

## **XML for blood ordering, investigation ordering and lab results**

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### ***Abstract:***

*Many Hospitals are inundated with clinically significant paper that is frequently illegible and misfiled (a polite description for lost). Using XML technologies Poole Hospital are exploring techniques for electronic filing of reports to casenotes, status tracking of investigation requests, and ordering control.*

### **Role of the medical record**

The basic requirement of a medical record is "that it be a faithful record of what clinicians have heard, seen thought and done- it should also be attributable and permanent". In practice the majority of medical records held in acute trusts today are incomplete, frequently illegible, rarely attributable and, given that they are hand written on paper, they are not permanent.

The problems associated with Medical records within the NHS are very well known . They exist as various types of documents, many of which are highly structured, produced and therefore available electronically. Many are semi-legible, written on a degradable medium in inks that fade. These documents are filed (with less than 100% accuracy) into multiple cardboard files which then form the primary decision support tool for Doctors and associated professions. However these files are regularly unavailable and/or incomplete at the point of care. <sup>1</sup>

At Poole additional challenges are provided by the need to share casenotes with a neighbouring Trust within the same conurbation (where patients travel between Trusts faster then their medical records do) and the quantity of results to be filed. <sup>2</sup>

### **The Upton decision**

In June 97 we took key clinical and managerial staff off site to update the IM&T strategy for the organisation. It was difficult to raise their vision beyond the next couple of years, but we had a useful debate about the essential elements of the medical record, and also a lively one about whether we or the patient should hold the paper record.

The meeting confirmed the essential elements of a medical record as the referral from primary care, the pathology and radiology results, and any previous discharge letters. With these and no paper records, the clinicians felt reasonably comfortable to treat without casenotes. This work has since been confirmed by the experience of other Trusts in the UK, particularly the Royal Worcester Infirmary.

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<sup>1</sup> *In our outpatient clinics between 20% and 30% of Medical records are unavailable at the time of the consultation.*

<sup>2</sup> *Approximately 300,000 results to be filed annually*

## **EPR concept**

The NHS in the UK is now moving towards the use of electronic patient records for all healthcare trusts, which aims to achieve this project over the next 7 years. Many concepts and technologies have been tried at various Beacon sites in England and it obvious from this work that the major issues are organisational, although some technological issues such as mobile computing and electronic prescribing are yet to be conquered.

## **Ordering and reporting - the traditional way**

Currently medical staff request services from various departments by completing request forms and forwarding them to the departments concerned or, in the case of routine blood test, adding the request document to a clip located near the nurses station, ready for collection by the phlebotomists when they start their round on the ward. Pre-printed patient identity labels may be used on the form, although ensuring a steady supply of current labels and removal of outdated labels seems to cause more difficulty than one would anticipate. Medical staff may also produce orders in batches so that tests are carried out over a number of days. Where such orders are left on the ward they may be inspected and amended any suitable staff member, however once they are sent to the service department there is no record of what has been ordered or when the order was placed unless appropriate notes have been made in the medical record. Thus we have significant problems with repeat orders and unnecessary testing of patients. We believe that this may be of the order of 5% of all requests however as many such tests are weeded by lab staff without being recorded the figure is probably higher.

Traditionally, at Poole, up to 35% of X-ray films have not been reported where they are for internal use, so clinicians have to examine the films themselves, and record that this has occurred in the notes. This leads at best to unavailability of films when needed and at worst to their loss and repeated exposures for patients. The revised Radiation Protection regulations increase the onus on ensuring that films are only exposed where they will be reported on or reviewed.

Pathology results (Biochemistry, Haematology and some Microbiology) are available electronically across the Trust), Radiology results rely either on Medical staff looking at the films or waiting a number of days for printed x-ray reports.

The use of our traditional medical records also poses significant problems for researchers and audit teams, not only is it difficult to identify the records that may be of interest it may also be difficult to locate the record itself.

## **Current experience - access to results and manual ordering**

We undertook a simple survey of Doctors in the trust last year to show what facilities they currently have difficulty in accessing. The results are in Table 1. From 240 forms sent to all medical staff, we only had 10 returns, so these can only be taken as an indicator of levels of satisfaction.

	<b>Outpatient</b>	<b>Inpatient</b>
Access to referral letters	8	7
Access to Pathology results	6	7
Access to Radiology reports	5	5.5

Access previous discharge letters	6	7
Order Pathology tests	7	8
Order Radiology investigation	6	7
Order blood products	7	7
Scale 0= hopeless 10= perfect		
10 replies from 240 questionnaires		

**Table 1**

Some of the comments that came back with the questionnaires were more telling;

The system only works as my secretary and outpatients nurse work very hard to find all the records before clinic

Access to previous discharge letters and radiology reports is always difficult, and often delayed for at least 10 days

Requests are delayed by the time to take them to the laboratory

For outpatients, I hand the request to the patient, or risk losing it

Orders are slow to do, and I have no record of the requests

## **Scope of exploratory EPR**

The work that we undertook led us to produce a list of items that would enable us to test the organisational issues and benefits that an electronic patient record would bring to Poole.

1. Order Pathology investigation by Doctor- Print order and sample label locally and dispatch to lab with sample/specimen or print order in Lab (depending on whether Doctor intend to take sample immediately or await Phlebotomy round)
2. Order Radiology investigation by Doctor - Order printed in Radiology (to allow scheduling of work which currently tends to happen at end of day when medics deliver requests to department).
3. Order Blood products by Nurse - Order printed in Porters lodge and Blood Bank
4. Demographic details available from PAS - PAS will provide necessary details for staff to confirm
5. Current Inpatient lists available from PAS-This to be available by Ward or Consultant to facilitate ordering after ward rounds
6. Pathology results available-Path results will be matched to request and displayed (methodology for matching printed request, sample/specimen and result to be explored).
7. Radiology results to be made available electronically
8. Discharge summaries to be available from PAS
9. Referral letters to be available (scanned in outpatients until the time we receive them electronically)

10. Print "bleeding list" for phlebotomists on demand, order by selected wards (These could be configured as Phlebotomy round 1,2 etc.).
11. Appropriate security- control of individuals actions will be required
12. Adaptability- it is likely that it will be necessary to control users actions by rules that are based upon :- the individual, the requested action, the time, previous actions.
13. Bulk ordering of tests e.g. an admission pack for M.I.
14. Links to guidance and protocols that are already available on the Trust intranet.

This list allows for the provision of documents that have already been produced electronically or are scanned in at the trust to medical staff without the need to search a number of legacy systems. It allows us to provide an ordering system to try to overcome some of the problems previously described. The Trust already has a well developed Intranet which provides easier access to clinical protocols for medical staff, and we also developed a "Patient and Relative Information Service", appropriately called PaRIS, within our Intranet which allows for the provision of information to patients.

We undertook a procurement exercise, and selected Graphnet as our company of choice to work with, both on cost, and on their approach to the items we had identified as important.

### **Ordering - the XML way**

On paper, a single document is used to order lab investigations and Blood products. Interestingly these are usually designed by the Laboratory staff and not necessarily for ease of use by the staff requesting tests. The result is that requesting staff are frequently unaware of the rationale or anticipated content for information required on the form which they then incorrectly complete (if it is supplied at all). By the time nursing and laboratory staff have trained them in proper use of the forms, the next group of junior doctors replace them.

The use of XML allows the presentation of the requesting document to be decoupled between the medical staff and the lab. The clinician sees a form designed for ease of ordering. Details such as patient identifiers and requester are prefilled depending on login and location in the system. Ordering of predefined sets of tests (presets) and access to relevant protocols are provided at the order screen, and where data entry can be limited, preset selections can readily be used. The laboratory sees a form with all the details they require (mandatory fields completed) in a legible format, designed to support their workflows.

Thus on a medical assessment unit when a patient arrives with a working diagnosis of "Chest Pain" staff can select the patient on the system and "Chest Pain" from the preset list. This provides all the requests required by the units "Chest Pain" care pathway from the appropriate diagnostic departments. It is unnecessary for staff to write multiple request forms and individually route them to the correct department, and because the tests form part of an agreed care pathway the tests could also be ordered by a Nurse practitioner on the unit.

Rules enable the system to highlight to the doctor at the point of ordering, where a previous result of the same type exists. It is important that these advisory notices are flexible to allow groups of tests to be treated differently, but also for specific locations such as High Dependency Units to have different tolerances to others before the warnings occur.

### **Ordering blood products**

We were very aware of the need to include electronic prescribing in our exploration of electronic patient records however the work required to enable this on our current Pharmacy system was considered too extensive for this current project. However Blood products can be considered to be prescribed and administered, if not dispensed from the Pharmacy. Our current system is manual, long winded and relies on much human intervention. Following appropriate tests Doctors "write up " the prescription in the patients notes, Nurses then complete an order form and ring for a porter. The porter collects the order form from the ward and delivers it to the Blood Bank, where he waits for the blood products to be dispensed and delivers them to the ward.

Naturally our portering staff were keen to reduce the distance travelled. We have not succeeded in eliminating the paperchase completely- blood product requests are still written into patient notes, which are placed on the system by Nursing staff, using a view of the order form that suits their needs. This is then printed in the porters lodge, the porters are still obliged to walk to the lab, collect the products and deliver them to the ward. Nursing staff can then access a different view of the order form to acknowledge receipt of the products.

## **Why XML?**

We have seen that Medical staff need a minimum set of documents to be available when making clinical decisions and that our pre-existing methods encourage clutter and loss and has issues with legibility, status tracking and duplication. We see that XML is already in being used for document storage and communication processes in lots of other industries and the involvement of firms like Microsoft means that it is likely to become the de facto standard in many industries. Many in the NHS have experienced difficulties in using over designed, idealised standards as opposed to pragmatically developed working standards e.g. EDIfact versus HL7 for communicating laboratory results and the adoption of broad industrial standards has many attractions.

It is our intention to store primary documents from medical records in XML so that the information both supports clinical care and is useful for research and audit purposes. Documents stored in this way should not degrade in the same way that the physical casenotes does, and are available simultaneously at multiple locations.

The flexibility of XML documentation enables us to incorporate the diverse formats of patient information in a unified structure. The system suppliers to primary care services in the UK are starting to produce referral documentation, and anticipating receiving discharge letters in XML format. As the national vision of a unified Health Record for the population unfolds, we see XML as being a very pragmatic and elegant solution to passing meaningful data between disparate systems, as well as solving some of the long-standing shortcomings of our paper records.

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