

“UK Biobank’s achievements over the last 10 to 15 years are remarkable. The vast quantities of genetic and imaging data are driving forward imaginative approaches to analysis that would have been impossible to predict even a few years ago.”

Fiona Watt, Executive Chair of the Medical Research Council

UK Biobank was set up with the aim of enabling scientific discoveries that will improve human health, and has now grown far beyond what anyone could have imagined.

This large-scale biomedical database contains a wealth of information on all participants (including genetic, biochemistry, lifestyle and imaging data) and has over ten years of follow-up data from linked medical records, making this an unprecedented resource to enable novel and robust science to be performed.

The UK Biobank research resource is now the most valuable and vast it has ever been!

None of this would be possible without the commitment of 500,000 extraordinarily altruistic participants, and it has helped us reach some important achievements this year:

- Enabling vital research into the COVID-19 pandemic
- The creation of a new online analysis platform so that researchers can perform their analyses on the “cloud”, thereby increasing access for researchers from low-middle income countries
- Release of exome sequencing data for 200,000 participants
- Release of imaging data for 48,000 participants
- Hosting a virtual scientific conference that was attended by over 5,000 viewers worldwide
- Over 19,000 bona fide researchers have registered to use the resource from 80 countries
- Over 1,700 approved studies are underway
- Over 1,500 published papers

UK Biobank plays a vital role in managing a global pandemic

UK Biobank has been revolutionary in its approach to enable scientific discoveries, but never more so than in 2020 when the world has been faced

with a global pandemic. The breadth and depth of health data generously provided by participants is accelerating discovery into understanding

COVID-19, with over 670 research groups accessing these data, and over 60 papers already in the public domain.

Enabling vital research into coronavirus

We have, through your support over the last year, taken swift strides to help tackle the global pandemic by undertaking several major initiatives.

Expanding health data

Crucial health data on all 500,000 participants are being made available to researchers on a regular basis for the purpose of COVID-19 related research. These data come from hospital records (including critical care), GP records, COVID-19 diagnostic tests, and death registries.



This extra layer of detail about your health, coupled with the genetic and lifestyle data already available in UK Biobank, makes this dataset unique - and potentially transformative in the types of research it enables. UK Biobank data will help researchers better understand the extent to which genetic, medical and lifestyle factors affect whether a person experiences mild or severe symptoms of COVID-19, how quickly they recover and what are the long term health consequences of infection.

Getting your kids, and their kids, involved

For the first time ever, UK Biobank invited participants and their adult children and grandchildren to provide samples of their blood every month for 6 months. This will help determine the extent of past infection with coronavirus across the UK and to investigate how antibody levels change over time.

The £3 million study was funded by the Department for Health and Social Care (DHSC) and collected samples from May to November 2020. The rapid speed at which the study was set up meant that we were able to look at the extent of

past infection across the UK during the first wave of the pandemic and the start of the second. We were overwhelmed with support to join this study, with over 116,000 individuals volunteering in just 4 weeks! This meant we could quickly select 20,000 individuals to monitor the rates of past coronavirus infection across all ages, ethnic groups and regions. We were delighted to receive more than 90% of samples each month and look forward to sharing our findings with you.

We are very grateful for your ongoing support. Thank you!

A unique picture of COVID-19



In 2021, we plan to invite all of you to join a study to see who has coronavirus antibodies by sending you a self-test kit that you can take at home. It will involve taking a fingerprick amount of blood and you will see the results in about 20 minutes. These data will be crucial to enable scientists to understand the longer-term health consequences of this infection among those who have had no symptoms at all, as well as those who have had severe COVID-19 symptoms (including "long-

COVID"). The Department of Health and Social Care have donated all half a million home testing kits for the purpose of this study.

Based on this information, we also plan to invite some participants who have previously attended an imaging assessment (some of whom have positive antibodies, and some who haven't) to return for a second imaging visit. This will be the only study in the world to have imaging data from participants both before and after coronavirus infection and will enable new scientific discoveries about the effect of the virus on internal organs, such as the heart and brain (by comparing imaging measures before and after infection). Please be assured that all national COVID-19 guidelines will be adhered to and regular deep cleaning of the assessment centres will take place. The safety of participants and staff is of paramount importance.



Unleashing the imaginations of the world's best scientific minds

Over the next 5 years, the UK Biobank database will grow to 15 petabytes, which is more than 4 times the entire Netflix catalogue! This is largely due to the whole genome sequencing project that we are currently undertaking. The data contained in UK Biobank are currently downloaded by approved researchers, which requires a substantial amount of expensive storage space as well as computing power. We are now in the process of developing an online analysis platform which will enable researchers to access the data remotely, thereby democratising access to researchers from low and middle-income countries.

Funding of £20 million was provided by the Wellcome Trust and, following a careful and open tender process, DNAnexus, in collaboration with Amazon Web Services (AWS), were awarded the contract to develop the platform. This research analysis platform will be made available to the wider research community in 2021. AWS have also pledged \$1.5 million in research credits to support access to approved researchers from low and middle-income countries and early career researchers. By removing the need for expensive computing and storage space, the platform will enable more researchers than ever before to analyse our extensive database.

“This new platform will democratise access, helping us to unleash the imaginations of the world’s best scientific minds – wherever they are – to make discoveries that improve human health.”

Sir Rory Collins, UK Biobank Principal Investigator

Record numbers join our first ever virtual scientific conference

Every year we host the UK Biobank Scientific Conference to tell researchers, participants and the public about our achievements – and to get ideas about how to improve UK Biobank further. The current pandemic meant that our physical event was unfortunately cancelled, and taken to a virtual setting, however this came with a thick silver lining! We were absolutely delighted to host over 5,000 viewers from all over the world during the course of the day, making this our biggest audience to date!

Please visit our website if you are interested in seeing this year's event and to look out for more virtual events in the future. We plan to have events specifically for our participants, where you will be able to hear from experts and ask questions.

Genetic sequencing – the future of medicine is within reach

UK Biobank is enabling a revolution in genetic research – so that we can live healthier lives. Scientists want to know more about how our genes instruct our cells to behave, how they are influenced by other biochemical signals, and what can be done when they are damaged.

The exome makes up about 2% of our genome and contains the protein-coding genes. Exome sequencing data are particularly valuable for identifying rare genetic variants that affect proteins (and hence bodily function) and so can meaningfully lead to the development of new drugs.

UK Biobank has made available exome data for 200,000 participants, which linked to existing detailed genetic and lifestyle data within the database, has created a uniquely rich dataset to gain a greater understanding of human biology and treatments for disease. For example, these data have already shown that many loss of function genes identified in exomes are associated with the human lifespan.

Whole genome sequencing measures all of the letters of the genetic code (of which there are more than 3 billion), in both the coding (exome) and non-coding regions of the genes. These data will provide lots of new information on why some people get particular illnesses and others do not.

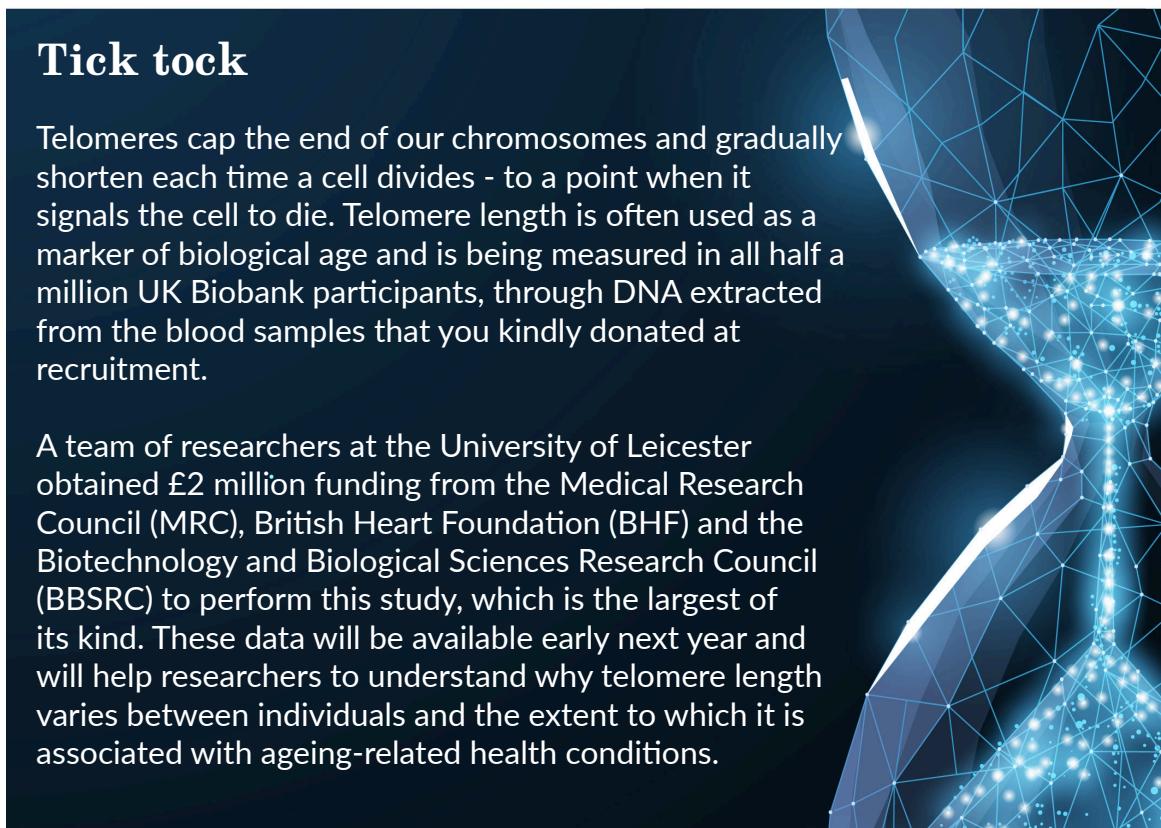
This £200 million project to perform whole genome sequencing on all 500,000 participants was funded by a consortium of Government, charity and industry, comprising of: UK Research and Innovation, The Wellcome Trust, Amgen, AstraZeneca, GlaxoSmithKline (GSK), and Johnson & Johnson (J&J).

The project has set off to a flying start and sequencing of the first 150,000 genomes has already been completed (in addition to the 50,000 that were sequenced through a vanguard project funded by the Medical Research Council). These data will be available to researchers in tranches from next year and will be transformative in developing a better understanding of human biology and treatments for disease.

Tick tock

Telomeres cap the end of our chromosomes and gradually shorten each time a cell divides - to a point when it signals the cell to die. Telomere length is often used as a marker of biological age and is being measured in all half a million UK Biobank participants, through DNA extracted from the blood samples that you kindly donated at recruitment.

A team of researchers at the University of Leicester obtained £2 million funding from the Medical Research Council (MRC), British Heart Foundation (BHF) and the Biotechnology and Biological Sciences Research Council (BBSRC) to perform this study, which is the largest of its kind. These data will be available early next year and will help researchers to understand why telomere length varies between individuals and the extent to which it is associated with ageing-related health conditions.



Did you know...

... novel methods have been found for heart transplantation?

Around 200 heart transplants are carried out each year in the UK. Current international guidance recommends using total body weight ratios to match heart transplantation recipients with their donors. However, these guidelines overlook specifics of gender, body composition or heart mass when matching recipients with donors. Researchers from Canada have suggested that taking these details into account will positively affect the outcome of heart transplant surgeries.

Researchers from the University of Calgary used imaging data from around 3,400 UK Biobank participants, who underwent heart MRI scans and dual-energy X-ray absorptiometry for body composition analysis. They used this to formulate equations that

included information on lean body mass and predicted heart mass, which improved the success rate of heart transplant operations. They validated these findings on a further 53,000 UK Biobank participants and put these forward as a valid tool to match donor hearts to suitable recipients prior to heart transplant surgeries.

They highlighted that significant under or oversizing of donor hearts was associated with a worse survival rate one year after a heart transplant operation – so these equations add valuable detail that will improve survival rates after heart transplant surgery.

Useful studies like this are truly revolutionising science!

Are there genetic links between higher levels of abdominal fat and gastro-oesophageal reflux disease?

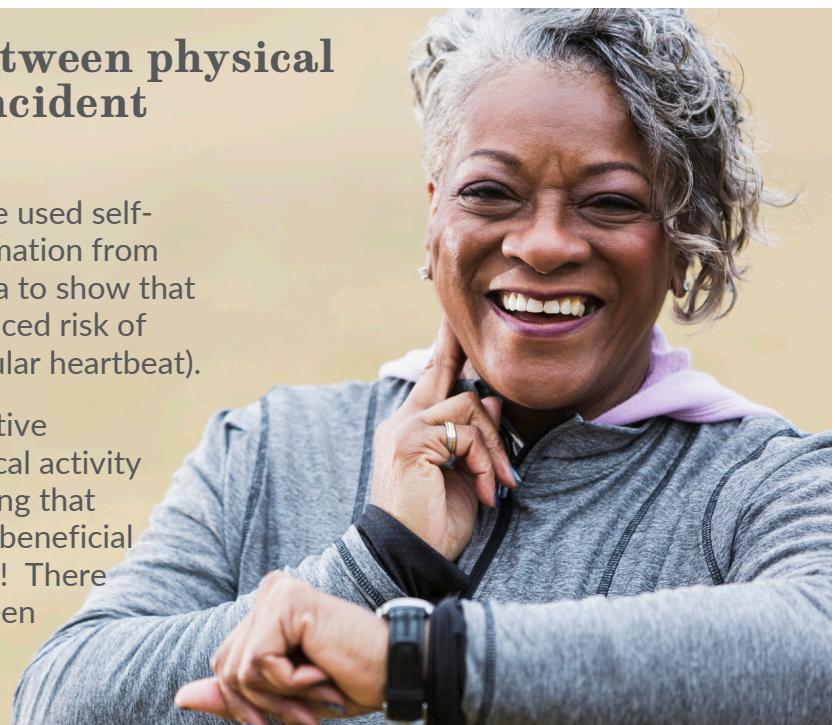
Gastro-oesophageal reflux disease (GORD) is associated with multiple risk factors but it's difficult to understand what really causes it. Researchers from the University of Exeter used data from physical measures and genetics from UK Biobank participants to find answers.

Whilst they found that all measures of obesity were associated with a higher risk of GORD, the genetic data confirmed that a higher waist to hip ratio was the strongest determinant of GORD. The research showed that each 5cm increase in waist circumference was associated with a 23% increase in risk. This research confirms that fat around the abdomen is an important factor in the development of GORD, and is much more important than an individual's overall weight or body mass index (BMI).

Is there an association between physical activity and the risk of incident arrhythmias?

Researchers at the University of Adelaide used self-reported physical activity data and information from linked hospital admissions and death data to show that physically active participants have a reduced risk of developing cardiac arrhythmias (an irregular heartbeat).

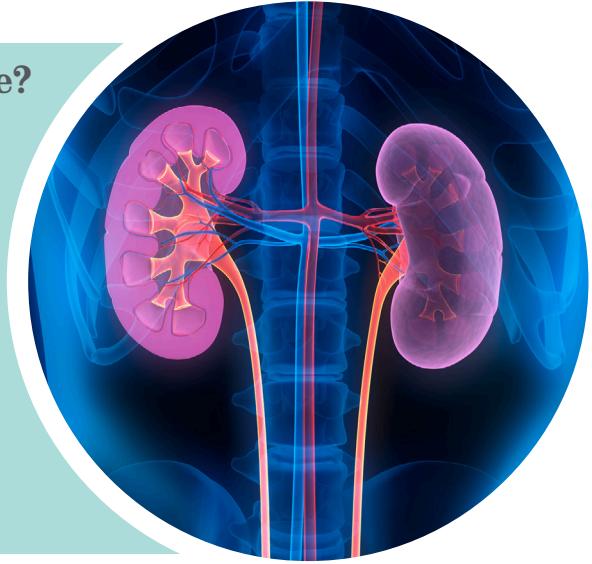
Even better, these data support a protective association of arrhythmia risk with physical activity across a broad range of activity, suggesting that moderate amounts of activity are just as beneficial as burning up a sweat for hours at a time! There was no evidence of an association between physical activity and a slow heart rate (bradyarrhythmia).



Does obesity increase the risk of kidney disease?

It was previously unclear whether obesity directly caused kidney disease or whether there were other factors involved. Using data from UK Biobank, scientists from the University of Oxford have shown conclusively that obesity is a direct cause of kidney disease.

The researchers studied over 1,000 genetic variations known to predispose people to obesity and found that the risk of chronic kidney disease is positively associated with fat deposits all over the body, both under the skin and around the organs. Hence, controlling weight could be a new way to reduce the risk of kidney disease.



Improved security

We have added an extra layer of security to our online participant portal to include a password to log in. Next time you visit the participant portal you will be asked to create a password in order to login to see your details. Using an extra password further improves our security, although please be assured that no personally identifiable information is contained within the website or the database that is available for research use.



We would like to thank all of our participants for supporting UK Biobank to become a major contributor to the advancement of modern medicine and treatment, enabling scientific discoveries that improve human health. You can find out much more about our successes on our website.

www.ukbiobank.ac.uk

More information: www.ukbiobank.ac.uk or join more than 14,000 other supporters by following us on Twitter @uk_biobank

UK Biobank Incorporated in England and Wales registered number 4978912, and registered as a charity in England and Wales, number 1101332. Charity registered in Scotland, number SC039230. Head office address: 1-2 Spectrum Way, Adswood, Stockport SK3 0SA. Telephone the UK Biobank Participant Resource Centre on 0800 0 276 276 9am - 5pm Monday-Friday. Email: ukbiobank@ukbiobank.ac.uk Website: www.ukbiobank.ac.uk