Principia Medicinae Digitalis Sotoniensis

Essays on the Evolution of the UHS Clinical Data Estate 1980 -2024

Section 1 Essay 8

The Classification and Indexing of paper records for Digital Clinical Systems: Lessons and Solutions

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Publication Plan

The essays which comprise this series will be made available in the first instance on my professional website, https://www.wessexsurgical.co.uk as downloadable PDF documents for review, comment and as a basis for further contributions. They will be amended, updated and supplementary as necessary and as any new material becomes available. All with knowledge and participation in the (University Hospital Southampton) UHS digital programme are welcome to contribute, by contact with me through dr1@soton.ac.uk.

Once the project is as complete as is achievable with the available contributions, final copies of each of the essays will be submitted to the University of Southampton ePrint server for formal publication.

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Section 1.

The History of the University Hospital Southampton Clinical Digital Estate 1980 to 2024

This is the eighth of a series of Essays which are intended to capture the history of the unique Clinical Digital Estate of University Hospital Southampton from the 1980s to the present day. I have reconstructed the narrative for this essay from the large series of minutes of the EDMS Steering Group; and from a large collection of personal emails covering discussions on various aspects of the implementation plan.

Essay 1.1. A Brief History of The digital transformation of Healthcare in the 20th Century

Essay 1.2. The Evolution of the Southampton Clinical Digital Estate 1990-2000

Essay 1.3. The Evolution of the Southampton Clinical Digital Estate 2000-2009

Essay 1.4. HICSS, eDocs and eQuest: The Building Blocks of the Southampton Electronic Patient Record, 1997 - 2009

Essay 1:5: The (Perfect) Electronic Medical Record

Essay 1:6: The Evolution of the Southampton Clinical Digital Estate 2010 – Present

Essay 1:7: The Oracle APEX story by Dave Waghorn

Essay 1:8: Document Classification and Clinical Information Capture

Essay 1:9: Electronic Document Management Systems and the OnBase story

When complete, the collection of essays will form an e-book which will explain how the system came about, how it evolved, and how its addresses many challenges of clinical informatics through its component design and integration. I and my co-contributors hope that the lessons learned from this demanding project will also help guide others who embark on similar programs.

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Introduction:

The transition from paper to digital healthcare systems has been epochal in its unique global challenges, and massively experimental. In this essay, I have sought to explore the challenges in moving from paper-based to digital medical record systems, with particular reference to the rationalisation of document structures, indexes and classifications in preparation for the adoption of a commercial Enterprise Document Management System (EDMS) in a large tertiary NHS Hospital.

This essay reviews the complexities and the lessons learned during an ambitious transition programme to digitise a very complex 50+ year old paper archive, while simultaneously adopting a commercial EDMS at University Hospital Southampton(UHS) from 2014 onwards. I have drawn in particular upon the rigorous and insightful work of Toby Cave of the UHS IT Team, who was charged with technical leadership of the project, and upon the various scoping discussions which we enjoyed during the project. Toby expended prodigious energy, patience and courtesy through the UHS Clinical Records Digitisation Programme.

This essay also provided an opportunity for reflection on the nature of clinical paper record generation and record keeping in the past century, and to learn from the local solutions which we developed and which may find wider resonance.

From 2013 onwards, we faced a complex challenge in engineering the transition from paper to a digital document management system. The key driver for this project was the mandate in that year from HM Government and the Department of Health for a transition to a digital NHS by 2017. This ambitious edict and deadline did not seemingly account for the adverse experience of exemplars such as the Wessex-IBM project failure in the 1980s (Essay 1:1), or the NPfIT programme in the previous decade (Essay 3:1).

It is not the purpose of this essay to analyse or deconstruct that high level decision. However, I note that the cabinet of Prime Minister David Cameron may have been encouraged by the excellent work of Francis Maude in the Cabinet Office in building Gov.UK, which had advanced the digital transformation programme of many Departments of State beyond Health.

The state of clinical documentation at University Hospital Southampton in 2013

Prior to 2013, the clinical records system at UHS was a complex admixture of paper and digital formats. They included some 2.5M volumes (folders) of paper notes and a large number (tens to hundreds of millions) of electronic documents across the eDocs, eQuest and HICSS systems and other component systems of the EPR. Many of the electronic documents were also duplicated as print-outs in the paper folders. However, there had been no systematic approach to e-documentation to date, so for example, paper-based anaesthetic charts had not been captured digitally for ease and speed of retrieval and review, despite their operational importance.

The paper based clinical records were of varying size, content and complexity. They dated back for many decades in many cases. They contained a heterogenous mix of document types including handwritten notes, printed letters, pathology, XRay and blood test results, administrative notes and annotations, and so on, some of which were bar coded and some of which were not.

They also included a very large number of pre-printed forms and check lists to cover all manner of clinical activities; and many documents that were generated during hospital admissions, including temperature, blood pressure and respiratory rate (TPR) charts; fluid balance charts and practice compliance charts, for example in relation to Deep Venous Thrombosis (DVT) prevention records, theatre and procedure check lists and so on. Nursing and allied health professional records such as Physiotherapy notes were a further rich source of analogue paperwork.

The complexity of the individual patient's health was often noted in the thickness and number of the record folders, and the busy clinician might face a long search to find a particular document in any one consultation with the record.

To ease the search for information within paper records, the folders were partially structured using a long established and colour coded clinical subject taxonomy, which had evolved locally over many decades. Overall, there was an Information Anarchy which had never been properly addressed with a formal discipline. General conventions of note and

record keeping were passed down by word of mouth rather than through logical and well policed policies, and standards of note keeping were generally honoured in the breach.

Individuals and departments would generate paper forms of a non-systematic design ad lib to suit local purposes, thus further adding to the paper tsunami. Those of us who had been brought up professionally in the paper era had learned to navigate and survive the the clinical paper economy, which was indeed chaotic, inefficient, unreliable, and expensive of clerical staff to administer.

The Move to Acquire a Commercial Enterprise Document Management System in 2013

The decision to move to a fully digital electronic document management system (eDMS) in Southampton in 2013 brought focus to the UHS digitisation process and the need for a clear strategic plan with logical objectives and well reasoned solutions. Specifically, it mandated:

- the urgent Audit, Analysis And Rationalisation of the existing paper document types in all forms of use across UHS and partner hospitals in the EDMS project;
- The determination of which historic paper documents would be digitised and why;
- The determination of a process for capturing and scanning newly generated documents from hospital admissions while work continued in the hospital;
- a process of applying an appropriate taxonomy, classification and metadata to every scanned document and collection of documents, so that they could easily be found and retrieved from the EDM system

- a process for similarly matching all of the electronic clinical documents in the various Trust systems, primarily eDocs, to the EDM system, whose classification would be structured for consistency around the National Treatment Function codes.

The technical considerations of this programme would also need to be matched to a clear understanding of the user needs at all levels, from front line health professionals to administrative leads, senior managers and IT professionals, if the project was to have any chance of success.

Implementation of the EDMS Acquisition and Integration Programme.

A UHS eDMS Steering Group of clinicians, IT specialists and clinical records specialists was therefore formed in 2014 to oversee the process. UHS and the IT team went to market and held a competition between eDMS providers to find a system which met the technical requirements of document capture at pace and volume. The eDMS integration programme at UHS progressed broadly through yearly phases, in that The project was conceived and set in motion in 2013. In December 2014, Hyland Software of Cleveland, Ohio was selected by competitive evaluation to develop its OnBase (Ver 16) solution for UHS;

- Contracts were drawn up and project definition progressed through 2015;
- The system went live for testing and adaptation in 2016;
- Conceptual and integration problems came to light in 2017;
- The programme underwent a strategic reset in 2018, re-establishing the primacy of the indigenous UHS EDocs and CHARTS EPR systems;
- The evolved solution persists into 2024, pending a review of the OnBase contract in 2025.

The Systematic Audit of Paper Holdings at UHS in 2013-2014

The first challenge was to understand the overall paper document holdings across UHS in 2013-2014, by volume, location and classification. This required:

1. A full audit of **where and where paper records were stored** around the Southampton Data Estate. Additional to the Nursling Health Record Store, there were a range of record collections that were still under the control and storage of individual services, for example the Eye and Maternity Services. Other records were stored by outlying hospitals and by partner Trusts, including the Solent and Southern Health Trusts.

2. A full audit of the range of **the types and ages of paper documents** that existed across the clinical data estate, so that they could be categorised, classified and rationalised into whatever digital storage and retrieval system was selected for the EDM programme.

3. The Prioritisation of the paper holdings into categories for digital scanning or long term “deep” paper storage in consideration of costs and of the time available for the project.

4. A clear understanding of the circumstances for the continuing clinical use of paper.

5. This audit would be in the context of the clarity as to the capabilities and design features of the OnBase and the design imperatives that our paper classification would have to meet to ensure display and retrieval of any one document or collection of documents at any tme and for any reason.

The preparation for digitisation of this historical mixed load of paper records also needed rigorous analysis to determine:

- What proportion and categories of old records held information of sufficient importance to justify scanning and electronic preservation;
- How best could the content of this collection be categorised into a rational structure that could be classified and prioritised for preservation, or that would inform the design of any future electronic document storage system, both for existing and future records;
- How best to design collections and scanning flows for new documents in a busy hospital whose work processes could not stop during the digital transition phase.

The Scanning Plan for Historic Documents

The UHS clinical record folders for individual patients were primarily stored in the Nursling Medical Records store, but also in various other departmental stores around the hospital estate, including the eye hospital and the maternity hospital. Some records were stored in unsatisfactory spaces, where damp and floods would prove particularly disruptive and destructive.

The Nursling Store was an offsite warehouse located two miles from the hospital. This imposed significant rental, storage, transportation costs and clinical risk, and it created a large administrative overburden from moving records around “24/7/365”.

The batch scanning plan prioritised the selective scanning of the most actively used historic folders. Given the volume of work and the time constraints, records folders would be scanned in their entirety and not sub-sorted. File contents would be captured using high capacity scanners to produce large PDF files wherein a single PDF may contain dozens or hundreds of individual documents. Optical Character Recognition (OCR) of the contents of the documents was ruled out as impractical. Documents had to be sorted at the point of

scanning into functional groups to enable subsequent users of the EDMS and EDocs systems to find critical content at speed and at least clinical risk of omission.

Before paper documents could be loaded to the incoming OnBase EDM system, they needed to be captured as digital images. An external scanning company was engaged for this process. The scanning plan needed to take account of the Back-scanning of historic records, and the Forward scanning of newly generated documents

A new strategy was needed for the “forward scanning” of new documents as they were created in clinics and on the wards. This also mandated the creation of a descriptive framework and the attachment of the metadata to every document to describe the time and source of its creation and its content, to allow accurate filing of the document in OnBase. Each document was also allocated a unique code number.

Fortunately, many of the key documents for each folder already co-existed as electronic documents in our primary clinical data estate, following an earlier decision to standardise letters, discharge summaries, operation notes and other key documents from 1995 onwards.

The plan also allowed for the long term storage of record folders on the sites of commercial storage providers which were not selected for scanning. Such records could be retrieved on demand and at a cost, if they were ever needed.

Nationally, the costs of paper record storage had led to the imposition of arbitrary Retention Policies, for set periods for the storage of paper records. These which would commonly be well within the lifetime of the individual patient, so key information might be deliberately destroyed for administrative convenience without regard to the benefits of the creation of a lifelong paper health record (PHR).

The team also planned for **the forward scanning of documents** which were generated during continuing clinical activity, primarily hospital admissions, while the digitisation programme evolved.

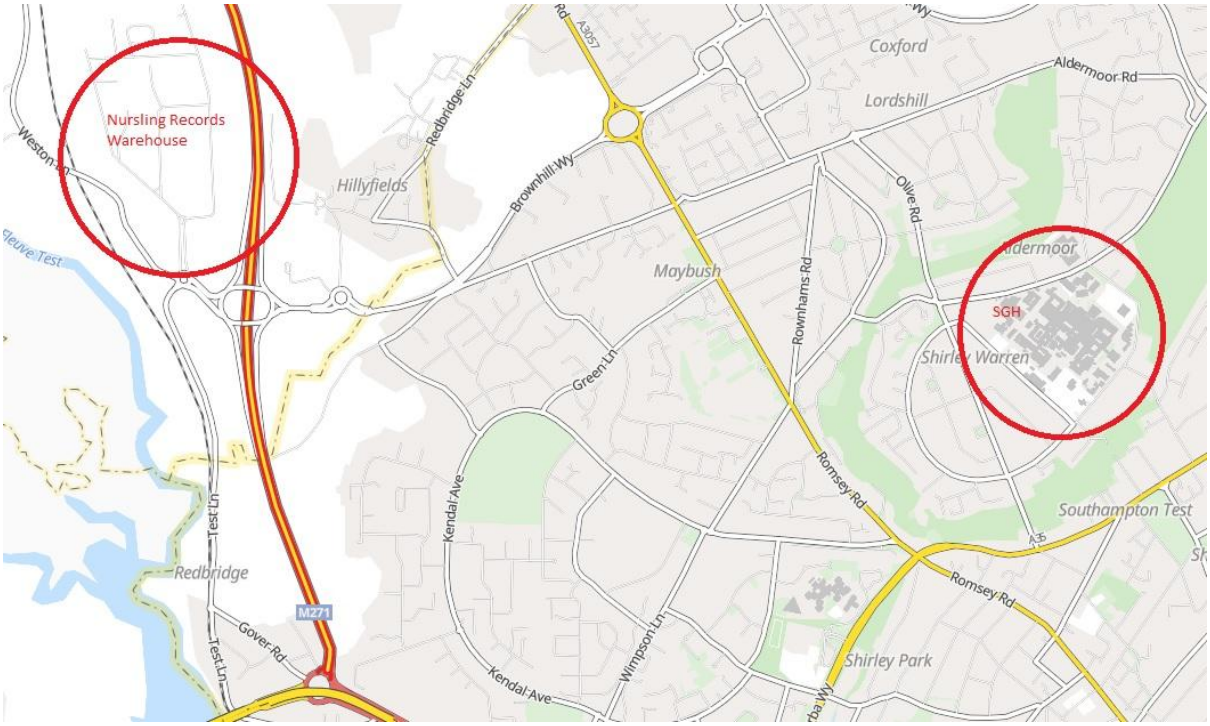

Figure 1: The tyranny of distance: the locations of Southampton General Hospital and Nursling Industrial Estate. Medical Records folders had to be transported between the two sites, some two miles and a large housing estate apart (Graphic based upon Michelin Maps)

Figure 2. The UHS Primary Medical Record Store in the warehouse in Nursling, Southampton, 2014 (Photo courtesy of Mr David Cable).

The Scourge of the PDF

From the critical vantage point of the end user, there was a real risk that the need to "PDF everything" would drown out key clinical documents in long strings of pages within unitary PDF wrappers, which were date stamped by the date of generation of the PDF rather than by the dates of the individual documents and clinical episodes. This would create a substantial time penalty and clinical risk for a clinician who was looking for important historic information in a long PDF document

The problem of document overload extended to the “forward” (ie immediate) scanning of documents arising from current clinical episodes, where critical documents (For example, an operation note) might be lost within around 50 pages of administrative and transient "process" documents which are of no further clinical value by the time of discharge for a typical day surgical admission. The problem would be worse for complex impatient admissions.

The Paper Document Discovery Programme in 2015

Toby Cave led a detailed project to evaluate the scale and scope of the scanning of the health records. In July 2015, he published a detailed Selective Paper Document Scanning Plan, stating that:

“During 2016 the Health Records Centre (HRC) will start scanning health record folders:

“Where a patient record is identified for scanning, the health record folder(s) will be scanned as follows:

- All the volumes and types of folders currently held within the HRC will be scanned.

- Where a patient has folders archived in Filestore (i.e. not used in over 4 years) these will not be scanned by default.

- For each volume of folders scanned, all the pages including the cover and blank sides of a sheet will be scanned (blank pages can be suppressed in OnBase).

- Each document scanned will include indexing information to identify the type of folder it came from and the volume number.

- Folders requiring additional security (safeguarding) will have restricted access to authorised staff... Other staff will (still) be able to see that the folder exists in OnBase.

- When a folder is scanned, the recorded tracking location will be changed in the Case Note Tracker (CNT), and a comment added "scanned to eDocs / eDMS".

- Where a folder is not scanned it will follow the current NHS retention policy as will scanned records. An eDMS retention policy will be drafted in 2017.

The types of documents from health record folders, and the approach to scanning, were set out in detail in the plan. All documents would be scanned at 200 DPI (dots per square inch) and that all health record folders would be scanned in line with British Standard 10008, which outlines best practice for transferring electronic data between systems and migrating paper records to digital files.

Following scanning and quality assurance, the contents of the health record folders would be destroyed unless otherwise stated.

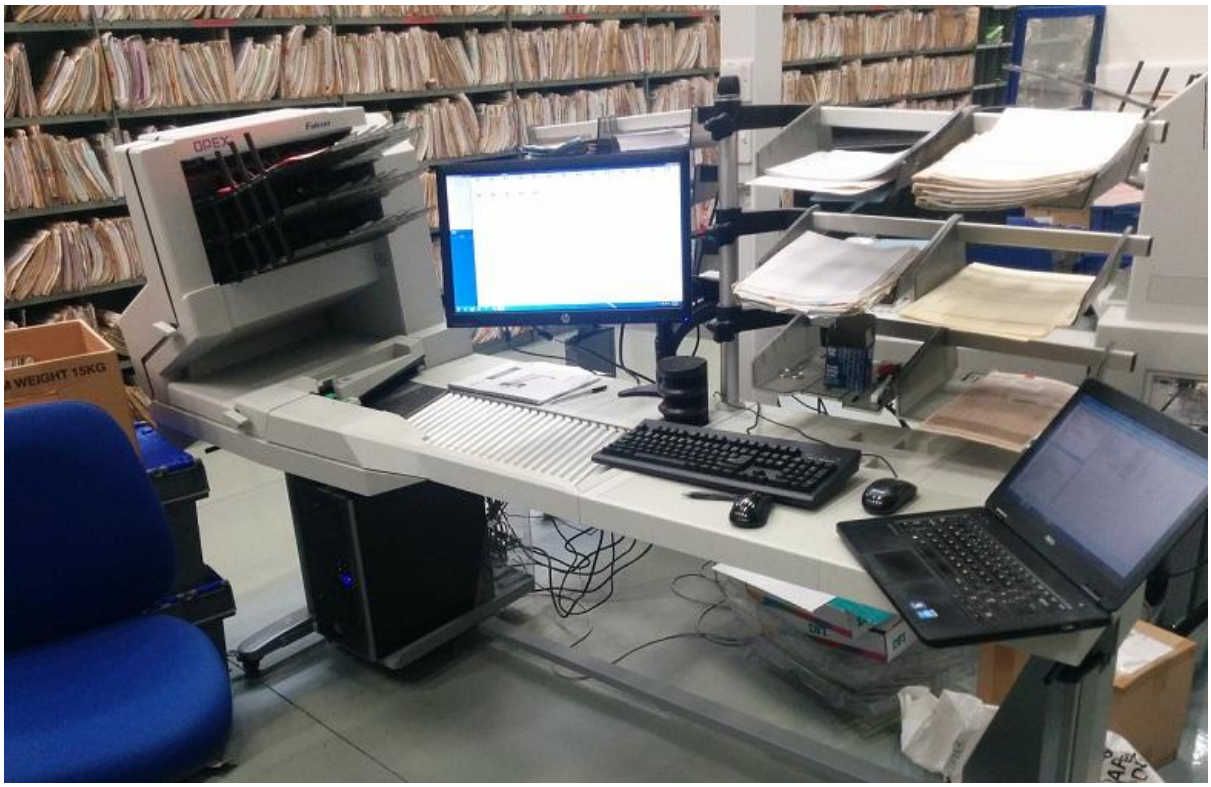

Figure 3: The Nursling Warehouse Scanner, 2016

Data Quality Assurance practices would include:

- Qualitative assurance through the Scanner Operator viewing of output during scanning.
- There would be Reconciliation of scanned documents against records recorded as scanned.
- The IT team would work with the clinical specialities to identify key documents to index.

Toby noted that "Several departments (e.g. Research, Cystic Fibrosis, Genetics, Child Psychology and Maternity) had their own health records stores. These would remain until at least mid 2017, when they would be considered on a case by case basis. However if health records are sent to HRC they may be scanned or archived to off-site storage".
The assessed cost of back scanning 45000 records was £25k.
Calculations of storage required for 20000 sheets for forward scanning per day worked out at around 1.2 roller cages of paper per day, or 6 roller cages per week.

By December 2016, agreement had been reached to start scanning Outpatients and inpatients in May 2017. Documents would be scanned into EDMS but also visible in eDocs between May 2017 and Nov 2017, before defaulting to the OnBase EDMS as the user interface for viewing documents. On completion of data migration (eta November 2017) eDocs document viewer would be decommissioned.

Outpatient scanning: would include the use of bar coded paper clinical history sheets which would then be scanned directly by admin staff into OnBase

Inpatient scanning: would use a new folder type called a "Folder for Scanning" (F4S), which would be created for all in patients on admission to hospital, for the aggregation of the paper documents which were still in widespread use , to include sections for the clinical history, Anaesthetic and operation records, Results and investigations, Additional records and forms, and safeguarding documents as required.

Back scanning: Patients who were regular attenders represented around 10% of records held in the library. Back scanned records would be imported into EDMS as single PDF documents. A process was also set up for Document corrections if incorrectly indexed.

Subject Access Requests (SARs) and Policies: The records team were servicing around 70 SARs per week. An OnBase SAR workflow was developed which could also be used by the litigation team who were servicing around 10 complaints per week.

UHS policies: were identified which would need to be amended to reflect changes implemented through EDMS included the Records management policy, the Still Photography and Moving Image Recording Policy, the Data Protection and Confidentiality Policy, the Informatics security policy; the Safeguarding Policy; Information Governance Policy and the Policy for the Safe use of Mobile Communications Equipment.

It was estimated that following decommissioning of the Nursling Warehouse towards the end of 2018, there would be some 900,000 remaining health records which would be moved to secure outsourced off site storage. Notes would be scanned on request to the eDMS.

Non-clinical uses of the EDMS (for example, financial and estate management documents) fell outside of the scope of the clinical eDMS project, but the same infrastructure could be applied to other uses, including personnel, research, and Standard Operating Procedures, to be managed as separate projects. Other exclusions to the project were the scanning of additional stores of paper health records held by Solent and Southern Health Trusts, and the Order Comms system.

The Wider Rationalisation of Paper-Based Processes

The minimisation of paper flows around the hospital required a progressive system-wide approach to rationalising traditional paper-based clinical working practices, with a range of solutions for the different sources of paper. By 2013, paper documents were accumulating at a high rate as former patients were readmitted to hospital; and as new patients were registered and as new paper forms were created and printed for a variety of practical reasons but with no over-arching discipline or document management policies.

In addition to the clinical records, much further paperwork was generated in the requesting and reporting of tests, and in the management of routine processes such as the booking of patients for surgery. The latter was a particular problem, as individual and collections of

booking forms (the TCI, To Come In cards) were mislaid from time to time, causing substantial problems for individual patients who were expecting surgery, and for the hospital with compliance with waiting times targets.

Paper based documentation was progressively reduced by strategies which included:
- a move to electronic test and specialist clinical services requesting without paper forms
- a move to electronic results reporting through eQuest without paper copies (eResults)
- digitisation of the surgical admissions process (e-TCI)
- the implementation of digital systems for ward nursing documentation
- the consolidation of printing systems to minimise the generation of paper documents by individual clinicians.

Early versions of some of these digital systems were suboptimal and there was a natural reluctance among health professionals and admin teams to move away from tried and tested analogue methods of requesting and reviewing the results of tests, for example.

In other cases, technology simply could not readily replicate the clinical notation practices of health professionals, for example in ingrained taught practice of surgeons to record surgical plans and observations in the form of hand-drawn diagrams. Nevertheless, many of the problems were ironed out by direct engagement between clinical users and the programming teams, such that optimal solutions evolved and analogue process were progressively eliminated in favour of robust digital solutions.

The Indexing of Electronic Documents in the UHS eDMS – Jan 2015 onwards

Our market survey and tendering competition had shown that commercial suppliers with proprietary EDM systems and designs had very little or no experience of storing, organising, prioritising and displaying clinical document collections of this complexity. Moreover, rheir systems were seemingly optimised for the retrieval of individual documents rather than for the retrieval of collections of documents in the organised patterns which were essential for clinical decision making. Indeed, we had already solved this problem of electronic information organisation with our bespoke UHS Lifelines interface to our bespoke clinical

data estate and evolving Electronic Patient Record (EPR) (as described in detail in the essays in Section 2.

Toby Cave introduced his plan for the Indexing of electronic documents in the UHS eDMS in January 2015 to his advisory Steering group, which included Derek Waller, Ashwin Pinto, Justin Davies, Ian Brewer, David Cable, Nilesh Patel, and myself for UHS, and Steve Rudland for Hyland eDMS

In eDocs we already had a rudimentary electronic document management system, but this locally developed budget product had not been designed for document storage and retrieval at scale or with the resources of a large enterprise document management company.

The plan was that the new eDMS would merge information from eCaMIS, eDocs, historic eDocs, scanned paper records, and prospective scanning and eForms to create a "blended view" of documents from different sources and with different metadata structures and indexing challenges.

Matching the paper document holdings to the design features of OnBase

During late 2015 and early 2016, we began to focus on the challenges of matching our established subject indexing to the needs of the new EDMS. This was a critical function, because it would determine what would be displayed on the immature and evolving OnBase interface, and under what labels. At this point, the strategic plan was that OnBase would absorb EDocs/Charts, and EDocs would be retired as the Trust's primary EDM.

Our widely understood "traditional" classification of paper documents at UHS had to be adapted to a new and untested system of document allocation in the new eDMS, which in turn had not been designed or adapted specifically for the requirements of a clinical information system.

The High Level Subject Taxonomy ("Top Tabs") proposal in the OnBase v16 interface

Toby proposed a possible solution to digitised document indexing to allow clinicians to find information as easily as possible, using a "Top Tabs" subject taxonomy in the OnBase

interface. This Taxonomy was based on the NHS National Treatment Functions which are supported and listed by the NHS data dictionary. Each tab would open a folder of underlying documents.

Our first challenge was to determine what Subject Taxonomy should be displayed in the Top Tabs" on OnBase, and what subject matter each Tab should represent (Figure). Our initial discussions centred upon how we could replicate the EDocs subject fields in OnBase.

It was decided that there would be four groups of Top Tabs for display on the OnBase screen, as follows

Top Tab Category	**Logic**	**Subsidiary Tab (Examples)**
Treatment Function (TF)	The TF is based on Document Speciality. Tabs are only displayed where related documents exist.	Dermatology Respiratory General Medicine
Document type	This indicates the purpose of the document, irrespective of treatment function.	Discharge Letters Consent forms
Historic scanned folders	This indicates all paper health records for a patient, including whether they have been scanned, volume, date opened and type.	IHR Volume 1 opened 26 Oct 2004
New and Personal	This displays any new documents since the user last viewed the patient record. The user may set the view to Personal preferences.	NA

Treatment Function Tabs

These were to be aligned to the Clinical Speciality. A patient may have one or more Tabs open, but Tabs would not be shown if that patient record has no documents which relate to this Tab. These Tabs also were intended to contain all of the relevant documents from eDocs and from the scanning programme. Tabs would be colour coordinated to match the existing UHS convention, eg surgical tabs are red.

-Departmental information systems (eg Aria for Clinical Oncology, Medisoft for Ophthalmology) were to be indexed under their usage speciality. Where a departmental information system was used across more than one Treatment Function, documents would be indexed according to the speciality under which the patient was listed at the time, recognising that this arrangement would present technical challenges where patients moved between specialties).

- Sensitive and Safeguarding documents in fields such as Clinical Genetics and Child and Adolescent Psychiatry could have additional security added.

-Where a speciality has been renamed, documents would be indexed under the current name for the Treatment Function, and Tabs could be renamed as necessary.

- Imported and historic documents with no clear speciality would be is indexed under an "Invalid Speciality" tab.

Figure 4. A further screenshot of an early version of the OnBase document interface, displaying a number of colour coded tabs. It also displays documents as thumbnails. This hybrid interface highlights the challenges in such design of practical reading the clinical record.

The Mapping of National Treatment Function Codes to UHS Practice

In late 2015, Toby Cave mapped the National Treatment Function Codes which would be used in OnBase to UHS Practice. He explained that "Broadly, my proposal for indexing uses the National Treatment Function Codes (eg Breast Surgery, Gynaecology, Ophthalmology, Clinical Genetics) for the top tabs". He felt that his solution would give us a good basis for the display of "top tabs" on OnBase without the overcrowding that is highlighted in Figure .

NHS National Treatment Function Codes (NTFCs) and **Main Specialty Codes** are used to support the national reporting and analysis of clinical workforce activity throughout the NHS and through data sets such as the **Commissioning Data Sets (CDS)**.

The NHS Data Model and Dictionary provides a reference point for approved Information Standards Notices to support health care activities within the NHS in England. It has been developed for everyone who is actively involved in the collection of data and the management of information in the NHS: see https://www.datadictionary.nhs.uk/)
Treatment Function Codes (TFCs) describe a division of clinical work which is based on main Specialties but which also incorporated approved and recognised clinical sub-specialties and treatment portfolios as are used by care professionals

The historic document classification system that was embedded at UHS was not wholly aligned with the more modern NTFC codes which had logically been designed into OnBase without a detailed understanding of our own classification

Most terms and descriptors were consistent between the UHS Classification and the national TFCs (eg General Surgery/General Surgery), but the exercise did highlight some inconsistencies across the UHS CDE as for a speciality where a locally recognised speciality or topic in eDocs was not mirrored by a National Treatment Function. For example “Clinical Governance Support Unit”, “MDT”, and “Southern Health”. Southern Health and Solent Health documents would be available under a “Southern/ Solent” tab but also indexed under a treatment function Tab.

Treatment Function Codes also introduce the concept of the **Main Speciality.** The Main Specialty is the Specialty within which a consultant is recognised or contracted to a clinical organisation. For example, my own Speciality is General Surgery, code 100, of which my specialist interest in Endocrine Surgery is a sub-speciality. Specialties are divisions of clinical work which may be defined by body systems (dermatology), age (paediatrics), clinical technology (nuclear medicine), clinical function (rheumatology), group of diseases (oncology) or combinations of these factors.

Specialties are recognised by the Royal Colleges and Faculties and the General Dental Council. This list is maintained by the General and Specialist Medical Practice (Education, Training and Qualifications) Order 2003 and European Primary and Specialist Dental Qualifications Regulations 1998. Main Specialties are normally aligned to the European Specialist Medical Qualifications Order 1995 and European Primary and Specialist Dental Qualifications Regulations 1998, in Anglicised form.

From the mapping of NTFCs against their UHS equivalents, we noted that some Speciality Tabs in eDocs were logically grouped together for a patient's diagnosis. For example, "Cancer Care" also included Clinical Oncology and Medical Oncology. Whereas some care groups included a wide range of different specialities, such as "Medicine & Elderly Care" (named "Emergency and Specialist Medicine" in eCaMIS. This category includes many different specialties across a range unrelated treatments eg including Ophthalmology, Dermatology, Gastroenterology.

At UHS, Care Groups were administrative constructs which divided up Specialities according to practical management and organisational issues. These were broadly reflected in the allocation of relevant digital documentation to similarly labelled folders in the eDocs and eCaMIS systems. We also noted that some Care groups in eDocs and eCaMIS had similar specialties, but used different names. For example:
"Women and newborn" in eCaMIS was "Obstetrics, Midwifery & Gynaecology" in eDocs.
"Emergency and Specialist Medicine" in eCaMIS was "Medicine & Elderly Care" in eDocs.
Similarly for "Intensive Care" vs "Critical Care", and "Clinical Support" vs "Support Services"

Some Specialties were duplicated across more than one care group. For example;
The Care Groups "Cancer Care" and "Pathology" both included "Clinical Haematology".
The Care Groups "Cardiovascular and Thoracic" and "Surgery" both included "Cardiovascular and Thoracic" speciality.
Child health: most but not all paediatric specialities were under the child health care group;
Paediatric Cardiac Surgery was under "Cardiovascular and Thoracic" Care group;
Paediatric Radiology was under "Radiology" Care group;
Paediatric Ear Nose And Throat was under "Surgery" Care group;

Paediatric Ophthalmology was under the “Emergency and Specialist Medicine” Care Group.
Paediatric Neurosurgery was under the "Neurosciences" Care group (and duplicated under Child Health Care Group)
Some specialties were listed non-intuitively, eg "Clinical Genetics" was under the "Neurosciences" care group.
Southern Health and Solent NHS Trusts each had just one care group and one speciality in eDocs, but many specialties in their equivalent eCaMIS systems.
Moreover, Care Groups and Specialities may have been renamed or Specialities moved between Care Groups over time.

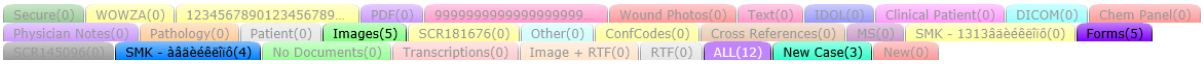

Figure 5: A tab based format for document filing in the original v16 version of OnBase.

The OnBase Tab model of information display

The challenge of the evolving partnership between the Hyland and UHS IT Teams was to secure the most efficient access to the OnBase record set for any clinical purpose. This user case demanded:
- optimum interface design to allow the user to focus on the task in hand;
- an overview of the document set for any one patient or record, from which to navigate to any content and time point
- an overview of key patterns in the dataset
- seamless transition between the existing UHS systems and the new OnBase system;
- An efficient and logical structure for the delivery of the information to the end user
- with the least possible delays in navigation around the system.

The data visualisation model that was proposed for the OnBase ver 16 interface was based upon coloured Tabs. Each Tab opened to a folder of documents in its particular category, and Tabs would only display if there were documents in that category within the system. Each Tab label also contained descriptive text to identify the Tab.

In the OnBase data model, each collection of documents under any Treatment Function would be represented on the OnBase interface by a coloured Tab From an analysis of a sample section of clinical records, Toby observed that for any one patient record, the average number of Treatment Function Tabs to be displayed would be 2.1. 98% of patients would have fewer than 10 tabs and 99.9% of patients would have fewer than 15 tabs.

However, 16 patients in the sample would have 22 – 26 Tabs. It was apparent that this would lead to a very cluttered screen and an unhelpful way of discovering documents. It also provided no visual reference structure for the relationships between documents and events.

Setting aside the issues of screen design, Toby saw that the model of document classification would have a number of advantages, in that:
- It would allow the application of security at a Treatment Function level for Safeguarding documents, for example in Child & Adolescent Psychiatry, or Clinical Genetics
- It would also permit the co-discovery and sharing of information between organisations at the Treatment Function level.
- It would avoid ambiguity where a speciality is duplicated over more than one Care Group, as was the case with eDocs.

From the mapping exercise, it appeared that 90% of UHS specialties would translate directly to the National Treatment Function Coding and OnBase Tabs proposal, while 10% would need the creation of local treatment function codes. In consequence, 89% of all documents that were imported from eDocs could be mapped directly to Treatment Function Tabs in OnBase, including 100% of documents since Jan 2012.

Toby aimed to create a logical separation of documents between specialties, which would be understood nationally. He saw the need to create other non-treatment related Tabs in OnBase, but that the proposed solution would give a good basis for Top Tabs without overcrowding the interface.

UHS e-document holdings could be broadly categorised in two groups, vis High Level and Clinical Categories. **High Level Document Categories** included:
Clinical Records (handwritten notes, outpatient clinical letters, inpatient episode summaries, operation notes, oncology planning documents etc etc), which are primarily represented by e-Docs at present
Test results, (including radiology, blood tests, microbiology etc etc) which are primarily represented on e-Quest and GEPACS)
Nursing and allied health profession notes and charts which were generally pan-disciplinary; which contained much transient information; and which were primarily generated by inpatient admissions. These often constituted the vast bulk of any personal record folder,

Clinical Document Categories such as Surgery, Medicine and Elderly Care existed within e-Docs They had served us well in daily practice and were well understood across the Trust.

Subsidiary Tabs on the OnBase Interface for Document Types
Subsidiary to the NTFC-related Tob Tabs on OnBase, Tabs for **Document Types** on the OnBase interface would allow staff to find documents, irrespective of the speciality or care group under which they were treated. The Document Type Tabs would cover Outpatient letters and Outpatient notes; Discharge summaries and Consent forms; Medical photos Emergency Department attendances; Referral letters; Pathology and Radiology

OnBase Tabs for Scanned Historic Paper Records: The fast bulk scanning of historic records folders as single PDF files would not allow individual pages (documents) to be easily identified without the user scrolling manually through the file. There was no Optical Character Recognition function to automate date recognition for all history sheets, for example. The task of manual searching would be made a little easier because clinical folder records were generally filed in chronological order.

Toby thus proposed that separate Tabs should be created for scanned historic records. The document types within this tab would follow the same naming convention as the current paper folders, (History, Investigation results, Consent Anaesthetic & Operation records, Additional records). OnBase would also indicate the existence of all paper health records for

any one patient, and their location, and whether they had been scanned, with appropriate metadata.

The "New" and "Personal" Tabs in OnBase: The "New" tab in OnBase would display the most recent documents and any other new information since the user had last looked at this patient's record. The "Personal" tab in OnBase allowed staff to tailor to set personal preferences for quick access to key documents.

Other filters at the OnBase Tab level: Within the Top Tabs folders, filters would also be applied to include the Document type; the Admission type; the Date, Speciality and Encounter. The Encounter indicated an outpatient or inpatient attendance. It appeared that the transition of documents would be easy for the majority of subject areas, but we needed to consider how best to handle the "outliers" to keep the system as simple and standard as possible.

The Histopathology record or Tab (OnBase) would be critical for many practical academic and clinical reasons. We had recently established a huge clinical research advantage at UHS, having reactivated all histology reports back to 1990 on the back of the SBCDS project, thanks to the work of Keith Burrill, David Cable and Alan Hales.

I felt that it would be much easier to understand how it all fitted together once we had an alpha (test) version of the OnBase system and its interface up and running. There would almost certainly need to be a significant process of iteration, to test the data presentation model in practical clinical use.

The Rationalisation of Document Types in the UHS eDocs System

eDocs content was to be ported directly across to OnBase, so the document classification in eDocs would need to align precisely with the OnBase classification. Toby notified us in early March 2016 that he had indentified 589 document types in eDocs which were in need of rationalisation.

We needed to decide which Document types should have their own “Top Tab” on the OnBase interface, and which should be filed under an “All Other Documents Tab”. We also needed to decide on which document key words should be used for filters, that is (for example), by Speciality, date (visit), Document type, and Admission type (Inpatient or Outpatient). The structure of OnBase dictated that:

- Documents could have many keywords, which would be used to apply search filters.
- A single document could only be designated with a single document type.
- Top Tabs were based on document types, and one Tab could hold more than one document type.
- The same document could appear under more than one Tab
- We should aim to avoid having more than 200 document types

This was all somewhat confusing. Through early 2016, the complexity of the requirements for the indexing and retrieval of documents from the Hyland Interface had become very apparent.

On Thursday 10th March 2016, Toby and I had a wide-ranging discussion around the UHS eDocs Document hierarchies; e-Quest reports hierarchies, OnBase structures, and the handling of Photographs, which produced some valuable insights and potential courses of action. We formulated a practical rationalisation of the 589 document types on a hierarchical basis, where were based upon the “traditional” 12 high level colour coded subject areas (eg Surgery, Medicine, Cancer Care) with which we were familiar in paper notes and in eDocs.

Toby concluded in an email of March 13th 2016, that:

- The proposed coloured Speciality Tabs on the OnBase interface were essential.
- We could agree to a radical simplification of the 589 document types on eDocs to SEVEN types for display purposes on the OnBase Screen.
- The original document types would remain in the document metadata as keywords).
- There would be Top Tab on the OnBase interface for each Speciality (Eg Orthopaedics), within which folder we would include the documents of Permanent (ie long term) clinical importance, as follows:

An Overarching Description of Four Document Types

During this discussion we recognised that regardless of the detail of any Tab based classification system, we could broadly categorise documents in any clinical records system, into **four functionally distinct document types**, which could be virtually allocated to one each of for virtual drawers in an electronic filing cabinet Figure 6). The categories were as follows:

A. Documents of Permanent Clinical Utility. These included:

Outpatient notes and letters; Inpatient clinical and nursing care notes

Discharge Summaries and Other Clinical Correspondence

Operation, Anaesthetic and Consent records

B. Documents of Transient Clinical Utility These included:

Many inpatient charts and Peri-operative documentation (eg WHO checklists)

C. Documents of Administrative Utility; These included:

Outpatient and inpatient attendance invitations

Protocol documents and Patient information sheets

D. Warning and Safeguarding Documents

These documents of critical importance apply to a relatively small cohort of patients. We considered that where-ever a patient has such documents, they would be automatically flagged up on a separate timeline (using the UHS Lifelines framework) or under a separate Tab (using the current OnBase page format). Safeguarding documents would necessarily be subject to separate user access controls.

The attraction of this simple, utility based model of document classification was that for the vast majority of daily clinical activities (eg outpatient visits, anaesthetic pre-assessments, hospital admissions), the critical document types (A and D) would automatically and selectively displayed by one or other data visualisation system. In my view, this would be achieved most efficiently in an upgraded UHS-Lifelines type of format), while all other documents (B and C categories) would remain available in OnBase or any other branded EDMS for specific purposes (Figure 6), such as case reviews and medico-legal requests.

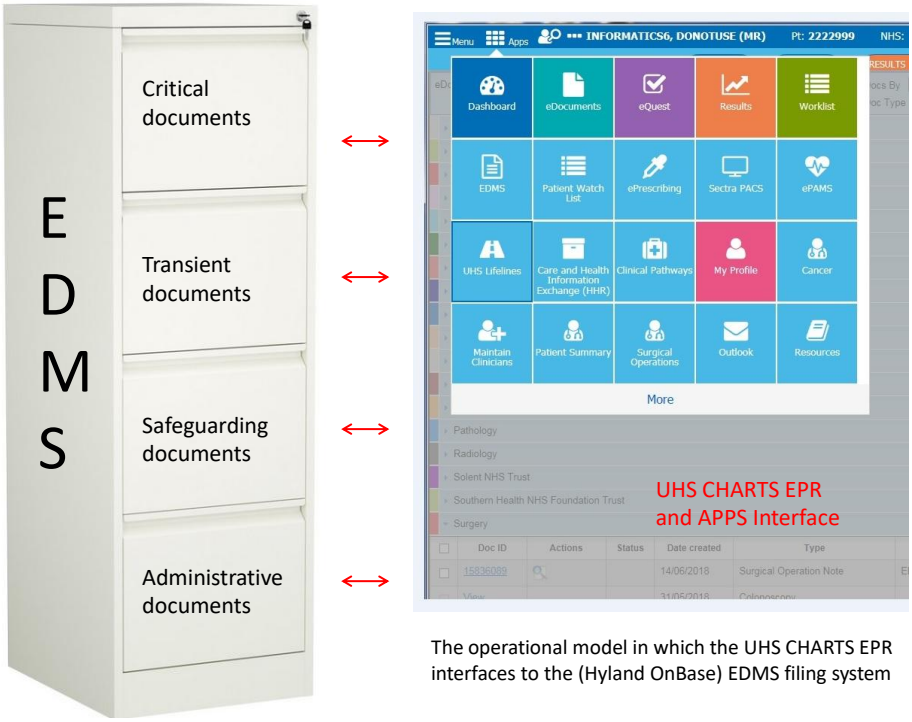

Figure 6: A simple utility-based classification of documents for filing in an EDMS (Rew and Cave 2016), and its relationship to the primary EPR Interface

The seven document types in this functional classification were as follows:

- Nursing notes charts and forms
- Clinic notes and letters, including referral letters and external documents
- Investigation results (including photos)
- Anaesthetic and Operation records (including treatment and consent)
- Admin letters
- Discharge Summaries
- Inpatient History

Toby also noted that:

- The “clinical permanent / transient” idea was also very helpful.

- We would include an “All” tab to include **transient** information.

- The Speciality Tabs would only contain **permanent** information.

We would combine this functional classification with the existing clinical speciality classification to fully categorise and locate any document on the OnBase interface.

Keyword metadata would also be applied to every document, to identify:

- The unique “Encounter” identifier for the outpatient clinic or inpatient admission
- The Date that the document was generated
- The Speciality to which the content applied
- The Document type (ie as listed above)
- To where and to whom the document was sent (eg GP, patient, notes)
- The Detailed document name, as recorded in eDocs, where relevant

Categorising "Place Request" Hierarchies and Terminologies in Equest

We needed to consider how requests would be placed for investigations and services as and when OnBase became the primary EPR interface. It was clear that there was confusion around the functionality in eQuest, which had evolved as a tool for requesting both test results and clinical services. This problem could be readily addressed by some simple conceptual changes, whereby the different functions of eQuest would be overtly acknowledged and addressed in modifications to the eQuest interface.

The "Place Request" Button would be replaced by two distinct buttons, vis **"Request Test Result" and "Request Service"**: Those Services and Referrals which were accessible through equest could be listed for selection in a drop down menu or menus.

Photographs, video and multimedia imagery as "Tests" rather than Documents

We needed to consider how photographs, video and multimedia imagery would be categorised and managed within OnBase. We recognised that imagery in its various forms subserves at least five functions in clinical records, vis:

- as an identity image of permanent record (facial features, whole body pictures) which convey a range of key information, and which have permanent utility as a measure of aging or of the onset of subtle disease processes
- as a record of "transient utility", for example of the response of a cutaneous condition to treatment
- as a permanent record of treatment, for example "Before and After" photographs of a plastic surgical procedure
- as a treatment planning tool, for example coronary artery imagery.

This category also included computer and CAD/CAM imagery which may be used eg for complex surgical reconstructions and advanced applications, eg in the correction of paediatric developmental anomalies

- for education, academic and research purposes.

Photographs and other imagery relate to an action at a point in time and a snapshot of the patient, both literally and metaphorically. They may thus be managed in data terms as tests rather than documents. This arrangement had the further benefit of further simplifies the vexing issue of numerous document types.

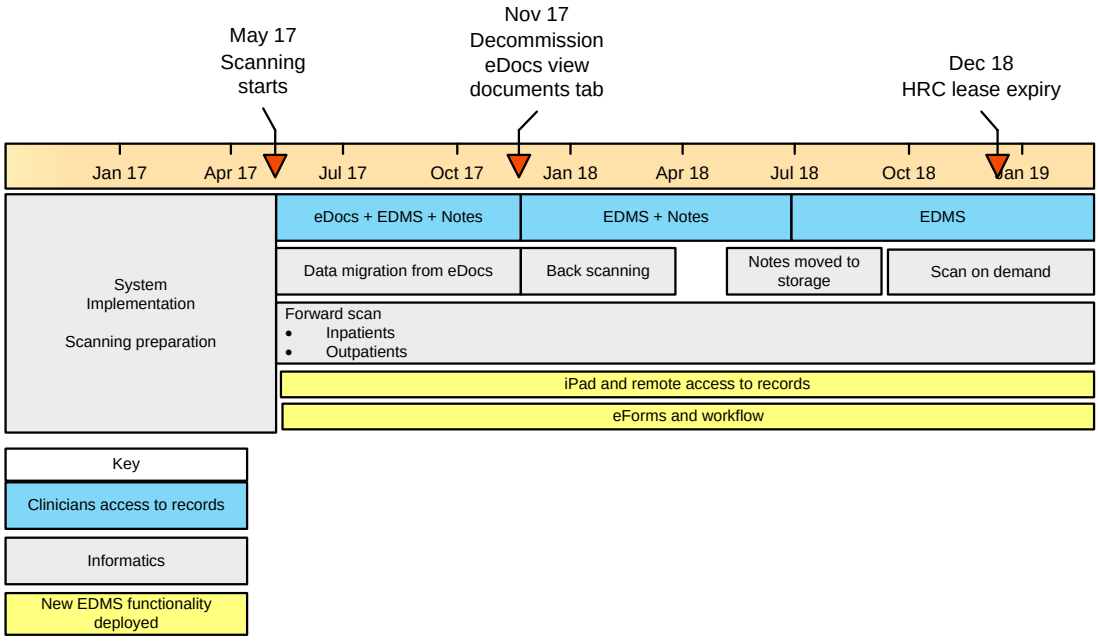

Figure 7: Illustration of intended EDMS project phases of record migration, 2017-2018

The Document Scanning Plan

Given the scope and scale of the clinical paperwork across UHS and its partner organisations, Toby was tasked to develop an efficient document scanning plan, that maximised the digital capture of the most used and important clinical documents. The deadline for emptying the Nursling warehouse was now December 2018. Any delay would have serious practical repercussions for the scanning workload, and a range of options were considered around the continuity of the eDocs system, vis a vis the need for clinicians to use both eDocs and OnBase with their very different interfaces to access documents

The scanning plan was developed in parallel with the document classification project, against an unstable technological solution in which two electronic systems, OnBase and UHS Charts, were both partnering and competing to secure the best clinical usability solution.

By early May 2016 the clinical discovery programme was complete. Progress was being made on:

- Indexing and security systems
- Medical Photography, security and mortuary use of EDMS for photography.
- Safeguarding; indexing and security in EDMS.
- Document migration from eDocs to OnBase.
- Completion of file formats for scanning by Hugh Symons, external supplier.
- Extraction of historic scanned records in the CD view system at the HRC to EDMS.
- Detailed mapping of eDocs “document names” to EDMS “document types”.
- Options appraisal for scanning CardioTochoGrams (CTGs) from maternity records to EDMS.

By early August 2016, the system was being built; It required 14 interfaces to enable EDMS to be fully integrated with the EPR.

- Document types had been built as agreed by the EDMS SG and the first integration messages have been received for demographics from PAS.
- Mapping tables had been designed to translate the EDocs Directorate based indexing system to the speciality based system to be displayed as tabs in EDMS.
- bar-coding of documents was in progress.
- Agreement had been reached as to how the back scanned files would be indexed, based on the record type, date opened, volume number and section. Each section will be a large text searchable PDF with the history section scanned in colour to facilitate searching.
- CTGs would be scanned as long (up to 5M) traces.

Between November 2017 and December 2018, clinical records folders for long retention reasons, regular and sustained attenders would be scanned into EDMS. The remaining records folders would be moved to an offsite storage facility from May to September 2018 in time for the expiry of the lease of the Nursling Warehouse. As this, paper notes would no longer be provided; although they could be scanned into EDMS on demand.

Documents would be stored by Document Type with Keywords. A detailed OnBase Solution Design document was also published, to address Capture, Management, OnBase Workflow, and Delivery for documents and processes which were not directly related to the CHARTS EPR, including Business processes specific to the OnBase Implementation and the OnBase Infrastructure.

Specific Considerations for the Digitisation project:

In addition to the general challenges of formulating a workable classification system for the EDMS as the intended new EPR for UHS, a number of other issues were raised:

The Handling of Internal Correspondence and Referrals: On 23rd March 2016, a problem with searching the OnBase interface came to light during the breast MDT, where it was much easier to find a referral letter from the respiratory service to the breast service within the UHS Lifelines interface in CHARTS than in the OnBase Clinical Viewer. It was not intuitive that the Respiratory Tab needed to be searched in OnBase to find the original letter. This highlighted an important generic question as to how best to handle internal letter referrals in the EDMS model.

The "Black Economy" of "Informal" patient-related information: Information has traditionally flowed in informal ways around the healthcare ecosystem, some of which was readily captured on paper and some of which was not. This included phone calls, both on and off the premises, and at all times of day and night; emails; and handwritten annotations to paper documents.

The Handling of clinical emails within the UHS Clinical Data Environment/EDMS

In mid-April 2016, I noted the issue of the increasing amount of traffic on UHS email accounts about specific patients, for example in respect of direct referrals, feedback from pre-assessment nurses and so on. These messages often had practical clinical significance, and should be automatically and formally incorporated into the clinical record, otherwise their content could easily be overlooked.

Toby noted that OnBase enabled integration with MS Outlook. However, a workable solution had yet to be devised or implemented.

“Ad-Hoc” and “Informal” Communications about Patients: We discussed the introduction of an “ad-hoc correspondence” document type for patient records. This would be used for ad-hoc communications such as emails to/from patients/GPs and Advice & Guidance, which would enable the documents which were not linked to a specific inpatient or outpatient encounter to be stored and retrieved; specialty would be a keyword rather than document type.

In October 2016, we returned to the issue of "Informal" information flows, emails, notes, annotations and admin instructions in a paperless EDM system. A surgical colleague had highlighted the challenge of replicating the common practice of digital replication of handwritten annotations on paper documents. These often usually contained important instructions for admin and secretarial staff, such as "see soon", "add to waiting list" and so on.

This annotation function was even more important with results and reports, when actions needed to be taken and instructions communicated to other staff, as for example by radiologists, who needed to highlight an important and unexpected anomaly on an imaging report, but who were then uncertain as to how best to flag up and create an alert on the finding.

There were a number of possible solutions to these problems. It seemed essential to provide a flexible annotation and highlighting tool within the personal EDM record, and to move all extraneous correspondence, patient specific information for which emails are currently used, notes etc into the individual record envelope as a critical risk mitigation feature. Toby felt that a solution would become more apparent once the system is live.

It was apparent that this was a Serious Risk Issue for the UHS clinical informatics community which must be thought through and addressed. It was very important not to see this as a problem which was platform or organisation specific, as it applied widely across the digital informatics programme.

Version Control of Documents: This also highlighted the problem of "version control" of drafted and serially altered documents, as a printed letter may pass through several hands and annotations during the patient journey around a hospital, following which multiple PDF copies of the same letter or report may be created. This is commonly seen in medicolegal case reviews. It also produces a challenge of "action confirmation" to ensure that any note, message or instruction is received, acknowledged and acted upon

Once such a system was built, there would need to be an absolute ruling as to the use of the system in all cases. The design of the system would need to be as quick and convenient as possible for all users in all circumstances.

Barcode assignment of document types in OnBase: To assist with tracking documents through the digital ecosystem, it made sense to assign a descriptive Barcode to each document type. Toby Cave identified almost 900 different forms and document types to which barcodes would apply. The list which he circulated highlighted the organisational challenges in the control and reduction of problems with this collection of document templates, which included duplication, and arbitrary, unnecessary and outdated data collection, much of which may never be looked at again after it has been generated (The Transient document problem).

There was a huge project before us to rationalise this list into a radically simplified data and document set and a more efficient way of working, as the then current and historic practices of uncontrolled form generation should not be allowed to self perpetuate indefinitely by habitual replication in OnBase.

Essay Summary

In this Essay, I have sought to describe the complexities in moving from a hybrid paper and electronic (eDocs) document economy at Southampton to a primarily digital economy. The process went through a number of key phases, vis:

Identifying the implications of the high level requirement to "go digital"

Proposing the solution: a commercial Enterprise Document Management system

Examining the global holdings of paper documents by the Trust

Prioritising these holdings for digital capture versus long term paper storage

Auditing, Defining and Rationalising the paper document holdings by subject against national standard Treatment Functions and the NHS Data Dictionary

Determining a logical classification system (Critical, Transient, Safeguarding and Administrative)

Determining a screen layout and design for the efficient search and retrieval of specific documents

Our local experience may help to explain why the challenges of moving to a fully digital NHS were once again under-estimated at Government level in the formulation of an unrealistic national plan as the timetable for the project continually slipped.

The Essay also prompts me to pose a number of questions around working practices which have concerned me for many years.

What is the minimum information set and flow that is required for safe and effective clinical practice?

How do we minimise the information overload that accompanies paper based and digital technologies? In many cases, this has become overwhelming rather than simpler in consequence of digitisation, particularly of inpatient records.

How to we impose the data principle of Enter Once-Use Often for many clinical applications?

How do we adapt technology in the creation of clinical documents to optimise the communication of factual information and its presentation to the eye of time-scarce professionals?

What does the optimal clinical letter look like? What information is essential and what is redundant?
Do we still need letters and traditional notes, when the technical systems exist to pass structured information around the healthcare ecosystem at light speed using digital informatics tools and interfaces?
These questions also lead on to considerations around the true ownership of clinical records and data: personal to the citizen and patient; or to the institutional health provider; or to the NHS centrally.

These questions are for a future essay. In respect of the particular story in this essay, we recognise that many hospitals and health providers in many countries have evolved their own subject classification systems over many decades. We hope that the lessons learned from our own experience will be of much wider value to other healthcare teams who have still to address the challenges of wholesale digitisation of paper-based clinical record systems.

In the next essay, I consider in greater detail the acquisition and history of the Hyland OnBase EDMS, from my own involvement in the process.