WORK THAT MATTERS: DATA SCIENCE VS PANDEMIC

AUDIO TRANSCRIPT

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Sachin Patel: The NHS COVID-19 app probably needs no introduction. The app itself has been downloaded more than 20 million times since its launch in September 2020. And it was used by venues up and down the country to check in customers and prevent oubtreaks. But how did the evolution of that app play a role in tackling the infection rate when we were in the middle of the pandemic?

And what does this mean for our attitudes to data in the delivery of public services? Hello and welcome to Work That Matters, a show where we talk to some of the people involved in initiatives that have transformed organisations and people's lives. We'll hear what drove them to embrace change, their experiences of working on these projects and what they've taken away from them. My name is Sachin Patel, and in this episode I'll be talking to someone who was at the heart of the response. Professor Mark Briers was part of the team at the Alan Turing Institute that worked on the NHS' COVID-19 app.

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His credentials in terms of data and statistics are numerous. At the Turing Institute, he was program director for Defense and Security, and the co-chair of the Research and Innovation Advisory Committee. He is currently an honorary senior lecturer at Imperial College London, where he teaches methodological techniques for use in a big data environment. And Mark is a council member at the Royal Statistical Society. Mark, welcome.

Prof. Mark Briers: Thank you.

Sachin Patel: First of all, would you like to explain who you got involved in this unique and crazy moment in history?

Prof. Mark Briers: I first got involved in the project because somebody senior within government contacted Sir Adrian Smith, the chief executive at the Turing Institute, at the beginning of the crisis, and was asking for people with various different kind of areas of expertise to support different initiatives going across governments. In part, I was chosen to kind of align myself to the app, as well as stepping forward

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because of my knowledge around defense systems and in particular around radar solutions and how they work. And so the natural parallels between radar and Bluetooth, radar being that kind of distance, estimation, procedure and Bluetooth being used for distance information in this context. It kind of lined me up quite nicely to work on the project. And so that's how I ended up sitting in front of the app team trying to figure out some stuff.

Sachin Patel: That's quite a jump from the world of radar to the world of public health. Can you talk a little bit about how that expertise in that particular type of location and technology transferred across to this setting?

Prof. Mark Briers: Yes. So distance is one of the well discussed – distance estimation is one of the well discussed items in the press around, you know, is a smartphone able to judge distance between two individuals? And if you think about how this device may be working, what's happening on your smartphone is that it's advertising, that, it's basically just shouting via a Bluetooth channel saying, "I'm here, I'm here",

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and it's doing that quite frequently. And then another device, a device that one of your friends say is listening for those shouts, and it's looking at the drop off in signal strength to be able to establish how far away the device is. So it's akin to if you're standing next to somebody and you're shouting, then you sound very loud, if you're standing far away from them, you're shouting at the same volume, then it sounds less loud, and you can judge that you're further away from them just based on the kind of the magnitude of that volume. That really did allow us to produce world-leading algorithms that made sure that if you were asked to isolate, you were genuinely at risk because you'd you'd been near somebody for the requisite amount of time, at the requisite distance and therefore should be isolated.

Sachin Patel: OK, I think I can start to see why they call you up, Mark. And we think we're all very familiar with the NHS COVID-19 app now. But you say, you know, the scrutiny, I imagine, really without parallel. This was definitely a first of its kind venture in a way.

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I mean, many of us have become very used to sharing health and location data through apps. But I think this is probably one of the first times I've seen the government take a similar approach. How did you arrive at this idea? What made the team think that this would be a useful tool in the pandemic?

Prof. Mark Briers: So there's been a number of studies over the years from academia suggesting that digital contact tracing may be useful for the containment and control of infectious diseases. The earliest paper I could come across was from 2010, but the kind of pivotal moment, I believe, was around February 2020 when a team from Oxford University published some modeling research, which suggested that digital contact tracing could help to play a part in containing the kind of transmission of the virus. And that paper was used to convince ministers and senior decision makers within governments that there is something within the context of an app as

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part of a collection of activities that you could help to contain the virus. And so the decision was made to kind of move forward at pace on the development of the app.

Sachin Patel: Data clearly played a major role in making the case for developing the app. But what role did data play in the app itself, how it ingests data, what it what it does with it?

Prof. Mark Briers: So if we take a step back from the details of the app and just look at it a little bit more holistically, in my mind, the app was a data science research project. It had never been rolled out before in the U.K. or in fact, anywhere else around the world, at least at scale. And fundamentally, there's kind of two forms of data that could be useful from the app. The first is the data that stays locally on the device that is able to compute risk associated with interactions that we reach having and to be able to decide on our behalf and advise individuals as to whether they should isolate if the risk has exceeded a certain threshold. So that's the first form of data. So local interaction, data between individuals,

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the second form of data that could be useful and proved to be useful, was being able to gain privacy compliant insights from the application. So data from the application sent back to the secure NHS service so that we could understand what was going on, not necessarily an individual level in focusing exclusively on individual level, but an aggregate level, let's say a county level across England and Wales. Doing so, we were able to feed information up to decision makers around how the virus is changing as a function of space and time.

Sachin Patel: And is it fair to say that that data also had a role to play in proving that the app was actually working, you know, in terms of the differences from one area to the other?

Prof. Mark Briers: Yes. So there's a number of challenges associated with 'is an app working', you know, in a conventional application that gets rolled out, they get instrumented very heavily. And I'm sure we're all aware of different applications that take a lot of our data from our devices.

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Now, the underlying promise from the NHS COVID-19 uptime to the citizens was that we would do our utmost to make sure that this was the most privacy preserving application out there. And we stuck to that. But we did need to know that the application was working just in the sense of, it's installed on your device, is it doing anything at all? When you roll out an application to 20 odd million devices, just having that simple signal to say, yes, I'm working, yes I'm functioning, is useful. But then there's a kind of wider collection question, which is, is the app actually delivering any health value, have we all got a placebo installed on our device, or is it actually doing something useful? And so for that question, we did take some of the data that was passed back to the central secure servers and we're able to do the analysis of that data to disseminate the app was having positive health value.

Sachin Patel: I wanted to pick up on one thing you said earlier about the data that was sent back from the app to the NHS' secure environment and what was done with that to inform

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decision making. But I think before we go there, I just want to touch on, you know, what you said about installing almost a placebo on people's devices and the sort of concern or question mark over that. Over and above any impact the app has directly had, could you talk a little bit about those secondary effects maybe, that it's had in terms of people installing this app, using the QR codes and so forth?

Prof. Mark Briers: So there's a number of different features that we included in the app to promote health outcomes primarily, but also to promote adoption and to promote user engagement. And you mentioned QR codes, and I think that's one of the most interesting features that we delivered as part of the application, because I remember reading stories before the app was launched. The government introduced a policy that if we went into a pub or a restaurant, we had to write down our names and phone numbers and perhaps addresses. And that was leading

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to some individuals, particularly females, being harassed, as I read the stories, or remember the stories because people were kind of copying the details. And so obviously that solution wasn't particularly privacy preserving. And so the system, which is completely privacy preserving, you take a snapshot of a QR code, which I'm sure you're all familiar with, stores information locally on the device never gets sent back anywhere. We don't know who the individual was, nor where they checked in. That information is critical for a lot to allow us to send messages back to individuals that may have been in the venue in a way that is completely privacy preserving, the details of which I can go through. But that was just one way in which we were able to drive user adoption, by having QR codes placed in millions of venues around the country – well, England and Wales. And what we got was, well, we had free advertisement. It was a genius idea, really. We had free adverts all around the country encouraging people to download the app. And in doing so, they were promoting their own individual privacy. They were promoting their own individual health outcomes, and they were also protecting

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Their communities, their loved ones or friends and so on. So we felt it was a win-win from every perspective.

Prof. Mark Briers: Going back to the point about how that data is being used to inform the broader decision making. Could you talk a bit about that?

Prof. Mark Briers: Yeah, sure. So on a daily basis, each device, each up sends back about 30 or so data items. So we can't link it to you or me or anybody else. And the only thing we can link it to is the postal district that you specify when you first register with the app. And so we can't join these things at the time. There are no identifiers in any way, shape or form. These 30 data items, what they allow us to do is to track the evolution of the app, whether a collection of individuals are in isolation or not, and the reasons for their isolation - you know, is it because they've tested positive? Was it because they've been asked to isolate and so on? So we can compute proportions of individuals with within a particular area being asked to isolate. And that's really useful because that information comes back on a daily basis.

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So it's near real time and it comes back over overnight essentially, and it's near real time. And therefore it gives it gives decision makers, policymakers, public health officials at the national and local levels insights that they wouldn't be able to glean in such a kind of timely manner.

Sachin Patel: What other sort of impacts did you see from the app? What was it doing and what does it have to say for itself?

Prof. Mark Briers: So we published a nature paper in May. And if you search for the epidemiological impact of the NHS COVID-19 app using your favorite search engine, then you'll find our paper. And in that paper, we were able to demonstrate that the application in England and Wales in 2020, so that's from September through to the end of December 2020, was able to have a median estimate of 600,000 cases of covid. So in those three months alone, that's 600,000 cases, and that translates into at least the low thousands of deaths averted too.

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Although that number is much more difficult to establish because it requires lots of additional analysis. But we were able to demonstrate through this peer reviewed research that the output had a very positive health impact. And that's in no small part to the population adopting the app for many, many reasons. And that's just 2020 alone. Of course, the app still in existence from the point of launch until today. And so we know that it will be at least twice that number now, if not greater, given the different surges of the virus that we've had since that point.

Sachin Patel: Could you talk a little bit about how the data was used from the app to actually inform that that paper in nature?

Prof. Mark Briers: What we wanted to do was to get as many users as possible, so in an ideal world. Everybody would have downloaded the app and we'd have had 100 percent across the country and that would have caused a challenge for us in a sense, from a statistical perspective. But actually, what we were able to do in reality was take the differences between, say, one county and another county,

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and use those differences in terms of app uptake and the trajectory of the pandemic during that period and the studies in September to December, and look at the differences in app uptake and the differences in pandemic trajectory and then established the results and kind of app impact.

Sachin Patel: That's a really interesting dynamic. And if I'm understanding you correctly, you were using the very fact that the app had different levels of take up in different parts of the country. And that played a part in terms of how you demonstrated the efficacy of it.

Prof. Mark Briers: Exactly. It's a blessing and a curse. So regions that have been hardest hit by the pandemic tend to have the lowest app adoption. And obviously the converse is true, too. And so what we wanted to do was to ensure that those regions that had low app uptake actually adopted the app because we knew that by adopting the app they could gain greater health impacts and there'd be a lower number of cases.

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How did you manage to ensure the rigor in terms of how the data was used, what it was being used for whilst delivering at such pace?

Sachin Patel: So we had, we were blessed with the A Team, in my opinion. We had the very best people from across the country working on the app. And my job was to ensure that there was scientific rigor underpinning the app. And so I would work, from a scientific perspective. I would work with leading academics from the UK and from around the world to ensure that the best possible scientific solution was able to be developed from a risk characterization perspective. But we also had a really strong data governance team. They were working with the Information Commissioner's Office, taking advice and making sure that it was from a data governance perspective, everything we was doing was above and beyond anything we ever needed to do, with respect to privacy, security, ethics and so on. And we had the National Cybersecurity Center supporting us and providing input from a

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cybersecurity perspective so we can ensure that people's data were always going to be safe and the application that was deployed was as bulletproof as one can make such an application and so on and so forth. So we really genuinely, in my humble opinion, we really genuinely did bring the best people that we could find together. And that paid dividends ultimately.

Sachin Patel: I suppose so often we think of apps as being developed by technologists. What would you say about the diversity of the team in terms of the breadth of expertise and disciplines?

Prof. Mark Briers: If you ask me, you know, 18 months ago, I would have thought that a strong application would just need some strong computer scientists, programmers, maybe, a mathematicians or two, but certainly some data scientists - I would say that, of course - and that would be all you need. But actually what we were able to do at the app and this this paid dividends was to pull together a very

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large enough, diverse team. So we had policy specialists, we had legal specialists, we had communication specialists. We had people that were able to understand the accessibility of such an application, not just its usability accessibility, but also from a hard to reach community perspective, how we can engage with such communities in order to drive adoption and to promote positive health outcomes in those communities and so on and so forth. We have people who are translating the app into - the text on the app into multiple languages. And it was all of these individuals that came together around the shared common goal and that enabled us to deliver such a strong app. I think I genuinely think hand on heart, that if it had just been a bunch of technologists that delivered this up, then it would have been fine but it wouldn't have been anywhere near as strong as it turned out to be.

Sachin Patel: I imagine that's one learning point that maybe you'll take into future endeavors. Were there any other factors, I suppose, looking back, that you think,

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you know, I'll take that with me? That was a lesson learned.

Prof. Mark Briers: I think over the past year, my communication skills have improved. The ability to communicate quite complex statistical insights to ministers, to the press, to people who needn't necessarily have statistical knowledge in a way that allows them to understand the complexity at the level they need to understand it, allows them to make decisions that they need to make, but that doesn't hide them and shield them from some of the detail that exists, because the detail, the statistical detail is important to know. Statistical nuances are important. So I think my ability to communicate has certainly improved. That's something that I'll take forward as an individual over the next year and many years ahead. It's how I'll be constantly looking at others for inspiration as to how they communicate complex technical and statistical information to non-specialists in a way that drives the right outcomes and in a way that

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drives the maximally beneficial decisions.

Sachin Patel: Well I think the explanation of the technology earlier in our conversation, I think is testament to that. And on a personal level. How did you find working on this app, on this challenge, in this unique situation?

Prof. Mark Briers: I've worked for some amazing organisations in the past in defense and security, in academia and so on. But I can genuinely hand on heart say that this has been professionally the best year of my career. It's just been such a humbling experience to work alongside experts, to contribute to the pandemic response in a way that, you know, at times felt - it felt unbearable just because of the pressure that was on us, the scrutiny that was on us, but we all maintained our focus on the thing that mattered, which was delivering a non-pharmaceutical intervention at scale. And that was, we were determined to make sure that it was going to deliver positive outcomes. And then the results that we produced, which demonstrated that were something that I'll live with for the rest of my life,

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as something that I'm proud of, not just my involvement, but the whole team's involvement.

Sachin Patel: It's something you'll live with for the rest of your life. What a note to end on. Mark, thanks so much for sharing your experiences and insight with us. It's been fascinating to hear all the thought that went into such a groundbreaking app.

Prof. Mark Briers: Thank you very much. It's been great to chat with you and thank you for having me today.

Prof. Mark Briers: And thank you for joining us to hear about this moment that mattered. We'll be back next time with another story about embracing change. And if you enjoyed this podcast, please share it with your friends, family and coworkers. Again, thank you.