PETRAS

Summary Edition

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COVID-19: The Internet of Things and Cybersecurity

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The COVID-19 pandemic has inspired a range of Internet of Things (IoT) innovations to help stop the spread of the virus. This is a summary edition of COVID-19: IoT and Cybersecurity.

Past editions are found on the PETRAS website.

A table showing a timeline of key developments in the UK digital contact tracing effort is attached as a supplement to this briefing.

Overview

- A detailed timeline of UK digital contact tracing shows the many factors that have influenced the development of the now decentralised app currently awaiting trial before further release.
- Interest in IoT devices that are helping stop the spread of COVID-19 has dramatically increased. We present 14 use-cases in the UK context.
- Wearable devices are especially popular globally with many countries deploying these in order to enforce quarantine, maintain social distancing and assist with contact tracing applications.
- Despite the controversy, so-called 'immunity passports' continue to attract interest from governments and the private sector. The WHO has continued its stance that there is currently no evidence that people who have recovered from COVID-19 and have antibodies are protected from a second infection. Ethical concerns with these passports include discrimination and other harms such as targeting and profiling.

How IoT devices could control the spread of COVID-19 in the UK

In an attempt to tackle coronavirus there has been increased interest in the use of wearables around the world. Devices such as Fitbits, smart bracelets and patches are some of the wearables deployed to aid in the effort. The benefit of using this technology is that the virus can be picked up even before symptoms appear – this is done by monitoring 'biomarkers' such as heart rate or skin temperature.[1]

Remote monitoring would allow patients to 'track their own biomarkers in communication with their doctor, and health authorities could observe the emergence of disease indicators at a population level'. Difficulties with the use of wearables include their demographic and geographic ownership. Where ownership is low, outbreaks may be missed.[2]

Wearable devices for health monitoring

In the UK in April, a remote digital monitoring solution was being used in a traveller quarantine setting near Heathrow Airport to remotely detect signs that a patient's condition is worsening, detecting vital signs every two minutes, in contrast to manual recording hours apart.[3] A wearable patch monitors respiratory rate, temperature and heart rate. The trial, REMOTE-COVID is led by Imperial College London[4] in partnership with the NHS[5] and Sensium. The trial aims to monitor for patient deterioration, understand which people are most affected by COVID-19, and reduce the potential exposure to staff.

The wearable patch system has since been deployed in a hospital setting in the Wrightington site at the Wrightington, Wigan and Leigh NHS Foundation Trust in the UK, as well as successfully deployed in new hospitals in the Netherlands and France.[6] The 'smart patch' is now expanding to

healthcare providers in the US via a partnership with a US-based accelerator in June.[7]

Wearable devices for maintaining social distancing

In May, a number of UK companies started testing a wearable device called Bump. The device was developed as a specific response to the UK government's social distancing measures and is marketed as a preventative measure to help businesses enforce social distancing.[8] The device is worn on a special lanyard around the neck, or clipped to clothing and uses Radio Frequency (RF) to then alert the user via flashing lights and sound when a contact has occurred. Wearers and site managers are able to access the systems analytics in the cloud. The device became available for commercial use in June 2020.[9]

Wearable devices for early detection of COVID-19

King's College London launched a mobile app, Mass Science[10], in July to investigate whether heart rate, activity and sleep data collected by wearables such as Fitbits, can give an insight into early warning signs of COVID-19, when analysed in conjunction with data on location, mood, mental health, and COVID-19 symptoms and diagnosis. If successful, the results could be used to develop a continuous monitoring system which sends alerts to the user when they may be experiencing early symptoms of COVID-19.[11]

Remote monitoring platforms to monitor patient health at home

In June, the NHSX launched a partnership with Huma, a British health technology startup to support 'Virtual Wards' which aim to 'see how healthcare teams can get patients to hospitals at the right times for better outcomes, [and] better support early intervention to avoid patients needing ITU care and help to prevent virus spread'. The partnership involves the roll-out of a remote patient monitoring platform to six hospital sites. Initial trials from April involved patients with mild-to-moderate COVID-19 symptoms who had been discharged from hospital being monitored remotely at home for deterioration. The remote monitoring platform includes a mobile app combined with remote testing equipment including a pulse oximeter device and photoplethysmography carried out using a smartphone camera.[12]

Remote monitoring platforms to discover biomarkers for early identification of COVID-19

In July, Huma announced a partnership with the Fenland Study research team at the University of Cambridge to understand the progression and early signs of COVID-19[13]. The study plans to measure how many people 'have evidence in their blood of previous infection with COVID-19' and to investigate 'whether it is possible to identify the COVID-19 pre-symptomatic phase using measurements of symptoms collected via Huma's smartphone app. Researchers can ask participants to provide data through the smartphone app using data from sensors and connected devices.[14]

Remote monitoring of breathing to provide early warning of sudden breathlessness

In April, a privately-owned UK-based engineering company received funding from UK Research and Innovation to develop a prototype 'non-contact breathing rate monitor that will give medical staff and carers early indication that an individual suffering from a respiratory illness is in need of more urgent care'.[15] The company states that monitoring patients' breathing may be more accurate than taking someone's temperature in spotting the disease. Prior to the pandemic, the company completed a 12-month clinical trial and confirmed that the monitor could track differences in breathing down to an accuracy of a quarter of a breath per minute'.[16]

Automated robotic fulfilment platforms for grocery orders

In July, Tharsus announced their partnership with the Ocado Group, an online grocery platform provider, has been extended to 2024. Tharsus will continue to manufacture the robots that make up the automated, robotic fulfilment platform which will be paramount as the process of fulfilling grocery orders moves online as shoppers increasingly move towards contactless home delivery services.[17]

Drones for transporting medical supplies

Oban Airport is using drones to deliver medical supplies to island communities in Scotland. The trial aims at changing the way health services link to remote communities. The drones are provided by Skyports, a London-based drone delivery service in conjunction with the NHS.[18]

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Smart speakers to provide health advice

Following a partnership between NHS and Amazon announced last year, Amazon Alexa devices began automatically searching the official NHS website when UK users ask for health-related advice in July. This is likely to be beneficial for more vulnerable patients such as elderly people who may find browsing the internet for answers difficult, or having to physically visit a clinic. Health Secretary Matt Hancock has also praised the NHS for embracing the technology, believing it could relieve the NHS of some stress.[19]

Mobility data to understand the impact of lockdown measures

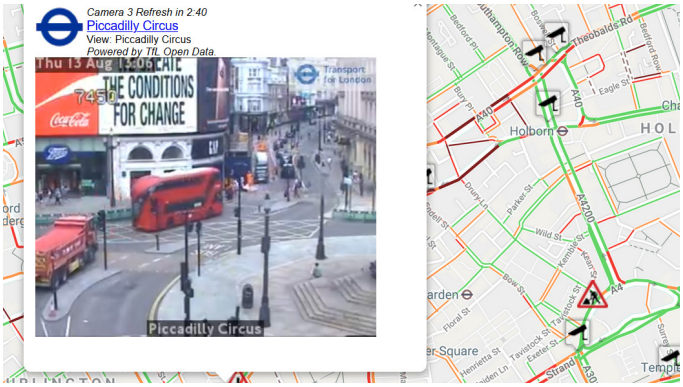
A camera feed network is monitoring anonymous social distancing across 16 of the UK's towns and cities. A company called Vivacity developed a new feature on their smart video sensor devices immediately following lockdown which is able to measure the distance between individual pedestrians.[20] Data from this network is being used to inform the COVID-19 response in the UK.[21] An analysis on social distancing adherence has been released to support researchers, local authorities and government in decision-making as lockdown guidelines are relaxed.[22]

The Smart Cambridge project has provided an analysis on a quantitative metric for the degree of lockdown in Cambridge, UK.[23] The data is collected by a network of urban sensors in the region. Pedestrians, cyclists, cars, vans and trucks are classified from images from Vivacity cameras and then counted. Updated graphs up to 20 June are available.[24]

The Newcastle Urban Observatory updates a COVID-19 Live Impact Dashboard for the Newcastle area. Data collected includes traffic volumes against a baseline[25]; pedestrian flow[26]; car park occupancy[27]; air quality[28]; and energy consumption.[29]

A new website is using pedestrian flow and car park occupancy data to show real time information about the number of people on a busy street in Newcastle and produces a traffic light system which indicates how easy it is to practice social distancing at a certain time.[30] Data from these networks have allowed decision-makers in Newcastle to see how changes in national policy play out in real-time in the city.[31]

The Alan Turing Institute is currently undertaking a project to bring together datasets capturing mobility, transportation and traffic activity over the city of London.[32] Data is sourced from JamCam cameras[33], traffic intersection monitors, and GPS activity from the Turing's London air quality project utilising city-wide air quality sensors.[34] This will help policy makers to better understand 'busyness' and 'enable targeted interventions and effective policy-making'. The end product 'will be an application program interface (API) with which the Greater London Authority, Transport for London, London Data Commission, and the Office for National Statistics may query for access to both the data sources and the analysis outputs from the algorithms and statistical models developed.' This project could potentially help authorities in London to better understand 'the extent to which people are staying home' and serve as an 'early warning system' that can trigger necessary interventions.[35]



Machine learning and AI to understand critical care

Pre-COVID, a team from Imperial College London developed an algorithm, the AI Clinician, to suggest treatment for sepsis. As reports show sepsis is a major part of severe cases of COVID-19, the team are using tools in machine learning and AI to map the COVID-19 pandemic to 'understand the longitudinal critical care disease trajectory in infected ventilated patients in order to provide clinicians with prediction models of survival, deterioration, and intervention success'.[36]

Robots for remote cleaning

In May, Heathrow Airport began trialling thermal imaging temperature checks which 'continues to perform well in a live operational environment. The airport has since also installed disinfection robots that use ultraviolet (UV-C) light to kill viruses overnight.[37]

Image: © www.tfljamcams.net

Researchers from the University of Essex have partnered with facilities management company Cloudfm to develop an IoT based system to minimise human involvement in the cleaning process. The plan is to deliver automated disinfection systems for personal protective equipment (PPE), testing and monitoring equipment, ventilators and beds in a hospital setting.[38]

Smart bins as a proxy for economic activity

Smart bins can alert local services when they are full and need collecting.[39] However, Leeds City Council realised that this data combined with knowing the location of these bins are a 'pretty good proxy for the economic activity going on around them'. For instance, the 'amount of rubbish going into bins around train stations has fallen... suggesting that public transportation is still being avoided by city dwellers'.

The head of data at the Open Data Institute in Leeds believes that smart bin data could 'boost small businesses' ability to recover in the long term, as they get a clearer picture of the places where potential customers are congregating'. The insights from this proxy data show that opening smart city data to the public allow smaller businesses, who cannot pay for detailed analysis, to make decisions. It also brings into focus the importance of utilising and repurposing data that is already available.[40]

Thermal imaging for symptom tracking

On 21 May, Heathrow Airport began trialling the suitability of thermal imaging cameras to screen for passengers with raised temperatures. The trial will last for one month. The results of the trial could help determine if this equipment could form part of the Common International Standard for aviation in a world with COVID-19. The trial uses infrared sensors to monitor passengers and identify individuals who may have higher temperatures. No personally identifiable data of passengers or colleagues will be stored or collected.[41]

A report in February by researchers at the London School of Hygiene and Tropical Medicine estimates that 46% of infected travellers would not be detected (depending on certain factors) and that airport screening is 'unlikely to detect a sufficient proportion of 2019-nCoV infected travellers to avoid entry of infected travellers'.[42]

How wearable IoT devices could control the spread of COVID-19 (global focus)

Wearable devices for enforcing quarantine - Bulgaria and Hong Kong

Polish software house Comarch provided fifty 'LifeWristbands' to health authorities in Sofia, Bulgaria to be used in home quarantine in a pilot scheme from April till July.[43]

A user's health is continuously monitored, and a voice call function using a built in SIM card allows quick medical assistance. The SIM card also allows law enforcers to call and check whether quarantined individuals are at home and a built-in GPS module means that authorities know if a person violates quarantine.[44]

In March, Hong Kong made it mandatory for arrivals to wear wristbands and download the corresponding StayHomeSafe app in order for authorities to ensure visitors were adhering to a 14 day home quarantine. The user wears the wristband during the quarantine period and must keep the mobile app running on the phone with location services, Bluetooth and Wi-Fi turned on. The app detects these signals and monitors a change in signal to determine if you have left your dwelling without permission. The app can also request that you confirm your presence by scanning a QR code on the wristband.[45]

From 1 April South Korea made it mandatory for anyone arriving from abroad to self-isolate for 14 days. Compliance was monitored through a location tracking app: Self-Quarantine Safety Protection.[46] However, some people left their phones at home in order to get away with breaking the self-confinement rules. In response, the government issued wristbands, which connect to the app via Bluetooth, to those who were caught breaking quarantine. The wristband would alert officials if someone tries to leave their home or destroy the wristband.[47]

Wearables devices for early detection of COVID-19 - Liechtenstein

As part of the COVI-GAPP study and supported by the Liechtenstein Government, 'sensory bracelets' were voluntarily provided to approximately 5% of Liechtenstein's population in April.[48] The device monitors skin temperature, resting pulse rate, perfusion, breathing rate and heart rate variability.

The aim of the pilot is to collect data to allow early detection of COVID-19 as well as becoming a remote measuring device for high-risk groups that are self-isolating. The researchers hope that the first round results expected in Autumn will support expansion before the potential second wave of infection. The project is still ongoing till December 2021.[49]

Wearable devices for maintaining social distancing - Belgium

In a response to a call by the Flemish Government to create digital solutions for helping society through the current corona crisis, technology company Rombit launched a digital bracelet to prevent coronavirus infections on the workfloor[50] in April. The device was later tested at the Port of Antwerp.[51] The bracelet works by sending warning signals (visual and vibration) to the user when they get too close to another worker. Location data is not shared with the employer. The bracelet also permits contact tracing within the workplace, an infected user can consent to a health advisor accessing a list of wearable IDs that have a logged contact-event.[52]

Wearable devices for temperature monitoring - China, Global

A Chinese wearable technology and innovation company, KC Wearable, has developed a 'smart helmet' that can screen the temperatures[53] of up to 200 people a minute. The device is powered by facial recognition technology and an infrared camera, and 'has the potential to link up to other data on COVID-19 tracking apps'.[54] The company reports that it has scanned over 80 million people in China.[55] The company reports that the smart helmets are being used in over 35 countries[56], including to Italian police[57] and in Fiumicino airport in Rome[58], as well as in airports and logistics hubs across South Africa, as well as in the UAE, Turkey, Kuwait, Chile, and the Netherlands[59].

Wearable devices for contact tracing - Singapore

Singapore was one of the first countries to release a digital contact tracing solution, TraceTogether, which uses Bluetooth technology to alert users to potential contacts with COVID-19. The solution requires a centralised data storage, and does not adhere to privacy specifications required to utilise the Apple and Google API. However this meant that the app must be left running in the foreground on Apple systems, and therefore is a drain on battery. Singapore decided to stay with TraceTogether rather than move to a different approach, and stated that the accessibility of TraceTogether is the top priority.[60] Subsequently, the government announced TraceTogether Tokens to complement the existing app.[61]

The first batch of nearly 10,000 TraceTogether Tokens were distributed to vulnerable senior citizens who are not digitally connected from June 28.[62] The device is designed to be carried around by the user. Every five minutes it scans to detect other TraceTogether devices, or users of the TraceTogether app and records proximity data (which it stores for 25 days). The battery allows the device to scan continuously for between six and nine months.[63] To allay fears on data privacy, the government held a 'tear down' event for experts to analyse the device.[64]

Wearable devices and other tracking technologies in the workplace - is it ethical?

Despite workplace tracking technologies being able to potentially speed up the lockdown process, as restrictions ease, companies may decide to keep using these technologies if there are no incentives to stop. There are also serious ethical issues involved with increased workplace surveillance. Privacy International believes that although increased monitoring and surveillance may bring greater efficiency and productivity in the workplace, there is 'little regard for workers rights and well-being'.[65]

The Ada Lovelace Institute has also expressed concerns with what will happen 'post-crisis if an employer decides to keep on monitoring'. They warn that 'we could be sleepwalking into further surveillance without safeguards in place' and that the boundaries on data and workers' rights are shifted when data is being sent to your employer about your social distancing at work (e.g. tracking who you congregate with). This shift creates 'opportunities for abuse, breach of rights and discrimination'.[66]

Immunity passports

Immunity passports, or antibody certificates, have long been seen as a method to help lift lockdown restrictions. The digital credentials are given to people who had the virus and are now presumed immune, and for significantly lower risk demographics. These passports are controversial, the World Health Organisations warned against their use[67] on 24 April by stating that 'there is currently no evidence that people who have recovered from COVID-19 and have antibodies are protected from a second infection'.[68] This guidance is continuously monitored, and as of August 2020 has not been updated.

Ongoing work on the immune response to COVID-19 suggests immunity passports cannot be relied on

On 14 July, researchers at King's College London analysed the immune response of more than 90 patients and healthcare workers at Guy's and St Thomas' NHS Foundation Trust. They found that 'people are producing a reasonable antibody response to the virus, but it's waning over a short period of time[69] and depending on how high your peak is, that determines how long the antibodies are staying around'.[70]

A pre-print on 30 July outlines findings which have implications on the usefulness of antibody certificates and the durability of vaccine protection. However, the study notes that the role of T-cells generated through infection or vaccination on 'immunity' to COVID-19 has not yet been studied, and these may provide some protection.[71]

These early studies are adding to the evidence that receipt of a positive COVID-19 antibody test does not prove immunity against acquiring the virus again or passing it on to others.[72] Accordingly, a passport, digital or paper, certifying that you have had coronavirus and are therefore 'safe', should not be relied upon.[73]

The UK has looked into antibody certification and researchers have preemptively created privacy preserving suggestions - not enacted

In the UK, the Secretary of State for Health and Social Care announced on 21 May that the government was looking at systems of certification to ensure people who have positive antibodies can be given assurance about what they can safely do'.[74]

On 2 June, a US-UK research collaboration[75] preprint presented 'SecureABC: a de-centralised, privacy-preserving system for issuing and verifying antibody certificates'. The team also propose a framework of general principles and a set of security and privacy requirements for immunity passport systems. The 'decentralised design of SecureABC allows for user privacy by design, and ensures that the healthcare provider (or government) does not learn when or where a citizen uses their certificate'. SecureABC minimises centrally stored data in order to prevent abuse and for the system to be easily dismantled after it is no longer required. Certificates may also be revoked in 'a privacy preserving-way' if necessary.[76] A note on the proposed framework; the authors do not believe a single scheme 'can simultaneously satisfy all of these properties as several of them present a trade-off'.[77]

Some start-ups have been looking into ways of adapting their existing anti-fraud systems for immunity passports. Onfido, a UK-based digital identity startup, has reportedly been in talks with the UK government in May. This start-up offers 'single-use QR codes and digital holograms that prevent users from taking screenshots or photographs of other people's codes and attempting to use them as their own'.[78]

On 22 June, the Ada Lovelace Institute launched a page to monitor systems for verifiably sharing private health data relevant to public health (for example, health status apps and digital antibody certificates). The page will be updated on a regular basis.[79]

The Parliamentary Office of Science and Technology is producing rapid-response content on COVID-19. They released an analysis on antibody tests for COVID-19 on 16 June which includes an

analysis on immunity certificates.[80] The Scientific Pandemic Influenza Group on Behaviours (SPI-B) provided recommendations to the government to maximise the benefits of antibody testing while minimising potential harms.

Alternatives to QR codes - VCodes

QR codes are becoming more popular than ever during the pandemic. As well as being a key feature of many digital immunity passport solutions, they are being used for contactless ordering in pubs and restaurants, where the QR code can be printed or carved into surfaces, then scanned with a smartphone to show a menu.[81]

However, using QR codes is not without risk. Cybersecurity experts warn that security flaws could pose a danger to the user.[82] It is possible to trick users via phishing attacks by putting up fake QR codes, and QR codes themselves can be manipulated to change encoded information, potentially producing attacks on backend software.

A British cybersecurity company, VST Enterprises, has signed a deal with a US cybertech company to supply VCode(R) technology to create a digital health passport, COVI-PASS. VCode(R) technology can be scanned from up to 100 metres, and the company believes that unlike Bluetooth or QR codes, the privacy of the user cannot be violated. The company is shipping 50 million digital health passports 'to both the private sector and Governments in over 15 countries'. The company is also in talks with the NHSX and the Home Office to be used in various care sectors, as well as with the United Nations.[83] COVI-PASS is in beta and will be available in August.[84]

VST Enterprises also produce a V-Health Passport which has been updated to include a users' immune status and the CEO stated in May that the passport would be rolled out for UK summer sport, where the health passport would need to be scanned to buy a ticket online, and again at the sports venue entrance.[85] This has not seemed to have occurred in the UK as sport venues have not reopened to the public yet this summer.

Certificates to show 'lower probability' of recontracting COVID-19 in Chile - postponed

Against the WHO's warning, Chile decided to go ahead with plans for 'release certificates' just two days later on 26 April. The decision was backed by the Deputy Health Minister saying that the purpose of the certificates were not to prove someone's immunity, but rather to show that these people have completed the self-isolation process and therefore have a lower probability of contracting the disease again.[86] Nevertheless, Chile's Minister of Health decided to postpone the project just before launch in May because the issuance of certificates could cause discrimination in the job market between certificate and non-certificate holders.[87]

Immunity cards for access to higher-risk areas for people who test positive to COVID-19 antibodies in Spain - abandoned

Madrid authorities announced plans in July to introduce 'COVID cards' to people who have tested positive to COVID-19, in a pilot phase in September.[88] However the plans faced swift backlash from politicians, rights groups and epidemiologists due to concerns of discrimination, violations of data-protection laws, and being medically unsound. The authorities backtracked on the plans a day later, and have said the cards would not be issued.[89]

Integrated identity verification for lower risk hotel bookings in the US - pilot phase

AI-based identity company Onfido has partnered with Sidehide, who create a mobile hotel booking app. They are integrating an immunity passport into the hotel booking platform, so that Sidehide users can verify their identity and immune status with hotels. They can also use the app to bypass check-in, reducing contact between guests and staff.[90] The system was set to launch as a proof of concept in Miami in June.[91]

Sharing immune status for confidence and peace of mind in Estonia - pilot phase

In May it was reported that Estonia would start testing the world's first digital immunity passport. Back to Work is the non-governmental organisation developing the passport. Back to Work believes that 'the team's passport could help once immunity is better understood'[92] and that they will develop their technology simultaneously with scientists. In June, Estonia began testing its Immuunsuspass app which was developed by Estonian technology firms Transferwise and Guardtime working with health specialists.[93] Companies such as Radisson Blu Sky Hotel Tallinn, A&T Sport, and PRFoods are already participating in the pilot project. The

passport works by a user accessing a database via their Estonian ID to query a database for test results. The user can then choose to share the data related to immune status using a QR code to any individual or institution that requires it.

The developers note that if 'it turns out that there is no immunity, then at least we know that one way out has been thoroughly tested, although it has ended up in a dead end'.[94]

Corporate solutions to keep the economy running

In June, Deloitte Switzerland issued guidance to corporates on how to protect the workforce while keeping the economy running. They state that immunity tests could come into effect under three scenarios - Government-enforced testing; Strategic initiatives by corporates and Private action by employees. Deloitte offer to bring in expertise on managing immunity testing and to make the risk management framework strong and robust.[95]

PwC Spain partnered with blockchain startup Vottun, consulting firm RocaSalvatella, and mobile app company Basetis in May to develop and pilot a blockchain-based digital health passport.[96] The device works so that COVID-19 test results are recorded on Vottun's platform which can then generate a credential as a QR code.[97]

Software company Bizagi is offering a new application called 'CoronaPass that 'validates a certificate of immunity generated by a health authority'. Similar to other solutions, users apply for certification based on their COVID-19 antibody test and then receive a CoronaPass QR code that can be presented for validation.[98] The company suggests users use their passport as ID, as they foresee the system being used by international travelers.[99] The CEO reports that Ernst & Young are one of the first companies in the private sector to use the technology.[100]

Ethical concerns around the deployment of immunity passports

If voluntary technologies start edging towards being compulsory for social participation, serious ethical concerns must be taken into account.

If prior infection does provide sufficient immunity, and passports begin to be rolled out, then there is the potential for them to be used to discriminate against those who are not immune and could cause other types of harms such as targeting and profiling.[101] Immunity passports would effectively decide who is and is not allowed to participate in public life. This was Chile's reason to postpone its immunity passport project on 10 May. Protections need to be in place to protect communities that can be harmed by the collection and potential exploitation of this data.

The word "technosolutionism" has grown as it is believed that these schemes 'are putting innovation and appearance over public health'.[102] There is a danger that society becomes stratified 'where those who can afford to prove their immunity will have access to space and services that the remainder will no - de facto becoming second class citizens'[103] - this has been called 'immunoprivilege' by the New York Times.[104]

To address this in the UK, the Coronavirus (Safeguards) Bill 2020[105] sets out to introduce 'coronavirus status' as a protected characteristic under the Equality Act 2010.

Are workplace temperature checks allowed under GDPR?

The Belgian Data Protection Authority has issued guidance on temperature checking during the COVID-19 crisis. Its aim is to provide advice for businesses checking employees for fever on entry to the premises. The guidance which can be found in French[106] or Dutch[107] (and an unofficial English summary), states that organisations cannot record the results of temperature checks or the organisation's response to temperature checks. Organisations cannot use thermal cameras, digital temperature scanners, or other 'automated measuring means'. However, under GDPR the 'simple reading of individuals' temperatures without recording any data does not constitute a processing activity...and is therefore allowed from a data protection standpoint'.[108]

Endnotes

1 https://www.ft.com/content/f13106bd-dc49-455e-ad9c-5aec256f9aa8
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COVID-19 Digital Contact Tracing UK Timeline

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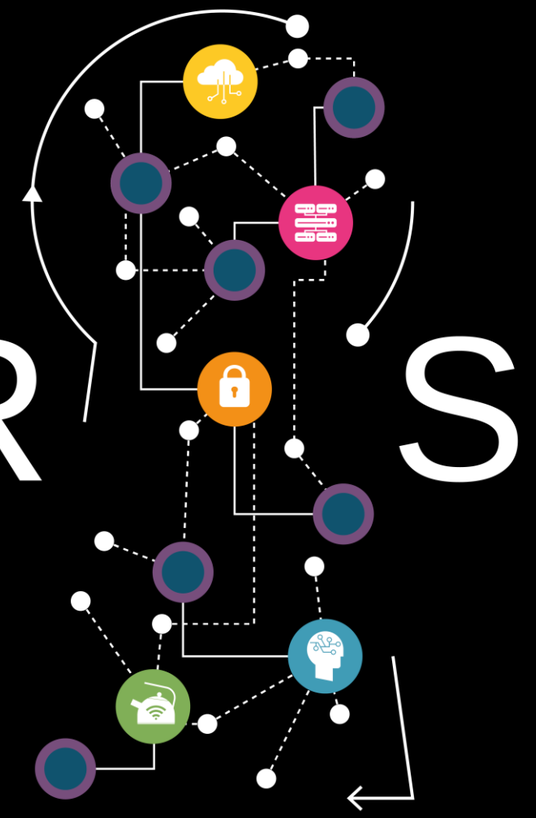

COVID-19 Digital Contact Tracing UK: Timeline

	Media	Concerns/Ethics	UK legislation	UK regulation	UK government	Europe	Research	Technology
17-Feb							A preprint (peer review June[1]) by members of SAGE on the efficacy of contact tracing for the containment of COVID-19 finds that the success of contact tracing relies on the speed and efficacy with which a person suspected of having the infection can be contained, and that some cases will generate at least unidentified secondary case which 'would need detecting by other means'.[2]	
11-Mar					A £500k contract (#1) to develop, deploy and maintain the NHS COVID-19 app is awarded to Go Pivotal (UK) Ltd.[3]			
12-Mar				The ICO release a statement on data protection and coronavirus stating that 'regarding competence with data protection, we will take into account the compelling public interest in the current health emergency'.[4]				
18-Mar					NHSX announce that they are 'looking at whether app-based solutions might be helpful in tracking and managing coronavirus'.[5]			
19-Mar						The European Data Protection Board makes a statement on the use of mobile location data.[6]		
21-Mar		An open letter signed by 'responsible technologists' calls upon the NHSX to follow best ethical practice when designing a contact tracing app.[7]						

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7307459/
[2] https://www.medrxiv.org/content/10.1101/2020.02.14.20023036v1.full.pdf
[3] https://www.contractsfinder.service.gov.uk/Notice/d192d980-6fcd-4137-b9e0-29c47a9141e3?origin=SearchResults&p=1
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[7] https://medium.com/@rachelcoldicutt/open-letter-contract-tracking-and-nhsx-e503325b2703

23-Mar					A £1.3m contract (#2) for contact tracing app development and deployment is awarded to Go Pivotal (UK) Ltd.[8]			
03-Apr								A group of European scientists and researchers propose a decentralised system for Bluetooth-based COVID-19 contact tracing, called DP-3T, which they argue offers greater protection against abuse and misuse of people's data than apps which pull data into centralized pots. The current version of the open protocol was updated on 25 May.[9]
08-Apr						The European Commission recommends developing a common EU Toolbox focusing on the use of apps for contact tracing.[10]		
10-Apr								Apple and Google announce a partnership on COVID-19 contact tracing technology. The proposed solution is two-fold - both companies will first release APIs to enable interoperability between devices using apps developed by public health authorities, and secondly, will enable Bluetooth-based contact tracing into the underlying device platforms. Use of the Bluetooth functionality for contact tracing would require strong protections around user privacy from developers.[11]
11-Apr		A data rights academic, and member of the D3-PT consortium sends an email to representatives at the NHSx, NSCS, CDEI/DCMS and ICO stating Apple and Google's API 'appears to break' NHS's proposed digital contact tracing solution, and states that this will presumably require a 'rewrite of the NHSX app' to align with a decentralised protocol,						

[8] https://www.contractsfinder.service.gov.uk/Notice/ca3887ff-9485-4729-aa30-faff9ea894ec?origin=SearchResults&p=1
[9] https://github.com/DP-3T/documents/blob/master/DP3T%20White%20Paper.pdf
[10] https://op.europa.eu/en/publication-detail/-/publication/1e8b1520-7e0c-11ea-aea8-01aa75ed71a1/language-en
[11] https://www.blog.google/inside-google/company-announcements/apple-and-google-partner-covid-19-contact-tracing-technology/

		otherwise many users' phones will be required to have the screen on when in their pockets - a huge barrier for uptake.[12]						
12-Apr					The Health and Social Care Secretary announces the 'new NHS app for contact tracing' at the daily press briefing on the government's response to the COVID-19 pandemic. The statement details that the app will rely on self-diagnosis: 'if you become unwell with the symptoms of coronavirus, you can securely tell this new NHS app, and the app will then send an alert anonymously to other app users that you've been in significant contact with over the past few days...so that they know and can act accordingly'. In the statement, the Secretary commits to publishing the source code, and that they are working with experts in digital ethics.[13]			The DP-3T consortium release a statement on the Apple and Google joint specification stating that the proposal is similar to an early version of the D3-PT protocol and that they are happy to work with both companies. They encourage Apple and Google to adopt updated enhancements which increase user privacy.[14]
13-Apr			The first version of the Coronavirus (Safeguards) Bill 2020 (current version 6 May) is published online, as a way to provide safeguards in relation to contact tracing apps and symptom tracking. These safeguards are in addition to GDPR and ePrivacy Directive and are suggested in order to reassure against digital exclusion, ensure trustworthy uptake, data quality, data rights and accountability to an independent body.[15]					

[12] https://twitter.com/mikarv/status/1274647647832416256/photo/1
[13] https://www.gov.uk/government/speeches/health-and-social-care-secretarys-statement-on-coronavirus-covid-19-12-april-2020
[14] https://github.com/DP-3T/documents/commit/a0a88c3efebb40640a455886f7c63d7cc748f7e9#diff-ea0cd12131808821e2dc116c46719959
[15] https://osf.io/preprints/lawarxiv/yc6xu

14-Apr	Narrative in the media starts to focus on the problems that centralised contact tracing apps have encountered with Bluetooth functionality. The proposal that the NHS contact tracing app will have similar usability issues if it does not conform to a decentralised model is highlighted.[16]							
15-Apr						The European Parliament recommends a common EU approach to contact tracing apps pointing out that they may not be obligatory, be decentralised, and that the principles of data protection by design and data minimisation are observed.[17]		
16-Apr						The European Commision also published a Common EU Toolbox for Member States containing requirements for efficient tracing apps.[18]	A mathematical model developed by UK researchers for the NHSX found that 'the epidemic can be suppressed with 80% of all smartphone users using the app, or 56% of the population overall'. The research also discusses how rapid testing in the community would result in fewer quarantined people compared to self-diagnosis.[19]	
17-Apr				The ICO published a formal Opinion on the Google and Apple approach to contact tracing technology. The Opinion confirms that the Google and Apple framework appears to align with data protection principles.[20] The Information Commissioner released a series of questions to developers of contact tracing technology, to ensure that the 'privacy implications are properly considered, and that they do not put public trust and social licence at risk'. In the post, the ICO reveal they have offered advice and support on transparency and		The European Parliament adopts a resolution on coordinated action to combat the pandemic, and endorses a decentralised approach to contact tracing (Paragraph 52).[22]		

[16] https://unherd.com/2020/04/can-your-smartphone-crack-covid/
[17] https://www.europarl.europa.eu/doceo/document/RC-9-2020-0143_EN.html
[18] https://ec.europa.eu/health/sites/health/files/ehealth/docs/covid-19_apps_en.pdf
[19] https://github.com/BDI-pathogens/covid-19_instant_tracing/blob/master/Report%20-%20Effective%20Configurations%20of%20a%20Digital%20Contact%20Tracing%20App.pdf
[20] https://ico.org.uk/media/about-the-ico/documents/2617653/apple-google-api-opinion-final-april-2020.pdf

				governance of the NHS contact training app.[21]				
20-Apr		The Ada Lovelace Institute produce a rapid evidence review on the technical considerations and social implications of COVID-19 technology. The review urges the need to assess the efficacy and impact of digital contact tracing apps; the establishment of gatekeepers of the deployment of technologies in emergencies; and the adoption of additional safeguarding legislation.[23]						
21-Apr						The European Data Protection Board adopts guidelines on the use of location data and contact tracing tools. The guidelines recommend an interoperable framework and takes the position that contact tracing should be voluntary and focus on proximity information rather than tracing movement.[24]		
23-Apr					The NHS app is tested using 300 personnel and their families at RAF Leeming in a scenario set up to simulate people's experience of shopping.[25]			
24-Apr		The Ethics Advisory Board sends a letter to the Secretary of State for Health and Social Care which cautions against proceeding with the contact tracing app 'without widespread access to virological testing', and that 'false positive alerts could undermine trust in the app and cause undue stress to users'. The letter also states six principles to ensure the app is ethical[26].			The CEO of NHSX announces that they will be launching a contact tracing app 'in the coming weeks'. The announcement also states that NHSX will comply with 'law around the use of your data' and that they are working with Apple and Google on their support for tracing apps. They also commit to publishing the 'key security and privacy designs alongside the source code'.[27] A letter from PHE to directors of public health acknowledges an integrated			

[22] https://www.europarl.europa.eu/doceo/document/TA-9-2020-0054_EN.html
[21] https://ico.org.uk/about-the-ico/news-and-events/news-and-blogs/2020/04/combatting-covid-19-through-data-some-considerations-for-privacy/
[23] https://www.adalovelaceinstitute.org/wp-content/uploads/2020/04/Ada-Lovelace-Institute-Rapid-Evidence-Review-Exit-through-the-App-Store-April-2020-1.pdf
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[25] https://www.raf.mod.uk/news/articles/rafs-digital-airbase-tests-covid-19-tracking-app/
[27] https://www.nhsx.nhs.uk/blogs/digital-contact-tracing-protecting-nhs-and-saving-lives/

					approach to contact tracing, complementing traditional contact tracing methods.[28] The CEO of NHSX announces the establishment of an Ethics Advisory Board.[29] Membership includes members of the Centre for Data Ethics and Innovation board.[30] Links to the Ethics Board have since been deleted after the disbanding of the board, however the Terms of Reference remain.[31]			
28-Apr			The Science and Technology Committee hears oral evidence on the minimum safeguards on how technology can be used to ease lockdown. Speakers include the CEO of NHSX and the lead author of the proposed Coronavirus (Safeguards) Bill 2020.[32]					
29-Apr		A statement signed by 177 security and privacy researchers in the UK calls for the NHSX to publish a Data Protection Impact Assessment immediately.[33]						Apple and Google release the first version of their exposure notification API to developers to collect feedback.[34]
01-May		Ethical guidelines for digital contact tracing systems for COVID-19 are published by the Oxford Internet Institute comprising 12 factors to guide the design and development of ethical digital tracing systems.[35]			A £3.0m contract (#5) for the development and deployment of a minimum viable product and limited period of support of the app is awarded to VM Ware UK (formally known as Go Pivotal (UK) Ltd).[36]			
03-May							The National Cyber Security Centre publish a technical paper[37] and a blog[38] on the security and privacy characteristics of the app and infrastructure	

[26] https://nhsbsa-socialtracking.powerappsportals.com/EAB%20Letter%20to%20NHSx.pdf
[28] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/881231/Letter_to_DsPH_on_contact_tracing.pdf
[29] https://www.nhsx.nhs.uk/blogs/digital-contact-tracing-protecting-nhs-and-saving-lives/
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[37] https://www.ncsc.gov.uk/files/NHS-app-security-paper%20V0.1.pdf
[38] https://www.ncsc.gov.uk/blog-post/security-behind-nhs-contact-tracing-app

04-May		The Ada Lovelace Institute outline the steps required to make an app trustworthy before it's deployed and state that 'there is not yet the evidence and justification for an imminent national roll out'.[39]	A legal opinion on technological responses to COVID-19 states that a centralised system would require significant justification to be lawful.[40]	The Joint Committee on Human Rights hears oral evidence from the Information Commissioner, academics and the CEO of NHSX to explore how the right to privacy (Article 8 ECHR) can be protected if a contact tracing app is rolled out in the UK. The Information Commissioner calls for the NHSX to release the source code and Data Protection Impact Assessment.[41] The ICO publish expectations on how contact tracing solutions may be developed in line with data protection by design principles, and recommends best practice.[42]	The CEO of NHSX answers questions from the Joint Committee on Human Rights on whether it is possible for the NHSX to change from a centralised to a decentralised framework for the contact tracing app, and confirms that 'if we need to shift then we will'.[43]		Apple[44] and Google[45] release sample source code, example user interfaces and policies that developers must adhere to in order for their apps to be approved for use[46].
05-May								A proposal on the interoperability of decentralised proximity tracing systems is released by the DP-3T team.[47]
06-May				The NHSX release the Data Protection Impact Assessment for the NHS COVID-19 App Pilot Live Release Isle of Wight[48].	A new £3.9m contract (#8) is awarded to Swiss IT firm Zuhlke Engineering to 'support and run the proximity mobile application services for the UK'.[49]		A preprint study from Trinity College Dublin measures Bluetooth Low Energy (LE) received signal strength in real-world settings, and finds that 'development of accurate methods for proximity detection based on Bluetooth LE received signal strength is likely to be challenging'.[50]	The NHSX release the source code for the contact tracing app on GitHub (now archived)[51] and discuss the code in a blog post.[52]
07-May			The Joint Committee on Human Rights publishes a report on Human Rights and the Government's Respose to COVID-19: Digital Contact Tracing[53] and proposes a draft Bill, Digital Contact Training		Everyone on the Isle of Wight receives access to the NHS contact tracing app in a trial roll-out period.[55]			

[39] https://www.adalovelaceinstitute.org/wp-content/uploads/2020/05/Ada-Lovelace-Institute-Provisos-for-a-Contact-Tracing-App-4-May-2020.pdf
[40] https://www.awo.agency/covid-19-legal-opinion.pdf
[41] https://parliamentlive.tv/Event/Index/6f0f52cf-9fda-4785-bf63-af156d18b6c7
[42] https://ico.org.uk/media/for-organisations/documents/2617676/ico-contact-tracing-recommendations.pdf
[43] https://parliamentlive.tv/Event/Index/6f0f52cf-9fda-4785-bf63-af156d18b6c7
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[51] https://github.com/nhsx
[52] https://www.nhsx.nhs.uk/blogs/code-behind-nhs-covid-19-app/
[50] https://www.scss.tcd.ie/Doug.Leith/pubs/bluetooth_rssi_study.pdf
[53] https://publications.parliament.uk/pa/jt5801/jtselect/jtrights/343/34302.htm

			(Data Protection) Bill, that would regulate the processing of information in respect of contact tracing.[54]					
08-May							A study exploring the feasibility of protecting the population using isolation coupled with digital contact tracing via a mobile phone application is published in Science. The study found that immediate notification through a contact tracing app would be sufficient to stop the epidemic if used by enough people, especially when combined with physical distancing. They advised careful oversight by an inclusive advisory body.[56]	
09-May		An analysis of the Data Protection Impact Assessment is written by a data rights expert and finds 'significant issues which leave the app falling short of data protection legislation'.[57]						
12-May						A new ETSI group is established to provide a standardisation framework to enable developers to build interoperable contact tracing apps.[58]		
13-May						The eHealth Network proposes guidelines for the cross-border interoperability of approved contact tracing apps to guide developers when designing apps. This is the first action to come from the European Commission's 'Toolbox' on 16 April.[59]		
18-May					The Secretary of State for Health and Social Care announces that 'everyone aged five and over with symptoms is now eligible for a test'[60]. The unavailability of testing was previously a reason why the development of the app required			

[55] https://www.iow.nhs.uk/news/CORONAVIRUS-TEST-TRACK-AND-TRACE-PLAN-LAUNCHED-ON-ISLE-OF-WIGHT.htm
[54] https://publications.parliament.uk/pa/jt5801/jtselect/jtrights/correspondence/Letter-to-Rt-Hon-Matt-Hancock-MP-Secretary-of-State-for-HSC-Draft-Bill.pdf
[56] https://science.sciencemag.org/content/368/6491/eabb6936
[57] https://osf.io/preprints/lawarxiv/6fvgh
[58] https://www.etsi.org/committee/1769-e4p
[59] https://ec.europa.eu/health/sites/health/files/ehealth/docs/contacttracing_mobileapps_guidelines_en.pdf
[60] https://hansard.parliament.uk/Commons/2020-05-18/debates/8FA78498-C990-4246-A745-AE0F36F7B948/Covid-19Response

					self-diagnosis of symptoms rather than a test diagnosis.			
19-May							A detailed security analysis of the released source code[61] for the NHS COVID-19 app is conducted by security experts, as well as a response by the NCSC.[62]	
20-May					Northern Ireland's minister of health announces that Northern Ireland is working on their own version of a contact tracing app, and that this was necessary to ensure that it is interoperable with the app being developed in the Republic of Ireland.[63]			
21-May			The UK government rejects calls for new legislation by the Joint Committee on Human Rights to enshine privacy protections around digital contact tracing.[64]					
28-May		The World Health Organisation releases ethical considerations to guide the use of digital proximity tracking technologies for contact tracing.[65]	The Leader of the House of Commons rejects a motion by the Joint Committee on Human Rights to raise their Digital Contact Tracing (Data Protection Bill) as a Private Members' Bill.[66]		The UK government launches the NHS Test and Trace service across England. The contact tracing apps are not supported by a contact tracing app.[67]			
29-May		The Joint Committee on Human Rights presents a new comparative analysis between the protections under the proposed Digital Contact Tracing (Data Protection Bill) and the existing situation under the Data Protection Act. The letter urges that the Secretary reconsider his decision to reject the Bill.[68]						
09-Jun	Media report that there is pressure to consider a different version of the contact tracing app which incorporates the Apple and Google framework.[69]							

[61] https://stateofit.com/UKContactTracing/
[62] https://www.ncsc.gov.uk/blog-post/nhs-covid-19-app-security-two-weeks-on
[63] https://niassembly.tv/committee-for-health-meeting-wednesday-20-may-2020/
[64] https://committees.parliament.uk/publications/1223/documents/10345/default/
[65] https://www.who.int/publications/i/item/WHO-2019-nCoV-Ethics_Contact_tracing_apps-2020.1
[66] https://committees.parliament.uk/publications/1283/documents/11444/default/
[67] https://www.gov.uk/government/news/government-launches-nhs-test-and-trace-service
[68] https://committees.parliament.uk/publications/1284/documents/11453/default/
[69] https://www.ft.com/content/5ba7dc0a-6fee-4f17-9894-e12dcf9ed286

16-Jun						European Member States agree to technical specifications for interoperability[70], which includes a ready-to-implement Federation Gateway Service[71] to connect all the backends behind the different national apps.		
18-Jun					Following the field testing of the NHS contact tracing app on the Isle of Wight, the UK government announces that development of the app will shift from the current app design to work with the Apple and Google framework.[72]			
Mid-Jun	Media reveal that lead project managers from the NHSX step back from the contact tracing app project, which will be handed to the NHS Test and Trace team to be managed by Simon Thompson, a former Apple executive and current CPO of Ocado.[73]							
24-Jun			The Joint Committee on Human Rights writes to the Secretary of State for Health and Social Services acknowledging that while some concerns have lifted with the switch to a decentralised contact tracing app, the public still require answers to topics on data protection, privacy and non-discrimination rights.[74]					
28-Jun	Media report that technical work on the new version of the contact tracing app is now being led by Swiss IT firm Zuhlke Engineering, who were awarded a contract back in May.[75]							
06-Jul		The Ada Lovelace Institute release a report on the lessons developers and policy makers must learn from the						

[70] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1043
[71] https://ec.europa.eu/health/sites/health/files/ehealth/docs/mobileapps_interoperabilitydetailedelements_en.pdf
[72] https://www.gov.uk/government/news/next-phase-of-nhs-coronavirus-covid-19-app-announced
[73] https://www.bbc.co.uk/news/technology-53083340
[74] https://committees.parliament.uk/publications/1596/documents/20233/default/
[75] https://www.ft.com/content/2fb504a3-fbc7-40a8-8996-f7dae596c831

		public about COVID-19 technologies. The report identifies six lessons that should be used in design and development which consider the preferences and legitimate concerns of members of the public.[76]						
09-Jul							A preprint by the Alan Turing Institute investigating techniques for using Bluetooth Low Energy received signal strength as a proxy for distance between two smartphones suggests that 'good risk prediction can be achieved' in real-world data sets using 'Unscented Kalman Smoother with Gaussian process data distribution'.[77]	
14-Jul							A preprint shows the initial findings of the Test and Trace programme on the Isle of Wight, including the test version of the NHS contact tracing app. The results showed that the epidemic on the Isle of Wight was controlled 'more significantly' than other epidemics in other authorities, however the 'data is not yet available to establish a causal link'.[78]	
16-Jul			The Parliamentary Under Secretary of State for Innovation responds to the Joint Committee on Human Rights on privacy concerns surrounding the decentralised contact tracing app. The letter reaffirms the position that existing legislation is sufficient, and commits to completing a new Data Protection Impact Assessment and Privacy Notice, as well as an Equality and Health Inequalities Impact Assessment.[79]					

[76] https://www.adalovelaceinstitute.org/our-work/covid-19/covid-19-report-no-green-lights-no-red-lines/
[77] https://arxiv.org/abs/2007.05057
[78] https://www.medrxiv.org/content/10.1101/2020.07.12.20151753v1.full.pdf
[79] https://committees.parliament.uk/publications/1942/documents/18853/default/

20-Jul					The development of the revised contact tracing app became part of the Department of Health and Social Care's NHS Test and Trace Programme.[80]			
21-Jul	Media report on the inside story of the development of the contact tracing app, with agreement that there were fundamental flaws in changing expectations and commitments, as well as lack of clarity on the use of the app, with no one person responsible for the delivery.[81]							
23-Jul	Media report that the Ethics Advisory Board established in May to provide timely advice, guidance and recommendations on ethical issues during the development of the NHS contact tracing app has been disbanded.[82]							
30-Jul					A business plan is published by NHS Test and Trace shows commitment to an app that supports the NHS Test and Trace Service. The app will use the new Google/Apple framework to allow citizens to: identify symptoms, order a test and receive support if they need to self-isolate; enable people to scan the QR code of venues they have visited; and identify when they have been exposed to people who have COVID-19 or locations where there may have been a source. The app will be shortly released for a trial before further roll out.[83]			
13-Aug					A trial of the decentralised contact tracing app starts on the Isle of Wight as well as withNHS volunteer respondents in the UK. Shortly, this will be expanded			

[80] https://www.nhsx.nhs.uk/covid-19-response/nhs-covid-19-app/
[81] https://news.sky.com/story/coronavirus-the-inside-story-of-how-government-failed-to-develop-a-contact-tracing-app-12031282
[82] https://www.telegraph.co.uk/technology/2020/07/23/nhs-contact-tracing-app-ethics-board-scrapped/
[83] https://www.gov.uk/government/publications/developing-nhs-test-and-trace-business-plan/breaking-chains-of-covid-19-transmission-to-help-people-return-to-more-normal-lives-developing-the-nhs-test-and-trace-service

[redacted]					to residents in the London borough of Newham.[84]			

[84] https://www.bbc.co.uk/news/technology-53765240

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