UK Biobank launches world's biggest body scanning project

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The world's largest health imaging study, funded by the Medical Research Council, Wellcome Trust, and the British Heart Foundation (BHF) is launched today. It will create the biggest collection of scans of internal organs, and transform the way scientists study a wide range of diseases, including dementia, arthritis, cancer, heart attacks and strokes.

The £43m study will involve imaging the brain, heart, bones, carotid arteries and abdominal fat of 100,000 current participants of UK Biobank, a visionary project set up in 2006 by the MRC & Wellcome Trust to create a research resource of half a million people across the UK to improve health.

The multi-organ scans will be analysed alongside the vast data already collected from UK Biobank participants. This extra layer of data, for all health scientists to access, will give new perspectives on the best way to prevent and treat multi-faceted conditions like arthritis, coronary heart disease, Alzheimer's disease and osteoporosis. It will also spark novel ways to analyse and interpret scans, with potential benefits for research as well as for the investigation of patients in the future.

For the last ten years UK Biobank has gathered huge quantities of data on its 500,000 participants—including their lifestyle, weight, height, diet, physical activity and cognitive function, as well as genetic data from blood samples. Linkage to a wide range of health records is also under way, including data from general practices.

Cathie Sudlow, Professor of Neurology and Clinical Epidemiology at the University of Edinburgh, and UK Biobank's Chief Scientist, said: "This very large number of participants involved in the multimodal imaging study is impressive enough. But what makes it truly transformational is the opportunity to combine the rich imaging data with the wealth of other information already available or being collected from participants, particularly their health and diseases during follow-up for many years to come."

Funding visionaries

Life Sciences Minister George Freeman MP said: "Stunning advances in imaging and informatics are opening up new ways to diagnose, treat and potentially prevent diseases like dementia, heart disease and cancer. Our £20 million investment in this - the world's biggest collection of imaging data - is helping make the UK a world leader in 21stcentury life science."

Dr Sara Marshall, Head of Clinical Research at the Wellcome Trust, said: "Capturing such a vast number of images of the human body, in both health and illness, will chronicle disease in a way never attempted before.

"Each day we're discovering more and more about how genetics and lifestyle play a part in the onset and development of diseases, but this extra piece of the puzzle - seeing physical changes even before symptoms develop - will give us a completely new perspective on how we can prevent and treat them."

Understanding and preventing diseases

Professor Paul Matthews, Head of the Division of Brain Sciences at

Imperial College London, chairs the group of academic experts who have been supporting UK Biobank to create this additional resource. He said: "One of the crucial questions we can start to answer is, what happens in the brain years before dementia, stroke or other disorders are diagnosed? Can we understand it and find new ways to treat or prevent the onset? Scientists will also be better able to discover how brain diseases such as depression, stroke or Alzheimer's disease are affected by our genes, environments and lifestyles."

The availability of so much imaging data will help put the findings from smaller but important imaging studies already undertaken in context. "Researchers can now test ideas quickly, armed with no more than a good idea, appropriate software and access to the necessary computational resource," said Professor Matthews.

Tackling brain conditions

Professor Stephen Smith, of the Oxford University Centre for Functional MRI of the Brain, leads the brain imaging component of the study. "The brain imaging data is incredibly rich - we have one kind of image that tells us about brain anatomy, another that tells us about complex patterns of brain activity, and yet another that tells us about the brain's 'wiring'." He says that further value will be added because of advances that will take place in the way in which these complex images are analysed.

"UK Biobank will be by far the largest brain imaging study ever conducted. It will not only provide valuable insight into common conditions like dementia, but also capture early markers of more rare neurological disorders like motor neuron disease (ALS). We aim to discover new early signs and risk factors of disease, in the hope that earlier targeted treatment, or changes in lifestyle, could prevent major diseases from ever happening," he said. The addition of genetic data and

the analyses of blood samples and data collected from lifestyle questionnaires will further strengthen the resource.

Preventing broken bones & fractures

Nicholas Harvey, Professor of Rheumatology and Clinical Epidemiology at the Medical Research Council (MRC) Lifecourse Epidemiology Unit, at the University of Southampton, leads the musculoskeletal component.

He hopes the study will help prevent the huge burden of broken bones resulting from osteoporosis (thinning of the bones), a significant public health issue which costs the UK economy more than £3 billion a year.

"The really exciting thing about these imaging data is that we will have the opportunity to study bone mass and determinants of osteoporosis in relation to other common chronic non-communicable diseases such as diabetes, atherosclerosis, hypertension, dementia, and sarcopenia (muscle loss). This is a unique research opportunity and promises to deliver ground breaking scientific information," said Professor Harvey.

Insights into cardiovascular disease

Professor Steffen Petersen, of Barts Heart Centre and Queen Mary University of London, led the development of the heart imaging protocol. He said: "Heart disease is still an all too frequent and unexpected cause of death. This imaging study offers us real insight into the heart itself on a scale hitherto impossible to imagine. This is a fantastic resource for researchers both in the UK and overseas. I know many who can't wait to see the data and start using it to improve health."

Professor Jeremy Pearson, Associate Medical Director at the BHF, which funded the pilot project of the heart imaging protocol, said:

"These scans will allow researchers to investigate heart health in greater detail than has ever been done before.

"This study could not only help us to better prevent and treat heart disease in the future but make current MRI techniques for scanning the heart faster and more effective. Improving diagnosis of heart disease will save lives by driving earlier and more targeted treatment to prevent heart attacks."

Learning about fat distribution

The MRI scan will provide key information on the amount and distribution of fat and muscle mass. Combining these data with information about lifestyle, genetics and markers in the blood (like hormones, sugar and cholesterol) will hugely strengthen UK Biobank for studies into obesity and diabetes, high blood pressure, high cholesterol, cardiovascular disease and some cancers and other medical complications. With increasing evidence to suggest that fat distribution, rather than amount of fat, is important for determining an individual's risk of future disease, abdominal MRI provides an exciting opportunity to examine the predictive importance of particular fat depots (visceral, liver and pancreas) and the relative distribution of fat for the development of disease.

How the study will be run

An initial study of 8,000 participants has just been completed at a purpose-built scanning facility at UK Biobank's headquarters in Stockport, which is now being used for the main study. The people scanned do not receive any feedback about their health, unless potentially serious abnormalities are spotted during the imaging. Imaging will include:

- MRI assessment of heart chamber diameter, the volume of blood flow, and how the heart changes as it pumps blood around the body, thickness of the heart wall and the size, shape and stiffness of the thoracic aorta, the vessel that delivers blood from the heart
- MRI measures of brain structure and function, volumes of grey matter and the mapping of major brain connections
- Dual-energy X-ray absorptiometry measures of bone density, osteoarthritic change at spine, hip and knee, fractures in the spine, and fat distribution throughout the body
- MRI measures of abdominal fat volume including in the liver and pancreas
- Ultrasound assessment of two major arteries, the carotid arteries, that run either side of the neck to the brainRecruitment will continue in the north west of England, and will roll out to the south (Reading) and the north (Newcastle) over the coming year.

Provided by University of Oxford