Principia Medicinae Digitalis Sotoniensis

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

Section 1 Essay 9:

The Challenges of Acquisition and Integration of an Enterprise Document Management System in a Major UK Teaching Hospital

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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 UHS digital programme are welcome to contribute, by communication 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 ninth in a series of Essays which are intended to capture the history of the unique Clinical Digital Estate of University Hospital Southampton from its origins in the 1980s to the current day. The transition from paper to digital healthcare systems has been epochal in its uniqueness, and is continuously experimental.

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

In this essay, I have introduced the challenges in information and document management in healthcare systems through the transition from paper-based to digital medical record systems, with particular reference to the Hyland OnBase Electronic Document Management System which was acquired by University Hospital Southampton in 2014.

When complete, the project will form an e-book which will addresses many challenges of clinical informatics revolution, drawing upon the practical experience of University Hospital Southampton over 35 years. I and my co-contributors hope that the lessons learned from this demanding project will also help guide others who embark on similar projects.

Essay 9 Contents

Definitions

The following definitions will help the reader to follow the narrative in this essay:

- The Paper Health Record, PHR

- Electronic Document Management System (EDMS); This is a general term for a system which help an organisation to manage its document flows by electronic means, including the document capture as electronic images, labelling, filing and retrieval tools. EDM systems are widely used in commerce, industry, law and public bodies, which have traditionally generated and processed large volumes of paper in the course of these systems. Where these systems include financial management tools, they are commonly referred to as "**Enterprise Document Management Systems**".

EDocs (eDocs) : This is a bespoke document Management and Word Processing system which was written specifically for the Southampton Hospitals Clinical Data Environment by Alan Hales. It has been fully integrated with other Southampton Electronic Patient Record (EPR) tools within the bespoke local CHARTS EPR wrapper

CHARTS: This is the bespoke "single sign-on" EPR system, which was locally developed and which evolved from the Hospital Integrated Clinical Support System (HICSS) as previously described in Essay 4. CHARTS went live at SGH in 2016. It comprises a range of software tools of daily importance to clinical teams, including eDocs, eQuest, UHS Lifelines, Surgical Ops, Sectra PACS (Radiology) and CHIE (GP records).

OnBase is the commercial EDMS which was chosen for the digitisation of the vast quantity of historic and ongoing paper documents which had not already been or were being generated and processed using EDocs. OnBase was built by Hyland Inc of Westlake, Cleveland, Ohio, which designated a support team to adapt OnBase to theSouthampton requirements. OnBase went through three version evolutions, V15, V16 and V18 from the initial contract.

Introduction

Through the 2010s, pressure was building at UK national level to accelerate the move from paper to digital systems for clinical information storage and management. However, the primary focus of the effort was on the technology of computerisation rather than on the primary disciplines of document rationalisation and optimisation of clinical decision making through better information delivery. When University Hospital Southampton (UHS) chose to accelerate its digital programme with the acquisition of a commercial Electronic Document Management System (EDMS) in 2013, there had been no prior rationalisation of paper documentation or of the core information flows.

Hospital teams therefore faced the parallel challenges of rationalising traditional paper documentation estates, and the introduction of new and untried technologies in the implementation of comprehensive Electronic Patient Records (EPRs).

The History of the Electronic Document Management System at UHS

Document generation at UHS had been standardised on Microsoft Word 6 templates from 1995 onwards. Metadata had been added to each document to link it to the individual patient through the 7 digit hospital number, a date-time stamp, and a subject taxonomy. Discharge summaries and outpatient clinic letters were among the first documents to be so labelled.

The standard subject taxonomy of the hospital specialities to which the documents were allocated that had been created many decades previously, and long before computers were commonplace. In this system, clinical notes on paper were coded with a coloured strip on the right hand margin which denoted the clinical subject, for example red for General Surgery, blue for Medicine and Elderly Care, black for Orthopaedics, Green for Cancer Care and Yellow for ENT.

This convention was carried over into the eDocs document management system. The launch of eDocs in 2004 coincided with a substantial increase in the volume and range of standardised electronic documentation. For example, HICSS Surgical Ops records were

displayed in eDocs, which also incorporated the archive of Word 6 documents between 1995 and 2004.

Therefore, by 2013, there was a rich collection of patient-associated electronic documents dating back to 1995. These were linked progressively to reports from the eQuest results module, including blood and microbiology tests, and covering all forms of radiology investigations. We were subsequently able further to enrich our electronic report collection back to 1990 with 342K histopathology reports from our early e-archives (Rew et al 2021).

In the previous essay (1:7), I explained how records were digitised and structured for the intended ease of organisation in a commercial EDMS. In this essay, I will focus on the acquisition and population of the Hyland OnBase Enterprise EDM system and the lessons learned over the decade from 2013 to 2023 from the attempts at integration of the commercial EDM alongside the locally developed, and well established Charts EPR at UHS.

In March 2013, the UHS Trust Executive Committee (TEC) approved an Outline Business Case (OBC) for the procurement and implementation of an Electronic Document Management System (EDMS), under the clinical direction of Dr Derek Waller, Consultant Physician, and the technical direction of Mr Toby Cave from the Information Management and Technology team.

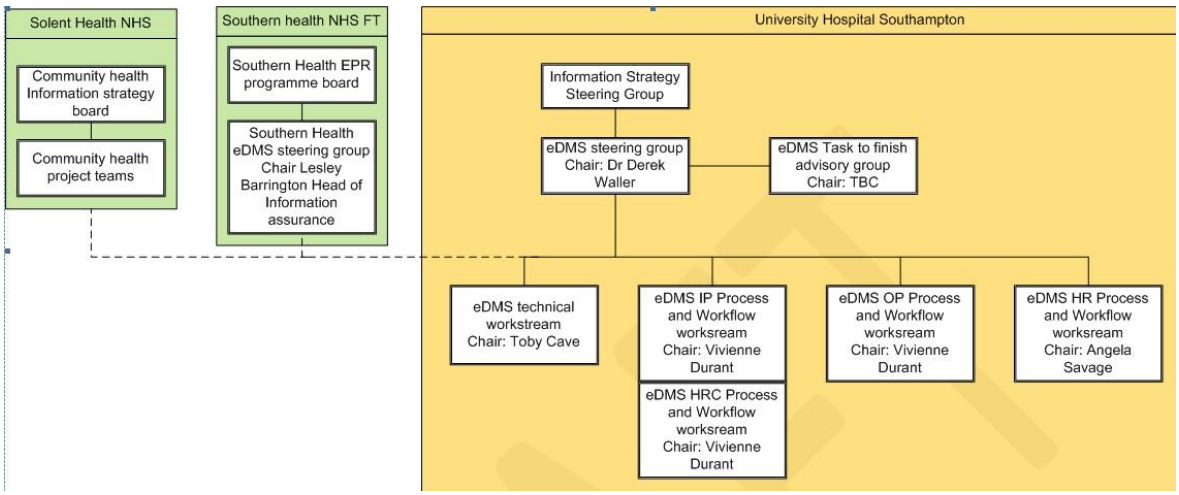


Figure 1: Diagram of The EDMS Project Governance Plan (Figure courtesy of Toby Cave Esq)

Development of the EDMS Project through 2014

During 2014, a project management structure was created. Clinicians with a particular interest in the programme, and subject experts from the Trust's existing document management streams were co-opted. Two other local NHS Foundation Trusts, Solent Health and Southern Health, which were already users of the UHS EPR, joined the programme.

On 26th February 2014, Dr Derek Waller, the Trust Clinical IT Lead at that time, invited UHS Consultant participation in the project, stating the ambition that:

"UHS will procure an electronic document management (EDM) system this year, which will be at the heart of a future fully electronic patient record (EPR). I am looking for senior clinicians to join a working group to help to guide the development and introduction of the EDM over the next year.

The EDM will sit alongside eDocs as a repository for all future clinical records. Past records will be scanned in at the time of a new patient encounter, and new records scanned after the encounter. All future patient contacts will then use the EPR in place of paper notes for accessing information about previous encounters, and the paper notes will no longer be available.

The way that clinicians search for and view records through the EDM, and how they are catalogued and displayed to the user will be a crucial part of the development, as it will determine how the full EPR will be accessed in future years".

On 8th May 2014, Toby Cave sent out a Trust-wide invitation to clinicians, stating that "we are looking for clinicians to be involved in:

Procurement: helping us selecting the correct system, will include inputting to requirements specifications, evaluating lengthy responses and site visits;

Quality Assurance: Piloting early versions and suggesting improvement;

Process: designing how the system should be used

Acting as a Local champion: in raising awareness of the programme and helping manage the transition to use.

The terms of Reference of the EDMS Project

These were as follows: The eDMS Steering Group (eDMS SG) would be chaired by Dr Waller. It would report to the Trust Information Strategy Steering Group (ISSG). The eDMS SG would oversee the strategic direction, delivery and take up of the eDMS. It would oversee value for money and alignment to the UHS IM&T strategy. Membership would consist of representatives of each of the clinical divisions; Southern Health NHS FT; a senior representative from the supplier; and a representative from NHS England following their award of funding. Other representatives would also be invited to participate at the discretion of the Chair.

Meetings would be held at monthly intervals and the proceedings would be accurately minuted. Highlight reports would be produced. The EDMS SG would take overall authority for the scope and strategic direction of the project and its implementation, including expenditure, revenue and return of investment.

- The EDMS SG would also be responsible for ensuring that both local and national Information and Communications Technology (ICT) policies and standards are addressed, and that the service was safe for patients and staff.
- It would ensure that the eDMS complied with local and national standards for data protection, information and clinical governance.
- It would manage issues and risks to the eDMS project to clinical services.
- It was also empowered to create “task to finish groups” on an ad hoc basis.

The activities of the EDMS Steering Group, from 2014 onwards

A number of digitally engaged colleagues accepted the invitation. Early on, we debated as to whether there were alternatives to external procurement of an EDM system, and as to whether expansion and development of the existing internal systems would be as - or more – operationally effective and sustainable at a lower cost than an external purchase.

We also debated whether the Trust should entertain bids from suppliers with proprietary, “closed” systems or with open source software systems that we could more easily adapt. For example, I was keen to promote a unitary interface for the UHS EPR which could interface to any external product, for which UHS Lifelines (see Section 2) was well suited.

The Process to Choose the EDMS Supplier

On 11th November 2014, Derek Waller informed the EDMS Steering Group that:

"The EDMS implementation team have now carried out four site visits to view our shortlisted systems in action... It is becoming clear that we will need to have a single interface for accessing all our records, and the chosen system will probably replace eDocs for all functions except creation of letters and discharge summaries. The optimal system will include:

- Rapid and intuitive access to all documents. To achieve this we will rely on a combination of the ease with which the EDMS can index documents, and our scanning strategy

- A timeline for quick identification of episodes of care

- Creation of workflows e.g. letters for checking and electronically signing, results for patients who have been flagged for review

- Ability to create electronic forms for digital data entry. This will be essential for a fully paperless outpatients and later inpatient records

- iPad and other mobile device functionality

- Remote access or ability to cache records for outreach clinics and peripatetic services

... We plan to present the full business case for the preferred supplier and scanning strategy to Trust Executive Committee, Trust Investment Group and Trust Board in December".

The open competition between four candidate suppliers was conducted through November 2014, and scored by members of the IT and EDMS SGs. Each bidder was offered a three hour slot to present their data management solutions for four clinical and scanning scenarios. Each Supplier offered an EPR in various stages of development, and a document scanning and collation system.

The Choice of the Hyland OnBase EDM System

On 25th November 2014, Toby announced the outcome of the competition. He noted that:

"Hyland Software of Cleveland Ohio has been chosen as Preferred Bidder to supply the OnBase Electronic Document Management System....

Hyland scored well in the OBS (Output Based Specification) covering all core requirements well. They included additional innovations which would sit well alongside the existing UHS EPR, and their proposal was strongly supported by clinicians

The proposal is to scan the records that were stored in the Health Records Centre (HRC) to make them available electronically.

The project is aligned to the HRC lease expiry in May 2017.

-It will remove the requirement for storage of paper health records, enable UHS and partner Trusts to function in a paper light environment, and will enable clinical staff to digitally record information in eForms on a tablet or mobile device.

UHS and partner trusts agreed to work collaboratively on the EDMS project and to split costs and resources in proportion to the activity undertaken for these trusts in HRC."

In matters of practical integration with our existing systems, Derek Waller noted that:

"...We must improve the availability and reliability of hardware.

- The stability and refresh speed of our software is key to better functionality and we are working closely with Ascribe (suppliers of eDocs, eQuest and HICSS) on this.

- The scanning strategy will not be a 'scan everything in case' process, but will be intelligent and limited to what is essential. This is currently being finalised".

Consultant Anaesthetist Michael Celinski noted that:

"I do think the primary aim of the project is document scanning – the EPR bit may be an added benefit, but I am not convinced at this stage that it is necessary as we do have other solutions.

Some basic Forms in electronic format would make life easier in the whole process and needs to be looked at in tandem, but should not be seen as an entire EPR.

How and what we scan is a point of debate – its risks, costs and benefits.

I am also looking at other ward based EPR solutions which are interesting and which would slot into any document repository that we use....".

Development of the OnBase EDMS implementation plan through 2015:

Negotiations, contract specifications and project planning proceeded with the Hyland team through 2015 around their OnBase Version 16 Enterprise Management System.

OnBase was a generic document management system of considerable technical virtuosity and complexity, but it had yet to be adapted or optimised for the very particular challenges of electronic patient record. It was described by Hyland as a "content services platform for managing content, processes and cases, which unites all of the critical *systems* and information in an organisation", allowing the storage and retrieval of scanned and electronic documents, including PDFs. Images, Word documents, spreadsheets and so on.

During 2015, considerable work was also done on establishing the technology requirements of high capacity scanning and new computer servers to store and manage the data, and the back scanning project got underway at the Nursling site, as described in Essay 1:8..

Hyland and UHS established project teams with good communications, and workflows for documentation migration to electronic methods of working and scanning were set up. It was also apparent that such a complex project would require a detailed and wide-ranging Communications and Engagement Plan for training, awareness and to smooth the uptake of the new systems, with opportunities for user feedback.

The success of the EDMS project hinged upon a number of Dependencies and Assumptions, which included:

- the expiry of the lease on the Nursling Warehouse on 24th December 2018;
- the interoperability of the OnBase EDMS and the CHARTS EPR;
- the sufficiency of infrastructure investment, particularly in end user devices to support the move to electronic working;
- the willingness of staff to use predominantly digital systems;
- and that the selective scanning approach would prove sufficient for clinical needs when so many paper records had simply been sent to deep storage.

The scale of the scanning of paper documents and the transfer of electronic documents into OnBase was as follows:

Documents from eDocs / Historic data load: 14 Million, Date range: 2007 to current

eDocs archive documents: 3.7 Million, Date range: 1997 to 2007
In 2007 eDocs had imported a large number of word documents stored on file shares. Date fields were extrapolated from the document name which included the month and year of treatment. These documents were dated to the nearest month, but there were a small number of cases where the document might be up to a year out of date and where the date field could not be extrapolated.

Back scanned case notes (to be scanned post Nov 2017): 400,000, Date range: 2015
Regular attenders' records would be scanned and indexed to the date that the record was created. The files scanned would include a wide range of date fields due to the nature of the information contained. These documents would be large PDFs reflecting the sections of the original case note indexed under the Scanned historic tab.

Back scanned case notes (previously scanned): 24,000, Date range: 2015
In 2015 UHS undertook an interim back scanning exercise to relieve pressure on the Nursling Health Records Centre. Back scanned notes related to paediatric and maternity patients who were not under any current of planned episodes of care. The files scanned included a wide range of date fields due to the nature of the information contained. The only available date field for these documents is the date they were scanned (ie 2015). These documents would be large PDFs reflecting the sections of the original case note indexed under the Scanned historic tab.

Back scanned ITU charts: 5570
Prior to the implementation of MetaVision, ITU had scanned and archived their ITU charts to eDocs. The date of the documents was the admission to ITU date. Where a patient had an episode in ITU with more than one chart, all charts would be single documents under the same admission date.

In July 2015, Toby Cave updated the EDMS SG that in matters of Procurement, a finance lease was being investigated. Contract negotiations with Hyland were nearing completion. In terms of implementation, specification of the server hardware was complete. Two industrial scanners have been set up at the Nursling Hospital Records Centre (HRC) and configured for the common UHS case notes. A workstream had been set up, with the Initial back scanning of 15000 long retention records.

By the end of 2015, Toby was able to report that contracts had been signed with Hyland and that work to procure storage for residual records (rented space in remote warehouses) was under way. The closure of the HRC in Nursling had been put back to the end of 2018.

In December 2015, the national Digital Health newsletter reported that:
"UHS has received £1.35 million from NHS England's 'Integrated Digital Care Fund' to digitise its existing patient records and replace paper processes with electronic forms.
The project has selected Hyland's EDM system OnBase, which is due to be operational by the end of 2016. The objectives included:
- Scanning notes on demand in the trust's health records library, until its closure.
- Efficiency and selectivity: only scanning records of patients who are likely to turn up at the organisation in the next few years, or who are already on a care pathway.
- The remaining paper records are to be held in deep storage,
- IT firm Hugh Symons will support the trust's scanning activities in the early stages.
- The records that are scanned will be viewable directly through the trust's existing EPR.
- The use of electronic templates on mobile devices.
- The generation of more structured data than has been possible to date"
- Integration of information systems with the Southern Health NHS Foundation Trust and the Solent NHS Trust, which shared the notes library with UHS.
University Hospital Southampton's contract with Hyland was reported to have been drawn up for five years, with an option for a two-year extension."

See *https://www.digitalhealth.net/2015/12/southampton-plans-three-site-edm-project/*

Progress in the UHS EDMS Project through 2016

By March 2016, technical discovery with OnBase was complete and the OnBase software had been installed on UHS Servers. In April 2016, Hyland Global Services published their Specification for the UHS EDMS Integration Programme following local discovery sessions with UHS, Solent and Southern Health NHS Foundation Trusts .

The initial plan was that there would be complete integration of the UHS EPR with the OnBase EDMS before scanning started. This would include the migration of all electronic documents that were held in the CHARTS eDocs EPR to the OnBase EDMS, with a view to completion by October 2017.

Through 2016, work intensified, with regular meetings of the EDMS Steering Group to consider both the broad and specific issues, in anticipation of the Live Launch of OnBase in early 2017. Regular monthly Highlight Reports were produced and a series of discovery workshops were held with the subject matter experts to identify and iron out problems.

Hyland issued a series of documents which set out the specifications of the system and their design solution in detail. Concurrently, development continued on the UHS CHARTS system, with further refinement and integration of the existing indigenous EPR programme

On 2nd February 2016, Toby Cave reported that *"We have now signed a contract with Hyland for OnBase; We aim to replace eDocs with OnBase in September 2016".*

The Technical Characteristics of the Hyand OnBase EDM

It is helpful to consider the general characteristics and functionality of the OnBase system, which recommended itself as the Southampton EDM solution. The system has gone through many iterations and version releases on broadly an annual basis. As paraphrased from the Hyland description of OnBase on the UK Government Digital Marketplace database:

"OnBase is a single enterprise information platform which centralises content in a secure location, from which it can be accessed on demand. It can be used:

- To capture documents and other information at source, regardless of format

- To organise data and documents in single searchable system
- To provide Mobile access to content
- To create personalised user interfaces
- To enforce access control lists and to provide full audit trails
- To configure workflows and add E-signatures
- To provide analyses of processes, records and system health
- To store, protects and destroy information in accordance with regulations
- to minimise error-prone manual data entry
- to manage content across multiple systems and locations

(www.applytosupply.digitalmarketplace.service.gov.uk/g-cloud/services/115365685416292)

Considerations around the local implementation of OnBase

Toby's plan posed a series of concerns for me, given the investment in time and effort that I and many others had put into building specialist integrated systems as components of the UHS EPR. If eDocs is were to be superceded by OnBase so quickly, then it was not clear what would happen to the document feeds which presently underwrote bespoke data systems such as UHS Lifelines (Section 2) and the Southampton Breast Cancer Data System (Section 3).

The target date of September 2016 also appeared to be a very ambitious timescale for implementation of the transition, given the considerable amount of work that would be needed to integrate the systems, to educate the workforce; and even to get the system up and running in a test format.

The eDMS report for June 2016 recognised the problems, and revised the ambitions, so as:

- To replace the eDocs Clinical Viewer with the OnBase Patient Window by December 2016;
- to advance the Scanning in Outpatients of Bar coded notes;
- to create of an Inpatient Record Folder for scanning on the patient's discharge from hospital, as many inpatient activities were still based upon paper records;
- To Back Scan the records of "frequent attenders";
- To development E-forms, for Patient consent and Pre-assessment by March 2017;
- To roll out of a digital referral management system by May 2017.

Our Visit to the Hyland Headquarters in Westlake, Cleveland, Ohio in August 2016

To help inform their venture into clinical records systems, Hyland recruited International Clinical, Nursing and Chief Information Officer Boards from their customer base of major healthcare providers in the USA, including from the Metro Health in Cleveland, and from the UK. Dr Johannes Waktare from the Liverpool Heart and Chest Hospital and I were co-opted to the Clinician Board. I had engaged with the Hyland team from early on, with particular emphasis on the design of a unitary interface for the new system, and I had shared out groundbreaking work on UHS Lifelines with the team.

In August 2016, Adrian Byrne and I were invited to attend Board meetings at the Hyland Headquarters in Westlake, Cleveland, Ohio. The Westlake campus is built in rolling parkland in a converted sports centre and an adjacent modern purpose built development centre, a short walk from the southern coastline of Lake Erie. I was impressed by the large open plan buildings, which contrasted dramatically with the cramped and dispersed facilities for the IT team in and around the hundred year old Old Nurses Home on the Southampton General Hospital site.

I was also impressed by the welcome afforded to us by the Hyland team in a range of discussions, and by the depth and breadth of clinical informatics expertise on the Clinician Advisory Board from major US Health Providers, including The Cleveland Clinic.

My particular interest was in further discussing the design and functional features of our UHS Lifelines interface, with the practical intent of developing it as a unitary and seamless interface between OnBase (v16 at that time) the existing UHS Charts EPR. I therefore spent quality time with the OnBase developers in Westlake in discussions about the key features of UHS Lifelines as an integration platform for CHARTS, eDocs and OnBase.

In early October 2016, I raised the question with Adrian Byrne as to whether we should explore a joint Clinical Software Development Centre between UHS and Hyland, who did not as then have a significant presence in the UK Health Informatics Market. As with all IT companies, where IT professionals talk primarily to other IT professionals, Hyland had as yet had little opportunity to engage with the clinical end users of their informatics systems in clinical workplace settings. A partnership between Hyland and UHS Southampton that an extended beyond a supplier-customer relationship might provide an opportunity to catalyse a productive development sandbox for information technology at UHS.

Coding in the Open

The UK Government Digital Service had promulgated the philosophy to “Code in the Open". Our conversations with Hyland exposed the difficulties in making the unique UHS and evolving systems available to the wider NHS and beyond, “Coding in the Open” might make a public service virtue of our opening up are unique coding products for the wider health care software development workforce via coding platforms such as GitHub. This approach would also allow us to crowd-source coding improvements to our home-grown systems as others adopted the concepts. Regrettably, I was unable to make any progress at UHS with this line of thinking.

Developments with the EDMS Programme in 2017

Through 2017, work at UHS continued at pace on the scanning programme, and on technical integration between the now operational OnBase v16 and the existing UHS Clinical Data Estate. However, it gradually became apparent that while OnBase was a powerful document storage system, it could not replicate the evolved complexity and sophistication of the locally well established eDocs system, and that an attempt to replace the established systems with OnBase would carry too much clinical risk.

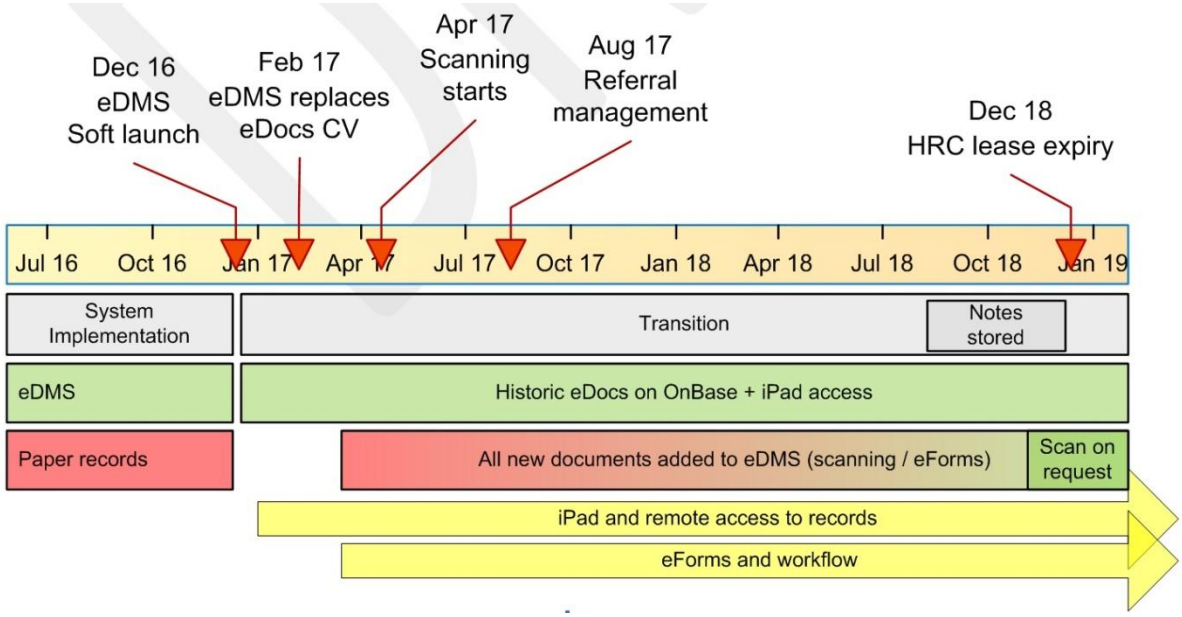
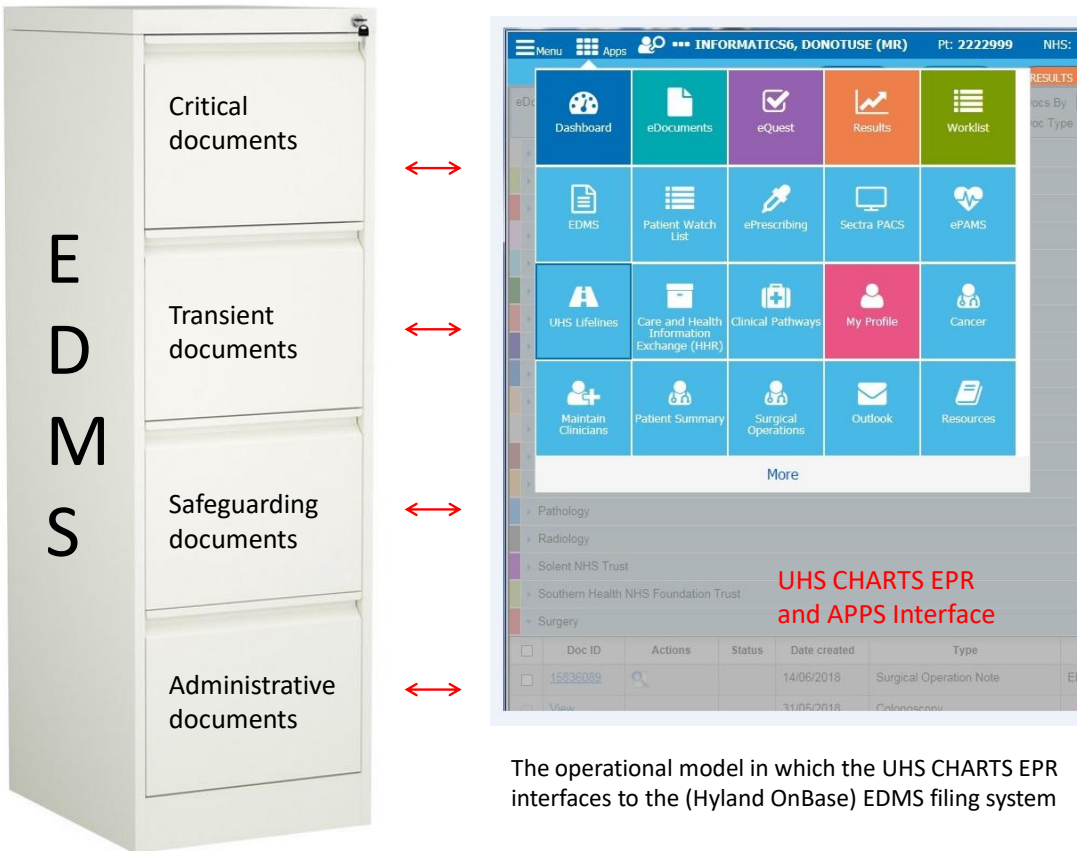


Figure 2: The draft EDMS Project Plan for 2017 and 2018



The operational model in which the UHS CHARTS EPR interfaces to the (Hyland OnBase) EDMS filing system

Figure 3: A simple utility-based classification of documents for filing in an EDMS (Rew and Cave 2016), and its relationship to the primary Charts UHS EPR Interface

It became apparent to me early on that OnBase should evolve as a document storage adjunct to the existing Trust EPR, rather than become the EPR itself, as it had not been developed for this role. In this model, OnBase would provide structured storage of scanned and archived documents which could be recalled ad lib into the CHARTS Interface (Figure 3).

Regrettably, even this more modest proposal for OnBase was stymied by the difficulties in recalling documents from OnBase into CHARTS. In test runs, it was often taking many seconds if at all to open OnBase documents during clinics and in other use cases.

Moreover, it was becoming apparent that OnBase was not readily able synchronously to open the collections of documents, display the patterns of documents and provide the fast navigation in the formats which clinicians needed to provide efficient and safe clinical consultations (Figure 4).

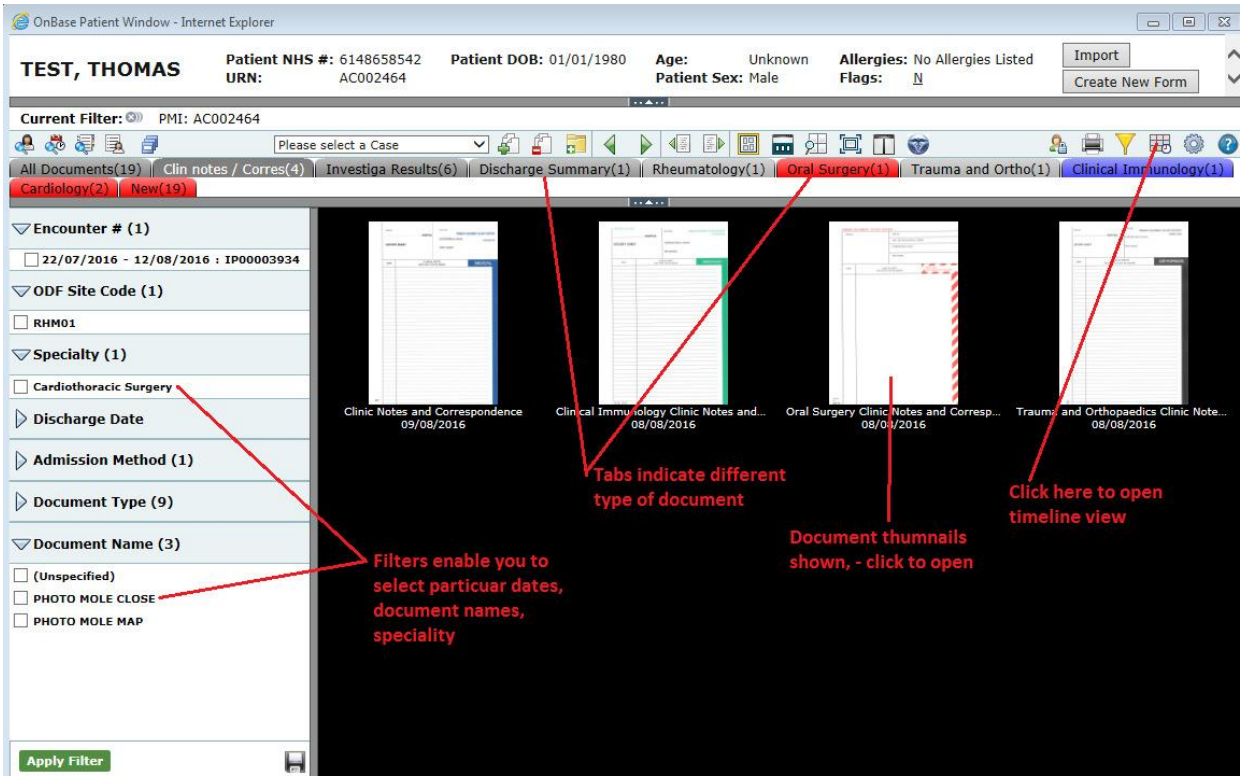


Figure 4: This screen shot illustrates the initial complex hybrid interface design for the OnBase 16 solution, using a combination of Tabs, Document Images and list mode options.

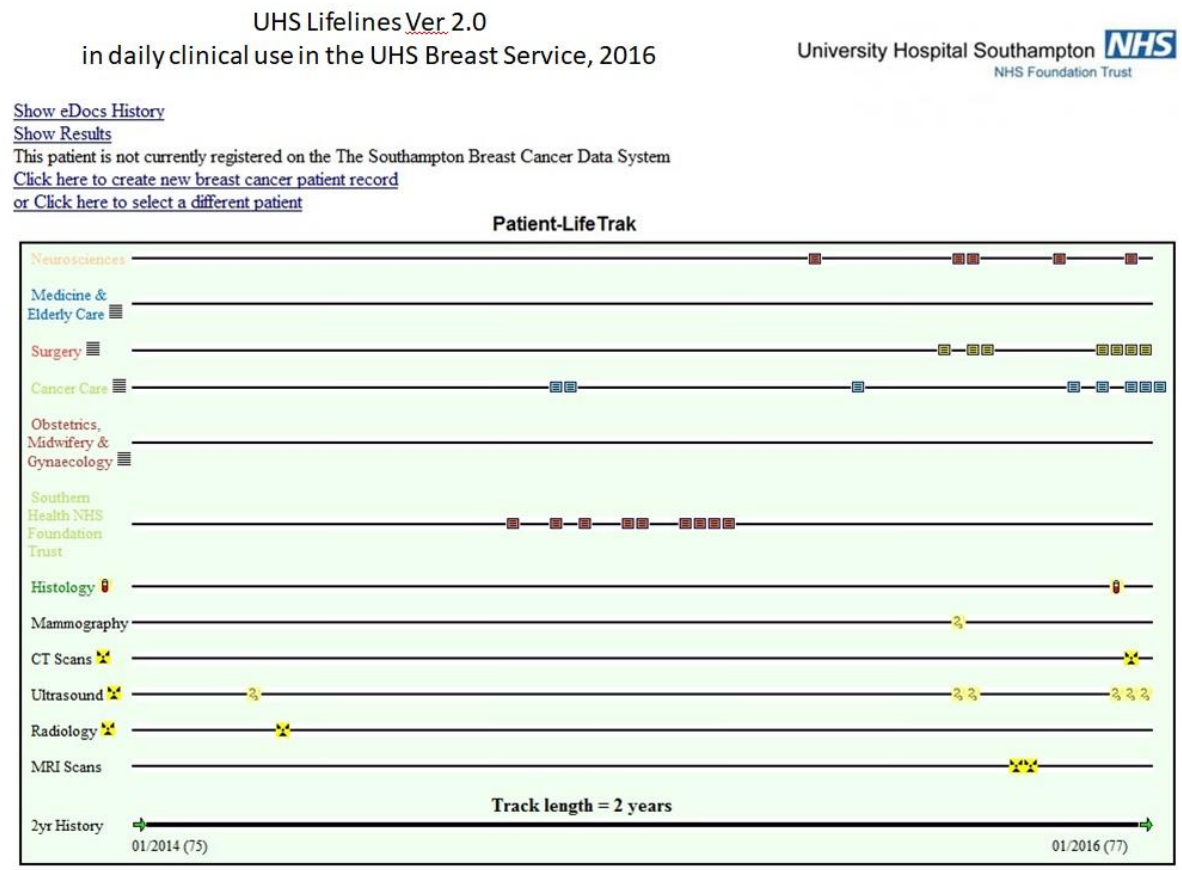


Figure 5: The UHS Lifelines model of the coherent display of clinical information in the EPR. This slide was discussed with the Hyland team in August 2016 in Westlake. The full history and explanation of UHS Lifelines is covered in the collection of essays in Section 2

The visualisation and interaction with the clinical record involves pattern recognition of multiple documents, events and clinical sequences, rather than merely the reading of individual documents. The unresolved technical challenge of clarity of design and speed of access to the story in the clinical records led to considerable debate within the EDMS SG as to how most effectively to maintain the speed and safety of the historic and live scanning programmes, given the substantial investment in the programme and in OnBase itself.

We had already solved the fundamental problem of coherent information display with the development of the UHS Lifelines Interface, which was now live in the UHS EPR and under further development (Figure 5).

Emerging Problems with the OnBase Interface Design and Function in 2017

Toby Cave noted that "the OnBase test system contained the many (405) permutations of document types, eight file formats and 11 methods of document ingestion.
He also noted that "in terms of the perceived risk of drowning out critical clinical documents, the OnBase EDMS had specific tabs to show key information such as clinic letters and discharge summaries.

However, the mapping the documents from eDocs, eDocs attachments, HICSS and the eDocs archive (plus future bar-coded scanned documents) had been a complex process, which effectively required the re-mapping of 15 Million historic documents to an agreed future digital record structure*".*

EDM Interface Design: Recognising and Displaying Document Patterns

There were by now very legitimate concerns about how the interfaces in the OnBase EDMS would look and feel to the end user, when compared with those with which users were familiar in eDocs, and how this would impact upon safe and efficient working. I noted that:

- Robust, agile, and relentless end user research and iteration was still not built into the culture of the new system
- It was critical that every clinical user has the option of an informative record overview screen before diving down into the specialist content. The OnBase interface and its early timeline model did not adequately address this key function.

I felt that we should not abandon the ground held by the current EMIS suite of systems until OnBase was properly proven, even if this took several years, and the 2017 timetable was far too prescriptive.

I recognised that pressing the case with the EDMS SG for delay and reconsideration might well prove unpopular when so much effort, hope, resource and expectation had already been invested in the primary OnBase EDMS adoption plan. However, I was convinced that a constructive counter-proposal was the correct approach.

By July 2017, the key arguments in favour of the model as set out in Figure 5 were that:
1. e-Docs was a mature clinical tool, working in effect as a "Précis Tool" for the UHS medical record. It displayed critical documents (letters, discharge summaries, operation notes) but it does not needlessly capture or display the mass of "transient paper" documentation which has negligible clinical value after the discharge of the patient from hospital.

2. In any clinical record system, documents of “transient value" (eg fluid and stool charts) soon outnumber "critical" documents by a ratio of up to 10-20:1. Any attempt to display all such documents in real time systems would flood the user with trivia and impose a massive time penalty in clinics and theatres, to the extent that the hidden costs and imposed inefficiencies could well drown out the savings from the closure of the Nursling file store..

3. Hyland OnBase was clearly not optimised, tried or tested as a display system for medical records with EPR functionality. It was not clear that the lessons which we had learned around clinical data visualisation has yet been taken on board in our research and development work at UHS had more widely been taken on board, as was evident to me in EDMS SG meetings.

4. The ambitious timetable was already slipping, and the migration of eDocs content into OnBase had not yet been completed. The document capture programme into OnBase is itself a major learning curve which was incomplete.

5. It was not too late to maintain e-docs as the primary document interface on a daily basis for as long as it would take for the EDMS to mature. The OnBase EDMS programme could then mature as a deep storage solution for rarely needed documents, which could nevertheless be called up ad lib from eDocs.

Soon afterwards, I learned of some progress with the OnBase interface design from Michael Kraft of Hyland, with whose team I had spent time a year previously in Westlake, Michael informed me by email that in the matter of the re-design of the OnBase Patient Window (OPW):

With the Timeline view, the development team has assessed the third party tool vis.js and we have decided to move forward with using that for our Timeline View re-design…."
(Vis.js is an open source, community developed "dynamic, browser based visualization library. The library is designed to be easy to use, to handle large amounts of dynamic data, and to enable manipulation of and interaction with the data").

Derek Waller noted that *"once data migration is complete, we need to ensure that important clinical information that is only held in EDMS is readily accessible to all.*"

By the 16th March 2017, it was clear from use of the Hyland OnBase v16 test interface that the early plan to merge eDocs into to the OnBase platform would not work as intended. The OnBase interface was evidently suboptimal in design and end-usability terms. This created a significant threat to efficient clinical service delivery at UHS in the short to medium term. It was also clear that these design constraints would take considerable time, commitment and intelligent programming to address.

In October 2017, the problem with severe delays (latency) in importing documents into eDocs & UHS Lifelines from OnBase crystallised during a Breast Cancer Multidisciplinary Team meeting, when I tried to open a document from the new OnBase capture system during an MDT meeting. It took 20-30 seconds to open each document, thus seriously impeding the safe progression of busy clinical sessions.
Similarly, colleagues in the Gynaecology Service had identified a problem of recognition and awareness of the OnBase document icon on the CHARTS interface, which did not communicate its meaning or give any indication as to what lay behind it, in terms of numbers, type and date range of OnBase documents.

In seeking solutions, Toby Cave noted operational design issues with the eight local web servers and an intermittent speed issue in opening OPW from Charts. This problem was difficult to isolate and fix, due to the end-to-end process of opening a document from Charts. The solution would involve OnBase, EMIS software, network and server issues.

The Decision to retain the UHS eDocs Document Management System

Fortunately, EDocs and Equest continued to serve the hospital well within the Charts EPR wrapper, and there was much more effective functionality which could yet be developed in those systems with intelligent re-design. By preserving eDocs as the established EMR interface for the foreseeable future, it would be quite possible to place the historic and rolling e-capture PDF Files with their e-tagging and QR codes in eDocs, pending resolution of the EDocs/OnBase debate.

This strategy would secure the core objectives of the EDMS programme, vis
- to complete the digitisation of active clinical records at UHS;
- to store all clinical documents in OnBase.

It would buy time for progressive improvements to CHARTS and for the Hyland team to evolve the OnBase interface to a higher level of usability for hospital staff.

The key challenge would now be to ensure that all Onbase/EDMS stored documents were easily accessible and rapidly in OnBase and displayable in eDocs.

In late November 2017, anaesthetic colleagues highlighted problems in logging in to EDMS from CHARTS, and the slow speed of EDMS. One colleague commented that "I tried to search for anaesthetic charts by entering the word anaesthetic against the section I expected to find them in – and nothing came up. Can you tell me how this is supposed to work please, as the word 'anaesthetic' is the most obvious search term..."

Another anaesthetic colleague noted that

"OnBase is too slow. The steps that really are slow are:

- Starting OnBase - For some reason accessing server 16.0.0.20 seems to take ages. First accesses 16.0.0.2, then edm.uhs.nhs.uk. Interestingly enough if you do it repeatedly, it speeds up - so "caching" works- Is it running a script that is slowing things down, or is it a server issue - it really needs addressing. This occurs whether charts or EDMS Auto login is used. It does not feel like a network issue (using Wired Desktop) but I cannot be sure.

- The loading of the thumbnails for patient XY took about 30 seconds! This happens repeatedly when refreshing or changing views. And the thumbnails are actually unreadable-

- Where is the anaesthetic chart? ... The left hand document list does mention anaesthetic record, but I did not see that.
- loading the thumbnails is of no benefit (I mentioned this to you before). I am using a widescreen 24 inch monitor and cannot read any of them.

I also tried the "Full Text Search" – at the bottom left of screen – but this does not work. It - returns an error - if this worked you might have a partial solution to quick searches."

By the Autumn of 2017, there was a general sense from clinical users that the Trust had at last got eDocs broadly right, and that it was widely accepted. Clinicians had therefore been articulating the view in recent EDMS meetings that eDocs should be allowed to mature, with OnBase developing in parallel as the filing cabinet to which a user would revert for those "deep dive" documents which are otherwise rarely needed other than for legal reviews.

In this model, the scanning process via OnBase would directly feed the "critical" documents into the subject specific tabs in eDocs, with which we were all familiar, while the "transient documents" (TPR, fluid, stool charts and so on) were kept completely out of sight but retrievable for medico-legal or research purposes.

Progress with the Scanning Project through 2017

Document scanning continued at pace. Derek Waller reported on 23rd November 2017 that *"The roll out of our new Electronic Document Management System (eDMS) is probably the biggest step towards universal digital records that the Trust has made to date, and it has begun with the Care Group at the Princess Anne Hospital (Maternity and Women's Health). To date we have scanned over 90,000 records and are scanning several hundred new records each week. ...*

We have not been able to slow down implementation of eDMS until data migration is in place, since the business case depends on closing the records library at the end of 2018....
- eDocs will continue to display letters, discharge summaries and similar documents;
- Scanned records are visible in the eDMS and eDocs, but the eDMS will not be a complete record until all data is migrated from eDocs".

Nevertheless, new problems became apparent with the EDMS/CHARTS interface. The assumption that the software would work to the standards which all users would expect of their personal computers, in terms of near instantaneous responsiveness and linkage between systems proved to be misplaced, and threatened services in outpatient clinics, where the risk of missing key documents had also increased.

The CHARTS EPR was now running very slowly, with load times of up to a minute. Key documents in EDMS were not being flagged up in eDocs/CHARTS. If and when such files were found, there was no way to link the document to eDocs other than to print the document out in EDMS and rescan it into EDMS, which would be a form of madness.

The case for slowing or pausing the EDMS roll out programme while these critical issues were sorted out was becoming compelling, and Adrian Byrne temporarily suspended the integration element of the project in December 2017.

Developments with the EDMS project through 2018

Strategic Clarity for the Primary Clinical Interface & workable solutions for UHS

The problems which had been accumulating during 2017 with the experiences of the initial launch of the eDMS were causing front line clinicians increasing concern. I stuck my neck out and summarised my own concerns about the strategy in an email of 13th January 2018 to members of the EDMS steering committee, as follows:

"... I regret to note that three months of increasingly challenging testing of the OnBase launch on the clinical front line at the PAH have highlighted the need for strategic clarity, clinical safety, service efficiency and common sense around the EDMS programme, as it affects the true end users. It is also clear that some of the basic assumptions that we made about the integration process now need to be wholly reassessed.

From the clinical user perspective, it is essential to have one trustworthy, absolutely reliable data interface as the master (EPR) reference system for all documents and records in a busy clinical service. With 20 years of evolution behind it and considerable further improvements

in the pipeline, (I suggest that) CHARTS remains the only game in town for this purpose for foreseeable future.

In contrast, Hyland are new to this particular requirement, their expertise being in document e-filing and emphatically not in clinical interfaces. We were mistaken to assume that the eDMS programme would produce a seamless transition from CHARTS to a new interface and operating system, which is being built on the fly by IT specialists with a different experiential grounding.

The experience of the past three months (at the Princess Anne Hospital) is that we are now required to work off two interfaces (CHARTS & OnBase) which are storing different sets of documents; where the interoperability is so slow as in practice to make the system unusable; and where the subject taxonomies are not harmonised. Moreover, the dependence upon a team of image capture technicians means that real world delays and filing errors are creeping in, with the growing reality of documents not being available either in paper or electronically when needed in a fast moving clinical service.
In simple terms, the system is presently too risky and costly to permit continued use without a radical rethink. My proposal is therefore that we unite around a methodology by which CHARTS remains the primary interface for the foreseeable future.

In this model, all documents which we have classified as critical in clinical operational terms (outpatient letters, discharge summaries, surgical and anaesthetic notes etc) will be made available within CHARTS as e-Docs or virtual e-Docs rather than OB documents.This eliminates the need to access these OB documents via additional permissions "on the fly" from eDocs in busy clinics, or as necessarily in practice, sometimes to bypass them completely.

Fortunately, I understand from a recent long discussion on the subject with (senior IM and T staff) that such a solution is in fact technically possible without loss or wastage of work already done. Using this model, the eDMS programme will continue to act as the master electronic filing cabinet (e-Nursling if you like) for the transient documents which will rarely be looked at again through the link in eDocs, but which can be when the need arises.

In order to maintain record integrity, eDocs can be back-loaded into eDMS "off line". This may produce some duplication of documents in the eDMS master file, but such minor impurities should be an acceptable price to allow clinicians to do their day job safely and efficiently. If we get this right, we can still end up with a national exemplar system, but the Facts on the Ground have now changed, and so, I suggest, should the Plan".

On 16 January 2018, a clinical colleague on the EDMS SG endorsed my concerns, stating: *"... I feel that communications about the go live could have been better. Although the system is relatively easy to use it surprises me that many people do not seem to know how to use it. A quick user guide would have probably been useful. Other than the speed of launching, the platform has definitely speeded up from first use, and since removing the thumbnails I have had no issues with speed.*

If you are looking for a particular document, and it has been scanned with the correct description, the system works well and quickly. ... However in one case an (important) chart appears not to have been scanned in, so i decided to search for it in the documents. This aspect proved impossible and this is where the limitations of the system appear. (I also note that there is) no chronological list of documents. The documents are labelled and tagged in small sections under one date, so these sections cannot be reconstructed to one chronological overview.

Therefore trying to get any useful information from an inpatient episode is laborious and would probably entail trying to print out 10-15 different subsections and trying to piece them together. This is not quite how I envisaged a paper-light system. In the matter of small sections or clusters of records, even the inpatient medical notes were split up into multiple sections because patient was seen by multiple teams from different specialties. You therefore have to open up each section separately for 1-2 pages (and usually in wrong order) to understand what is going on.

Moreover, we have not properly prepared the printing of bar-coded headers on hospital documents. For example, anaesthesia charts are not currently bar-coded, so there is a significant chance that they will not be scanned into the correct hierarchy.

Sadly, I do not believe any retrospective (old notes) scanning will ever result in adequate ability to search for relevant documents - such as anaesthetic charts.I therefore am not convinced that your suggestion of using eDOCS as the solution will solve the problem, because most of it is a scanning issue on top of OB's limitations.

On some patients I also struggle to find information in eDOCs when there is a pile of clinic appointment letters and useless information with 100 documents under one specialty. I can imagine it will become quite unwieldy with even more.

It would be helpful to be able to use Optical Character Recognition (OCR) to search all documents in one go and search for text. However, Tthis would be very onerous on the server and computing power."

The eDMS Project Review of February 2018

Such concerns from various quarters led Jane Hayward, the UHS Director of Transformation to request a review of the EDMS project in February 2018. Jane noted that several other Informatics projects were being rolled out concurrently, including Enhancements to the Charts EPR, The Electronic Surgical Admissions process (eTCI), Sample360 and Safetrack.

The concerns which had been more widely noted with the EDMS Project included:
"Delays in the scanning process"
"Delays in immediate access to case notes"
"It is not easy to find things in the system ..."
"The 3 page cardiology admission assessment document is being scanned onto the system so all the pages are in the wrong order resulting in a serious medico legal risk"
"Drawings from surgery need to be scanned in to eDocs rather than straight into the eDMS"
"The (slow) speed of the system impacts on the cognitive flow of the consultant".
"List view is more useful and quicker than viewing document thumbnail images"
"The speed of the connection with the Princess Anne Hospital is too slow"
"Issues regarding Cardiotocography (CTG) records"
"Improvements needed to document management in the Pre-assessment process"
"Standardisation of the consent process"

"Adequate IT hardware provision for system users"
"Procedures for the disposal of paper records post scanning"
"Loose filing currently does not get filed in case notes.
"The Steering Group currently does not have adequate oversight of the project
"Improved communications and user feedback are needed"
"Increases in scanning loads"

The outcome of Jane's Review and the Action Plan was reported to the EDMS SG on the 27th February 2018. It recommended a return to scanning clinic notes directly into eDocs until the information flow issues between OnBase and EDocs had been resolved.

Our Second Visit to Hyland Headquarters in Ohio in January 2018

In January 2018 Adrian Byrne and I were invited back to Cleveland for a further meeting of the Hyland International Advisory Boards. On 22nd January, 2018 we visited the Metro Health Public and Emergency Care Hospital for North East Ohio at the invitation of Dr. Jonathan Siff, Associate CMIO, at the hospital. We discussed the challenges of clinical informatics at length. We visited the Emergency room and talked to junior doctors who were using the EPIC (tm) software system in their duties.

At the Hyland Healthcare Advisory Board Meeting on Wednesday 24th January 2018, during a discussion about optimising EPR interface design, the Chief Clinical Information Officer of the Cleveland Clinic powerfully observed that:
"On average, my clinicians have seven minutes per outpatient consultation. I estimate that they spend five of those seven minutes chasing up and collating key clinical information."

In 2019, Hyland upgraded OnBase v16 to OnBase v18. This upgrade would include electronic referral grading and a major upgrade to improve the user interface, leading to direct digital entry of information into the patient's record. This created both opportunities for improved functionality and challenges in respect of additional workload on systems integration.

Over the following three years on this project, the OnBase 18 demonstrated a number of improvements. However, the alignment of the eDocs/Charts and OnBase systems remained

fundamentally dissimilar, and it did not ultimately prove possible to secure a seamless and "invisible" solution to information exchange. Moreover, for reasons which were lost in the technical thicket of authentication rules, it did not prove possible over this period to achieve real time recall of documents which were stored in OnBase into UHS Lifelines. Delays or 20 seconds were commonplace, as were loading error messages.

In 2015, the expectation for the demand for prospective scanning of all new clinical paper output by UHS had been 23,000 documents daily for In- and Out-patients. However, by 2018 the daily volumes of demand were closer to 30 000 sheets of paper. Plans were developed to address this backlog, by reducing the duplicates in paper sent for scanning, and by;
- Speeding up scanning through better document organisation,
- better indexing of documents by function such as admissions, history and theatre sheets);
- Removing the backlog, by outsourcing to a specialist scanning supplier until February 2019. Following scanning, paper records would be destroyed.

The Conclusion of the First Phase of the UHS EDMS Project in December 2018

On 31st December 2018, Toby Cave thanked the EDMS SG team for their support throughout this major transformation in his final "Highlight" report for the first phase of the project. He noted that the EDMS team would continue to work with Care Groups to help optimise their use of the EDMS and then move on to develop the EDMS functionality.

On a positive note, the EDMS implementation team were able to report on 28th January 2019 that the first phase of the EDMS project had achieved the following:
- Hyland OnBase v16 had been upgraded to v18
- The Health Records Centre at Nursling had been closed,
- The Hospital Scan Bureau was now scanning 30 000 sheets of paper each day.
- All UHS care groups which had been using the Nursling Warehouse were live with the EDMS, into which they were scanning documents from In-Patients and Out-Patients and using scanned historic case notes.
- Un-scanned case notes for inert records with no predicted future activity had been moved to offsite storage. By 2019, 150,130 historic case notes had been scanned and 1,036,443 case notes remained in offsite storage.

Developments in 2019: Phase 2 of the OnBase EDMS Project

Also in January 2019, the programme brief was released for Phase 2 of the EDMS Project. The Strategic Vision remained the provision of healthcare at UHS without the need to record information on paper. Information would be recorded in real time during clinical contact with patients (or soon after) and rapidly available to other staff. Electronic workflows would streamline the patient journey, improve information sharing and improve the experience of patients and staff.

However, the optimisation of the use of the OnBase EDMS across the Care Groups was still incomplete. New work streams included the electronic grading of case referrals; a major upgrade to improve the OnBase user interface. It was acknowledged that a truly paperless strategy would take "years" due to the number of different paper forms in use; the complexity of their associated processes, and the workplace culture changes which were still needed. Phase 2 of the project would therefore focus on the optimisation of workflows and further develop the EDMS platform to move UHS from **paper-light** (scanned paper) to **paperless** working, through the electronic entry and distribution of all clinical data.

There were a number of Care Group processes which did not easily transfer to the new EDMS standard operating procedures. These included:

Anaesthetics - Anaesthetic record availability.

Women and Newborn - Maternity Record Scans and Maternity liaison forms

Child health

Emergency Medicine - Migration of historic CasCards to EDMS using a direct interface between the Emis Symphony system and EDMS to allow storage as multipage documents.

Informatics - Training and technical handover.

There was a need to optimise the handling of technical calls relating to EDMS, of use of the OnBase system and of the scanning and indexing of e-documents. Additionally, UHS had also recently acquired further software systems from external suppliers, including:

- MetaVision® Patient Data Management System from IMDsoft for Critical Care
- Nursing Observation recording in e-PAMS, the electronic Patient Acuity Management System from IMDSoft (see https://www.nursingtimes.net/roles/nurse-managers/e-system-to-revolutionise-way-nurses-record-patient-obs-26-05-2015/ .

- Metavision Safetrack for the electronic collection and oversight of nursing observations
- Rolling developments of Charts, MyMR and eDMS as a family of integrated applications.

Steps Towards optimisation of the EDM System in 2019

Phase 2 of the OnBase EDMS project was intended to achieve the following:

- A single point of access (via Charts) to all of the documents relating to patient care.
- Electronic forms to share clinical data between forms and systems, to reduce duplication.
- To improve clinical decision making and efficiency.
- An Outpatient e-Referral pathway to consent and pre-assessment for clinical procedures.
- Improved theatre and bedside documentation.
- improved management of Subject Access Requests for solicitors and claimants
- Better information distribution to authorised stakeholders, including GPs and the Hampshire Health And Care Information Exchange CHIE, using Care Connect.
- The development of a common dataset based on SNOMED CT, be used with eForms.
- The launch of an eForm from the Outpatient worklist in Charts.
- The re-use of data items that were captured in nursing care plans.
- To digitise physical therapy services at UHS, with retirement of their records store.
- To review the information management of Mental Health Services at UHS and Southern Health Trust, including child and adult psychology, psychiatry services and safeguarding.
- A Fractured Neck of Femur (FNOF) pathway around a single multi tabbed document.
- The recording of Clinical Genetics information at the Family level rather than Patient level, creating a structure of documents aligned to a family ID.
- Closure of the medical photography department following staff training in uploading images to eDMS from iPhone Operating System (iOS) devices and Personal Computers.
- To manage the consequences of the imminent upgrade to V18 of the OnBase system.
- To train in house UHS staff to build applications within OnBase.

Non clinical uses of the EDMS, for example in Human Resources management, were judged to be Out of Scope for this phase of the project.

Significant risks to the programme in early 2019 were perceived to include:

- The inability to supply, install and manage the large number of End user devices (tablets, desktop PCs) that would be needed for full digitisation
- Imperfect alignment of the Functionality between the EDMS and EPR
- Management of the culture change among hospital staff
- Cost containment: The EDMS supplier costs were perceived as prohibitively expensive.
- non-attainment of planned system capability through excessive complexity
- Process complexity in specialist fields, eg Clinical Genetics

Authentication errors and speed problems:

In March 2019, Toby reported that:

"it is clear that we have some serious work to do in making EDMS work for clinicians. Specifically, we need to address the following challenges.

- Delays Forward scanning: By mid March we will be back to 48 hour turnaround. This has not been easy, as in February we scanned 900,000 pages.

We have identified 5 separate technical areas where problems exist. These include:

- OnBase Patient Window OPW error functions when attempting to open it from Charts;
- The slow speed of opening OPW from Charts
- Authentication issues (ie the EDMS does not log you in)
- Inability of eDocs to load OnBase documents
- OPW is opening PNG file formats slowly.
- The eCamis clinical viewer displays a catastrophic error message

We are working with suppliers EMIS, Hyland and Microsoft to recreate the issues on a test bed where we can record diagnostics and error logs".

On 5th July 2019, Toby sought clinical guidance on which document filter items and display columns should be used, as there were restrictions in the new version. He highlighted these issues on te following two screenshot-based diagrams. He listed the display columns and filter items in the OnBase v16 version of the Interface which was in current use:

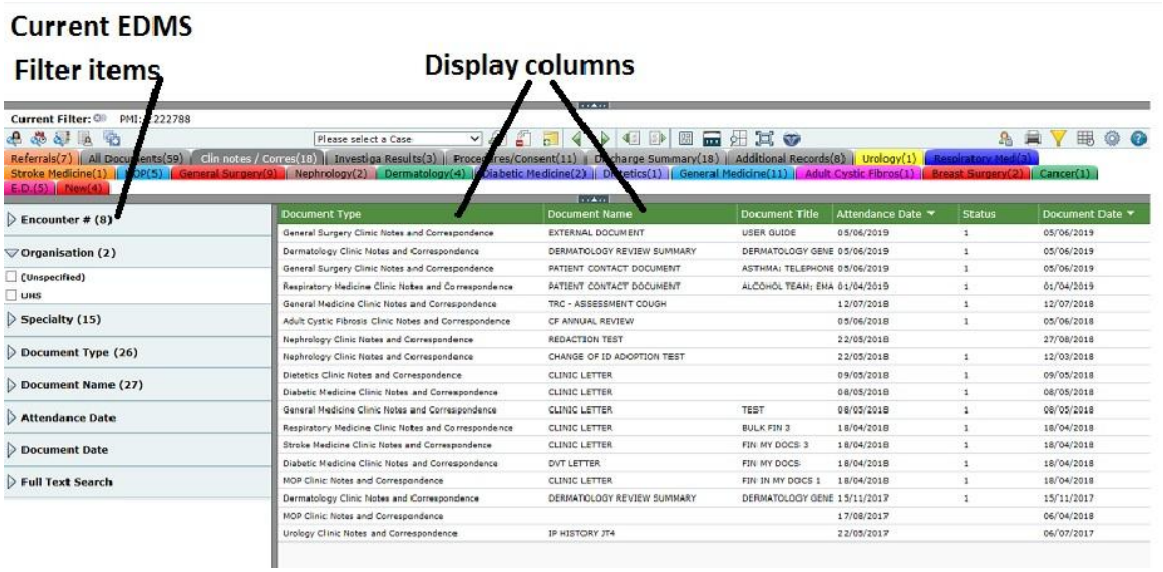


Figure 6. Old (OnBase 16) Interface

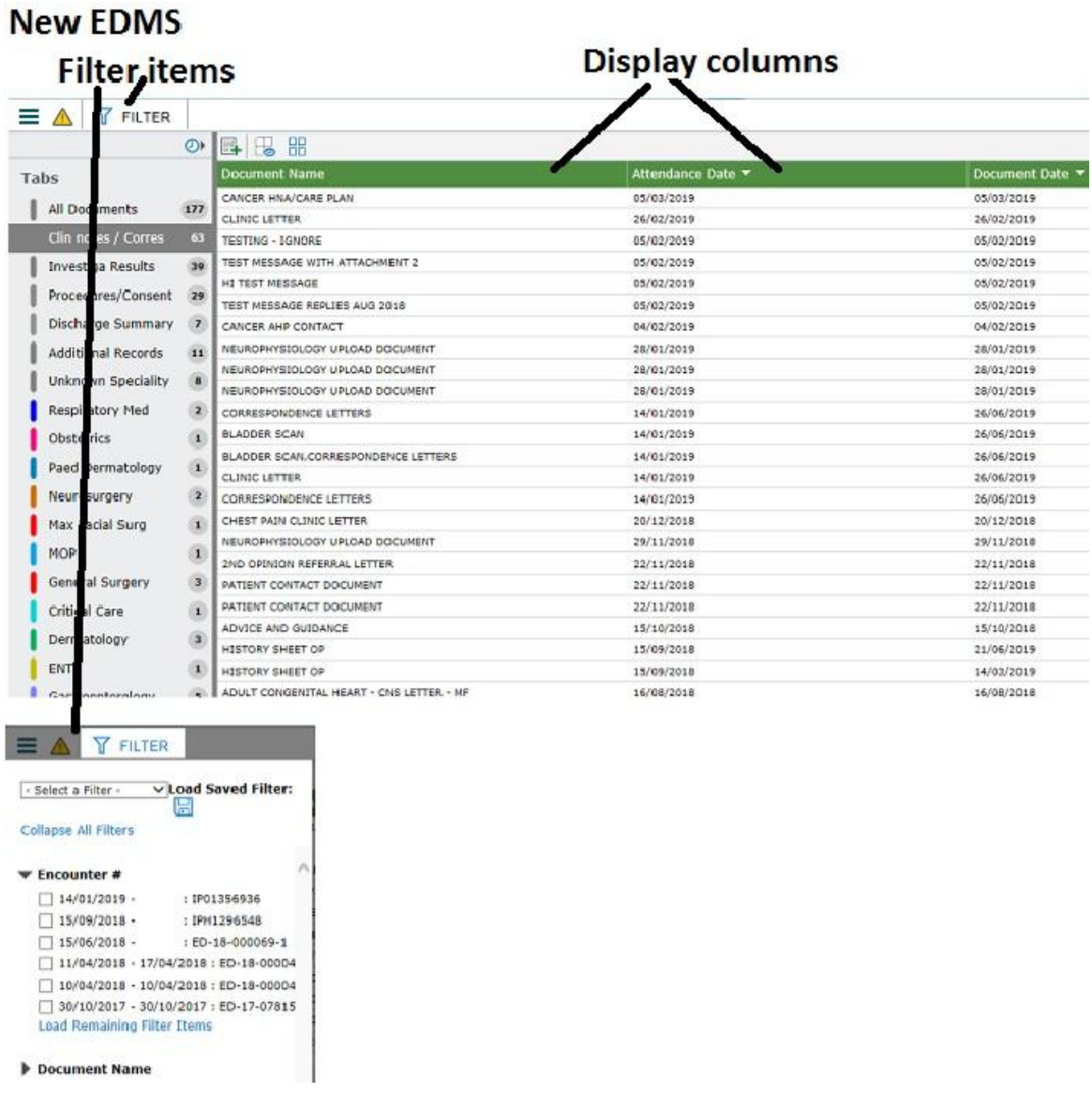


Figure 7: New Interface OnBase 18

The columns which were **displayed** were the Document: Type; Name; Title; Status (eg Draft / final, from eDocs); Date and Attendance Date.
The Items to **filter** upon were The Encounter number; (The unique document ID); The Organisation; Speciality; Document Type; Document Name; Attendance Date; Document Date; Full text search

Figures 6 and7Y (above) are screen shots of the (v16) and new (v18) interface versions . It is clear from these images that despite the simplification of the v18 screen, it still makes for a very complex way of interacting with clinical information, and a very inefficient way of interacting with screen space.

On 6th July 2019, I observed that this change was now becoming a very “interesting” conceptual problem. The OnBase 18 interface had been simplified and "de-tabbed", the need for which I had emphasised in discussions in Cleveland, and it was now looking somewhat less like an LSD Trip. However, in my view, we had to continue to strive for a single optimised user interface for the organisation, which must now logically be based around CHARTS.

In this approach to system unification, future versions of OnBase 18 would need to be:
- Invisible, other than when absolutely needed.
- Harmonised in terms of document subject taxonomy with eDocs/CHARTS, and vice versa
- Visually harmonised, so that movement between the systems is seamless.
- Harmonised in terms of our critical/transient/safeguarding/admin taxonomy (see Essay 8), so that time and effort spent searching in Onbase 18, when really necessary, is optimised and logically structured.

It appeared to me that philosophically, Hyland was still wedded to the single document retrieval process, where as the work on UHS Lifelines had taught us that it is the **patterns** and the **temporal relationships** in the documents which are critically important to the user experience and efficient interaction with the Electronic Patient Record. Collective agreement and a clear public statement of the design and operational principles which would guide future development work on the common EPR had now become urgent.

On Monday, November 18, 2019, Michael Celinski wrote to me to say that:
"As you are aware, there are plans to go paperless on the wards by next December (2020) - although its do-able, unless we get the interface right, it could be a disaster - glad you are still involved to discuss".

I replied that *"... we now need to move on and look robustly at a range of issues, including:*
a. process optimisation in the generation of clinical data across the Trust: what is needed, what is not needed, and what is duplicated across multiple systems and thus suitable for an "enter once, use more often" approach
b. transparent simplification of all pathways and processes, so that user do not develop and pass on so many work around and multiple choices in the use of Trust systems
c. Standardisation of the document and data taxonomies, and the look, feel and inter-operability of all systems across the Trust. This will mandate some interesting conversations with suppliers about open access use and design standards.

It would (in my opinion) be highly desirable to merge the look and feel of OnBase 18 into CHARTS, in and out of which data in the Onbase "Filestore" should flow seamlessly and without the need for users to enter the "devil's kitchen".

However, there are many other Trust systems including the Aria and Mosaic cancer care systems, where data is far more heavily siloed and centralised than should be the case.
Clearly, there is much to discuss at a strategic level and a lot of innovation work still to be done."

Through 2019, it had progressively become more apparent that the ambition to use the Hyland OnBase EDMS as a complete solution for the UHS Electronic Patient Record was unrealistic. A series of practical concerns about the capabilities of the OnBase EDMS crystallised in the realisation that OnBase was not going to be able to deliver on the initial ambition to replace the existing eDocs document management system or the CHARTS EPR.

However, by the end of 2019, the OnBase EDM system was well embedded at UHS as a document storage solution, while the bespoke UHS Charts system went from strength to

strength as a prime EPR system. The trust thus ended up with a hybrid document management solution comprising two bespoke systems with different design philosophies rather than a truly unitary system as experienced by the end user.

Derek Waller retired with honour, and Toby Cave's skills were redirected to other projects. The EDMS Steering Group was disbanded and the Covid pandemic redirected the attention of the IT Teams to more immediate challenges. The dispersal of the members of the IT department to home and offsite working disrupted the face to face engagement which has proved so powerful in the development of the UHS EPR.

Clinical Reflections on the Hyland OnBase System in 2024

In June 2024, I invited commentary from senior and digitally aware colleagues who have been closely involved with the EDMS from the outset and who remain involved in the summer of 2024. Feedback included the general observation that:

"The system has never really worked as hoped".

"It over-promised and under-delivered."

"clinicians really disliked it because it was easy to put data in but very difficult to get data out"

"We thought the metadata methodology would work but it did not"

"the search function was awful"

"We identified the need for Optimal Character Recognition (OCR) early in the development process, but it was never implemented"

"An excellent repository of data in theory but in practice, anaesthetists could not readily find anaesthetic charts records, despite their importance to clinical practice

"Toby Cave helpfully built some filters but data retrieval never fully improved"

"OnBase took too long to load, and the OnBase e-Forms were overly complex"

"Annual conversations with Hyland have continued, but we have never fully or satisfactorily resolved the issues".

Discussion

OnBase was undoubtedly a powerful document filing system, but it proved very difficult to align it to the evolving UHS CHARTS EPR, or to the powerful document and reports management and visualisation tools embodied in component systems such as eDocs, eQuest and UHS Lifelines. OnBase was primarily an electronic document management system which had evolved out of business and corporate requirements.

When the Hyland team had pitched for the UHS contract in 2014, their pitch was seemingly the most adaptable solution to the UHS requirement, and the Hyland team were engaging and collegiate. However, unwittingly, over five years from 2014-2019, we had collectively revisited the experiences of corporate technology in healthcare which dated back to the 1980s (Esay1:1), in the under-estimation of the complexity of a project in a field of human endeavour with which they were somewhat unfamiliar.

Critically, as had not been well or widely understood at the time of the bid, health professionals are not so much informed in their decision making by individual documents and reports, as by the patterns in the information over time and across multiple body systems and interventions that create a truly holistic assessment of any patient.

Therefore, the design of the user interface was as important as the technical specifications for the labelling and recall of individual documents. It was clear from the outset that the OnBase v15 and v16 interface designs would not display documents in a format that was simple and logical to navigate, and the overly detailed classification was impractical to use.

To their credit, the Hyland team recognised the need to understand the clinical challenges of the Electronic Medical Record, and they formed advisory boards comprising both US and UK clinical informaticians and technical specialists. However, the vision of seamless interoperability between OnBase and the UHS Charts systems with a common interface design between both systems did not prove wholly achievable. Attempts at the seamless integration of the commercial proprietary software from Hyland to the locally built, bespoke systems at UHS were continually thwarted by technical issues at the interface between two excellent systems with different design philosophies

The state of digital transformation in the NHS in 2020

In November 2020, The UK House of Commons Public Accounts Committee reported on the state of digital transformation in the NHS. It concluded that:

"Digital transformation of the NHS is a huge challenge due to the vast array of IT systems, many of which are out-of-date legacy systems that cannot easily interact with each other. - The Department's previous attempt to reform how the NHS uses IT, running between 2002 and 2011, was both expensive and largely unsuccessful. We are therefore alarmed at how little progress has been made against current ambitions.... The Department published its digital strategy in 2014 and in 2016 it set up the Digital Transformation Portfolio to deliver the strategy....

- Improving digital services is at the heart of delivering the NHS Long-Term Plan but remains a huge challenge to deliver.... The Department did not achieve a 'paperless NHS' by 2018, and this target has now been watered-down and moved to 2024.

- We are far from convinced that the Department and NHS bodies have learned the lessons from previous IT programmes. Without this, they risk repeating the mistakes that led to those programmes failing to deliver and taxpayers' money being wasted.

- Successful delivery of the digital ambition for the NHS will require effective governance, realistic and detailed plans, sufficient investment nationally and locally, and clear accountability...

- Despite publishing its Vision for digital, data and technology in 2018, the Department still does not have an implementation plan for how this will be delivered in practice. Current governance and accountability arrangements are both overly complex and insufficiently defined".

On 11th March 2024, Sarah Dawood, writing in the New Statesman Periodical, noted that "*- The government is running before it can walk on NHS digital transformation", and she asked very perceptively "When doctors can barely log into their computers, why is the Chancellor focusing on artificial intelligence?*

- In his March 2024 Budget, the Chancellor vowed to transform the NHS digitally. Jeremy Hunt pledged £3.4bn towards boosting the health service's productivity, particularly through "harnessing new technology" such as artificial intelligence (AI) to reduce admin and speed up diagnoses.

- This feels like déjà vu – the government has promised this grand transformation before, yet the NHS remains woefully behind on its digital proficiency. Ten years ago, when Mr Hunt was health secretary, he promised to make the NHS paperless by 2018.

- This target was missed, and Sajid Javid, in his tenure as health secretary, then set a new target of 2025. In July 2023 this was declared unachievable by the government's Infrastructure and Projects Authority.

- Today in 2024, nearly three quarters (71 per cent) of NHS trusts still use paper records to some degree, with patient notes and drug charts being particularly analogue. Four per cent of trusts are completely paper-based, meaning they have no electronic patient-record system....

- Doctors and nurses have told me of the infuriating technological hurdles they face, and how these woefully inadequate systems hinder them from being able to do their jobs properly. This includes being unable to log on to a staff computer for 40 minutes; struggling to share patient notes between teams; squinting to read other doctors' scrawls on blood sample labels because their department doesn't have a working printer; and sifting through chaotic, bedraggled stacks of patient notes with no semblance of order or organisation.

Adrian Byrne's reflections on the Southampton EDM programme in May 2024

Adrian retired as Chief Information Officer at UHS following a career at the helm of the UHS digital programme some 20 years. His career spanned the entirety of the EDMS project and we both enjoyed both the hospitality of Hyland during the development phase, and many thoughtful discussions and email exchanges as the project evolved and as we imbibed the lessons. He kindly contributed the flowing reflections in his inimitable style:

"This account is a bit anecdotal so it will need some cross referencing and updating with the thoughts of other past colleagues...

- The plan for the Hyland OnBase EDMS has certainly changed since its inception. We originally thought that the OnBase document folders would be used more than they have been, but in terms of lessons learned, I think that they are over complicated.

- We thought we would use the software clients of which there are many - too many again - but we ended up more generally using the direct interfacing that was developed by Alan Hales for the UHS Lifelines interface.

- This is another key lesson that I have learned, in that probably doesn't matter what specifications that you put in a plan at the outset: its a bit like buying a toy for a cat. You end up throwing it away because it preferred the cardboard box that it came in.
- All products suffer from a range of mutually exclusive options and people need to watch out more for this. In a specification (for a commercial software system purchase) you ask if it can do this that and the other and the answer is always yes. Then you make a choice about a set up (a system configuration) that excludes you from doing something you'd wanted to do.
- Supplier project teams also don't understand this problem and they let you fall into traps. In the case of Hyland we expected to use the OnBase Forms tool much more, but there are things in the software set up and operation that meant we kept running into trouble. The list of such problems is extensive: Workflow, triggers, things that need signing and then need signing again, partial and final data collection, database items versus text items, things that are already collected elsewhere.
- In the end though, broadly speaking, we ended up where we would have expected to be. In procurement we did not want to buy anything with too much of a fancy front end trying to be an EPR such as we perceived with the Kainos system which we considered in the selection competition. In Hyland OnBase, we deliberately bought a product that mostly is used behind an EMR such as Epic and I think that has been proven correct.
- One thing I do say to people a lot is: do not attempt a EDM project unless you're already largely paperless especially outpatients. You end up running a scan and print service which is very costly. EDM does not take you paperless.
- For the future of the EDM in Southampton, I think this is driven by two or three factors.

Firstly, the end of the contract with Hyland for OnBase which is now not too far away; Secondly, their drive towards putting OnBase on their cloud version, rightly or wrongly; Thirdly, the need to redesign or even re-implement, combined with a Hampshire wide contract for a common software system.

I believe that the next iteration needs to bring in regional partners which could include Hampshire Hospitals Foundation Trust (Winchester and Basingstoke, HHFT), Portsmouth University Hospitals and the Isle of Wight. This would justify the new business case, hopefully.

Other more recent developments have been driven by a tension between:
- The pandemic diverting strategy. We focused a lot on technology projects such as the implementation of Microsoft Office 365 and Microsoft Teams for obvious reasons. Money also dictated strategy as it continued to be targeted at specific things. This is a general problem and not new, as you're constantly diverted by funding for this or that.

Reflections and Lessons learned from the UHS EDMS transition project, 2013-2024

The purpose of this Essay has been to capture the key lessons and experiences of those involved in order to assist others who may go down this route in future, whether in healthcare or another industry or organisation. The project had worthy ambitions at the forward edge of radical digital transformation of the UK Healthcare System, for which no route maps existed.

There were many positives to draw from the programme.

From the human resource perspective, the appointment of very capable individuals to lead the project and to formulate a clear strategy set the programme on the right path, and the creation of an informed, robust and eclectic project steering group at the outset of the programme secured a diverse range of skills and insights, with a willingness to constructive criticism with the early identification of major risks, problems and avoidable costs.

The leadership of the programme was flexible and adaptable as circumstances and the facts on the ground changed, encouraging and tolerating robust debate and discussion at al points. This ensured that the key objectives of terminating the Nursling Records Warehouse; of developing a robust digitisation and transition plan for paper; and of installing a well regarded commercial Enterprise Document Management System were achieved.

The Hyland team also proved to be accommodating and collegiate within the formal constraints imposed by cost and contract. The opportunity to visit and work with them in Cleveland was generous, and it gave us and them insights, while we made contacts in the informatics environment of US Healthcare.

Paper has yet to be fully eliminated from any healthcare system, and it has properties and practical uses at the interface between human thought and digital design which may never be fully superceded. Nevertheless, much has been learned about paper and digital record management, which knowledge we will seek to capture in a further essay for this book.

The digitisation of healthcare systems therefore remains a work in progress, and it may well yet prove to be the case that “paper-light” trumps “paperless.

On the reverse side of the coin, we may never know whether an alternative approach to create a unitary EPR with a seamless EDMS, whether developed internally or built to a different or open source system, might have achieved a better end user experience for the many thousands of health professionals who use the UHS EPR on a daily basis.

The Hyland team will of course have taken their own lessons and reflections from the implementation of the OnBase contract. It is no criticism of the Hyland team to note the enduring lesson of Corporate IT in Healthcare, which is never to underestimate the complexities of Coding for Health, as evidenced by our narrative over four decades through the IBM and Wessex RHA story, and the NPfIT story.

The initial multiplicity and concurrency of aims in the OnBase project undoubtedly created challenges, but it was in keeping with the national and local drivers of the decade, and all goals were ultimately achieved, all be it with a workable and imperfect compromise hybrid solution between OnBase and the Charts EPR rather than a “pure” unitary solution from the end user perspective.

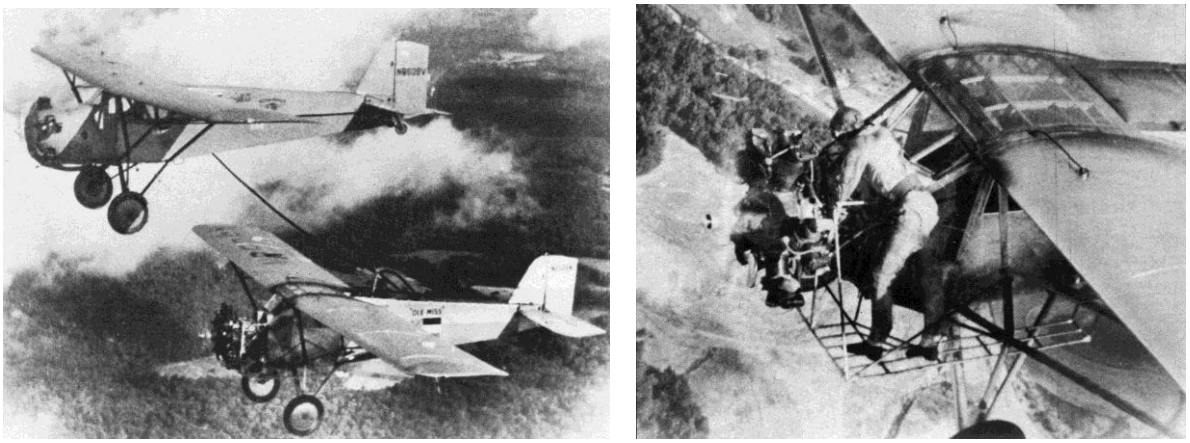
The costs were well managed, with no wastage, and the collective inputs of the hospital employees were robust, collegiate and insightful, such that changes in direction and emphasis were made in a timely manner when the evidence mandated it, regardless of prior plans and the risks of the “sunk cost fallacy”. In the end, a stable equilibrium was found whereby the pre-existing, indigenously developed and then embryonic CHARTS EPR would be further developed as the primary EPR at the hospital, with OnBase standing as a data storage solution whose limitations have never been fully addressed.

Document Discipline: The Law of Unintended Consequences in NHS Digitisation

Those who were around and following the early computerisation of society in the 1970s and 1980s will recall the earnest expectation that the digital office would eliminate paper. While this has probably been achieved in the best managed businesses and organisations, unstructured document proliferation has generally been allowed to run riot across UK health systems.

Computerised document and copy generation, printers and scanners have severely exacerbated the problem. The problem of document overload has only belated been recognised as a critical impediment to effective digitisation of the UK Health System, if at all. Indeed, anyone who has ever done a case review or a medico-legal case report will hang their head in despair at the proliferation of pointless print outs and unreadability of many computerised hospital records and the repetition, the blank sheets of paper and the empty space that accompanies them.

In all of the aspirational statements and promises about technical investment and the expenditure of further huge public funds, there is very little or no public discussion or evidence of ambition around the radical simplification and standardisation of documentation, forms and taxonomies across the UK clinical data estate.



Figures 8a and b.Early experiments in flight refuelling: the 1934-35 flights of the Curtiss Robin J-1 Deluxe, a small 165-hp airplane “Ole Miss”, images courtesy of the Vintage Aircraft Association https://eaavintage.org/outstanding-flights-ole-miss/

In conclusion, building on my previous analogy of “Building the Aircraft in Flight” (Essay 1:3), I am minded to use the analogy of two development aircraft in the earliest in-flight refuelling experiment.

In this analogy “UHS Clinical Digital Estate” and “Hyland” were connected by a precarious umbilical cord around which the software engineers would need to clamber to fix the problems. This was pioneering stuff, on which our successors and descendants will look with some bemusement and possibly even some amusement.

We can but hope that the experience at Southampton will simplify the learning curve around enterprise document management systems for those who come after us.

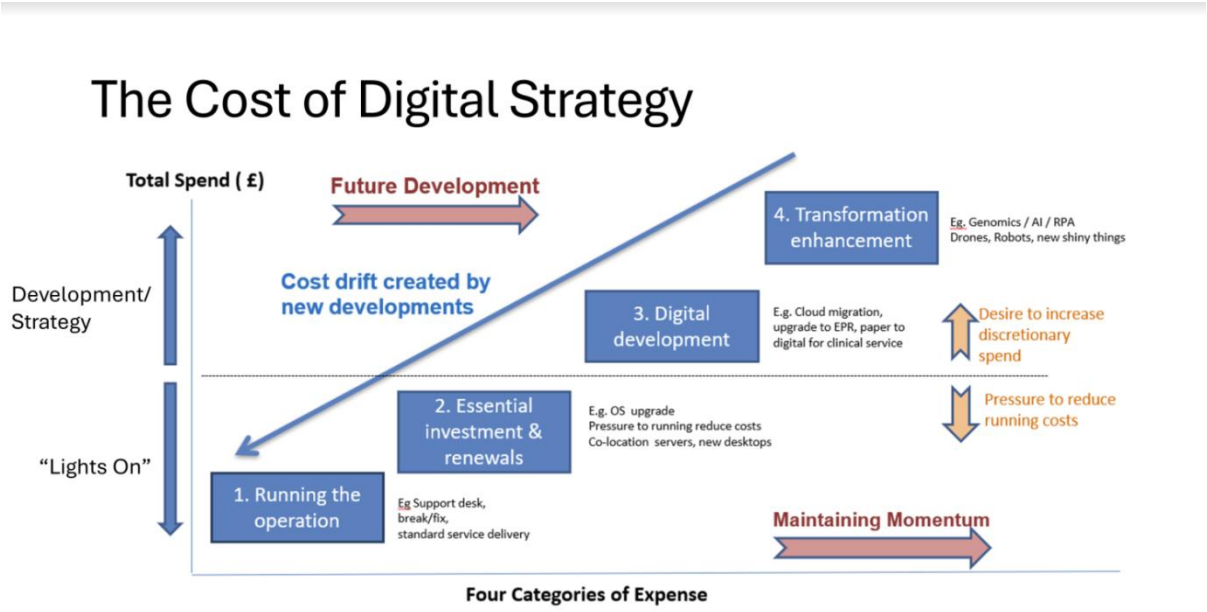


Figure . This diagram summarises Adrian Byrne’s thinking about the problems of funding a digital strategy for the hospital.

Adrian Byrne's (Final) Thoughts on the Future of the Southampton EPR in 2024

"The announcement by Tim Ferris in Feb 2022 that we (NHS Information Officers) would drive for convergence has created confusion. It is generally assumed that all hospitals will be settling on an anchor EPR/EMR. GPs and community have pretty well run away from it and left hospitals with the "problem".

(Tim Ferris was the appointed as the **inaugural National Director of Transformation at NHS England and NHS Improvement in 2021. He was** previously a Non-Executive Director on the Board. He was seconded from his role as CEO of the Mass General Physicians Organization in Boston, USA).

Those that have more than a very vanilla set of functions will find it hard to replace a "good-enough" system with a monolith product as they don't do niche things very well generally. One of these functions which we deliver very well in Southampton with EQuest is Order Comms acknowledgement, but there are others.

- Money is now being directed in a very targeted way from NHS England. In terms of digital maturity, NHSE has categorized trusts 0/1, 2a/2b, and 3 (nothing or business case, EPR just needs optimizing or extending, fully delivered)

- Local money for investment at UHS seems to have completely dried up

- There are no more obvious Return on Investment (ROI) business cases

- There is a need to replace components of the UHS informatics estate that have now been around for one or two contract iterations, but for which there are no new benefits cases to drive the project

- Some areas that desperately need updating are the Emergency Department (ED) and Ophthalmology

- It is difficult to align priorities across the acute collaborative, or contract end dates, and therefore no real means to fund the delivery of a strategy

- In my view, there is too much emphasis on EPRs when we could more easily standardise in other areas and give people a better experience

- I am concerned at the bland view that you should work as a Integrated Care Board (ICB) with no money to deliver that strategy, and where the priorities are not naturally aligned.

- The fact that the ICB is nott the only horse in town. We live among complex networks of pathology, radiology, cancer care, cardiac care, gastrointestinal care, shared care records

and a growing involvement from the private sector, and yet we seem completely to ignore all of this when everyone is talking about an unified EPR utopia.

I also consider that there are a number of other factors that may affect the next steps in healthcare digital development. They include:

- More development in mobility and peripatetic working

- More patient engagement

- How the acute collaboratives map out, and those clinical networks

- The changing pattern of business case approval, based on the financial health of your organisation

- The promised £3.2Bn and how that pans out

- The change of government

- The 2025 spending review

"To date, we've spent a lot of time and effort trying to maintain business as usual. Overall, in my opinion, we need to agree a route to a common good experience for system users on a desktop computer, and not try to keep adding to the legacy and technology debt other than where essential. The demands on the computing environment will continue to grow, so you add things but dont take away much. Every review and finance professional seems to think that costs will come down and that convergence saves money. We are going to struggle unless and until that bubble gets punctured".

Acknowledgements

I am particularly grateful to Toby Cave of the UHS IT Team, who put prodigious energies into the UHS Clinical Records Digitisation Programme, and to Adrian Byrne, Chief Information officer at UHS until 2024, with both of whom I enjoyed many wide ranging discussions about how best to optimise the project around the categorisation and rationalisation of the paper records in anticipation of digitisation.