

Pathology Workforce Profiling Project

Impact of Technology on Pathology Services

1 Introduction

The Pathology Re-Profiling Project is aiming to produce examples of the pathology workforce needed for the future. As part of the project, the potential impact of technology on pathology services and on the pathology workforce has to be estimated. A workshop was held on 19th February 2007 in order to explore this area and the initial findings were discussed at two further workshops (8th and 22nd March 2007). This report summarises the conclusions on the potential impact of technology on pathology services. It will be used in the next stage of the Re-Profiling Project as part of planning the workforce needed for the future.

This report summarises the expected introduction of technology over the next five years. It is structured around departments although, increasingly, departmental boundaries are expected to disappear.

2 Histopathology

In the longer term, with the introduction of image-based IT solutions, there is considerable potential for expansion of the role of technology within histopathology. The patient pathway has identifiable steps: a) from biopsy to tissue processing (rarely more than 24 hours), b) from tissue processing to issue of H&E stained section (rarely more than 24 hours), c) diagnosis (usually same day as b) and d) report issue (usually same day as c). The process is, in some cases, iterative with step b) being repeated if further investigations are required before a diagnosis can be reached or confirmed. The majority of results are issued within 24 to 36 hours of biopsy. Existing technology is mostly used in phase b).

Table 1 summarises the expected introduction of technology within histopathology. Many laboratories are already adopting this technology. It is expected to be taken up more rapidly in larger hospitals and more gradually in smaller laboratories. Digital imaging will bring the potential for electronic transmission of slide images for reading anywhere / anytime. The cost of digital imaging in histopathology is likely to be high, however, because of the supporting IT infrastructure required.

Table 1 Histopathology: Likely Impact of Technology

Process	Likely Technology
Reception	<ul style="list-style-type: none"> ○ Order Communications (when appropriate systems available)
Fixation and 'cut up'	<ul style="list-style-type: none"> ○ Accelerated fixation (microwaves an option) ○ Slide Writers ○ Macro-photography ○ Voice recognition, audio files
Processing	<ul style="list-style-type: none"> ○ Automated tissue processing (overnight and same day options are already available). The main improvements will be in more flexible scheduling and reagent management (xylene free).
Microtomy	<ul style="list-style-type: none"> ○ Largely manual or semi-automated
Staining and Finishing	<ul style="list-style-type: none"> ○ Automated processing is available for both functions. These are likely to be combined as a single module. Most manual staining would then disappear.
Reporting	<ul style="list-style-type: none"> ○ Greater use of voice recognition and audio files ○ In the longer term, digitised images will improve sharing of data, especially where a centralised technical phase serves a network of diagnostic centres.

3 Microbiology

Table 2 summarises the expected introduction of technology within microbiology. As with histopathology, many laboratories are already adopting this technology and smaller hospitals are expected to introduce these changes more gradually. In the longer term, digital imaging and pattern recognition by technology may have an impact. Workshop participants were less confident about the potential impact within microbiology than within histopathology. Manual processing, involving senior staff, will continue to be required for 'slow to grow' and 'difficult to grow' organisms.

Table 2 Microbiology: Likely Impact of Technology

Process	Likely Technology
Reception	o Order Communications (when appropriate systems available)
Urines	o Urine Analyser
Blood Cultures	o Automated processing already available
Enterics	o Multi-plex PCR ¹
GUM	o Multi-plex PCR
Swabs and fluids	o Tracking o Chromogenic media
Serology and immunological techniques	o Tracking o Common analyser platform with biochemistry and haematology
Category 3	o PCR identification at Regional Reference Laboratories
Sensitivity testing	o Automated PCR sensitivity testing

4 Clinical Chemistry

Table 3 summarises the expected introduction of technology within clinical chemistry services. As with histopathology, many laboratories are already adopting this technology and smaller hospitals are expected to introduce these changes more gradually.

Table 3 Clinical Chemistry: Likely Impact of Technology

Process	Likely Technology
Routine Chemistry	o Full tracking for elective requests, especially in larger hospitals o Automated sorting and limited tracking in smaller hospitals
Non-routine Chemistry	o Auto-storage
Specialist Chemistry	o Reference Laboratory (in house in larger laboratories; 'send away from smaller labs)
Auto-antibodies	o Some people consider that technology is not yet reliable enough for widespread introduction
Allergy and Proteins	o Automated analysis
Haematinics	o Full tracking for elective requests (partial tracking in smaller laboratories)
Molecular	o Automated processes already exist

¹ Polymerase Chain Reaction

5 Haematology

Table 4 summarises the expected introduction of technology within haematology services. As with histopathology, many laboratories are already adopting this technology and smaller hospitals are expected to introduce these changes more gradually.

Table 4 Haematology: Likely Impact of Technology

Process	Likely Technology
Automated: FBC ESR Clotting Screen INR	<ul style="list-style-type: none"> ○ Full tracking in larger hospitals ○ Automated sorting and limited tracking in smaller hospitals ○ Automated processing already available
Semi-automated: Malaria Haemoglobinopathy Specialist Coagulation	<ul style="list-style-type: none"> ○ Shared platform with chemistry
Manual: Blood films	<ul style="list-style-type: none"> ○ Full tracking in larger hospitals ○ BMS manual initial screen of results with reading by haematologist for oncology and haemophilia. ○ In the longer term, automated pattern recognition from digitised images in larger hospitals. ○ Smaller hospitals may refer digitised images to larger hospitals for reading, or send slides to larger hospitals as an alternative to reading locally.
Blood transfusion	<ul style="list-style-type: none"> ○ Larger hospitals: automation and remote issue (which will also provide a full audit trail) ○ Smaller hospitals may retain manual processes, or introduce partial automation.

6 General Issues

The further introduction of technology is expected gradually to break down the barriers between departments, especially between chemistry, haematology, immunology and serology. Relevant issues which cross existing department boundaries include:

- Order communication systems could speed up and simplify the pathway considerably but effective systems are not widely available at present. The system adopted has substantial implications, including for type of container and test acceptance criteria.
- Pre-analytical stages are expected to become more automated, in particular:
 - i. No data entry required
 - ii. Front loading onto track in larger hospitals (stand-alone pre-analytics in smaller hospitals)
 - iii. Integral specimen reception (checking for leaks will still be manual)
 - iv. No centrifugation
- Shared platforms across chemistry, haematology, immunology and serology will develop.
- Many results will automatically be routed to the requester.
- Management of pathology services, including data collection, audit, training and meeting CPA and MHRA requirements, will also be affected by greater use of technology. The impact on the workforce is discussed in section 9.
- Increased testing for genetic markers may, in future, substantially change the pattern of work for some departments, especially histopathology and microbiology.

- Some departments are now querying the move to fully tracked systems as the inherent batching of tests may not be the best way of managing the flow of work through the department.

7 Point of Care Testing

Workshop participants reached the following conclusions in relation to Point of Care testing:

- The growth of Point of Care Testing will continue to increase. It will continue to be very labour intensive, especially in relation to training, QA, replacing fluids and dealing with problems.
- Supporting Point of Care Testing is already impacting significantly on the workload and workforce of pathology services. There are differing views about the role of scientific staff in supporting Point of Care Testing. In some large volume areas, laboratory staff actually run the Point of Care Testing service. In other areas, remote support is sufficient.
- It is essential that this growth is coordinated and managed. Without this coordination there is the potential a) for inefficiencies in use of staff and financial resources and b) for errors to occur.
- All Point of Care Testing should comply with ISO 22870:2006 Point of care testing – Requirements for quality and competence.
- Each health economy should have a Point of Care Testing Policy which covers the criteria for supporting Point of Care Testing, responsibilities for maintenance, support, education and advice, standardisation of reference ranges and the situations under which a machine should be withdrawn.
- Each health economy should establish a Point of Care Testing Committee with responsibility to develop and monitor implementation of the Point of Care Testing Policy. Where a health economy wide policy is not yet in place, Trust policies and committees should be established.
- National guidance on this subject and review by CPA would be welcomed.

The future need for Point of Care Testing will depend on transport arrangements and the ability of pathology laboratories to respond quickly to requests. Point of Care Testing is expected to develop least where there is good transport to a large 24-hour laboratory where technology has been adopted extensively. There will be greater use of Point of Care Testing in areas with longer travel and smaller, less automated laboratories. The need to support Point of Care Testing will therefore differentially impact on the workforce of smaller laboratories in more rural areas.

Table 5 shows which Point of Care Testing was considered to be justified, based on:

- Value to the patient (speed of patient pathway)
- Value to the requesting clinician
- Value for money

Table 5 Expected Point of Care Testing

Location	Expected Point of Care Testing
A&E (and ambulance services)	<ul style="list-style-type: none"> ○ U&E, Sepsis, D-Dimer (DVT) and Pregnancy Testing in all departments ○ Blood gas analysis only if rapid laboratory service not available ○ Further discussion is needed on cardiac enzyme testing ○ Increasingly ambulance services may carry out some of the tests previously performed in A&E departments
Theatres and Intensive Care Units	<ul style="list-style-type: none"> ○ Lots of continuous monitoring ○ Lots of percutaneous monitoring ○ Other Point of Care Testing may be justified depending on local circumstances, especially the interest of staff in theatres / ICUs. ○ Growth of Point of Care Testing would significantly reduce laboratory's urgent workload.

Wards	<ul style="list-style-type: none"> ○ Blood glucose ○ Some theatre / ICU type monitoring on high dependency units
GP surgery / health centre / clinic	<ul style="list-style-type: none"> ○ Urines, blood glucose, coagulation ○ Total cholesterol, full lipid profile, NTproBNP, D-Dimer ○ If funding allows, other monitoring of relevance to chronic disease management, for example, thyroid levels, monitoring for drug abuse
Out-patient clinic	<ul style="list-style-type: none"> ○ Specialty specific Point of Care Testing where this will significantly speed up the patient pathway, for example in GU Medicine, Oncology, Coagulation and Diabetic Medicine. Possibly also Neurology and Rheumatology.
Community Pharmacy	<ul style="list-style-type: none"> ○ Pregnancy Testing ○ Blood Glucose ○ Coagulation ○ Also specimen collection ○ NB. Results of tests in community pharmacies may not be entered into the patient's medical record. Arrangements for advice and follow up need to be clear.
Self / Home	<ul style="list-style-type: none"> ○ Pregnancy Testing ○ Blood Glucose ○ Coagulation ○ STD testing ○ Fertility testing ○ Occult blood testing ○ Drugs of abuse testing ○ Alcohol testing

8 Other Issues

- Transport arrangements, including air tubes, and transport times are currently the main limiting factor in improving the responsiveness of pathology services.
- Greater use of technology will change the skill mix required. This may not, however, lead to cost savings, especially if transport times limit the extent of centralisation and associated economies of scale.
- Because of the importance of order communications systems, planning for transport arrangements and the introduction of technology need to be coordinated.
- Physical space currently often limits laboratories' ability to adopt new technology. Ability to take advantage of available capital can be constrained, for example, by impending large PFI schemes.
- Alongside greater introduction of technology, considerable service redesign will be needed in order to achieve the most efficient patient pathway.
- Some of the barriers to the introduction of technology are considered to be more traditional than absolute.

9 Workforce Implications

The introduction of technology will impact on the pathology workforce in the following ways:

- Staff will need different qualifications – especially if technology is extensively adopted.
- Fewer staff will be involved in data entry
- The administrative burden within pathology services will be reduced.
- Staff with skills to run automated platforms will be required. These may be 'in house' staff or outsourced to supplier firms.
- Quality assurance will be organised differently. Monitoring quality will increasingly become inherent to all roles within pathology services. Overall responsibility for meeting and monitoring quality requirements is likely to be undertaken by a small specialist quality team within each pathology service.
- Staff training may be easier because there will be fewer tracks and fewer platforms.

- Supporting Point of Care Testing is already impacting significantly on the workload and workforce of pathology services. There are differing views about the role of scientific staff in supporting Point of Care Testing.
 - E-learning packages are likely to be developed to support the training needs associated with Point of Care Testing.
 - Senior medical and scientific staff will continue to be required for:
 - Interpretation of results
 - Customer liaison
 - Demand management
- Opinions differ as to whether more or less of these staff will be needed in the future. Increasingly, these staff will work within Service Level Agreements which specify their contribution to the laboratory service.

10 IT Implications

The introduction of technology also has implications for IT infrastructure within pathology services:

- Suppliers may, in future, develop smaller versions of equipment for smaller laboratories and Point of Care Testing. Currently, mainly 'big' equipment is available which may not be cost-efficient to introduce into small laboratories.
- Existing IT platforms are limiting the potential to adopt new technology, in particular because:
 - There are a limited number of suppliers
 - IT platforms are often rigid
 - There is often difficulty in establishing links with other pathology systems and Trust PAS systems.
- There is likely to be a reduced total number of platforms with associated reduction in maintenance costs.
- Large laboratories should be able to run more equipment on a 24/7 basis.
- Access to capital funding to develop adequate IT infrastructure will be required before organisations can take advantage of potential technical solutions. Business cases will be easier to justify in larger laboratories with high volumes of activity.
- Manufacturers of pathology systems may start also to provide pathology services.

11 Service Implications

The introduction of technology in pathology will also impact on the services available for patients and referring clinicians:

- Turnaround times will be more appropriate and responsive to customers' needs
- Fewer laboratory errors
- Greater cost-efficiency, especially in larger laboratories.
- Small laboratories may find it increasingly difficult to run a 24/7 'hot lab'.
- There may be a move to greater centralisation of laboratories, especially in areas with good transport links or short transport times.

There may be additional benefits where a pathology network agrees to purchase platforms from one supplier including, for example:

- Cover for 'down times'
- Efficiency of education and training
- Reproducible results which are easily communicated as the patient moves between hospitals in the network.
- Some tests undertaken at only one site within the network – giving greater cost-efficiency.
- Potential for coordination of quality management across the network.