location, that's all the cross-fertilisation between the two. So principally, it starts right in drug discovery. So both identifying, coming up with clinical hypothesis and testing those early stage drugs, and trying to figure out how best to what's the kind of best patient population, how do you develop biomarkers, how do you drive them? So that absolutely calls that sort of collaboration right the way through development. Then again, testing in a clinical setting, generating data, feeding that back into the science base, generating further biomarkers, stratifying all the way through.

So drug discovery thing is sort of central. It's always in partnership, and we've been lucky enough to have a couple of major successes in that area, which helps fund further research in other areas as well. We've got, whether it's innovative radiotherapy procedures that are being developed in the clinic, we have lots of clinician researchers who have got joint appointments in both places. And from the area that I work, they're the people that drive most of the business, they're the people that generate a lot of the innovation, and they're the people that are often open to work with companies to take it into, drive it to the patients and to get that impact. So it's been absolutely central for us, that co-location and that working together, I think, is we work essentially as a comprehensive cancer centre in that sense.

SARAH HAYWOOD: Raphael, you are one of these academics that comes running to the tech transfer office door as a serial entrepreneur on your third company. I know you're working in a really fascinating area, what we refer to as advanced therapies, and you're trying to unlock some of the bottlenecks and some of the technical challenges associated with bringing cell therapies into the clinic and to patients. Could you just start off for the audience benefit? Because perhaps everybody here hasn't got a deep life sciences background, but just saying a little bit about what we mean by advanced therapies, what cell therapies are, and then perhaps some of the things that need to be solved to really take these approaches through to patients.

PROFESSOR RAFAEL CARAZO SALAS: Absolutely, yeah. Thank you. So, first of all, we start with cell therapy. We're used to taking drugs to get treated. You have a headache, you get an aspirin, you have temperature, ibuprofen, you have cancer, you take a chemotherapeutic drug. But ultimately, all diseases in our bodies boil down to cells dysfunctioning in our organs and our tissues. So you can imagine that actually cells themselves could be the drug. And so that is what cell therapy is, basically using cells as drugs. It's been around for a while. I mean, we're used to blood transfusions, bone marrow transplant. That's a cell therapy, very complex one, but in its modern meaning, we mean special types of cells that have a very defined functionality that will compensate, restore, or get rid of something that's going on in the body.

So the poster child in the cell therapy space is something called CAR-T therapies that some of you may be familiar with that are now not just a billion dollar industry, but also a main type of alternative therapy for some types of blood cancers. But that's just the tip of the iceberg. So these are functionalized immune cells that can then be put back into a patient to target and chew up, let's say, the leukaemia, for example. But that's just one of many possible applications. You can imagine our cell dysfunction in heart conditions, or in metabolic conditions, or in retinal problems. Cell therapy is the space, basically, that focuses on developing cells as potential therapeutic products. It's great. It's a new pillar of medicine. It is already generating revenue as an industry.

It's projected to be more than $80 billion worth by the end of the decade. But it's plagued with problems. So cells are, you know, every molecule of aspirin is the same as every billionth molecule of aspirin, but every cell is kind of like a person. Let's say cellular cells are slightly different. The flip side of that coin is that cells do things that are much more interesting than drugs. You know, an aspirin could not become an ibuprofen, but a cell type of one kind could become a cell type of another kind. So they're great if we could leverage the power, but they're harder to work with.

And in terms of an industry, that translates into lots of money being invested in R&D and then manufacturing that then end up just like for drug discovery to go from bench to bedside, taking, you know, $1 billion to $2 billion, and then therapies that are really expensive. So how

expensive? In this country as a world first, in October, November, I think a therapy called Casgevy, for sickle cell disease, was approved as world first. And that's projected to be $2 million a dose. I cannot afford that. Most people in this room cannot afford that. Can the NHS afford that? The alternative from American companies is projected to cost $3 million a pop. In fact, CAR-T, back in the day, was thought to be the most expensive therapy that was ever going to be, and there was half a million dollars a dose. Now we're talking about $2 million, $3 million.

So where's this going to go? So unless we do something dramatic to change the cost of these therapies, we're going to make very few, if at all, therapies for very few conditions, for very few people that the public or private systems are not going to be able to sustain. And so this is where we come in as an industry. So we're leveraging artificial intelligence and real-time monitoring platform technologies that allow us to basically see during the development and eventually during the manufacturing process of therapies, where the basically where the costs are going up. So what happens is it's developing a cell therapy is a bit like a horse race. You start with 20 horses, then there's a lot of mistakes and then one of them is going to win.

So we're trying to lift that mist cloud by visualising in real time how cells are following instructions to become a functionalized cell type, whether it's a nerve cell, a pancreatic cell, a heart cell, so that we can improve use, reduce cost, reduce time, which eventually will mean more therapies for more people, for more conditions, for less cost, essentially.

SARAH HAYWOOD: Becks, you've already told us that you're wearing several hats here, but I'm going to ask you to put on the Bluesky AI hat. So, as part of the team that is developing the technology, which I know is currently being trialled within the NHS in Nottinghamshire. So can you tell us a little bit about what it's trying to do and what the application is?

REBECCA GANS: Absolutely. So we use machine learning to analyse face and voice data to understand medically relevant expressed behaviour. So just as an example, depression. And what that means is that at scale, if you think about it, 2019, pre-pandemic, they said there were a billion people in the world who actually had diagnosed mental health issues. Post-pandemic, is it 1.5 billion? They haven't actually confirmed that, but fundamentally, we're looking at 15% plus of the global population. But we also have - there's not enough mental health staff, there's not enough experts, there's not enough beds. So what Bluesky is doing is developing something where you can have an objective assessment on your device, ethically managed in terms of your data, to actually evaluate your mental health well-being at scale.

So what that means is you can actually monitor your mood and manage it earlier. That helps with prevention, obviously a massive thing for the NHS, but also, if you are diagnosed, how do you actually manage and empower yourself to manage your own condition and also help your clinicians manage them more effectively? The issue with the current things are in place every time you analyse your own mental health. It's subjective. You use something like PHQ-9. I've done it myself after my dad died and I had counselling for grief. You're just always looking at this little indicator and it's subjective. Whereas what we need to move towards is where we can is objective data in terms of analysing our own health and wellbeing. And that's what we're actually offering in terms of Bluesky, we're doing a clinical trial with MedTech.

So at the moment we're going through that and we're working with Nottingham and we're also working with partners as well, going out into primary care in Manchester. So we're growing our collaboration group, which is fantastic. So we're right at the early stages there. But the other

thing we're doing, which is maybe part of the solutions later, we're aiming to make it easy for the NHS to start to say yes.

One is we're looking for partners who are already in the NHS where we are really good adjacency, but the other side of it as well is we are working with pharma, so they're doing clinical trials and they are looking, and we are actually just signing contracts where they're going to use our technology to actually establish the efficacy of their clinical trials by actually understanding people's mood as they go through their clinical trials, we're not diagnosing monitoring moods, so we can do that non-clinically, which means when we get to the point where we're actually through clinical trials, we've been working with big pharma. It makes it a lot easier for NHS to say yes, because NHS is risk averse. Remember, I am an NHS non-exec, so I say it with love.

SARAH HAYWOOD: Let's turn to this question of how do you get into this behemoth of the NHS? We heard from Kristen about the opportunity. This is a service that has 60 million people using it, data, fantastic capability, but also some challenges. And I think perhaps sometimes there's a sort of misconception that because it is a national health service, that it's one system that can procure and adopt and spread easily. And I know, because you're sitting here nodding, that you know, that what I'm going to come to is actually, that's not the case at all. So, Becks, you know, you've already said you're on the other side of the desk as well in terms of being on the board of an NHS foundation trust. What are the organisational challenges in terms of adoption, spread, procurement, etcetera?

REBECCA GANS: It's worse than Noah's ark, isn't it? It's not even two by two, it's going one by one when you're selling. It's an absolute - well, very hard work. So, fundamentally, you do have a system that operates with sovereign organisations that are all measured on an individual basis, even within their regional framework. So, you know, I'm Greater Manchester is where we are. So we think Greater Manchester integrated care systems, what that means when you're selling into the NHS, you go in one by one, and then on top of that, you have to say, is there another overlay in terms of what happening at your regional system at GM level?

You'd argue that should make it easier, but because the integrated care systems vary in their, how they've settled down and their effectiveness, what they're dealing with the challenge that's in the NHS right now with money and activity, it means it's actually very difficult. So what you have to be ready for