



ACADEMIC HEALTH SCIENCE CENTRES

SPECIFIC THEME / WORK PROGRAMME

1. DETAILS OF THE PROPOSED ACADEMIC HEALTH SCIENCE CENTRE (AHSC)

Name of the English NHS Provider/University Partnership:

Cambridge University Health Partners

2. THEME / WORK PROGRAMME

2.1 Name of the theme/work programme.

Theme 3: Medical informatics

2.2 Aims and objective of the theme/work programme.

The vision underlying this theme is that increasing our use of medical informatics will support a paradigm shift in clinical care, education and research. To achieve this vision, the programme has three workstreams:

- (1) Transforming our approach to patient records by implementing a full electronic health record
- (2) Developing research informatics to interrogate complex datasets (including genomics) and interface these with phenotypic information
- (3) Training in medical informatics.

Workstream 1: Implementing a full electronic health record (EHR). High quality care depends on the availability of good quality data and access to the right information by the right person at the right time. This is vital for the experience of patients, carers and health professionals. Academic medical centres in other countries have published impressive clinical and financial data demonstrating the benefits of an EHR for individual hospitals and the healthcare system as a whole. Our current approach – which is largely based on paper records combined with legacy computer systems – is simply not fit for purpose.

In light of these compelling arguments, CUHFT and PHFT have committed to an eHospital programme. This £200m investment over 10 years will deliver a single integrated digital patient care record underpinned by Epic and Hewlett Packard. We have embarked on a full scale implementation and will switch to the EHR in October 2014. The current documentation processes within both CUHFT and PHFT are substantially paper-based with both hospitals positioned between levels 2 and 4 on the HIMSS Analytics EMR Adoption Model (http://www.himssanalytics.org/hc_providers/emr_adoption.asp - level 7 being truly paperless). eHospital will move the Trusts to a comprehensive digitised clinical and administrative system (HIMSS level 6) with integration of all systems including prescribing and all aspects of clinical related orders and results reporting. Achieving level 7 status is an explicit aim for the future – of the 2% of US hospitals which have achieved this status, two-thirds use the Epic system.

eHospital will significantly improve many aspects of patient care. For example, full electronic prescribing and drug administration will reduce the number of associated adverse events (whether transcription, interaction or allergy related) leading to fewer clinical complications.

Wide ranging passive and active clinical decision support based upon a powerful and flexible rules engine module will provide automatic guides, prompts and alerts with best practice informed by NICE and specialist society guidelines.

The system will avoid the need to collect data repeatedly; with test results, medication history, clinical

documentation and treatment summaries all available in one place. Valuable clinical time, freed up by not having to look for documentation, will be redirected to delivering hands-on care.

Crucially, patients will have access to their own data from any internet connected device through the MyChart patient portal so engaging them in helping to define and shape their own healthcare going forward. This will include the ability to enter their own data for clinical review e.g. medication, blood glucose monitoring, home peak flow measurements etc.

Operationally, the presence of near real time reporting linked to clearly defined outcomes will mean that clinical services will for the first time be able to truly monitor their performance so enabling a spiral of continuous improvement informed by accurate analysed data. In time with linkage to the Trusts' risk management systems, the effect on patient safety will be profound.

Suitable governance frameworks will be put into place to facilitate the use of identifiable, pseudoanonymised or fully anonymised datasets for clinical and research use. eHospital will then form the platform on which CUHP will embed evidence based clinical decision support (medical, nursing, pharmacy related etc.) linked to local, regional, national and specialist guidelines. This will ensure that clinicians will "do the right thing" when caring for patients, and also provide them with the ability to explore and understand the rationale guiding these approaches.

Almost all of the data captured within Epic will be structured and / or coded. All clinical signs / symptoms / diagnoses will automatically be converted to ICD-9, ICD-10 and SNOMED CT with documentation structured according to the recently published Academy of Medical Royal College guidelines (<http://www.rcplondon.ac.uk/resources/standards-clinical-structure-and-content-patient-records>). In addition CUHP will be able to create its own discrete, reportable data elements and to embed these fields into forms, questionnaires and note templates.

Workstream 2: Developing research informatics. Increasingly addressing biomedical research questions requires computational approaches and sophisticated bioinformatics. A striking example, in which Cambridge is an internationally leading position, is exploiting the power of next generation sequencing approaches and interfacing the genomic data from pathogens, humans with rare diseases, and cancers with clinical datasets and phenotypic information. This is necessary to understand disease mechanisms, and develop diagnostics and novel therapeutics. To address this we are building a critical mass of bioinformatics expertise with resource embedded in research teams. We are investing in new academic posts in medical informatics (Chair, Reader, University Lecturer) and biostatistics (Chair) to further enhance the clinical school's academic strengths in this area (led by Professors Tavare and Richardson). We also plan to expand and relocate the computational infrastructure of the School of Biological Sciences (SBS) and the SCM for data analysis, integration and storage to a single dedicated facility that will significantly decrease costs and increase access and data sharing. In addition, the University has a major investment programme in high-performance computing and secure data storage.

The full potential of linked phenotypic and genotypic data will only be realised if there is linkage between systems across our research and clinical organisations. CUHP, through the NIHR Cambridge BRC is leading on two related initiatives that will develop methods to achieve this. Through the NIHR BioResource Cambridge is supporting and providing expertise to participating centres to identify and implement effective platforms and process-driven informatics strategies to provide data linkage. The Rare Diseases Translational Research Collaboration is being led by Cambridge and Newcastle and is developing information systems which will be based on a "hub and spoke" model, where the hub will be a patient-focussed disease database, and the spokes will be deep-phenotype databases and genotype repositories held by collaborating organisations. Underpinning these initiatives is the NIHR Health Informatics Collaboration, which has an overarching objective to enable an environment where the NHS, academia, industry and patients work collaboratively to capitalise on the advantages of data sharing.

At a local level CUHP will ensure that clinical information in eHospital and CPFT's Case Register Interactive Search (CRIS) has a link anonymised connection to relevant genomic sequence databases. This will build on two related informatics initiatives in the interpretation of clinical and genetic data developed at the European Bioinformatics Institute (EBI; <http://www.ebi.ac.uk>) and the Wellcome Trust Sanger Institute in partnership with CUHP investigators; the Database of Chromosomal Imbalance and Phenotype in Humans Using Ensembl Resources (DECIPHER, (<http://decipher.sanger.ac.uk>) and the Deciphering Developmental Disorders (DDD, <http://www.sanger.ac.uk/research/areas/humangenetics/ddd/>) Project.

To ensure that data can be shared appropriately, we will develop a 'medical informatics hub' comprising NHS eHospital analysts and BRC staff to deliver an unparalleled feed of structured model-based clinical data to researchers with all appropriate governance and ethical frameworks in place. Configuration of the system to accommodate research-based workflows eg the ready identification of patients for research studies, the ready identification of episodes that might constitute a study-related adverse event etc. will substantially enhance investigator-led and industry-sponsored clinical trial based activity. In addition, the

system will also record consent for research use of clinical data and there is functional integration available with clinical trials management systems using industry-accepted IHE (Integrating the Healthcare Enterprise) profiles that ensure interoperability between EHRs and research systems.

An important aim of this workstream is to ensure that we exploit the opportunity to build on a comprehensive EHR. Our strategy will be to build infrastructure around Epic for research data services and particularly to develop collections of models and tools, together with the University of Oxford. The implementation will be as open source software and we will work with the informatics community in the UK to achieve collaborative resource development. This approach will be significantly faster than attempting to replicate Epic functionality in multiple existing systems and will provide significant gains from the much higher investment in the eHospital project.

Workstream 3: Training in medical informatics. There is a pressing need to increase training capacity in computational approaches for young clinical and non-clinical informaticians / researchers to underpin “the spiral of continuous clinical improvement” as well as the current research challenges, and over the longer term, to establish stable career pathways and research leaders in these areas. In response to the growing need for data analysis and data management training for all basic and medical researchers, the SBS has recently committed substantial resources to the relocation and expansion of the University of Cambridge bioinformatics training facility. This investment more than doubles the current capacity and will accommodate up to 50 students at any given time in a flexibly configurable teaching suite. The SBS has also increased academic capacity to extend the service and implement new courses to fulfil the need of students and research staff across the University. Such courses utilising clinically relevant datasets (to include issues of ethics, access privileges and encryption alongside data handling and integration) will use examples from the informatics hub to support clinically-related projects that will be co-supervised with computational and bioinformatics investigators in SBS. As an example, in a recent Part II SBS project we generated an ontology of dermatological disease (DermO), exploiting cutting-edge semantic approaches to produce a structured terminology that can now be applied to both patient care and research problems integrating disease information from a range of domains including pharmacogenomics. Using DermO, components of diseases can be disaggregated into their constituent manifestations for automated interference reasoning and machine learning applications as well as data extraction from EHRs. The tool can now be applied to phenotype-based integration of disease information with other domains such as drug effects to support drug repurposing and novel therapeutic applications, and also used to identify phenotypic relationships between known diseases providing information on common underlying pathways.

2.3 Description of how the proposed theme or work programme will contribute to the aims of the AHSC.

CUHP is committed to driving the open use of clinical and related data in innovation and research in the health sciences, and supporting improved and novel care and enhanced productivity in healthcare.

2.4 Description of how the proposed theme or work programme will contribute to the further integration of research, health education and/or patient care and how this will lead to improvements in patient care.

All clinical data including CUHP defined elements are to be exported daily to a SQL Server-based reporting system and to a ‘dimension fact’ based data warehouse. The currently progressing acquisition of an NHS Interoperability Toolkit certified data integration engine will further facilitate the linkage of this clinical data with other datasets including public health, social care, genomic and others as and when such datasets become available and accessible to the Trusts.

The fact that eHospital will provide for all clinical staff to securely access at any time, and from any location, a single care record for each patient, entering data in a structured and coded manner means a paradigm shift in the quality of routinely collected clinical data in terms of its usability and meaning for driving clinical care, education, training and research. Linked with the development of the Cambridge Biomedical Research Centre medical informatics theme and the opportunities presented by the strengths of the wider University provides an unparalleled infrastructure and environment on which to further the declared aims of CUHP and drive our agenda of local integration for global impact.

2.5 Description of how the theme/work programme will involve and enhance multi-disciplinary and multi-professional working.

Our EHR will provide a **single** integrated digital patient care record – all members of the clinical care team from whichever discipline and field of practice will contribute to the same clinical record and each will see the whole record in its entirety. This will be a major advance towards truly integrating multi-professional / disciplinary working.

The software supplied by Epic will be configured by approximately 100 seconded members of CUHP organisations including 19 Consultants, 10 senior nurses, 8 pharmacists as well as other technical, managerial and operational clinical and non-clinical staff. Validation sessions have already been attended by approximately 500 members of clinical staff from all areas of the hospital.

These and other processes including system testing, user acceptance testing and then training, will draw upon identified “clinical readiness” owners from every team, discipline and area in our hospitals. Our approach requires multi-disciplinary input, review and “sign-off” of the system to be deployed. Such close multi-professional working will lead to the deployment of a system where such patterns of working and sharing of documentation and knowledge will become the norm.

The plan for a ‘medical informatics hub’ on the campus to provide a single point of contact for researchers to access eHospital data will reduce barriers to data access and will provide a rich academic environment for new research efforts in clinical informatics. Our plans will bring together pre-clinical and biological sciences undergraduate teaching in informatics and provide excellent computational biology training and support at all levels from undergraduate to Principal Investigator.

Both GSK and AZ have indicated that one of their priorities for collaboration will be medical bioinformatics and systems-based computational approaches. Creating productive industrial relationships is central to our strategy and the establishment of an accessible informatics hub will clearly facilitate this.

2.6 Description of leadership and key individual and organisational contributors with responsibility for delivering the theme/work programme.

The eHospital Programme Board is led by Dr Keith McNeil (CEO, CUHFT).

Dr Afzal Chaudhry, Consultant Nephrologist is the Chief Clinical Information Officer.

A Medical Bioinformatics Steering Committee provides strategic oversight for the theme and includes the following:

- Dr Afzal Chaudhry, Chief Clinical Information Officer
- Professor Anne Ferguson-Smith, Professor of Developmental Genetics
- Professor Patrick Maxwell, Regius Professor of Physics
- Professor Duncan Maskell, Head of the Council of the School of Biological Sciences
- Dr James Brenton, Honorary Consultant Oncologist, Lead BRC bioinformatics theme
- Professor Simon Tavaré (Professor of Applied Mathematics & Director of the CRUK Cambridge Institute)
- Professor Ben Simons (Herchel Smith Chair in Physics)
- Professor Sylvia Richardson (Director of the MRC Biostatistics Unit)