

Pathology Laboratory System Redesign – a case study from Barnsley Hospital NHS Foundation Trust in the North of England

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The Pathology laboratories are sited in a 570 bed associated teaching and research hospital affiliated with a local University.

The local area consists of countryside, towns and villages forming the Barnsley Metropolitan Borough. Located in Barnsley, the hospital is at the centre to support the healthcare needs of local residents in and around the Borough. It serves an immediate population of 226,000.

A range of acute services from A&E, maternity, general and specialist surgery to critical care, medicine, elderly people's services and paediatrics are offered. The hospital treated almost 60,000 inpatients in 2009/10, almost 72,000 people came to the hospital in an emergency and over 263,000 people attended an outpatient appointment. These figures are anticipated to rise with increased population projections of 62.8% for the 65+ age demographic by 2016.

The pathology services are delivered as a strategic collaboration with a neighbouring Trust. The combined population covered by this service is 498,000.

The Blood Sciences Laboratory at the Hospital was operational in March 2007. A laboratory redesign combined the disciplines of Clinical Biochemistry, Haematology and Immunodiagnostics into a single automated Blood Sciences facility.

At this time, the laboratory processed 1600 chemistry and immunoassay samples, 800 full blood counts and 300 coagulation samples per day, originating from the hospital and 50 local GP practices.

Efficient sample processing in the Chemistry Department had become almost unmanageable prior to the redesign due to the workflow of samples received and the inability of the previous laboratory instrumentation to deliver predictable turnaround times.

Background

In 2005 the Pathology Directorate at the hospital commenced a procurement exercise to replace the majority of the analyser platforms in Clinical Biochemistry and Haematology. At this time the Directorate was under pressure to meet a significant, recurrent cost improvement target while facing a consistently increasing workload and wage bill, a situation common across NHS laboratories. The Trust was actively developing existing collaborations with a neighbouring laboratory and working towards a merged service model.

After years of unplanned Cost Improvements, based on random savings, it was clear that a strategy for real reform was essential. The procurement would be the

trigger for major change and the introduction of advanced pre and post analytical automation would be the catalyst. However, the pathology management team were aware that automation alone would not deliver radical change and must be viewed as one of the key parts of an overall strategy for change that includes a change of culture, working patterns and process. The latter is the most fundamental piece of the reform strategy. It is essential that laboratory managers understand their processes, identify deficiencies, streamline and consolidate and, wherever possible, establish a single process for routine activity.

Process

In the laboratories there were multiple processes attempting to achieve the same outcome and a significant bottleneck in Specimen Reception due to the burden of specimen registration. All community pathology specimens arrived at midday with samples standing for hours waiting to be processed. There was significant variation in the time samples spent in centrifuges prior to analysis as well as a clear lack of analytical capacity to cope with the increased workload. The workforce was under significant pressure and morale was low.

The directorate realised that a number of parallel process engineering changes needed to be introduced in order to deliver radical reform. Projects were initiated to:

- Implement and roll-out an electronic requesting and reporting system (ORDERCOMMS) for GP surgeries and ward areas
- Set up a new GP specimen collection service under the direct management of pathology
- Introduce an analytical solution that embraced the automation opportunities emerging in this area
- Commence a workforce reconfiguration exercise to ensure that the right skills were available at the right time.

It was clear that all of these elements had to come together to deliver any real benefits.

ORDERCOMMS

The directorate built on the success of the GP messaging project and targeted the GP community first rather than the in-patient environment. It was evident that a significant bottleneck existed as a consequence of the labour intensive manual request registration, a task exacerbated by the huge volume of GP work arriving at midday. There were massive productivity gains to be realised if surgeries could be persuaded to generate a significant proportion of their requests electronically. The Sunquest ICE system was chosen, configured and rolled out across the GP community. It became evident that to ensure a timely implementation the laboratories had to take control of the roll-out and deliver this themselves. To this end a small team was established and a champion seconded to drive this forward. This was a very challenging but successful exercise.

Presently (2010) 75 % of GP requests from the local health community are generated electronically. This exercise was repeated across the GP community of our partner organisation and at present approximately 50% of surgeries are using the system with full coverage expected by the end of 2010. A similar team prepared the hospital areas for the switch to ORDERCOMMS. This commenced in January 2010 and at present all wards, the Emergency Department, Pre-assessment unit and Children's services are live with the system. The General Outpatients implementation is still outstanding.

The process of registration using ORDERCOMMS allows for the application of LEAN principles. Requests and samples are handled once and quickly moved to the analytical phase. An experienced support worker can register and barcode label more than 150 requests per hour, a 4-fold improvement in efficiency compared to the manual process. The system has realised many benefits, the registration workforce has reduced and paper reports are no longer provided.

Laboratory Automation

In the procurement phase of the analyser replacement exercise the team sought to replace current equipment with newer, higher throughput alternatives as a bare minimum. The team challenged prospective tender respondents to deliver a significantly expanded, total laboratory automation solution within a financial envelope restricted to deliver an appreciable recurrent saving. After receiving the first offerings from suppliers it was apparent that the extended solution was feasible. However, there were numerous proposals to add pre and post analytical automation to the process. These included:

- Free standing sample sorters for chemistry and immunoassay processing with manual transfer to analyser platforms, utilising support workers to move the samples around. Haematology analyser replacement only with no additional automation.
- Tracked solutions for chemistry and Immunoassay with or without on board centrifugation. Haematology analyser replacement only with no additional automation.
- Tracked solutions for chemistry and Immunoassay with or without on board centrifugation and a separate track for haematology analysers.
- Fully tracked solution for chemistry, Immunoassay, haematology and coagulation.

The procurement team felt that the best way to achieve radical change would be to implement the latter solution. This would deliver a true Blood Sciences solution and become a catalyst for the change management required.

Siemens were awarded the contract to provide their Labcell solution under a managed equipment service contract. The equipment profile delivered a doubling of throughput for clinical Biochemistry and sufficient capacity for the first 5 years of planned growth. The additional automation provided pre and post analytical

sorting and a much-simplified process utilising Labcell sample racks in specimen reception to facilitate a 'touch it once' approach. Mixed samples from each order are placed in the racks and presented to the sample managers by the support staff that registered the request. The whole system is balanced for a predicted test mix that includes samples that require centrifugation and those that do not and it is imperative that samples are loaded in this way.

The whole system can load and unload mixed samples at a rate of 600 per hour with on-board centrifugation offering 480 samples per hour. With mixed load trays containing samples requiring centrifugation and haematology samples that do not, at a ratio of 2:1, the centrifugation throughput is not a bottleneck and the system is in balance.

The system is unavoidably multi-disciplinary and must be resourced accordingly making this the ideal catalyst for workforce reform.

A key benefit of the system is the scalability of the Labcell. The system was initially configured for the anticipated growth of the local community chemistry and haematology workload (including Immunoassy) with sufficient space to add coagulation at a later date.

As part of the development of the strategic partnership the Partnership Board decided that all community pathology work would be processed at this hospital site. This required an additional chemistry analyser to be added to the Labcell and an additional haematology analyser for use off track for clinic work.

There is sufficient space within the footprint of the laboratory to add a further 5 metres of track if required. This would allow for additional equipment to be added allowing for a potential doubling of processing power if required.

Workforce

The Directorate management team decided to take the opportunity to create a true Blood Sciences department consolidating the functions of clinical biochemistry, haematology, blood transfusion, Immunology and serology. Clinical autonomy was retained but the reconfiguration of the scientific and support teams meant that significant savings could be realised. The departments already shared a single reception function utilising multi-disciplinary support staff and the implementation of the Blood Sciences Labcell necessitated an extension of this into the laboratory.

All of the staff within the individual departments that were to make up the new Blood Sciences had been fully engaged in the whole procurement decision making process and the vast majority believed in the change. The department identity was quickly established with name badges and signage changed to reflect the new approach. All individual laboratory meetings were re-configured and delivered as Blood Sciences combined meetings. A Blood Sciences senior management team became a crucial group charged with delivering the cultural change and arriving at a new management structure that would remove managerial duplication and be fit to lead the change. As a consequence a new structure was implemented and immediately delivered a significant reduction in managerial cost, fortunately as a result of timely retirements. Subsequent task

based analysis saw the introduction of a higher-level support grade given the title of Biomedical Assistant (BMA). This role has developed over time as more and more tasks have been identified as appropriate at this level. Whenever a post becomes vacant a skills gap assessment is performed to ascertain the grade of staff actually required. In a number of instances the new BMA has been introduced instead of the previous Biomedical Scientist (BMS). There is a need to be mindful that a minimum number of BMS staff must be retained to ensure a robust 24/7 service is maintained. This skill mix exercise has been very successful and has resulted in a reduction of scientific grades and a reduction in staff costs.

It is imperative that the department is staffed with the right grades but these need to be available in the right numbers in relation to the workload pressures which have clearly moved from the traditional core day. The reception staff availability has been tailored to provide minimal cover up until midday, maximum staff until 5pm with a third of the number following on until 8pm in the evening. Similarly, four Biomedical Scientists work until 8pm with 2 BMS taking over for night duty. In the latter period all routine work is completed for that day and the majority of instrument maintenance performed in preparation for the following day. The Reception area has been re-designed to improve workflow and support LEAN processing. All members of staff in this area have had LEAN awareness training and their procedures modified to ensure that specimen registration is in balance with the whole process.

GP Specimen Collection Service

Whenever the directorate has conducted a user satisfaction survey of its GP users there are a number of recurring issues. In particular, the high numbers of inappropriately high potassium results generating duplicate testing and patient concern as well as the number and timing of the specimen collections from their surgeries. Surgeries are opening longer and later creating sample integrity problems due to the length of time some samples stand before processing. The directorate commenced a procurement project for a new collection service dedicated to pathology specimen collection. Prospective companies were tasked with providing a service that:

- Utilises dedicated, temperature-controlled vehicles that meet all the requirements of the carriage of dangerous goods act.
- Employs dedicated, trained drivers
- Utilises digital time stamping of pick up times
- Guarantees a maximum journey time of no more than 2 hours from the first pick up to delivery in the laboratory.
- Introduces a collection service that meets the needs of the GP surgeries.
- Creates a schedule of runs that delivers collections to the laboratory in balance with the laboratory's processing capacity.

Where we are now

The four reform projects converged towards a completion and commencement date of April 2010. The new complete process is now in place, working well and delivering the following benefits:

- All GP surgeries have at least 2 collections per day with the majority having 3
- The first collection arrives at 11.30am and the last at 7.30 pm.
- There are 9 routes collecting from the GP communities of the two merged health communities as well as some out of district surgeries.
- No specimens are in transit longer than 2 hours.
- Collections containing approximately 300 tubes are staggered to arrive every 30 minutes
- At present approximately 50% of the partner community work is coming through to this site as only surgeries utilising ORDERCOMMS are processed here. This figure is changing rapidly as more and more of the partner GPs move to electronic ordering. It is envisaged that all the work will have transferred by the end of the year.
- A minimum of 4 and maximum of 6 reception registration stations are in use at all times during the delivery period, which guarantees a registration rate of 600 tubes per hour. At full capacity the Labcell can load 600 tubes per hour and unload 600 tubes per hour.
- The process is balanced and runs at full capacity from 11.30 until 20.30.
- 95% of all tests available on the analysers on the Labcell are reported within 2 hours of receipt.
- The application of extensive Auto-validation rules within the new LIMS has significantly reduced the amount of time spent validating and authorising results.
- As a result of single pass registration and labelling and automated processing 85% of the workload passing through the Blood Sciences department is never touched by anyone other than a support worker.
- The Blood Sciences scientific workforce has reduced from 32 to 24 Biomedical Scientists.
- The registration staff numbers have fallen from 14 to 10
- The Biomedical Assistant workforce has grown from 0 to 6
- The staffing budget has released £350000 of savings towards the cost improvement plan.
- Repatriation of referral tests, the managed equipment services contract (MESc) and initial partnership consolidation opportunities have realised a further £400000 of savings giving a total cost reduction of £0.75M.
- In 2007 there were 2700 tubes processed every day in the department. In 2010 there are 4200 tubes processed and this is expected to grow to 5500 by the end of the year. It is not envisaged that the staffing establishment will increase.

- The department has retained full CPA accreditation status in all disciplines and Blood Transfusion has gained full MHRA compliance.
- The number of elevated potassium results from GP surgeries (a marker of sample integrity) has fallen by 40% since the introduction of the new collection service.

Quality has not been sacrificed for efficiency.

After several years of planning and hard work the benefits of process reform are plain to see. However, we see this as the start of the improvement cycle and the team will continually strive to identify every opportunity to increase efficiency and pursue workforce alignment and development benefits.