

The research commercialisation office of the University of Oxford, previously called **Isis Innovation**, has been renamed **Oxford University Innovation**

All documents and other materials will be updated accordingly. In the meantime the remaining content of this Isis Innovation document is still valid.

URLs beginning <u>www.isis-innovation.com/</u>... are automatically redirected to our new domain, <u>www.innovation.ox.ac.uk/</u>...

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Big Data for Population Health

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Deputy Director, Big Data Institute, Li Ka Shing Centre for Health Information and Discovery



University of Oxford



Li Ka Shing Centre for Health Information and Discovery

- New building:
 - 7500 m² in heart of Oxford medical campus
 - 350 BDI researchers (+ 200 population health scientists)
 - Opening Autumn 2016





Innovation in Medical Science - Transformation in Human Health

The Oxford Big Data Institute





Innovation in Medical Science - Transformation in Human Health

Founders and Directors

- Sir John Bell
 - Regius professor of medicine
- Peter Donnelly
 - Statistical and population genetics
- Sir Rory Collins
 - Population health, UK Biobank
- Dominic Kwiatkowski
 - Infection surveillance
- Gil McVean, director
 - Computational genomics
- Martin Landray, deputy director
 - Clinical trials & epidemiology













Big Data for Population Health

- Scale: Number of people (cases & controls)
- Breadth: Range of exposures & outcomes
- Length: Frequency & duration of observations
- Depth: Level of detail
 - Using the power of data to understand disease, develop treatments, and improve healthcare

Big Data... a strength of Oxford

Study type	Population	Size	Duration
Prospective cohort	General UK	2M	5-60 yrs
	General Overseas	2M	5-20 yrs
Clinical trials	Cardiovascular	100,000	5-20 yrs
	Renal	10,000	<10 yrs
	Screening	1M	<4 yrs
	Maternal	20,000	5-15 yrs
Routine datasets	Oxfordshire	4M	<50 yrs
	England	50M	<45 yrs
	Mother-child	7M pairs	<15 yrs



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Value of routine data



The value of routine healthcare data: The return of Mumps within the UK





Large-scale randomized evidence: Lowering cholesterol reduces risk of vascular events

20,536 patients randomized to simvastatin vs placebo in the Heart Protection Study





Heart Protection Study Collaborative Group Lancet 2011

Value of large numbers



Large numbers give clarity: Ischaemic heart diseases vs. Systolic BP



500,000 participants recruited in 3.5 years





OXFORD



Understanding the phenotype



Understanding the phenotype



Data collection directly from participants: *e.g. activity monitors*







45% agree to wear device Completed by >80,000 UK Biobank participants



Z-Axia

Example activities



Visual inspection of one day's recording





Activity stops at 10:07pm



8.6M readings/day, 7 days/person, 100 000 people

 \Rightarrow 6,000,000,000,000 readings



Turning samples into data

- Laboratory assays (500,000)
 - haematology, biochemistry, disease biomarkers (2015-16)
 - infectious disease panel (TBC)
- Genetic assays (500,000)
 - 820k markers (Affymetrix)
 - 250,000 SNPs in a whole-genome array
 - 200,000 markers for known risk factor or disease associations, copy number variation, loss of function, and insertions/deletions
 - 150,000 exome markers for high proportion of non-synonymous coding variants with allele frequency over 0.02%
 - Imputation of >70M markers using reference sequence data
 - (UK 10k; 1000 genomes phase III 2015-16)
 - Genotyping data on first 150,000 participants released May 2015



Record linkage





Hospital admissions following recruitment (linkage to national hospital episode statistics)



The future

Big Data... Collaborations & Opportunities

- Local
 - Medicine, Engineering, Computer Science, Statistics
 - NHS partnerships: Academic Health Science Centre / Network (n=3.3M)
- National
 - UK Biobank, 100 000 Genomes, UK Dementia Platform
 - NIHR Health Informatics Collaborative, Farr Institute
 - MRC Hubs for Trials Methodology Research
 - CRC Registered Clinical Trials Unit network
- International
 - Stanford, Vanderbilt, Global Alliance
- Technology
 - Google, Apple, iRhythm, AliveCor
- Regulators
 - FDA, EMA, MHRA, HRA



Innovation in Medical Science - Transformation in Human Health

NIHR Health Informatics Collaborative (HIC)

- Chief Medical Officer's Grand Challenge:
 - demonstrate use of routine clinical data for collaborative, translational research
- 5 Biomedical Research Centres
 - Imperial, UCL, Guys' & St Thomas', Cambridge, Oxford
- Exemplar therapeutic areas
 - acute coronary syndrome, renal transplantation, ITU, cancer, infection
- Task
 - establish clinical data repositories to known data standards
 - automatic data flows from clinical systems



framework for sharing data (and managing intellectual property) Innovation in Medical Science - Transformation in Human Health

Oxford Academic Health Science Centre (AHSC)

- Vision: an integrated & coordinated Big Data programme that underpins a world-class Learning Healthcare System
 - Patient & public engagement
 - setting agenda, building trust, collecting data, sharing information
 - Clinical care delivery
 - monitoring (individual & population needs)
 - decision support (treatment, referral & discharge)
 - Quality assurance
 - assessment, comparison, improvement
 - Discovery
 - causes, mechanism, treatment, consequence of disease
 - Evaluation



• service utilization, epidemiology, clinical trials, health economics

Innovation in Medical Science - Transformation in Human Health

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