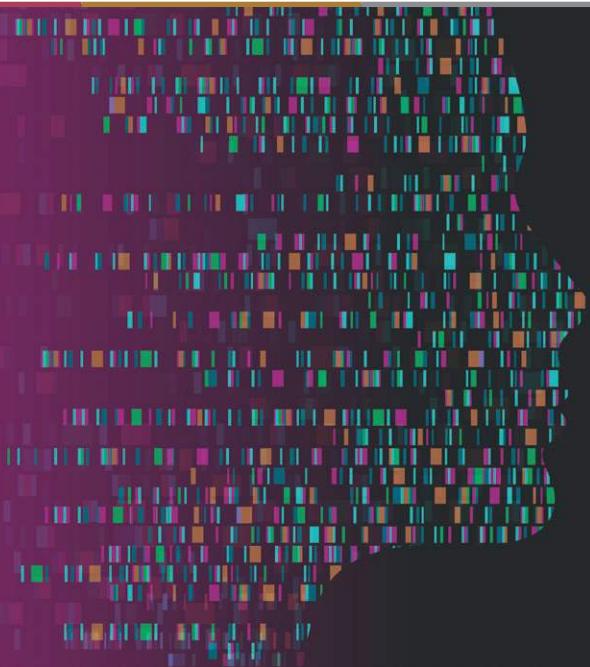


UK Biobank Newsletter 2022

20 years of UK Biobank: the UK's most valuable scientific asset

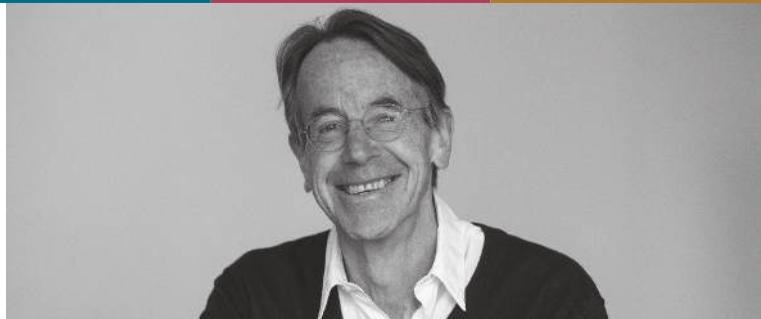
“The value of sharing data has never more clearly been shown than in UK Biobank. Things are possible now that were never possible before, and that's what makes it such an exciting resource.”

Ben Neale, Program Co-Director, Broad Institute, USA



- A truly global resource – now with researchers in over 100 countries around the world
- Transforming our understanding of human health – enabling research into the genetic, environmental and lifestyle determinants of disease
- Prevention through prediction – enabling identification of biomarkers predictive of disease
- Help us reach our goal of 100,000 participants scanned in the UK Biobank imaging study

A note from UK Biobank's Principal Investigator and Chief Executive



Professor Sir Rory Collins, CEO and Principal Investigator, UK Biobank

UK Biobank is transforming global research by enabling scientific discoveries to improve public health. As a health resource, it is scientifically unparalleled due to its scale, depth of data, duration of follow-up and ease of accessibility – making it the UK's most significant scientific asset to address a wide range of health-related research questions. With its unique breadth and depth of data, UK Biobank has become the world's most important health resource.

The greatest credit of UK Biobank's success goes to you, through your generosity in sharing biomedical samples and your genetic data, providing information about your lifestyle and allowing us to follow your health over time. Your continued commitment to UK Biobank, by completing regular online questionnaires or attending an imaging visit for example, is enabling the global scientific community to better understand how to improve the prevention and treatment of disease.

“The thing I always say to people who take part in any study is just a big ‘thank you’ because it’s a very generous act. It’s one where people understand that you can be part of creating knowledge that will benefit other people.”

**Sir Patrick Vallance,
Government Chief Scientific Advisor**

Sir Rory Collins

A handwritten signature in black ink, appearing to read "Rory Collins".

Please stay in touch

UK Biobank would like to keep in touch with you and give you the opportunity to help further if you wish to do so. We would prefer to keep in contact with you by email (as this is the most cost-effective and environmentally friendly way of staying in touch), so if you have an email address we would be grateful if you would consider sharing it with us.

You can update your contact details (email address, phone number and postal address) by logging in to the participant website at www.ukbiobank.ac.uk/members or by calling or emailing the Participant Resource Centre on 0800 0 276 276 or at ukbiobank@ukbiobank.ac.uk.

Whilst we like to receive updated contact details directly from our participants, we realise that it is not always easy to let everyone know when you move home or change a phone number or email address. For this reason, we give you a helping hand from time to time by checking and updating your contact details (if required) using information shared with us by the NHS and Royal Mail (through a data quality service provided by Experian). These checks not only allow us to keep in touch with you, but also ensure that we can adhere to the UK General Data Protection Regulation that requires UK Biobank to maintain accurate and up-to-date records. Please note that the data we share to enable these checks to be completed do not include any health-related data that you have provided to UK Biobank.

Please see our Participant Privacy Notice (www.ukbiobank.ac.uk/privacy-policy) for further information about how we process, store and use your data in a manner that is consistent with the basis on which you joined UK Biobank.



UK Biobank: a valuable UK asset

UK Biobank continues to demonstrate its significant impact on the UK health and life sciences sector by enabling advances in public health and medicine. For example, in recent years UK Biobank research has led to the introduction of new targeted prevention and screening strategies in the NHS as well as influencing the Government's reporting on COVID-19.

UK Biobank's success has inspired the creation of similar resources in other countries.

Influencing policy through the pandemic

During the recent coronavirus pandemic, emergency legislation allowed UK Biobank to access GP data for its 500,000 participants for scientists to conduct COVID-19 related research. These data enabled scientists to identify the genetic, lifestyle and clinical determinants of severe COVID-19, such as obesity, prior kidney failure or previous infection.

Over 800 approved research groups accessed these data and produced more than 250 papers on COVID-19, which are now available in the public domain. This research has influenced health policy (most notably the UK Government's reporting on the differential impact of the virus on minority ethnic groups) and has demonstrated the value of an established resource like UK Biobank in contributing to our Government's preparedness in the face of medical emergencies.

“UK Biobank has conclusively demonstrated its capacity for rapid response in a global health emergency, and carried out timely research that is critical for public health.”

Professor Bernard Keavney, former Chair of the UK Biobank International Scientific Advisory Board



Paving the way to individualised healthcare

In a world first, on the back of research using UK Biobank's genetic data, a pilot scheme has been conducted within the NHS to enable GPs to identify those at high genetic risk of cardiovascular disease.

Genetics is a known risk factor for many common diseases, including heart disease. However, until recently, it has been impossible to identify the contributory effects of multiple genetic variations across thousands of points in our DNA, each of which has a small effect on risk. Through the development of a genetic testing method known as polygenic risk scores, researchers are now able to identify an individual's risk for a given condition based on their genetic profile.

Polygenic risk scores pave the way for a low-cost genetic test to be incorporated into primary care settings to identify people at high risk of one or more common diseases. For example, this method has shown it can identify the 8% of the population who have more than a threefold increased risk for coronary artery disease. These individuals could benefit more from adhering to a healthier lifestyle and starting cholesterol-lowering treatment earlier than current recommendations.

This would not be possible without you and the genetic data we have been able to make available to approved researchers. We look forward to the results of the NHS pilot at the end of 2022.

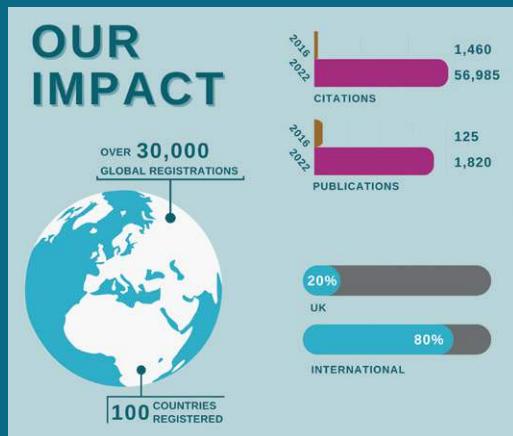
“UK Biobank data is so vast, and so detailed. It has changed the way we do research in human genetics. We are beginning not only to understand the complex genetic basis of a whole variety of devastating human diseases, but also how to better use this genetic information to understand how to predict and treat these diseases.”

Professor Nicole Soranzo, Senior Group Leader at the Wellcome Sanger Institute

UK Biobank... only just getting into its stride

During UK Biobank's Scientific Conference in 2021, Fergus Walsh, the BBC's Medical Editor and a UK Biobank participant, likened UK Biobank to a fine wine, remarking that UK Biobank gets better over time in the same way the best flavours develop.

The exponential growth in the number of researchers from a broad range of research fields demonstrates the value of UK Biobank for enabling a greater understanding of why and how diseases develop. Thirty thousand bona fide researchers from around 100 countries are now using the UK Biobank research resource, with over 6,000 scientific papers published to date.



As more findings emerge, they continue to strengthen the database for new research projects, as analyses are returned and incorporated back into the resource in the spirit of open, scientifically peer-reviewed science.

“You’re changing not only health and medicine but you are changing language, culture and the way people think about health.”

**Professor Sir Jeremy Farrar,
Director, Wellcome**

UK Biobank is the most mature and widely accessible resource available to researchers anywhere in the world, and it will only become more valuable for generating insights into health as we continue to follow your health over time. We are driving discoveries to improve human health and your time, effort and support over the years will be repaid many times over by the scientific community in the decades to come.

Ever-increasing scale and accessibility

UK Biobank is unique not just in the scale and richness of the data but also in its open access model, which sets it apart from other health research studies around the world, making the resource as widely accessible to global researchers as possible.

To further improve the efficiency and accessibility of the resource, we launched the UK Biobank Research Analysis Platform, an innovative cloud-based technology, in 2021 following a £20 million investment from Wellcome. This platform allows researchers worldwide to access and analyse the UK Biobank database in a secure online research environment. Approved researchers no longer need expensive equipment or large data storage capacity; all they need is a laptop and an internet connection.

We are delighted to have celebrated the one-year anniversary of the UK Biobank Research Analysis Platform and its use by over 2,500 researchers. We are continuing to enhance it for global researchers with new tools, greater opportunities for collaboration and increased accessibility via the platform credits programme. The UK Biobank platform credits programme enables access to early career researchers and those in lower- and middle-income countries through the generous donation of \$1.5 million of credits from Amazon Web Services.

As a result, the UK Biobank Research Analysis Platform opens up the resource to a broader range of researchers, thereby enabling the world's best scientific minds to conduct important health-related research.

The complexity and scale of the resource continues to expand and will grow to more than 40 petabytes by 2025. To put the vast scale of these data into perspective, it would take over a century of continuous viewing to watch 40 petabytes worth of 4k ultra-high definition movies.

Impactful research

Researchers in 100 countries around the world are registered with UK Biobank and are using it to answer new and important questions about how to improve our health and prevent disease.

USA

Protective genes against obesity and diabetes

Institute: Regeneron Genetics Centre

Data used: Exome sequencing data for over 450,000 participants, and imaging data for 46,000 participants

Findings: Scientists identified 16 genes associated with fat distribution, from which the *INHBE* gene was linked to around a 28% lowered risk of type 2 diabetes, a lower waist-to-hip ratio and a more favourable metabolic profile, i.e. lower liver enzymes, triglyceride levels and blood glucose levels. This could lead to the development of drugs that mimic this genetic variant, which may be beneficial in reducing metabolic disease like diabetes.

England

COVID-19 and changes to brain structure

Institute: University of Oxford

Data used: COVID-19 infection records and UK Biobank imaging scans of the brain

Findings: Brain regions related to smell show a decline following mild COVID-19 infection. Researchers used imaging scans to capture both pre- and post-infection data from around 2,000 UK Biobank participants. Findings revealed tissue damage and shrinkage in areas related to smell, and a reduction in participants' abilities to perform complex tasks. A key question for future brain imaging studies is to see if this brain tissue damage resolves over the longer term.

Find out more at:
[www.ukbiobank.ac.uk/
impactfulresearch](http://www.ukbiobank.ac.uk/impactfulresearch)



Finland

Genetic risk of dementia and social isolation

Institute: University of Helsinki

Data used: Self-reported social isolation data and electronic health records

Findings: Social isolation and loneliness have been associated with increased risk of dementia, but it is not known to what extent a genetic risk of dementia has an effect. Overall, 8.6% of participants reported that they were socially isolated and 5.5% were lonely. After follow-up of over 8 years, the findings indicate that there is no associated risk of dementia with loneliness, but that those participants who were socially isolated and had high genetic risk were most at risk of developing dementia.

China

Links between social isolation, loneliness and dementia

Institute: Fudan University

Data used: Health records data and lifestyle questionnaire data for 460,000 participants, and neuroimaging data from 32,000 participants

Findings: Socially isolated individuals, rather than those who feel lonely, were found to have a 26% increased likelihood of developing dementia and had changes in the brain structures associated with memory, which may explain the association between social isolation, cognition and dementia.

Australia

Reproductive health and dementia risk

Institute: The George Institute for Global Health

Data used: Lifestyle and physical measures

Findings: Using data from UK Biobank, women's reproductive health has been shown to be associated with dementia risk. Early and late menarche, and younger age at first birth, were associated with a greater dementia risk in women.

Ever been pregnant, had an abortion, longer reproductive span and later menopause were associated with a lower risk of all-cause dementia, after controlling for key confounders. Hysterectomy indicated a higher risk of dementia, whereas the contraceptive pill resulted in reduced risk. More work is needed to understand these associations.

UK Biobank is changing the way science is approached...

...Prevention through prediction



UK Biobank has recently released de-identified exome sequencing data on 470,000 participants to approved researchers around the world. Exome sequencing measures the region of the genome involved in coding proteins and enables researchers to identify disease-causing genes for the development of targeted treatments.

Scientists in the USA have used these data to uncover a gene (*GPR75*) that protects against obesity. Not previously known to play a role in obesity, *GPR75* is part of a group of genes that encodes receptors in the brain responsible for regulating energy balance. This is an exciting link for researchers, as these genes

are associated with appetite control, food preferences and even levels of physical activity.

Individuals with at least one inactive copy of the gene have, on average, a lower BMI and tend to weigh about 12 pounds less than those without the mutation. Scientists are now pursuing multiple therapeutic approaches to safely replicate the effect of this genetic mutation for personalised treatments.



...Advancing our understanding of human health

UK Biobank is enabling further advances in our understanding of human health following the creation of the world's largest whole genome sequencing dataset.

By measuring every base pair (pair of letters) across the genetic code, of which we each have over 3 billion, researchers can investigate rare and undiscovered genetic variations present in one individual over another and their effect on disease outcomes. Access to whole genome sequencing data across all UK Biobank participants is data at a scale and depth never seen before in genetics health research.

Using the whole genome sequencing data, researchers in Iceland have recently shown that many rare genetic variants that play a role in health and disease cannot be examined through exome sequencing alone.

The combination of genetic sequencing data with rich clinical and lifestyle data in UK Biobank has equipped researchers to answer questions about why some individuals develop particular diseases and why certain conditions worsen in some individuals over time.

These data have created an encyclopaedia of information to advance drug discovery and development through our understanding of the genetic architecture of disease. It will enable a greater understanding of the effectiveness of medicines for individuals, allowing for personalised treatments.

“A thank you – without people participating in research, we don't progress in terms of our disease understanding and our medicines will not be as effective. Thank you.”

**Mene Pangalos,
Executive Vice
President,
AstraZeneca**

AstraZeneca is a member of the public-private partnership which provided £200 million of funding to enable whole genome sequencing in UK Biobank.

Understanding the long-term effects of COVID-19

When the COVID-19 pandemic occurred, the short- and longer- term potential effects of the virus on internal organs were unknown. The UK Biobank COVID-19 repeat imaging study is the only study in the world to collect scans of internal organs taken before and after infection. Just over 2,000 participants took part – half of whom had previously had COVID-19 whilst the other half had not.

Along with biological samples, genomic, lifestyle and clinical data, the data collected in this study is enabling the research community to investigate the SARS-CoV-2 virus across the clinical spectrum – from asymptomatic infection to more severe clinical disease – to characterise the effect of COVID-19 on internal organs objectively and comprehensively.

Thank you – with your help, we are able to make available de-identified data on SARS-CoV-2 antibody tests from over 200,000 UK Biobank participants. When linked with health outcomes data, these data offer an unprecedented opportunity for researchers to better understand 'long COVID' in the population.



What effect does COVID-19 infection have on the heart?

The UK Biobank COVID-19 imaging study has enabled researchers to look at changes over time in the structure of the heart following infection with the SARS-CoV-2 virus. Using de-identified data from over 1,200 participants from two separate imaging visits, both pre- and post-infection, researchers were able to assess the effect of the virus on the heart. Findings suggest that there are no significant changes in the heart following a mild (non-hospitalised) case of SARS-CoV-2.



“The crucial thing about prospective studies like UK Biobank is they continue to grow in value. It is already incredibly important for academics and researchers across the world, and this importance grows as people age, and you can follow them longitudinally.”

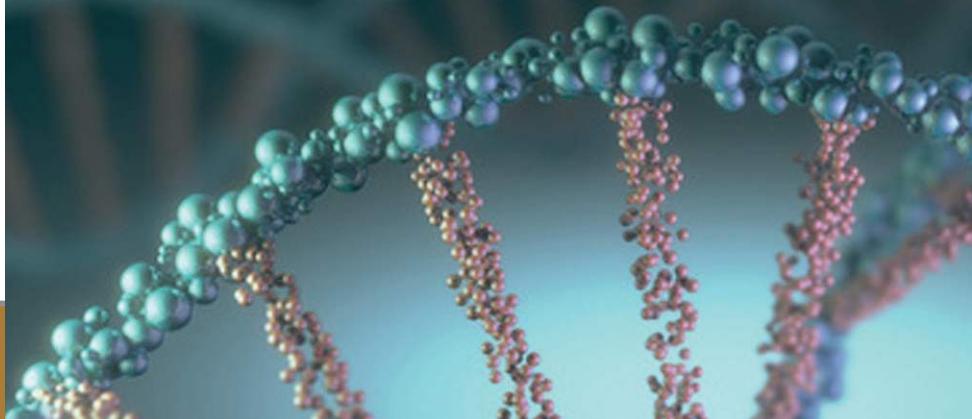
**Sir Patrick Vallance,
Government Chief Scientific Adviser**

Contribute further

From one UK Biobank participant to another:
why I took part in the world's largest imaging study



Dr Peter Craig, UK Biobank participant from Glasgow



Dear fellow UK Biobank participant,

Like you, I am a contributor to this very special resource and, as luck would have it, I was recently the 50,000th person to take part in the UK Biobank imaging study – which involved having MRI scans at their Newcastle imaging assessment centre.

If you have not already done so, you will receive an invitation to be scanned at your nearest UK Biobank imaging assessment centre. When I first saw the invitation, it felt like a big ask – to travel for about three hours and spend several hours being tested. But I soon realised that it was a good and important thing to do – an interesting experience in its own right and a real contribution to the health of the public. Having now had the assessment, I'd say to anyone considering their own invitation that taking part is like contributing to charity, but with your time rather than with money.

UK Biobank is unique in the world for its size, detail and ambition, but also for the way that participants are followed up. This means that the information we all provided at the first assessment, combined with the information collected through the imaging study, creates a truly rich database that enables scientists to understand how our health changes as we get older.

In the UK, we have an ageing population that is becoming prone to the kinds of health problems that UK Biobank is enabling research into, including diabetes, heart disease, arthritis, dementia and hearing loss. More recently, UK Biobank and we as participants have played an important role in helping to inform the science around COVID immunity.

By continuing to provide our data, we will help scientists to understand, prevent and treat all these conditions in the future. Numbers really matter in this kind of research. Getting to 50,000 participants scanned is a real achievement, and a good sign that the target of 100,000 is within reach. I really hope that on receiving your invitation you will also consider taking part, and that you will find it as rewarding as I did.

Kind regards,

Peter Craig

Help us complete the world's largest imaging study ever!



The UK Biobank imaging study is the most ambitious project to take pictures of the inside of the human body ever undertaken. We aim to scan the brains, hearts, bones and abdomens of 100,000 UK Biobank participants – and we are already more than halfway to this target.

If you have taken part – thank you so much. If you have not yet accepted your invitation, or not been invited, you can help us to achieve our goal! Please read the study information leaflet available at www.ukbiobank.ac.uk/imaging-information-leaflet and then call the Participant Resource Centre on 0800 0 276 276 to book your imaging appointment now.

It is very important that we have up-to-date contact details for you to be able to invite you to future assessments. You can update your details by logging in to the participant website here – please provide us with your email address if you have one:
www.ukbiobank.ac.uk/members

Enabling early findings

Heart MRI images from UK Biobank participants have been analysed to show that diabetes causes subtle structural changes to the heart.

These findings can be used to understand and detect early heart damage related to diabetes, allowing action to be taken before it can lead to serious problems.



Help us add extra layers of detail

UK Biobank is also uniquely placed to identify whether there are particular genes or biomarkers that affect the response to diabetic treatments and improve glucose control, and thereby the quality of life for those living with diabetes. www.bhf.org.uk



Take part in questionnaires

There are lots of things you can do to help us learn about your health and well-being from the comfort of your own home. We have been contacting participants for whom we have email details inviting them to participate in online questionnaires. These questionnaires allow us to collect information on health outcomes that is not easily available through linkage to health records, for example on chronic pain and mental health. Our current questionnaires are collecting data on pain, general health, food preferences and mental well-being. We are also launching a questionnaire on sleep at the end of 2022.

We are incredibly grateful that around 1 in 2 participants invited have completed each of our questionnaires. Because they generate digital results, there is little delay in making these data available to the international research community and published findings on many health conditions have already started to emerge from questionnaire data in areas such as diet and mental health.

You can check on what questionnaires you can complete by logging in to the participant website or by calling or emailing the Participant Resource Centre on 0800 0 276 276 or at ukbiobank@ukbiobank.ac.uk.

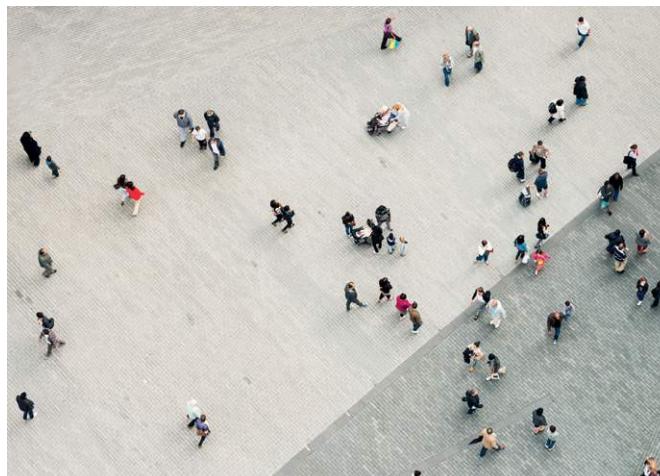
UK Biobank Pharma Proteomics Project

Proteins circulating in our blood may play a role in the development of many life-threatening diseases. A consortium of biopharmaceutical companies has come together to perform a study to measure circulating concentrations of almost 1,500 plasma proteins in approximately 54,000 UK Biobank participants, and will make these data available to approved UK Biobank researchers globally. A greater understanding of such markers offers opportunities for more precise, targeted treatments.

The measurement of a wide range of circulating proteins represents the next major step for UK Biobank, as these data will enable research into the association between genetic variation and circulating protein levels, which in turn will help researchers understand the links between genetics and human disease. Studying the levels of many different proteins in UK Biobank participants will allow scientists to assess the extent to which particular proteins are involved in the development or progression of different diseases and support innovative drug development.

“Genetics captures the blueprint of health and disease, and proteomics captures the end products of that blueprint – in many ways, they are two sides of the same coin. Proteomics is in many ways the technology we need to help unlock the full potential of genetics.”

Christopher Whelan, Director, Janssen



Our Future Health

Our Future Health

You may have seen or heard about a new research project announced called 'Our Future Health' which is starting to invite people to participate – much like we did about 15 years ago at UK Biobank. Our Future Health is funded by the Government, charities and the pharmaceutical industry and aims to assess the detection, prevention and treatment of disease in the NHS.

We are supportive of this new project, which is complementary to UK Biobank. It will build on the work of UK Biobank in successfully demonstrating how to establish large long-term population studies in the UK and allowing researchers around the world to use de-identified information about participants to make important discoveries about ways to prevent and treat disease. UK Biobank's success is of course down to you, the half a million participants who generously agreed to make information about yourselves available for health-related research.

Our Future Health does not know that you are already a participant in UK Biobank, so you may receive a letter from the Our Future Health team asking you to join the project. In order that the evidence generated in UK Biobank can be tested independently in Our Future Health, it would be scientifically better for people not to take part in both studies (although you may participate in both if you wish).

If you have any questions about how Our Future Health relates to your participation in UK Biobank, please contact UK Biobank's Participant Contact Centre on 0800 0 276 276.

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