King’s Fund Conference

Partnership models in the NHS

A cascade of partnerships

Professor Lionel Tarassenko CBE FREng FMedSci
Head of Engineering Science Department
University of Oxford
6 February 2018
First partnership – Oxford IBME

The Institute of Biomedical Engineering (IBME) opened in April 2008 as a research institute of the Department of Engineering Science on the medical campus in Oxford (8 academics, 110 researchers).

The IBME has enabled partnerships between engineers and medical researchers in four domains: digital health, biomedical image analysis, drug delivery and tissue engineering.
The IBME was awarded a 2015 Queen’s Anniversary Prize for Higher Education for “new collaborations between engineering and medicine delivering benefit to patients and the UK economy”.

Today the IBME is more than twice the size it was in 2008 (17 academics + 220 researchers + support staff). This growth has been catalysed by £60M of grant funding (Research Councils, National Institute of Health Research, BEIS, Dept of Health, Wellcome Trust & industry).
Second partnership – Oxford BRC
Second partnership – Oxford BRC
Second partnership – Oxford BRC

TECHNOLOGY & DIGITAL HEALTH THEME

- EPR Research Facing
- DATA Across the Region
- DIGITAL HEALTH Transforming Chronic Diseases

- Multimorbidity
- Hospital-Primary-Social Care
- Patient involvement
- Clinical trials of engineering innovations
Clinical trials of engineering innovations

- Asthma: 3 observational studies + 1 RCT
- COPD: 2 observational studies + 1 RCT
- Heart Failure: 1 observational study + 1 RCT
- Type 1 diabetes: 1 RCT
- Type 2 diabetes: 2 observational studies + 1 RCT
- Gestational diabetes: 2 observational studies + 1 RCT
- Hypertension: 1 observational study + 1 RCT
- Cystic fibrosis: 1 observational study
- Cancer: 1 observational study
- Early warning scores (SEND): 1 stepped-wedge trial
Machine learning for early warning


Heart rate
Breathing rate
Oxygen saturation
Blood Pressure
Temperature

Machine learning algorithm based on multivariate models can identify trends that signify clinical deterioration before individual parameters would generate an alert.
SEND: Nurse observations and Early Warning Score

- Evidence-based early warning score computed from vital-sign observations and ML algorithms
- Every patient in every acute ward in every Oxfordshire hospital has their early warning score evaluated twice a day using our system.
- 10% reduction in cardiac arrests the year after early warning score was introduced.
- 35 million observations from 130,000 patients since January 2014.
Prevalence of Gestational Diabetes (carbohydrate intolerance resulting in hyperglycaemia during pregnancy) is increasing rapidly (now around 10% of pregnancies) because of the rise in obesity and because women are having children later in life.

**GDm-health**: smartphone app for the woman + web-based system for clinician review and advice
GDm-health: management of gestational diabetes

Patients use the smartphone app to:

- **Annotate** blood glucose data with meal tags, medication doses and other comments
- **Review** personalised data screens (e.g. linking food intake and blood glucose)
- **Receive real-time advice** at home from the diabetic team in the hospital.
GDm-health: management of gestational diabetes

GDm-health is a digital health system fully integrated with NHS IT and clinical pathways.

GDm-health enables the diabetes midwives, registrars and consultants to review patient data, as prompted by prioritisation algorithms.

The diabetic team is then able give real-time advice remotely to the women between (fewer) clinic visits.
Third partnership – Oxford AHSN

Thames Valley Region

500+ Medtech companies

LARGEST Tech Cluster in UK

3.3 MILLION people
Third partnership – Oxford AHSN
GDm-health – AHSN support

Regional Adoption
Working with commissioners, clinicians and midwives to support uptake at hospitals
Staff training
Baselining of data and user support
Measuring and monitoring impact
Project management support

<table>
<thead>
<tr>
<th>Hospitals</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxford University Hospitals</td>
<td>Completed</td>
</tr>
<tr>
<td>Royal Berkshire Hospital</td>
<td>Completed</td>
</tr>
<tr>
<td>Milton Keynes Hospital</td>
<td>Completed</td>
</tr>
<tr>
<td>Frimley Health – Frimley Park</td>
<td>Completed</td>
</tr>
</tbody>
</table>

Business Support
- Business plan development
- Partner identification
- Facilitated introduction to Drayson Technologies

- At RBH 26% reduction in clinic visits for women using GDm health in comparison to normal care
- Time spent by diabetes midwives on clerical and administrative tasks cut by 50%
- Cumulative savings of £230,000
Fourth partnership – Drayson Technologies

Oxford (BRC) → regional (AHSN) → national (DT)

- The partnership with Drayson Technologies enables clinically-validated prototypes developed within the NHS for the NHS to go through the regulatory process (CE-marking, FDA approval, ISO certification).

- This in turn allows the adoption of the products (GDm-health, SEND, and EDGE-COPD) throughout the NHS, beyond the Oxford region.

- In parallel with this, a new phase of product development has been initiated:
  - From GDm-health to “Healthy Pregnancy”: addition of gestational hypertension module, and focus on early diagnosis of high-risk women
  - Development of integrated digital health solution for the ageing population
Fourth partnership – Drayson Technologies

Integrated digital health for the ageing population

Total patient care pathway (agnostic to patient location)

- Focus on chronic disease and multi-morbidities (COPD and heart failure initially)
- Integration of acute care, community care hospitals, and care homes
- The aim is to avoid regular re-admissions ("frequent flyers")
Fourth partnership – Drayson Technologies

- Drayson Technologies has signed a 5-year Strategic Research Agreement with the University of Oxford and the Oxford University Hospitals (OUH) NHS Foundation Trust. The company is funding two five-year Research Fellows (one Engineering and one Clinical).

- A new research programme in “AI for healthcare” has been initiated, which involves all three partners:
  - Discovering new patterns linking outcomes to patient physiology and treatment
  - Risk prediction scores for populations, sub-populations and individuals

- The partnership with Drayson Technologies has three components: adoption of digital health within the NHS, product development and further research with OU and OUH Trust.