

National Pathology Programme  
NHS Improvement Guide

# Service improvement in microbiology: **why, what and how**



*"Clinical excellence in partnership with process excellence"*



service  
improvement  
in microbiology:  
why, what  
and how

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# #1 [foreword]

Pathology services lie at the heart of healthcare services. The vision for the NHS pathology services puts patients first by providing services which are:

- clinically excellent;
- responsive to users;
- cost effective; and
- integrated.

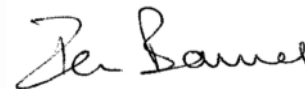
Effective microbiological services are a key requirement of quality in pathology. They can be provided by a range of healthcare providers in a wide variety of settings and it is therefore essential that patients needs are considered. Samples should be taken as locally as possible, with ease of access and in a timely manner to ensure early decision making regarding patient diagnosis, treatment and monitoring.

The NHS Operating Framework 2012/13 highlights five domains, of which Domains 4 and 5 are important for microbiology. Domain 4 requires all NHS organisations to actively seek out, respond positively to and improve services in line with patient feedback, while Domain 5 focuses on reducing MRSA bloodstream and clostridium difficile infections. The role of microbiology is significant in achieving these national objectives.

Moreover, the QIPP challenge to improve services for patients is now in its second year, and this document demonstrates how sites are rising to it. The pilot sites have demonstrated the need to focus on and measure the whole end-to-end patient pathway. They highlight the importance of user engagement, the impact this can have on appropriate testing and the need for user education in correct sample taking. Resultantly, the need for clinical and managerial leadership is fundamental to achieving sustainable improvement and service change.

The robust approach to improvement undertaken can be demonstrated in all eight descriptors of the new NHS Change model launched by the NHS Commissioning Board, and the DH Pathology Programme is very pleased to support the work of NHS Improvement to demonstrate how these improvements can be achieved using Lean methodology.

We commend this guide to all commissioners and providers of microbiology services.



**Dr Ian Barnes**

National Clinical Director for Pathology,  
Department of Health



**Dr Peter Cowling**

Consultant Microbiologist  
National Pathology Programme Adviser in Microbiology

#2

# [executive summary]

In 2006 the Review of Pathology Services in England by Lord Carter, endorsed Lean as the method of choice for improving processes in pathology services.

Working in partnership with the Department of Health (DH) Pathology Programme, NHS Improvement has supported a number of microbiology teams, including the eight acute Trusts in the former East Midlands SHA, to learn how Lean methodology can enable the service to achieve improvements to support the QIPP, (quality, innovation, productivity and prevention) transformation programme.

Multidisciplinary teams worked collaboratively to test and implement changes that deliver improvements for patients, staff and users of the service.

Over **2 million** patients will have benefited from the improvements in:

## **Quality and safety**

- Working with service users to achieve 'right first time' – addressing errors in sample labelling and requests.

## **Innovation**

- Using lean techniques to improve flow of samples, introducing technology to reduce test turnaround times.

## **Productivity**

- Reducing inappropriate demand by ensuring users are educated to perform the appropriate test correctly
- Matching capacity to demand and ensuring the appropriate use of staff skills
- Improving turnaround times (TATs) by removing waste from process flows to provide results more quickly.

## **Lessons learned**

Three important lessons have been learned in piloting and prototyping Lean thinking in microbiology.

### **1. Lack of a consistent standard and approach to end to end sample pathways measurement**

During the improvement programme, Dr Peter Cowling, National Advisor for Microbiology and Clinical Lead for the Path Links microbiology improvement team facilitated an important discussion with microbiology teams involved in the improvement programme to bring about consensus and recommendations.

A review of current guidance including Royal College of Pathologists, Keel Benchmarking, CPA and the Lord Carter Review of Pathology Services 2006/2008 identified a lack of consistent approach to measurement of the microbiology specimen pathway.

### **Recommendation:**

A consensus was agreed which recommended that the microbiology specimen pathway starts from the time the clinician considers the possibility of the diagnosis until a result is available to them. Key measures across the pathway include:

- Date and time the clinician produces the request form
- Date and time the specimen is taken (specimen collection)
- Date and time the specimen arrives in the requester's local lab
- Date and time the specimen arrives in the processing lab
- Date and time the result is available to the clinical user.

### **2. Process and wider system changes are required to support end to end pathway measurement**

Much of the pre-analytical phase is currently invisible to the laboratory and pathology laboratory information systems (LIMS) and processes do not support measurement of the end to end pathway. Teams have been required to resort to lengthy manual data collection to demonstrate basic end to end specimen pathways and this is often significantly incomplete.

**Recommendation**

Pathology LIMS providers are commissioned/required to support the changing landscape to allow a patient focussed approach to information across the patient pathway.

Pathology teams should collect this data and encourage patients and users to provide details of specimen timings.

**3. Face to face user engagement is essential to enable laboratories to engage and educate users to ensure:**

- Appropriate testing to defined and agreed protocols (reducing inappropriate demand)
- A 'right first time' approach to high quality specimen request forms and specimen labelling
- Appropriate technique for collection and handling of samples.

**Recommendation**

Microbiology works in partnership with users to provide visible access to agreed protocols for tests and educate users. A right first time approach is encouraged and endorsed by commissioners, clinical teams and users to ensure safety and efficiency.

**Key elements to bring about change**

Learning from other improvement initiatives in pathology services have confirmed the five key elements likely to bring about substantial improvements in the pathway are almost identical for Microbiology:

**1. Focus on the whole end to end pathway**

- Ensure all staff in the pathway understand up and downstream processes and how their own work impacts on others
- Use whole pathway data (from specimen request to result available) to understand how specimens, forms and results flow and identify bottlenecks and waiting.

**2. Adopt small batch sizes**

- Throughout the entire pathway - waiting to "fill" equipment causes samples (and therefore patients) to wait.

**3. Keep specimens moving**

- Daily, throughout the day, multiple deliveries from source of specimens
- Pull work through the lab
- Register specimens on receipt in small batch sizes – a focus on specimen processing as a priority may prevent results being issued in a timely fashion; move to processing in small batches to improve flow
- Register specimens on receipt in small batch sizes – a focus on specimen processing as a priority may prevent results being issued in a timely fashion
- Continuous authorisation of results.

**4. Establish first in, first out**

- No prioritisation of specimens unless absolutely necessary based on clinical need
- Today's work today.

**5. Appropriate testing**

- Work with users to design protocols and systems to support appropriate test requesting
- Develop acceptance policies that specify information and data quality requirements.

This learning guide provides microbiology teams with the basic tools to make changes to their processes, along with insight into how colleagues have used these tools across the whole patient pathway.

# #3 [introduction]

**Pathology services are faced with increasing demand and pressure to reduce costs whilst improving and maintaining clinical safety and quality. Traditional cost cutting methods including staff reduction fail to deliver the required savings because fewer staff are left with the same processes.**

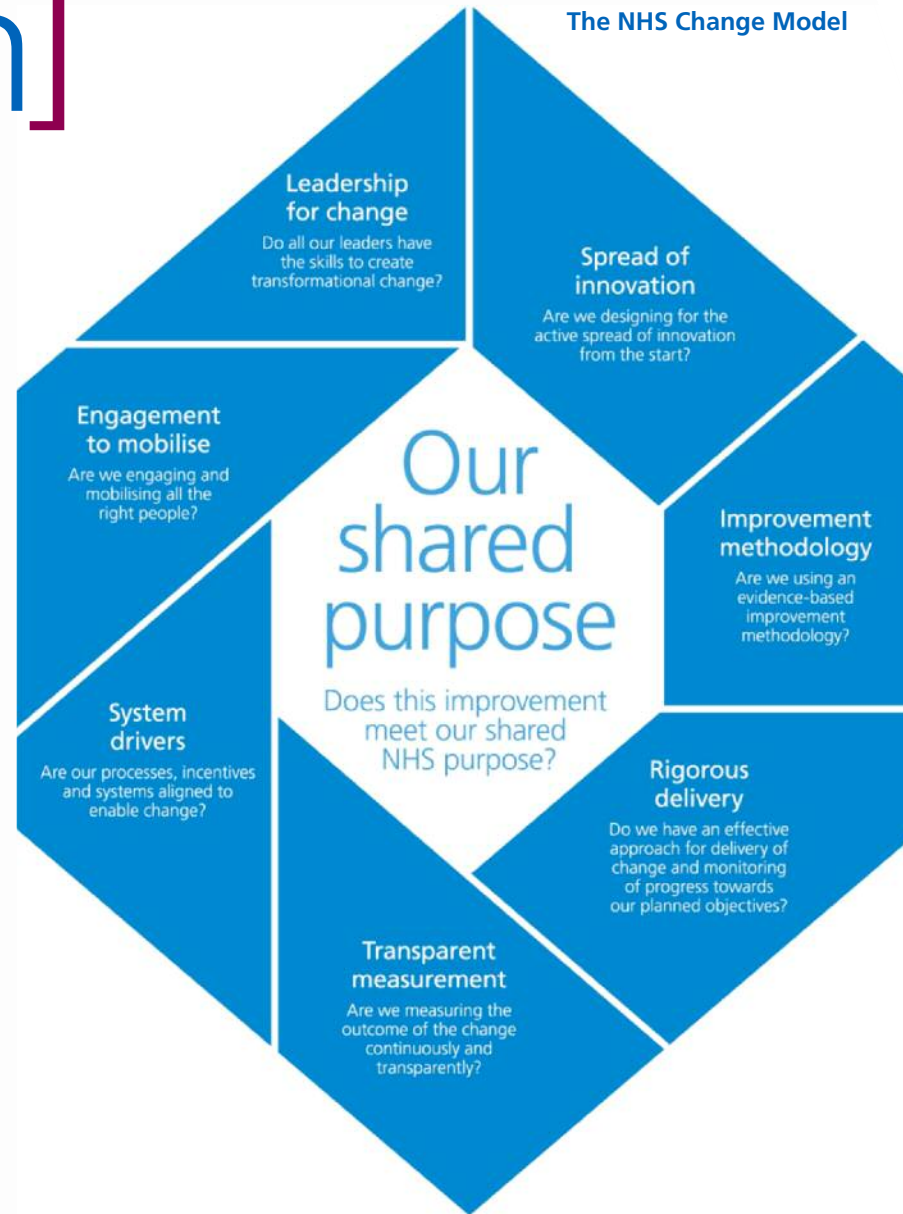
A Lean management system delivers reductions in error rates, waiting times and increases in productivity. Application by healthcare organisations across the world has improved outcomes for patients and reduced the cost of care at the same time.

NHS Improvement has worked with multiple teams across pathology disciplines to evidence the value of Lean methodology.

Application of Lean tools enables improvement of isolated processes but the impact of one off improvement efforts of this nature can be short lived. It is only when clinical leadership and operational management changes sufficiently that an organisational culture of continuous improvement can be achieved.

Jim Easton, National Director for Transformation for the NHS Commissioning Board has recently launched the NHS Change Model.

The model brings together familiar elements of any successful change programme and is designed to ensure the NHS can meet the challenge of the pace and scale of change required to meet future financial constraints and improvements in quality.





The key to the change model is not the individual components but ensuring all are addressed equally as part of any improvement effort.

“By doing that, we’ll amplify and reinforce our ability to drive change. We’ll take the skills we’ve already got, and take them to the next level in being able to make things happen.”

- **Our shared purpose: patient experience is at the heart of what we do and drives change**
- **Leadership for change: to create transformational change**
- **Engagement to mobilise: understanding, recognising and valuing individuals’**
- **System drivers: e.g. QIPP, CQinns, NHS Operating Framework**
- **Transparent measurement: for improvement and patient outcomes**
- **Rigorous delivery: project management, Plan, Do, Check, Act (PDCA) cycles and measurement of benefits**
- **Improvement methodology: Lean, capacity and demand, value and process mapping**
- **Spread of innovation: shared learning via multi-media techniques.**

Our programme of improvement predates this model. However, we can demonstrate how NHS Improvement’s approach in supporting clinical teams has addressed each of the eight elements of the model which should be at the centre of any improvement effort whether localised to a single department or at national scale.

Lean management is not simply an ‘Improvement methodology’ as described in the change model. It addresses all areas and provides teams with a checklist for continuous quality improvement.



# #4 [sites]

Following the Report of the Second Phase of the Review of NHS Pathology Services in England (December 2008) and the Department of Health's Response to the Lord Carter Report (December 2008), the DH Pathology Programme supported a three year programme of service improvement in partnership with NHS Improvement.

In line with the recommendations of the review, the pathology service improvement programme has been established to demonstrate improvements in efficiency, quality and safety across the end to end pathway of care and demonstrate the impact of effective pathology services on the wider healthcare system.

This document shares learning from 10 sites across two dimensions:

## Pilot and spread

- **St Helens and Knowsley Teaching Hospitals NHS Trust**  
Beginning in 2006, the Whiston microbiology team have been developing a Lean culture that has spread into other pathology disciplines
- **Whipps Cross University Hospital NHS Trust**  
A histopathology pilot site for an NHS Improvement programme of work 2009/10, learning has spread to the microbiology team.

## Prototype

- **East Midlands Strategic Health Authority (SHA) – Pathology Modernisation Programme**  
Working with microbiology teams across eight acute trusts to further evidence the value of Lean thinking.

NHS Improvement provided training in the use of Lean thinking to support sites to redesign the way that services are delivered, aiming for clinical excellence that is supported by process excellence to improve the users experience.

The approach required local ownership and sustainability underpinned by the training of all members of the team in Lean methodology. The programme took a collaborative approach, facilitating teams to network and share best practice at a series of sharing events.

Clinical teams were encouraged to visit exemplar sites to observe Lean methodology as part of everyday working and understand how improvements have been achieved.

## East Midlands SHA sites and leads:

- **Nottingham University Hospitals NHS Trust**  
Clinical Lead: Dr Mathew Diggle
- **Derby Hospitals NHS Foundation Trust**  
Clinical Lead: Dr Farah Yazdani
- **University Hospitals of Leicester NHS Trust**  
Clinical Lead: Dr Andrew Swann
- **Kettering General Hospital NHS Foundation Trust**  
Clinical Lead: Dr Essam Rizkalla
- **Northampton General Hospital NHS Trust**  
Lead: Andrea O'Connell
- **North Lincolnshire & Goole Hospitals NHS Foundation Trust (Path Links)**  
Clinical Lead: Dr Peter Cowling
- **Chesterfield Royal Hospital NHS Foundation Trust**  
Lead: Trevor Taylor
- **Sherwood Forest Hospitals NHS Foundation Trust**  
Clinical Lead: Dr Shrikant Ambalkar

#5

# [leadership<sup>for</sup>improvement]

## Leadership is behaviour:

“What we do as leaders is more important than what we say.”

Sir Nigel Crisp

One element of the new NHS Change Model is Leadership for Change. The narrative supporting this asks “Do all our leaders have the skills to create transformational change?”

Lean is the term popularised by Womack and Jones to describe a management system derived from the Toyota production system (TPS) that has been adapted and successfully applied nationally and internationally to a wide variety of industries including healthcare for over 20 years.

Why, when it seems so simple do lean initiatives often fail to sustain?

ThedaCare – a four hospital healthcare system in Wisconsin, USA - significantly reduced errors, improved patient outcomes, raised staff morale and saved \$27m in with no job losses. CEO John Toussaint MD said

“In the end the enemy of our improvement efforts was us. Leadership was treating each improvement initiative as time limited, a finite project conducted by a few members of staff or consultants. Improvements ended when a project was over because nobody was in charge of sustaining change and measuring results.

In order to change outcomes, leaders at ThedaCare needed to change”

Continuous improvement can, and will, only occur if the people who actually do the work are actively engaged with and understand Lean and their leaders change.

## Developing a lean culture

Culture change takes time and requires leadership. A great many models and theories exist to guide those wishing to develop their own leadership capability and approach.

Key steps to influencing the creation of a lean culture include:

1. Find change agents
2. Get Lean knowledge
3. Seize crisis
4. Map the value stream
5. Remove waste
6. Continuous improvement
7. Sustain.

A lean culture could be described as one where managers at every level go to the workplace and coach their staff in Plan, Do, Check, Act (PDCA) problem solving. A continuous process that is part of “the way we operate here”.

## Finding change agents

Achieving a culture shift starts with a small team working collaboratively with their department colleagues and users to improve identified areas of the process.

Identify a credible and respected improvement lead to head up this team. Look for a clinician or manager with the drive and enthusiasm to steer changes across the patient pathway.

Core team members should be drawn from across the entire pathway:

- Clinical colleagues who will actively commit to the improvement effort
- Laboratory representatives for each job grade
- Administrative/office staff representative
- User involvement – member of a patient group and a high volume user – from primary care, ward or clinic.

Core team members must understand the process within their stage of the pathway and:

- be able to contribute ideas/information on the process
- be able to influence the decision making process
- be prepared to test and implement changes across the pathway
- be committed to attend all team meetings, activities and work required between meetings.

### **Escalation planning**

An executive sponsor is essential to provide proactive support and access to relevant support services such as estates, transport, HR, finance and IT teams. They may be called upon to escalate key issues.

## **Engagement of your staff**

### **What is engagement?**

Another element of the new NHS Change model is engagement to mobilise. The narrative asks “are we engaging and mobilising the right people?”

There is no single definition of engagement but themes of commitment, involvement, communication and energy are clear.

“Employees who work with passion and feel a profound connection to their organisation. They drive innovation and move the organisation forward.”

**Meere**

“Employee engagement is about translating employee potential into employee performance and business outcomes.”

**Melcrum**

It is well established that change is difficult for most people. It is the responsibility of leaders to listen and understand individual perspectives and concerns creating an environment of open and honest communication.

### **How engaged are we?**

An Engagement Surveying Tool has been developed and is available at [www.improvement.nhs.uk/improvementsystem](http://www.improvement.nhs.uk/improvementsystem) to enable measurement and to motivate leaders at all levels to take action on results to improve their own leadership capability.

The 10 questions are based on the work of the Gallup organisation, Marcus Buckingham and Curt Coffman published in *First, Break all the Rules*.

## Communication

Establishing the framework for, and maintaining, good two way communication is critical to the success and sustainability of any improvement activity.

### Daily meetings - Huddles

An important mechanism for engaging staff is huddling.

A huddle is a daily, short and snappy face to face gathering of a team, preferably standing around a performance metrics display board, which addresses:

- 1. Focus** – on key goals and responsibilities for the day
- 2. Clarity** – clear, relevant and timely information to help staff perform their daily roles
- 3. Commitment** – listen and act on staff views, ideas and concerns and feedback progress of agreed actions.

When huddles are first introduced they may feel strange and uncomfortable for some people. Participation is likely to come from the same small group of individuals and so other mechanisms for eliciting input and views from the whole team can be used to support efforts to create an environment where all are comfortable to speak up.

### Suggestions boxes and notice boards

Suggestion boxes and notice boards provide an outlet for staff to make anonymous comments and raise niggles and suggestions. Share comments at the daily huddles and provide either an instant response or agree a timescale for investigation and feedback.

### 1-2-1s

Speak privately with individuals where necessary to make it known that their views and concerns are important. Ask their permission to raise their issues at daily huddles for further discussion.

After a period of time (which will be different for each team depending on the starting point) use of suggestion boxes and boards should diminish as the daily huddle becomes the focus for raising, discussing and resolving issues.

Daily meetings can (and should) be a formal part of department operations and minuted accordingly. The need for formal laboratory meetings will reduce and may be eliminated altogether.

More supporting information is available at:  
[www.improvement.nhs.uk/improvementsystem](http://www.improvement.nhs.uk/improvementsystem)

## CASE STUDY

# Managing the Lean journey

## University Hospitals of Leicester NHS Trust

### Summary

Change is difficult for some people. Positive encouragement and support for all - those who embrace change and those who are fearful and resistant initially is vital.

The Lean journey can be both difficult and challenging but with perseverance the outcomes are rewarding and beneficial to all.

### Understanding the problem

The bacteriology team chose to focus their early improvement efforts on the Urines process from receipt in the laboratory to the authorisation of the negative microscopy report. This is a high volume process that would provide significant benefits in time and efficiency to both patients and staff.

The mix between Biomedical Assistant (BMA) and Biomedical Scientist (BMS) staff was approximately equal. The great majority have been working in the laboratory for a large number of years and were very comfortable with current processes.

A core team was selected to lead the improvement effort chosen from people who had expressed an interest in Lean methodology and representing all job roles in the laboratory.

A staff engagement survey was issued to which 76% of staff responded (73 from 96). Only 37% of staff felt that their opinions seemed to count. Feedback also included criticism of the level of information being given about process changes.

### How the changes were implemented

Lean principles were new to most of the staff. NHS improvement provided teaching in the use of the tools and techniques and the team began by gathering baseline data.

The core team had training days out of the laboratory and regular meetings were held to formulate action plans. Due to unfamiliarity with the new tools and the time required to gather manual data, the planning stages took some considerable time.

These two factors led to a degree of resentment amongst the remainder of the team who were covering busy periods without their core team colleagues. Added to this was a lack of visibility of the work of the core team.

A perception also developed that only ideas of the core team would be implemented.

In addition to the core team taking time out, the management team also introduced daily huddles which were initially viewed as a further absorption of time that could otherwise be spent processing samples. They were introduced as a conduit for information but

participation of all staff was a challenge. Initially, Band 7s led the huddles in rotation but the meetings were not providing the two way communication expected from them.

After some reflection, it was decided that all staff should be given the opportunity to lead the daily meeting. Some came forward and others found the idea of speaking in front of their peers difficult. As time went on more came forward.

Once more staff from across all job roles began to lead the huddles the level of participation improved dramatically.

With the current state base line complete and feedback gathered via waste management sheets, improvement opportunities were identified. Implementation then proved to be equally difficult.

Some members of the wider laboratory team had formed the opinion that the changes were linked to individual agendas and as changes evolved on a sometimes daily basis some colleagues found it difficult to keep up and became increasingly frustrated.

One of the pivotal parts of the system required to make the new process work (real time registration) was not put in place until weeks after other changes had been made. This increased frustration and some became quite angry as they could see no benefit from the remainder of the changes made early on.

A single Band 7 was taking the lead for the training required to explain the changes. Her efforts were viewed by some long serving and very experienced colleagues as overbearing and controlling when the intention was simply to standardise the process.

There were particular difficulties too for the BMAs who had embraced the new system, not feeling able to show a Band 6 BMS the new method.

#### **Measurable improvements and impact**

With the Plan, Do, Study, Act (PDSA) cycle in the final stages of completion all colleagues had used and tested the new process. Most felt a positive benefit to the work flow and this has been evidenced in the process data.

When the adequate number of staff are available the stress levels seem to be reduced and there is a better sense of team work within the laboratory with the integration of registration BMAs.

Improvements in communication are evidenced in the following quotes from colleagues:

**“Its a lot smoother if there are enough people. There is less pressure on the BMS and there are less checking steps. Real time registration ensures that the results go out quicker - which is what its all about.”**

**BMS**

**“I think its much better - doing it in 10s means that you can do several things at once. I like it.”**

**BMA**

**“The process is slicker and it works, provided we have enough staff and enough registration staff.”**

**BMS**

**“The old system - we used to spend a lot of time on separating urines into four or five different racks. With the new system in place it is a better system than before. There is less time for the results to go out and there is less work for the staff.”**

**BMA**

#### **Key learning**

Staff 'buy in' to Lean may be challenging and efforts to support them through change is likely to be required over a long period of time. Seeing improved data and feeling the pace of work steady out will contribute to mindset shift.

Had changes been implemented more quickly, colleagues may have become less suspicious and resentful of the time out the core team members were taking.

The Band 7 taking the lead on the project felt they had little support from their peer group which made things very difficult. Remaining focussed, driven and dedicated to Lean resulted in successful delivery of the improvements.

#### **Key recommendations**

- Get senior staff and other key influencers on board prior to undertaking the project
- Communicate with staff at all levels and at all times.
- Inform everyone prior to starting a project - give specifics - how long, the aim of the project, what ideas may already be formulated, explain how changes may have to be made to fit in with the process
- Encourage colleagues to have the confidence to train others who may be more experienced than them
- Ensure staff feel valued as part of a team
- Never give up!

#### **Contact**

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## CASE STUDY

# Stop to fix - immediate leadership action

## Nottingham University Hospitals NHS Trust

### Summary

Changes were made to specimen reception in two phases. The second phase introduced date/time stamping of every sample without initially redesigning the process or the work area to accommodate the additional task.

The entire reception team disengaged completely and the process quickly deteriorated to a crisis situation.

Senior colleagues reacted quickly and worked alongside reception staff to understand the process and agree the necessary redesign.

### Understanding the problem

A number of issues relating to specimen reception required improvement to aid specimen flow

- Lack of standard work – morning and afternoon staff arranged the work area in different ways
- Messages regarding urgent specimens were captured on scraps of paper and could be lost or overlooked.

The majority of deliveries occur in the afternoon. Several staff were trying to help with the unpacking and sorting in a very small space. Samples were observed literally flying around the room!

### How the changes were implemented

The Lean core team began by observing the process and measuring:

- Timing of deliveries along with the specimen volume peaks and troughs
- Number of specimens requiring more than one test – either in microbiology alone or microbiology and another pathology discipline
- Spaghetti mapping the movement of staff, samples and request forms into, around and out of the area revealing multiple trips to an office area to access a photocopier which required the removal of laboratory coats and gloves each time.

### In the first phase of improvements:

- A bench top photocopier was purchased and installed in specimen reception
- A standard layout was sketched out and posted on the wall in the area for every staff member to review and critique
- After a reasonable period of time the agreed layout was put into place – the bench was marked out with tape. Boxes were labeled with the bench destination and a clearly labeled 'in' tray was placed for porters and service users to deposit samples in
- Additional sorting boxes were added for urines (GP and hospital) and MRSA (screening and multiple swabs) to front load the process and remove the further sort being carried out at the benches

- A white board was installed to hold van delivery information, duty medical staff telephone numbers and record messages regarding urgent samples
- The area was 5Sd with a number of items being moved to more appropriate areas and a trolley located to store required items under the bench to free up space
- Data showing peaks and troughs in deliveries was made visible along with a schedule for visits to main specimen reception to collect samples.

Small changes like the installation of the bench top photocopier made an enormous difference to staff engagement eliciting the comment "Lean helps get things done that we have been asking for for years."

In a later second phase of improvement, the specimen reception staff were asked to add the date and time stamping of every sample form to enable the service to accurately monitor end to end process performance and demand over time to meet a CPA requirement. A stamping machine was installed but the process and work area layout was not changed.

This change received a very negative response with comments like "people are now avoiding reception as it's so difficult to work in there at peak times." Staff members attributed this change to "Lean" and the situation quickly spiraled downwards to a crisis point where specimen turnaround times were being impacted with work carrying over to the following day.



Senior colleagues reacted immediately by working alongside specimen reception colleagues over the period of a few days to fully understand the process and concerns by doing the work themselves and the second phase of redesign was quickly agreed.

The work area was improved further to create two work cells for date/time stamping.

Samples are handled one at a time, date/time stamped and then sorted to centralised sorting boxes which have been further improved with colour coded name labels for fast identification.

At busiest times one sample type is taken to a bench for date / time stamping as there is currently insufficient space to accommodate the volume – this will form the next phase of improvement.

### **Measurable improvements and impact**

Provision of a desktop photocopier has removed a 65 metre journey and saved almost four minutes per case. Based on an average 60 journeys per week this equates to 195 kilometres travelled and 196 hours per year that is now used for value tasks.



Samples are now received, date stamped and collected by staff from the various benches within a few minutes of receipt.

Staff engagement with Lean thinking has been restored.

### **How will this be sustained and what is the potential for the future?**

The largest deliveries arrive during the afternoon and two people are unable to keep pace with the demand. At these times work is taken to a bench where further staff date stamp and sort samples.

Further improvement opportunities are being investigated to remove the need to split samples (and therefore photocopy the form) but working with users to supply two samples and forms where two tests are required.

Longer term improvement is required to create a large enough specimen reception area.

### **Contact**

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# CASE STUDY

## Creating an environment for improvement

Nottingham University Hospitals NHS Trust

### Summary

A number of factors contributed to the creation of an open environment that enables staff to raise concerns, ask questions and offer suggestions for improvements.

### Understanding the problem

Whilst the core lean team's attention was focused on improving the Urines process one member of staff who had attended a Lean Master class recognised that her own personal approach to working at the MRSA bench was different to her colleagues' methods (although still within the Standard Operating Procedure!).

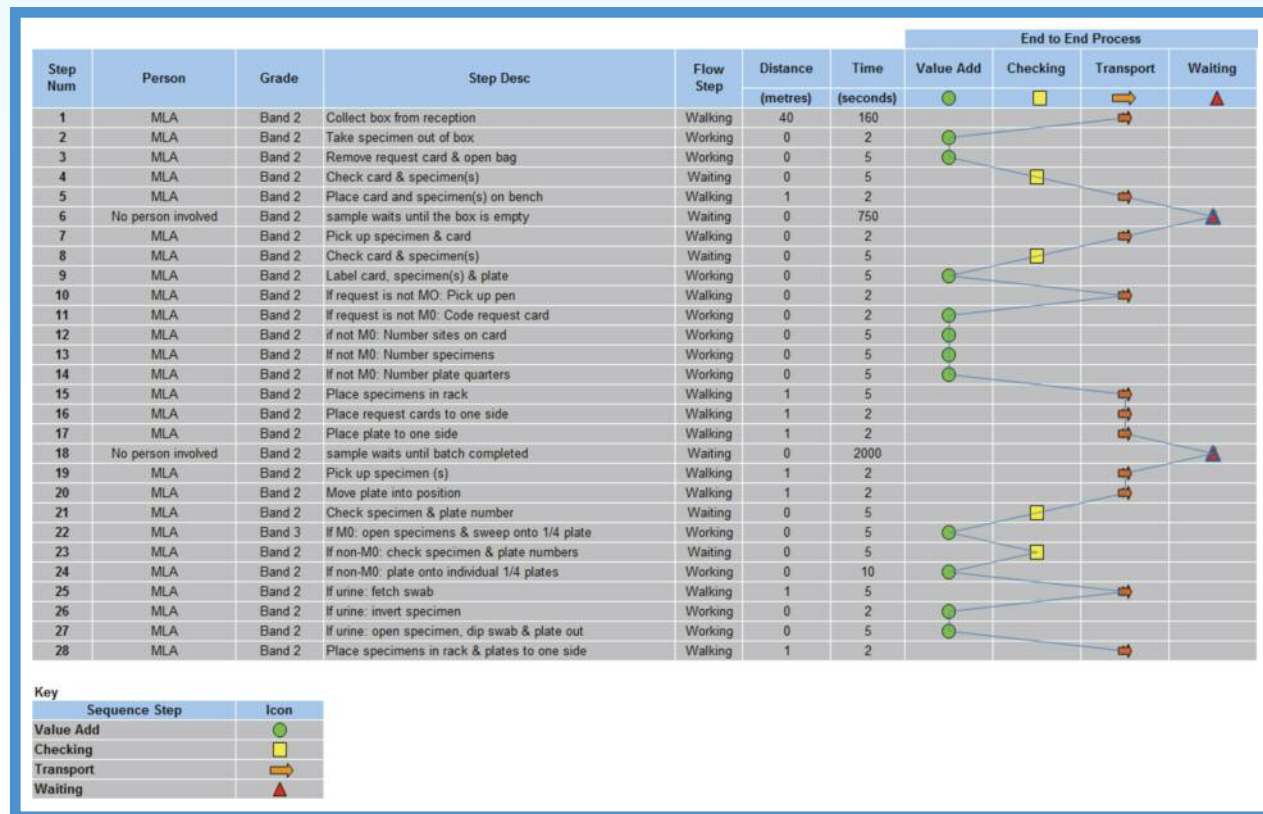
She brought her work method to the attention of the core team together with her assertion that it was more efficient.

The team supported her to evidence the improvement that her working method would deliver to engage colleagues in new standard work.

### How the changes were implemented

First steps in improvement were:

- Formation of a core Lean team – all job grades represented by enthusiastic and positive team members who worked collaboratively with the rest of the laboratory team to identify opportunities for improvement and test changes
- Introduction of daily huddles
- Creation of a communication centre where Lean information, problems and work in progress were shared
- Suggestions boards
- Lean drop in sessions.



The team worked with their colleague who offered the MRSA improvement suggestion on evidencing the benefits of a change to others.

They began with a timeline of activity to show the difference between the current process and the one piece flow that was suggested. They also used Process Sequence Charts (PSC) to capture the detailed process steps.

The PSC revealed waste in the form of multiple checks, waits and transportation as different parts of the process were done separately and in large batches. Samples were waiting for the whole batch to be completed before moving to the next stage in the process.

The proposed alternative process reduced steps from 28 to 16 and increased efficiency by 20%.

Simple visual aids were created to aid training in the new process as staff rotate around the laboratory. It includes instructions for handling large volumes of specimens at peak delivery times dividing tasks between staff members to ensure flow is maintained.

### Measurable improvements and impact

Handling samples in one piece flow rather than batching them into three steps removes 29 seconds of picking up, re-checking and putting down per sample.

With an annual workload of some 250,000 samples this equates to a time saving of 2014 hours or just over 250 working days.

Step Num	Person	Grade	Step Desc	Flow Step	Distance (metres)	Time (seconds)	End to End Process			
							Value Add	Checking	Transport	Waiting
1	MLA	Band 2	Collect box from reception	Walking	40	160	●	■	➔	▼
2	MLA	Band 2	Take specimen out of box (& date/time stamp)	Working	0	2	●		➔	
3	MLA	Band 2	Remove request bag & open bag	Working	0	5	●			
4	MLA	Band 2	Check card & specimen(s)	Waiting	0	5	●	■		
5	MLA	Band 2	Label card, specimen(s) & plate	Working	0	5	●			
6	MLA	Band 2	If request is not M0: pick up pen	Walking	0	2			➔	
7	MLA	Band 2	If request is not M0: code request card	Working	0	2	●			
8	MLA	Band 2	If not M0: number sites on card	Working	0	5	●			
9	MLA	Band 2	If not M0: number specimens	Working	0	5	●			
10	MLA	Band 2	If not M0: number plate quarters	Working	0	5	●			
11	MLA	Band 2	If M0: open specimens & sweep onto 1/4 plate	Working	0	5	●			
12	MLA	Band 2	If non-M0: plate onto individual 1/4 plates	Working	0	10	●			
13	MLA	Band 2	If urine: fetch swab	Walking	0	5			➔	
14	MLA	Band 2	If urine: invert specimen	Working	0	2	●			
15	MLA	Band 2	If urine: open specimen, dip swab & plate out	Working	0	5	●			
16	MLA	Band 2	Place specimens in rack & plates in tray	Walking	1	5			➔	

Key	
Sequence Step	Icon
Value Add	●
Checking	■
Transport	➔
Waiting	▼

### How will this be sustained and what is the potential for the future?

As improvement work has progressed staff engagement has increased to the point where the suggestions boards and Lean drop ins have become redundant. Questions and queries are raised on a daily basis either at huddles or in 1-2-1 conversations where staff members seek out a Lean team member, consultant or manager to discuss their idea.

### Contact

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## CASE STUDY

### Huddles - stop to fix

#### Northern Lincolnshire & Goole Hospitals NHS Foundation Trust - Scunthorpe

##### Summary

Twice daily huddles improve laboratory operations and reduce the time required for meetings.

##### Understanding the problem

Formal team communication was previously conducted through monthly meetings and sharing of the minutes.

Information was out of date by the time it reached staff and there was no interaction or feedback from staff.

Staff rotas took hours to prepare and were constantly changed and re-issued.

##### How the changes were implemented

Initially the meetings were once daily at 9.10 am. Staff posted issues on a board anonymously and the issues were discussed and allocated to someone to resolve.

As the late and on-call staff missed the morning meetings, the idea of holding a second meeting in the afternoon was raised and introduced at 4pm.

Initially staff were reluctant to join in. Over time, staff became more confident, sharing issues and becoming involved in solutions. The meetings are led by the team managers and on occasion staff members take a lead role.

Huddles make daily resource planning possible and straightforward, reducing the administration time previously required to manage changes. Staffing and workload data has become more visible and the team has been kept informed of actions being taken to address problems relating to staff shortages.

Communication with staff occurs at a time pertinent to the content of the information and there is no delay in staff receiving news that is relevant to them and their work. The daily meetings are recorded on a proforma for staff to refer to if they have been on leave.

The monthly formal meeting is now shorter and more focussed and efficient.

##### Measurable improvements and impact

Having the twice daily meetings has enhanced relationships and team working.

Problems are highlighted and dealt with more promptly.

The time spent in the monthly laboratory meeting has reduced by a third, as has the number of pages in the minutes.

##### Key learning

Communications are key to team performance and enable teams to manage more effectively particularly during times of pressure or major change.

Daily face to face communications ensure information sharing is open, timely and useful.

Issues boards are a good place to begin simple team problem solving activity but after time and with daily communications, problem solving becomes a part of daily work.

Daily meetings reduce wasted administration time and enable teams to plan daily work more effectively.

##### How will this be sustained and what is the potential for the future?

The twice daily meetings are now part of the ethos of the department.

Other disciplines have noticed the daily routine and have started the same practice.

##### Contact

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**DAILY MORNING MEETING PREPARATION**

Date: \_\_\_\_\_ Meeting taken by: \_\_\_\_\_

**FOCUS – HOW ARE WE DOING / WHAT DO I NEED TO DO TODAY?**

How did we do yesterday? Celebrate success!  
What are the 1, 2 or 3 key goals for the day? Who needs to be where, doing what?

	Reception			Consultant Covering	
	Cat 3 Lab			BMS On Call	
	MRSA			Staff on Leave	
	Mycology				
	Wounds				
	Genitales				
	Urines				
	Enterics				
	Media/Autoclave				
	Blood Cultures				

**CLARITY – WHAT DO I NEED TO KNOW?** (Messages / Communications to share with the team. Feedback on issues raised previously.)

**COMMITMENT – THE “STOP TO FIX” OPPORTUNITY** (Issues / problems – did everyone have a perfect day yesterday? No? Capture the problems and discuss how to resolve. Assign ownership and a timescale to feed back to the team. Some things will be a quick fix. Others will require investigation and take longer to resolve. USE VISUALS TO KEEP EVERYONE IN TOUCH!)

## CASE STUDY

# Engagement for successful change

## Northern Lincolnshire & Goole Hospitals NHS Foundation Trust - Scunthorpe

### Summary

- Early changes were not sustained
- Lessons were learned and the whole laboratory team engaged and involved in a week long improvement event to redesign bench flow.

### Understanding the problem

Having evidenced the performance of the process with value stream mapping, process sequence charts and defect data collection, the core Lean team implemented a series of changes at the urines bench to standardise small batch flow.

The department was experiencing instability as a result of high staff turnover and absence. The changes introduced failed to sustain.

It was decided to revisit the process along with others during a week-long focus – a rapid improvement event (RIE) – covering the majority of benches and involving the whole team on a daily basis.

### How the changes were implemented

- The laboratory had already taken steps to improve communication with the introduction of huddles – first once and then twice daily
- A significant investment in staff development involved the whole team attending a Lean awareness training day
- The consultant microbiologist and laboratory manager delivered lunchtime refresher sessions looking again at Lean tools and techniques in preparation for the RIE

- All staff participated in collecting base line data before the RIE including value stream maps, process sequence charts, spaghetti maps and defect data.
- During the RIE the team redesigned the majority of benches. Enthusiasm was such that one initially out of scope bench was included.
- A 'paper doll' exercise was performed, with blank lab layouts and scale models of the equipment and benches. All staff were invited to redesign the laboratory as they felt appropriate to support the best possible process
- A series of experiments were carried out to test ideas and adjustments and changes to the original plans were made and then implemented
- The IT department were involved to discuss IT problems and identify solutions with the team.

### Measurable improvements and impact

- Changes to the date stamping process released 2.5 hours MLA time per day (valued at £6,920 pa)
- Processing time saved due to introduction of flow processes and a dedicated MLA in specimen sorting (2 wte MLA - £57,830 pa)
- Savings in staff time following resolution of IT problems that hindered work flow (0.5 wte MLA 0.5 wte BMS £34,250 pa)
- Centralised management of telephone calls saving 2 hours per day staff time (BMS and MLA £ 7,545 pa)
- Defect reduction through improved management of negative urine reports - 90% reduction of over processing of negative urine specimens (100 specimens/week, assumed cost 75p per test £3,750 pa)

- Defect reduction - antenatal specimens sent to wrong laboratory solved by education of users (30 specimen reduction in staff processing time, transport and wasted specimens due to delay £4,700 PA)
- 25% improvement in space utilisation by new lab layout and 5S
- 100% staff involved in improvement projects
- Enhanced staff communication and relations.

Time savings have enabled the laboratory to manage workloads despite staff losses and 4.83 vacancies have been removed as part of pathology reconfiguration.

### Key learning

Some staff within microbiology at Scunthorpe had previously been given some rudimentary training on some aspects of Lean, but follow up, sustainability and incorporation into the laboratory culture was never achieved.

The core Lean team had been struggling to make an impact but after the RIE, performance, communication and ideas from the team was massively improved.

Visits to the histology laboratory in Lincoln were organised for staff to see for themselves and talk to their colleagues about how Lean was introduced there. The tools and techniques are now more relevant to the visiting microbiology staff and they have returned from the visits with new ideas and enthusiasm to make further changes.

### **How will this be sustained and what is the potential for the future?**

All of the laboratory staff are now involved with implementing improvements.

Staff are looking at the possibility of further improvements in the future in sections of the laboratory that were not part of the RIE.

Staff have ownership of the changes that have occurred and have taken responsibility for maintaining them and making further improvements.

Future work is planned with service users to reduce the defects associated with lack of understanding of each other's needs.

The team plans to do a deeper study of one of the work cells to understand takt time and flow. The learning from this cell will be applied to all work cells.

### **Contact**

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#6

# [voice of the customer]

## **What do patients and users want from microbiology?**

**Working in the new commissioning landscape will require pathology service providers to be responsive to user needs and to demonstrate and evidence the performance of their service in a meaningful way that is focussed on the quality and value of the service they are offering.**

Dr Hemel Desai, GP and Clinical Lead for the Transforming Pathology Services project, NHS East of England provided the East Midlands microbiology clinical and managerial leaders with a clear insight into what is important to primary care users and commissioners. His research revealed expectations that make it clear microbiology services have a responsibility to users and patients that begins well before the sample arrives in the laboratory.

## **Voice of the customer**

When redesigning services to meet user needs microbiology departments are recommended to consider the following feedback from GPs to Dr Desai:

- Treat us as customers – “can I telephone and get additional tests and results easily?”
- We require the following:
  - regular sample collection and delivery
  - a hassle free requesting process – “I have seven and a half minutes per patient to decide upon and request diagnostic tests”
  - timely results – with a recognition that there is often a wait for patients to action the next steps in their diagnosis by returning to the practice
  - a high degree of confidence in getting results back. Consistency across laboratory services is required because tests may be sent to multiple locations
  - advice available both pre and post analytical, for example, how to collect samples appropriately
  - access to the correct containers; which one for which sample?
  - quick and easy tests, for example, urine dip sticks are a good tool for decision making.

A survey of patients in the East of England revealed that they want:

- Easy, accessible sampling
- No repeat tests regardless of the reason
- Quick access to results by requesting clinician
- Information on how to provide samples
- Direct access to results.

Domain 4 of The NHS Operating Framework for 2012/13 - ensuring that people have a positive experience of care - requires all NHS organisations to actively seek out, respond positively and improve services in line with patient feedback.

There are a number of established methods and groups available to assist with patient engagement:

## **Patient Advice and Liaison Service (PALS)**

All Trusts have a Patient Advice and Liaison Service (PALS). This service has been introduced to ensure that the NHS listens to patients, their relatives, carers and friends, and answers their questions and resolves their concerns as quickly as possible - [www.pals.nhs.uk](http://www.pals.nhs.uk)

## **Patient Opinion website**

A website where patients can inform specific NHS organisations about their care allowing the organisations to provide a response - [www.patientopinion.org.uk](http://www.patientopinion.org.uk)



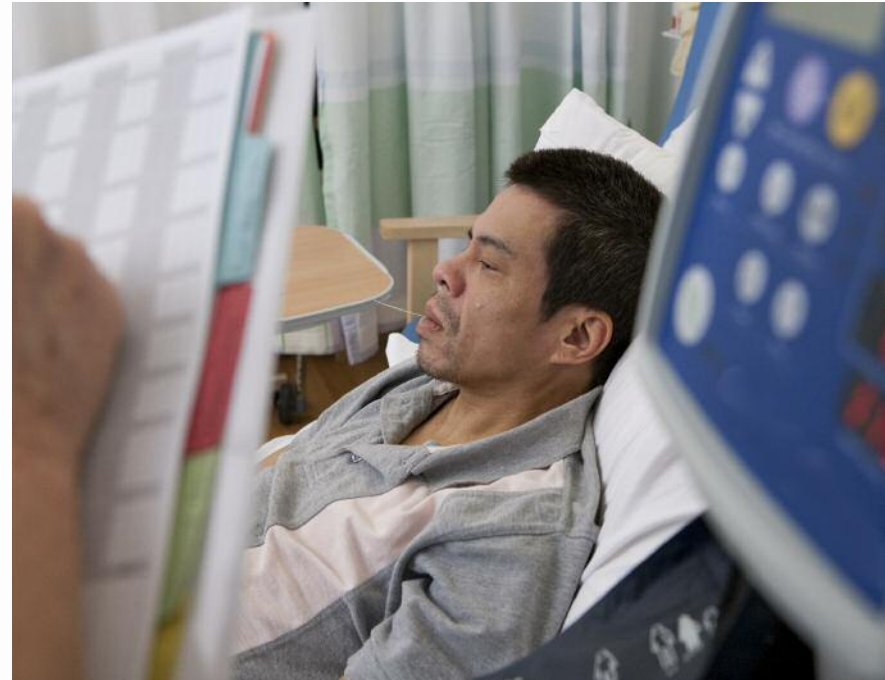
### **Engaging users to support improvement**

There are currently significant practical challenges that prevent end to end visibility of microbiology diagnostic testing not least the fact that many samples are produced by patients, in their own homes, to their own preferred timescales.

Microbiology departments must engage with patients and users to enlist their support in improving diagnostic pathways at the sample requesting stage. This could involve:

- Supporting users to request the appropriate test for the patient
- Identifying the correct container
- Education and information to confirm how to complete simplified request cards or mandatory fields in electronic requesting systems
- Providing date and time information – request and sample collection.

Visual management has been proven to influence considerable improvement in the quality of requesting and the reduction of inappropriate testing.



## CASE STUDY

# From laboratory to ward: engaging users as part of a laboratory improvement project

Whipps Cross University Hospital NHS Trust

### Summary

The change to a new primary urine container was an opportunity to increase engagement with users. This included visits to wards and GP practices, a “launch event” held in the hospital canteen, and creation of a visual aid designed to help users provide the correct sample types.

### Understanding the problem

The histopathology department at Whipps Cross had previously been a pilot site working with NHS Improvement with successful outcomes.

The results from this project acted as the inspiration for the microbiology department to start its own improvement programme.

A microbiology improvement group was set up including MLA, BMS, managerial, and medical staff with the support of the histopathology project leads (the laboratory manager and a consultant). This group decided that processing of urines would be a suitable area to focus on as this was the largest volume sample type received by the laboratory.

A sample pathway audit identified the three highest hospital users (antenatal clinic, A&E, and a surgical admissions ward) as well as three large GP practices.

Value stream mapping suggested that sample defects were a significant problem, and a specific defect audit identified a total of 15% of incorrect containers had been received in one week. These incorrect containers pose a storage problem and potential to be misplaced as they do not fit in either the storage or transport racks.

### How the changes were implemented

Introduction of a primary tube for collection of urine samples that could be used directly on analysers in both microbiology and biochemistry was suggested. The proposal was discussed and approved by the management groups of both departments.

The microbiology improvement group recognised that significant user engagement would be required prior to the introduction of the new tubes to prevent problems during the changeover. It was also recognised as an opportunity to engage with users more widely in order to understand what was important to them providing a steer on further improvement opportunities.

Ward visits were carried out by the consultant microbiologist, the chief BMS, and an MLA. Appointments were made to speak to doctors, nurses and midwives from these user groups to discuss current problems with urine samples, explain the advantages of the new tubes, and to demonstrate the use of the new tubes.

The consultant microbiologist also wrote to all hospital consultants and GP users to introduce the change. An A4 visual aid was produced to explain how a urine sample should be taken using the new containers, and this was sent out with the letters.

A more detailed A3 visual aid was designed for all microbiology samples. This provides information for request form completion and taking specimens as well as specimen types, containers, storage and transportation of specimens together with contact details of the laboratory. A laminated copy of this was to be placed in every clinical area where specimen containers were stored.

The productive ward team was approached to aid in ward staff engagement, and following a formal meeting, a launch event for the new primary urine tubes was held in the hospital canteen area, including a member of the productive ward team (PWT). This was held over lunch times for a period of four days, on the week prior to introduction of the new tubes and enabled the microbiology team to meet as many staff members as possible.

The press and communications department publicised the launch event through the trust email newsletter. The event stand was manned by members of the improvement group, including the consultant microbiologist who encouraged junior doctors to engage.

There was support from the manufacturer during the launch, which supplied pens and notepad incentives to attract interest and had representatives present to help answer questions.

The launch of the primary tubes and creation of the visual aids was also the subject of a medical grand round session conducted by the consultant microbiologist. This talk included a discussion of the importance of proper completion of request forms and an example of a serious incident resulting from a poorly completed form.

In order to accelerate the removal of old tubes visits were made to retrieve old stock and replace with the new primary tubes.

### Measurable improvements and impact

1. Minimising waste as a result of fewer samples being rejected (biochemistry rejected all samples sent in incorrect containers, meaning patients had to provide a repeat specimen)
2. Reducing the potential for errors due to the elimination of a decanting step in the laboratory
3. Reducing laboratory staff time due to removal of the decanting step and eliminating problems with storage.

The sample defect audit is being repeated to measure the improvement in incorrect container types received. A deadline for accepting these containers has been set. After this deadline all incorrect containers will be rejected with the addition of a comment instructing users on specific containers for specific tests.

### Key learning

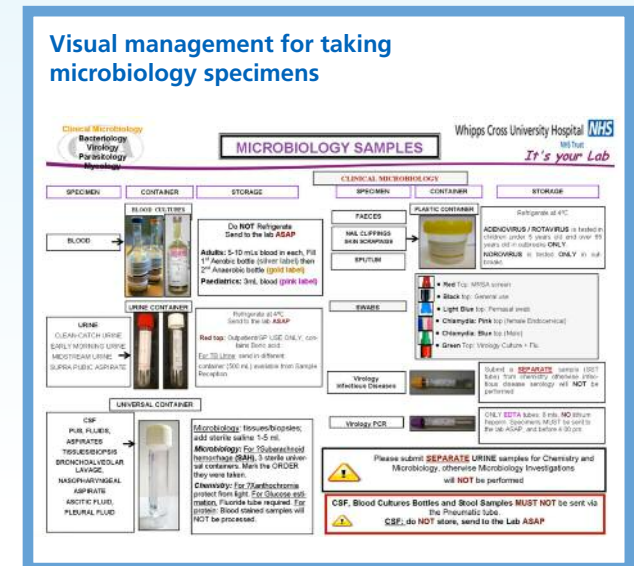
- Communication with staff around the hospital has given rise to new relationships and has improved knowledge and education amongst other departments
- The involvement of the PWT helping to organise the launch, as well as working with the Lean team to put together the visual aid and distributing this to the wards was valuable
- The influence of the consultant microbiologist was an added advantage in engaging with doctors
- The publicity through the email newsletter, the launch in the canteen and the medical grand round session all played a substantial part in the success of the introduction of the primary urine tubes
- The unsuccessful idea was the proposal for a visual aid for the whole of pathology. Although an attempt was made, after many meetings it was decided that pathology visual aid would be impractical as it would be too big and too chaotic. The microbiology visual aid was created instead.

### How this improvement benefits patients

- Safety for patients has improved as there is no decanting and therefore no possibility of sample mix-ups
- No need for repeat samples due to use of wrong container and the specimen being rejected by the lab.

### How will this be sustained and what is the potential for the future?

- The microbiology team have continued to visit the wards on a regular basis, speaking to nurses and healthcare assistants to reinforce messages about sample collection and answer any questions they have



- Work done in microbiology and histopathology has spread to central specimen reception, and the microbiology team have worked together with reception staff to start data collection and implement improvements in this area
- A project to redesign the request form is underway to help eliminate the issues that surround this area
- To implement Lean processes onto other benches starting with the HVS bench.

### Contact

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## CASE STUDY

# User engagement - ‘poducation’

## St Helens & Knowsley Teaching Hospitals NHS Trust - Whiston Hospital

### Summary

Safe use of the hospital air tube to transport blood culture bottles to the laboratory has stopped batching and ensured samples are placed on the analyser in a timely manner improving the probability of isolating bacteria of significance in patients.

### Understanding the problem

The pathology department at Whiston Hospital relocated to a corner of the new hospital site. This meant that ward staff and porters had to walk significantly further to deliver blood cultures.

This resulted in these samples being batched until somebody was going to the laboratory. This time delay between the samples being taken and being put onto the blood culture analyser delayed positive results and treatment

### How the changes were implemented

The microbiology department planned to introduce sending blood cultures through the air tube system as a pilot with two high volume users.

Before there was an opportunity to evaluate the pilot it became apparent that it was successful from the user's viewpoint as samples started arriving from sites that were not included in the original pilot.

A decision had to be made whether to stop the wards that had not yet been trained from sending blood cultures in this way or to accelerate the training to include as many locations as quickly as possible. It was decided to do the latter as the take up from the additional locations was an extremely good indicator of the success for users.

A Medical Laboratory Assistant (MLA) approached the laboratory manager and suggested that the training programme should be accelerated and volunteered to expand the training as soon as possible.

In addition to the training, visual management was produced and is displayed on every vacuum station in response to user demand to employ the vacuum tube to ensure safe and correct practice.

### Measurable improvements and impact

Blood culture samples are sent to the laboratory as they are taken from the patient and are put on the analyser as they arrive in the laboratory. This improves the probability of isolating bacteria of significance in these patients.

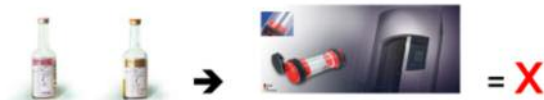
In addition, porters and ward staff do not break off from their usual duties to bring these specimens down to pathology:

- Increase from zero to 7,200 p.a. blood cultures arriving via the air tube
- About 90% of blood culture samples now arrive via the air tube
- The time taken to deliver blood cultures by staff is approximately nine minutes, which equates to just over 1,000 hours of walking removed per annum.

### Key learning

- The initiative was successful because pathology reacted to the needs and demands of the users. Users themselves highlighted the need to accelerate training for all departments and the department reacted promptly
- As the interface between users and the laboratory is well developed, it was possible to deliver the training in a compressed time period to provide assurance to all involved of the safety of the glass bottle in the air tube
- As pathology was relocating this was an issue that was perhaps overlooked due to the enormity of the move.

### Safe use of the POD system for transport of blood cultures



**BLOOD CULTURES MUST BE PLACED IN THE CORRECT CARRIER FOR TRANSPORT IN THE POD SYSTEM**



**THIS IS THE CORRECT TRANSPORTATION FOR BLOOD CULTURES**

### How this improvement benefits patients

Patient samples are analysed in a timely manner to identify bacteria of significance to ensure prompt treatment of infections.

### How will this be sustained and what is the potential for the future?

The improvement has sustained itself as it saves staff having to deliver a sample to the laboratory.

Engagement with users is on going.

Continued liaison with users and assessing any changes in requesting behaviour that indicates that a change in laboratory practice may be appropriate.

### Contact

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## CASE STUDY

# GP engagement when introducing a new urine collection system

St Helens & Knowsley Teaching Hospitals NHS Trust - Whiston Hospital

### Summary

Laboratory staff visited GP surgeries to introduce visual management and provide training in the use of algorithms for urine culture, leading to a reduction of 21% in inappropriate tests.

### Understanding the problem

The improvement team found significant inappropriate testing in the urines work stream which could be reduced to allow the department to release time to concentrate on value added activities in the areas of national importance (MRSA and C.Difficile testing).

A data gathering exercise was completed before the changes were made. This involved a multidisciplinary team from across the department and identified:

- 40% of urines tested were negative
- Inappropriate requests for urinalysis
- Poorly labelled forms and sample bottles.

### How the changes were implemented

From previous experience, it was clear that the laboratory needed to engage with the users and not make assumptions about what they wanted.

The primary care users were visited and key surgeries took part in a pilot scheme for the introduction of a new urine collection system. An earlier similar exercise had not been successful as users were not involved and assumptions were made about what was required by them.

The laboratory staff trained the surgery staff in the use of an algorithm and discussed the benefits to themselves, their patients and the laboratory.

A pilot study was run on several sites at the same time to introduce of a new sampling system for urine culture.

### Measurable improvements and impact

21.5% reduction in urine requests.

**“The new urine tubes are easier, safer and reduce the risk of cross infection.”**

**Infection control link nurse**

### Benefits achieved include:

- Health and safety improvements for staff as they no longer had to decant over 500 samples per day (no splashes or exposure to infections)
- Health and safety improvement for patients
  - no repeats due to cross contamination of samples
  - sample number mix ups mitigated.

### Key learning

- Never make assumptions - go out and visit your users - allow them the opportunity to ask you questions
- Ask questions of your users so you can provide the service they require, and not one you think they require.

### Things to do differently:

- Ensure staff are adequately trained in data gathering and analysis.

### How this improvement benefits patients

Improved safety and quality as new urine tubes do not require decanting reducing the opportunity for errors. Patients were not directly involved at the pilot sites, but they were asked for feedback on a questionnaire completed at the end of the pilot study.

All participants in the pilot gave a favourable response to the use of the new tubes.

#### Visual Management - Standard Work



#### Use Monovette Boric Acid Urine tube

Please fill to bottom of the label (see separate poster)  
Replace the stopper correctly to prevent leakage.

Label specimen with patient name, DOB or hospital  
number, location, date & time taken.

If high risk: label specimen & form with high risk sticker.

Transport to laboratory ASAP

#### How will this be sustained and what is the potential for the future?

From previous experience, staff recognised the possible failure of changes if users were not fully engaged and on board with the improvements.

#### Contact

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#7

# [understanding <sup>where</sup> you are]

## Base lining your service

**The first step of any improvement work is to create an understanding of what is actually happening, as distinct from what “should be” or is thought to be happening. Identifying the current situation should include the whole end to end journey of samples, not just in laboratory processes.**

The best way to do this is to ‘go see’. This means to physically walk the whole pathway and produce a photographic record of the process. It is recommended that this is done by the whole core team to ensure objectivity. It is clear that this activity is even more important in microbiology as much of the pathway before samples arrive is invisible.

Data from computer systems is often not representative of the process as samples may be booked in after they have been processed. Our experience has shown that few organisations are capturing the end to end process, excluding key steps such as date and time sample taken and date and time of sample receipt where booking in is taken as a proxy.

The pathway should be graphically represented as a current state value stream map. Measurements taken as part of value stream mapping will provide the baseline against which the impact of any changes to the process can be compared.

Every task undertaken while processing specimens will have an impact on turnaround times (TAT) and should therefore be included in baseline measurement. TAT is defined as the time the sample was taken from the patient to the date the result is available to their clinician.

## The purpose of measurement

- Understand the baseline position and how much improvement is made
- Set goals and ensure progress
- Prevent problems and errors
- Work with facts and not opinions
- Set standards
- Recognise success.

A single measure of end to end TAT is not as appropriate in microbiology as in some other Pathology disciplines. Learning has shown that the multiplicity of complex testing pathways demands individual measures that accurately reflect the behaviour and performance of each test.

High level % turnaround times used to track progress in the East Midlands sites failed to evidence the improvements teams achieved partly due to a lack of a standard approach to sample pathway measurement.

## Aligning measures to quality standards and outcome

One element of the new NHS Change model is transparent measurement. The narrative supporting this asks “are we measuring the outcome of the change continuously and transparently?”

Measures should be aligned to quality outcomes and international standards of cost, delivery, safety and morale.

## Measures in microbiology have included:

### Quality and safety

- Reducing avoidable harm with confidence that the result is accurate, eg. % errors in sample taking, request cards, data input and results letter
- Providing an accurate and timely result with relevant information e.g. information at time of test and with result
- % of requests received with omissions and/or defects in the data provided
- % staff trained to an agreed standard in a specific task.



**Efficiency - cost**

- Time saved by reducing waste
- Reduction in overtime costs
- Cost avoidance by bringing work back in-house
- Matching capacity and demand
- % equipment utilisation
- % staff availability and utilisation
- % staff absence
- Productivity
- Stock management, value and wastage.

**Delivery**

- End to end turnaround times – improvement against baseline.

**Team development and leadership - morale**

- Staff engagement
- Number of improvements delivered successfully
- Number of staff suggestions generated and implemented.

**Patient/user experience**

- Visibility of current laboratory turnaround times
- Critical results communication
- Clinical advice availability
- Patient and user feedback and complaints.

**Data collection**

Our experience has shown that laboratory information management systems (LIMS) are unlikely to support data capture and analysis of the end to end sample pathway. Where samples are processed and analysed before being booked in, the data will tell you little about process performance.

Manual data collection is often the only way to accurately represent both end to end and in-process turnaround times, until systems are established to collect the key stages of the end to end pathway. A sample of 100 is considered sufficient.

Defect data will require manual capture. The term 'defect' from the Lean perspective is any process that requires any element of extra work that prevents it from moving forwards along the process first time. For example, where a request form is missing a piece of information that requires a staff member to search or telephone for the information from another source.

A 'right first time' approach where every task can be completed within the reasonably expected time the task should take should be applied at every step of the process. Any task that requires extra activity and time should be considered a defect.

An additional defect type in pathology is an inappropriate test. These can occur where tests have been repeated unnecessarily, the wrong test type has been requested, the test is not performed to a standard protocol or where point of care testing has been completed but the user still sends the sample to the laboratory where it is repeated.

### Statistical process control

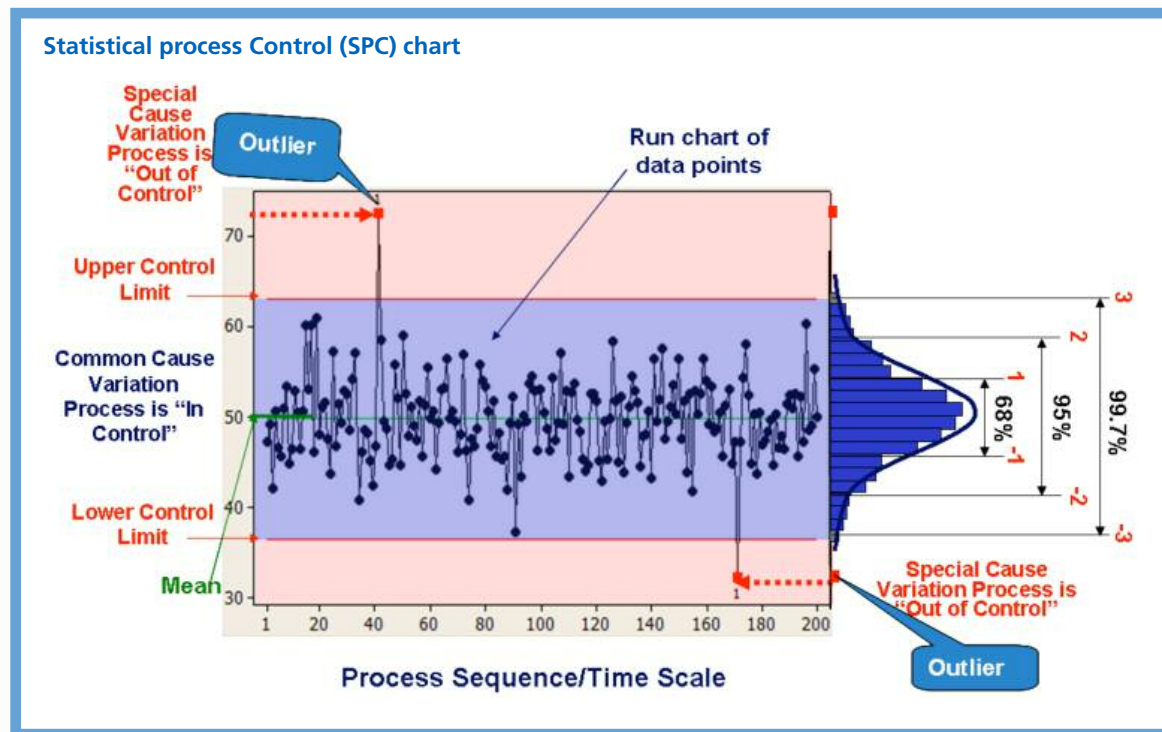
To determine the impact of changes made in the laboratory or other specific parts of the pathway process timings can be studied using statistical process control charts (SPC).

SPC will reveal variations in delay and wait times. Sources of waste can be detected, corrected and tracked to assess how or if these are reduced over time as a result of improvement changes.

SPC charts provide a graphical representation of the behaviour of the process being studied.

Statistical control limits are calculated from the data input and are displayed on the chart along with process average (mean) and its variation about that mean. If there is evidence of unusual variation or "special cause" (outlier) detected, then this 'special cause' should be investigated by using a root cause analysis technique.

SPC tools can be accessed via the NHS Improvement Reporting System or NHS Improvement excel data template. To find out more about SPC and the types of 'run rules' that are used to indicate out-of-statistical control situations please refer to our website or NHS Improvement publication "*Bringing Lean to Life: Making Processes Flow in Healthcare.*"



#8

# [a3 thinking<sup>for</sup> problem solving]

**A3 thinking is a simple problem solving approach that guides the user through understanding a problem, the root causes and planning counter measures. It enables the execution and communication of robust improvement via a single piece of A3 paper.**

Beginning with a consensus on the problem or issue you are trying to solve, the left hand side of the page is completed to document the current state. The right hand page is the innovative or experimental approach to solving the issue towards the future state.

Since Lean is primarily the description of a methodology to routinely solve problems everyday so that the daily work is delivered to specification, A3 thinking is the rigorous application of the Plan, Do, Check, Act (PDCA) approach.

It is the structured 'thinking' that is of most importance; the A3 report is of no significance in the absence of structured, agreed understanding and thought processes.

Describing the entire process – from current state, through analysis to future state on a single sheet of paper requires concise information. Creation of an A3 necessitates logical discussion and thinking, with ultimate agreement on experimentation to seek a better way forward. Distilling information to only the most relevant details for communication to the rest of the team ensures that a thorough understanding of the issue has been attained.

A precise A3 report prevents massive amounts of information being misinterpreted and inappropriate conclusions being reached by a multitude of staff. The best A3s convey the understanding of the problem and analysis without any explanation. Often, a graphical or pictorial representation of the issue at hand is better than a text summary.

The A3 report itself represents a shared understanding of the consensus of opinion on solving the problem. As a document, it encourages reflection on the learning that has taken place and ensures that a consistent message is able to be discussed and scrutinised. Ultimately, it allows the team to ensure that an agreed action plan is followed.

**A NUMBER OF DIFFERENT EXAMPLES OF THE USE OF A3 THINKING CAN BE FOUND AT THE BACK OF THIS DOCUMENT**

## CASE STUDY

# A3 problem solving – telephone calls

## Chesterfield Royal Hospital NHS Foundation Trust

### Summary

Communication between the laboratory and its users is an essential part of an efficient pathology service. However, microbiology staff felt that a number of 'phone calls into the laboratory were either inappropriate or ill-timed.

The core Lean team used A3 thinking to fully investigate the perceived problem.

### Understanding the problem

A simple template was developed for data collection. This was completed by all staff answering the telephone for 1 month capturing the time absorbed by telephone calls, their source and the nature of the calls.

### How the changes were implemented

Data was analysed by the core Lean team and then presented in graphical form to the laboratory staff for comments and suggestions regarding data collection methods. The laboratory staff were surprised to find that the data demonstrated the exact opposite of their perceptions.

The total cost in staff time for answering the telephone for one week is £64.91 of which 71% is attributed to MLA staff. The team agreed that this was not excessive and that the appropriate staff were answering calls for the majority of the time.

One improvement opportunity identified was to replace the fixed laboratory telephone handset with a portable telephone that allowed calls to be taken near benches eliminating the waste of motion.

### Key learning

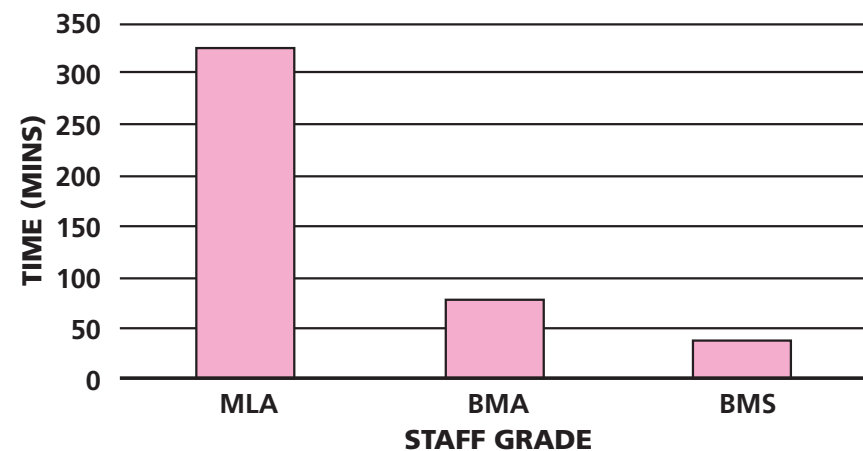
A3 thinking is a robust method for investigating perceived problems. In this case perceptions were proven to be essentially incorrect.

### How will this be sustained and what is the potential for the future?

The laboratory is undergoing major restructuring and as part of this process a central clerical and specimen sorting area will be created.

This will include a designated phone area which will be continually staffed by MLAs to significantly reduce the disruption to BMS staff.

Total time taken (per staff grade) on telephone calls



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# #9 [mapping<sup>the</sup> value stream]

- Lean improvement principles start and end with the customer. In microbiology it is the patient, GP, ward or clinic sending the sample
- A value stream map is created and used to describe all activities performed and the information required to produce and deliver the product or service (the result)
- A 'value adding' step is determined by whether the process changes the form, fit or function of the product or if the patient sees the 'worth' to them for that part of the process
- To ensure value in a process, the focus should be on improving flow, creating pull and striving for perfection.

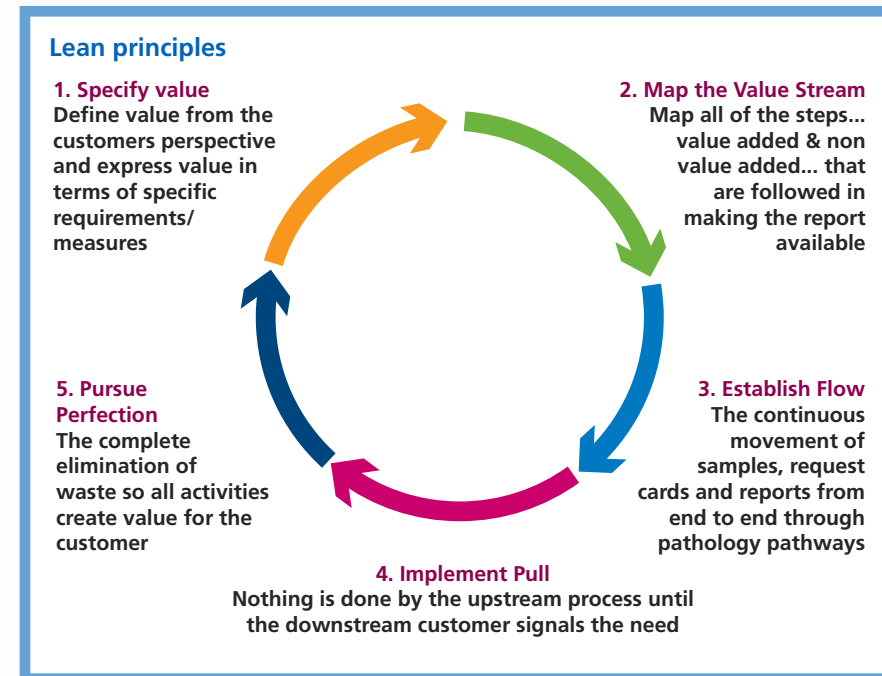
## What is a value stream map (VSM)?

A VSM captures and specifies activities, information and timing in a process. It differs from a process map in that it includes waiting times, inventory (bottlenecks) between steps, the number of people involved at each stage in the process, batch sizes, timings and defect rates. As well as identifying the trigger for each step of the process, it includes the movement of materials and the transfer of information.

It should ideally be a hand drawn representation of how all the steps in a process line up to deliver a service developed by a multidisciplinary team of people representing all roles in the patient pathway under review who have walked and observed the entire pathway.

The steps in the process are timed and categorised as value-added and non-value-added.

Teams will create more than one VSM. The first to show the current state or the way things are now. A subsequent VSM should be created to identify the 'Ideal' or 'Future' state; the idealised notions of the process in a perfect world, where all the steps are only value added steps. As improvements to current processes are made the current state VSM should be updated.



### Why do we need a VSM?

The purpose of a VSM is to:

- Provide the team with the customer (user/patient) perspective and keep focus on delivering to their expectations
- Provide a complete, fact-based, timed representation of the activities required to deliver a service
- Provide a common language and view to analyse the value stream and look for improvement opportunities
- Show how information moves to trigger and support the activities
- Show where activities add value and where they don't.

### How is a VSM created?

#### 1. Identify the pathway to be mapped

Start with high volume work streams where improvements are likely to yield the most significant benefits. For example: negative urine microscopy, negative MRSA, Chlamydia testing.

**Top tip:** Attempts to map the whole urines process with the multiple possible pathways a sample could follow will result in a very complex output that reveals little in the way of improvement opportunities.

#### 2. Represent the actual process

A VSM should be created to represent what is actually happening rather than what should be happening. The best way to capture the steps that a sample or patient goes through is to 'go see' or do a 'Gemba walk' - meaning to go to where the process happens and observe what actually happens and how long each step takes.

**Top tip:** Value stream mapping should only be attempted when every member of the team has walked the whole end to end pathway taken by a typical sample.



**3. Capture and analyse key data**

To understand and analyse the process, information is required including:

- Cycle time (the time required to complete one cycle of an operation; or to complete a function, job, or task from start to finish) The cycle time clock starts when work begins on the request and ends when the item is ready for delivery to the next stage of the process
- Waiting times (the time samples wait after completion of a step before the next)
- Changeover time (time required to prepare a device, machine, process, or system)
- Inventory levels (bottlenecks of work waiting for the next stage of the process to start)
- the number of staff carrying out the task.

This information is required to determine the 'Lead time'; the time taken from when the request is made to delivery of the result.

**4. Capture information and transport flows**

A VSM should also include a representation of how information moves in relation to samples and the transport of samples and requests both physically and electronically. This is critical to the timely and effective execution of the process. Location, quantity and frequency of information movement should be shown.

To identify this detail, some questions can be asked including:

- What information is being transmitted?
- When is the information being sent?
- Who receives the information?
- Where within the value stream is the information transmitted?
- What is the mechanism used to transport the information and sample?
- Is the information sent manually or electronically?

**5. Calculate the Lead time**

The lead time is how long it takes for one sample to move through the whole process from start to finish and includes transport, process time and waiting time. It should be from the time the sample is taken to the time the result is available to the clinician. Lead time includes value added (VA) and non value added (NVA) activities.

**6. Calculate the value processing time**

The value processing times is the time taken to complete the steps in the process which:

- Transform the product or service in some way
- Are performed correctly the first time
- The customer, user or patient would be willing to 'pay' for.

A quality VSM, developed from the observations of a multi-disciplinary team will tell you everything you need to know about where your process can be improved.

**Top tip:** To improve the quality of the process and therefore the outputs, start with the identification and elimination of defects. Inappropriate tests and rework inflate workloads and absorb resources inappropriately. Then focus efforts on reducing the waits between value steps.

**Webex resources**

A series of web based seminars that look at how to use Lean tools have been developed to assist teams and can be found on the NHS Improvement System. Email: [support@improvement.nhs.uk](mailto:support@improvement.nhs.uk) for your password.

### Process sequence charts

Whilst a VSM provides a high level view of a process and the potential improvement opportunities, process sequence charts (PSC) provide the fine detail that visualises every step in a process and whether each constitutes working, walking or waiting.

Preparation of process sequence charts requires close observation and scrutiny of a process before capturing it task by task, movement by movement. Having observed one person completing a process it is advisable to either observe further workers or to validate the chart with them to ensure it is a true representation. What is often discovered at this stage is the level of variation and lack of standard work in how processes are managed by different workers.

Processes should then be reviewed by studying the PSC line by line and asking which steps can be:

- Eliminated
- Combined
- Simplified
- Re-sequenced.

### Spaghetti mapping

A technique that is very easy to do and clearly visualises waste is spaghetti mapping. It requires either copies of estate maps (or a rough sketch) of the work area and a couple of different coloured pens alongside observation.

Watch and draw where the sample, the request card and the staff member moves. Every movement required to complete the journey of the sample should be included.

The result is a visible representation of the waste of motion that exists as a result of laboratory design and layout.





# #10 [demand & capacity]

## Definitions and measurement

In order to provide an effective service we must first understand the demand on the service and the capacity required to satisfy that demand.

Do not use activity data as a proxy for demand. A demand study looks at how many samples actually arrive and at what time (and often where from).

**Demand** is all requests for a service (what we should do), e.g. the number and type of samples and the time required to process them

**Capacity** is the quantity of staff / skills / kit we have available (what we could do), e.g. the number of samples one item of kit can process in an operating day or the number of swabs one FTE would be expected to process

**Backlog/queue** is the number of items 'waiting' (what we should have done), e.g. the number of samples waiting expressed in terms of time they would take to process

**Activity** is the work we got through in reality (what we actually did), e.g. the number of samples processed expressed in terms of time taken to process

When the demand and capacity are converted to time, excel tables and charts can be used to demonstrate the relationship between the two and potential for improvement.

## Understanding variation

Experience and evidence has demonstrated that many healthcare staff believe it is impossible to plan services to meet what is perceived to be unpredictable demand. Monitoring demand over time however will demonstrate how predictable it is. Capacity can be planned to reflect patterns of variation.

There are specific actions that cause variation, especially in pathology services. They include:

- Poor and infrequent transportation,
- Batch processing of samples with equipment designed to support efficiency of volume rather than the efficiency of flow
- Information transcription and IT applications.

All of these are under our control and can be changed.

Working in partnership with commissioners and Trust users will also enable departments to be alerted to special cause variation such as waiting list initiatives that produce a surge in demand.

## Reducing inappropriate demand

We know demand is rising in healthcare due to a variety of factors. However, we also know that many pathology tests are performed that are inappropriate or are duplicated unnecessarily.

The first step is to reduce inappropriate demand. This can be achieved by:

- discussing face to face with users the most appropriate test to diagnose the clinical condition;
- agreeing standard protocols and algorithms for testing;
- providing visual management at the point of testing; and
- continuing to educate users how to get the most from pathology testing.

### Reducing variation

Secondly, before attempting to match capacity to meet demand, it may be appropriate to consider how you might smooth variation in demand:

- Regular specimen transportation throughout the day (eg use of an air tube system, multiple van rounds)
- Reducing batching at all parts of the process (data entry/plating/plate reading)
- Eliminate the 'urgent' work-stream, adopting a first-in-first-out system - FIFO
- Pulling work through the process (only collecting work from specimen reception in the quantity required to optimise flow)
- Levelling the work schedule and synchronising processes to ensure optimal staff usage
- Balance staff shifts and holidays to ensure demand can be met
- Ensure staff skill sets meet the process requirements.

### Staff can work more effectively when variation is eliminated!

#### What do you need to do?

- Understand the demand on your service, measure it to identify patterns in variation
- Ensure correct skills / staff are available to deal with peaks and troughs in demand (smoothed where possible)
- Monitor demand and capacity against plan - weekly
- Increase capacity by removing waste (chapter 11)
- Do not assume 100% utilisation of your capacity - plan at 80% to allow for absence (annual leave, training, sickness etc)
- Use daily visual management to plan and report against:
  - demand (eg samples expected)
  - targets for activity based on capacity available (eg number of plates read, swabs cultured, urines processed)
  - the total number of samples outstanding
  - daily / weekly turnaround times shown in SPC to demonstrate variation in performance
  - root cause analysis (RCA) of issues/problems

- Agree and make backlog reduction plans visible
  - use temporary short term increase in capacity (overtime etc)
  - display progress against plan on a daily basis.

#### TOP TIP

**f a backlog exists and is constant, it is unlikely there is a problem with capacity!**

#### And some important don'ts

- Carve out – adding sorting steps to prioritise 'urgents' will cause a backlog and slow all the work down
- Use averages
- Plan at 100% utilisation of your skills and assets.

Business cases for additional capacity will be more robust if clear evidence of capacity and demand can be provided.

## CASE STUDY

# Flexible working to match capacity to demand

## University Hospitals of Leicester NHS Trust

### Summary

Equipment and department capacity has been increased to meet the demand for chlamydia screening.

### Understanding the problem

Departmental and Chlamydia Screening Office (CSO) turnaround times (TAT) were being breached. The equipment used in the testing has a finite capacity per working day which was insufficient to meet demand with the current way it was utilised. A backlog developed.

The laboratory had conducted a large scale 'time and motion' study in 2010 but had not been successful in implementing significant improvements due to various constraints.

### How the changes were implemented

The inventory data clearly showed peaks and troughs in the number of samples waiting to be processed during the day. The data was presented at a departmental meeting which included all staff.

The process for the chlamydia testing platform was discussed including the set processing time per batch of samples. In a given regular shift a finite number of samples may be tested.

The question put to the team was how to increase this number to deal with the backlog of samples?

A further rate limiting factor affecting the numbers being processed was the essential daily downtime of the testing machine for routine maintenance.

The team agreed to trial a voluntary early start rota. This was to enable the routine maintenance to be completed earlier and lengthen the 'working day' of the testing machine.

### Measurable improvements and impact

Following a range of improvements 82% of chlamydia screening samples are now reported within 24 hours despite spikes in workload by up to 59%. Patients are treated sooner, the backlog of work has reduced and staff have enhanced skill sets.

As a result of the early start rota the department is able to process 94 extra samples per day and patients receive their results sooner.

The staff have benefited as they have all had their training updated. Those who volunteered for the early rota like the opportunity to finish work earlier.

Once the 'early start' rota was established the demand study was conducted again evidencing a reduction in inventory throughout the day including a 36% reduction at 10am and a 64% reduction at 2pm.

### Key learning

Before any work was started on this Lean improvement project all staff were invited to attend a Lean thinking awareness presentation to explain the principles and benefits to be gained by the project.

This helped not only to allay fears of possible job losses but also to make everyone aware of potential gains through effective service delivery.

The programme supported by NHS Improvement has significantly accelerated improvements and provided the team with tried and tested tools and techniques to use for the long term.

### How will this be sustained and what is the potential for the future?

The new way of working is established practice as evidenced by individual training records for the BMA staff.

The new rota has benefited the laboratory in other areas as the BMA performs additional duties to ensure other equipment is ready for use by 9.00am

The improvements have been maintained and other processes within the laboratory are being examined.

The core Lean team has been proactive in raising the Lean project profile within the UHL Trust. Improvement efforts including chlamydia improvement data have been presented to the highest level of management at a meeting involving the CEO and executive board. Plans are also in place to develop a microbiology Lean website to share learning with the wider Trust.

### Contact

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## CASE STUDY

# Establishing a standard protocol for high volume tests that is shared with all users in their environment reduces inappropriate testing

St Helens & Knowsley Teaching Hospitals NHS Trust - Whiston Hospital

### Summary

Laboratory staff visited users on wards and in outpatients to introduce visual management and training in the use of algorithms for MRSA testing.

Inappropriate samples have been reduced and an additional workload of 38.4% for MRSA and 31% for Clostridium Difficile has been taken on at no additional cost.

Clostridium Difficile testing now takes place seven days per week - twice daily weekdays and once daily at weekends ie 12 times per week. Health and safety has also improved for patients and staff.

### Understanding the problem

Staff had been previously involved in Lean service improvement with NHS Improvement and with the help of their value stream map focussed on areas of challenge.

MRSA testing was identified as a 'green stream' (high volume) process as well as an area of national importance (year on year reduction in MRSA infection and 30% reduction in C.Difficile infection). C Difficile testing was only carried out three times per week

(Monday, Wednesday and Friday), which did not address the demand for a quick turn-around to reduce mortality, morbidity and cross infection.

The department management also wanted to reduce a high sickness rate by improving staff morale and working conditions.

### How the changes were implemented

A scoping meeting identified areas for improvement and a data gathering exercise was completed before the changes were made.

Information from users was obtained by visiting wards and departments to help to understand their needs. Giving users an opportunity to ask the laboratory staff questions during these visits also helped them to understand how the microbiology service works.

A visual aid detailing MRSA swab requirements was produced and the laboratory staff trained the hospital staff in the use of the algorithm, whilst informing them of the benefits to themselves, their patients and the laboratory.

C. Difficile testing was increased to every weekday and later to seven days per week.

### Measurable improvements and impact

Benefits achieved include;

- Saving money at £34,980 and staff time at 30.7 hours per week (bands 3-6)
- Increased workload for areas of national importance implemented without additional costs (CDT testing increased by 31% and MRSA testing increased by 38.4%)
- C.Difficile testing now takes place twice daily weekdays and once daily at weekends ie 12 times per week
- 99% of negative MRSA screens are now reported the day after receipt and 88% of MRSA positives are reported two days after receipt. Most of this is as a result of the introduction of a new media but also the extended working day and week
- Work previously sent to other labs has been brought back in house e.g viral serology of 30,000 samples per year (split between biochemistry and virology)
- Staff development – learning service improvement techniques and engaging with customers to shift focus to the patient

- Increased staff morale - all grades of staff are now comfortable with raising concerns or suggesting improvements to processes
- Lowered sickness rates - improved by 75% and frequently below the trust target of 4%
- Shorter TAT for samples - 30% without culture reported on the day of receipt increased to 42%, mainly due to continually reviewing the criteria for not culturing and the now well established extended working day and week.
- Appropriate testing introduced - a multidisciplinary team consisting of medical microbiologists and senior trust clinicians agreed guidelines for testing of suitable samples to prevent under-requesting as well as over-requesting
- A now well established extended working day and week has resulted in an increase in routine opening hours from 50.5 per week to 76 per week – an increase of over 50%.

### Key learning

- User engagement is essential to ensure changes are improvements
- Use visual management to clarify instructions
- Don't make assumptions about what your users want from the service – go out and visit them and ask
- Make your service available to answer questions from users
- Hold masterclasses or taster sessions in Lean improvement methodology
- Pick your improvement team carefully to ensure a cross section of job grades.

### How this improvement benefits patients

Visiting wards and seeing patients ensured that they are put at the heart of improvement efforts.

Microbiology staff realise they are part of a bigger team looking after the patient within the wider patient pathway, and see first-hand how the ward staff interact with patients and use their results.

*“It was obvious from the start how much the service to patients had benefited from the improvements that had been embraced by the whole department. A continuous improvement culture is totally embedded within the service which all grades of staff support.”*

**Chief Biomedical Scientist – Microbiology, who joined the team after improvement efforts began**

### How will this be sustained and what is the potential for the future?

TAT's are reported monthly to the trust executive team and action taken immediately if targets are not met. Through the data, problem areas can be identified and be corrected using Root Cause Analysis (RCA).

Improvement has been sustained because the staff have taken ownership of the changes and are proud of their achievements. The improvement has been spread throughout microbiology for all sample types.

The microbiology department now supports other departments with their improvement plans. Pre-op assessment and pharmacy have benefitted from help and support in service improvement from the microbiology team.

Planning is underway to increase C.Difficile testing to 3x daily in the week and twice on Saturday and Sunday – a total of 19 times per week- an example of the continuous nature of the improvements.

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## CASE STUDY

# Reducing inappropriate demand for MRSA testing

## Northampton General Hospital NHS Trust

### Summary

When a user requests a particular test the ICE system can be programmed to notify the requester that this test has been requested recently.

The user can then choose whether or not a further request is required which avoids unnecessary additional testing.

### Understanding the problem

The number of MRSA testing requests had been rising steadily since screening was implemented in 2008 and reached its peak in June 2010.

Audit revealed repeat requesting. As patients were moved from one ward to another they were screened for MRSA each time with some patients being screened multiple times during their stay in hospital. Most patients were screened more than once during their stay.

The majority of requests came from the admissions unit however the users in this area were not using electronic requesting.

### How the changes were implemented

Microbiology worked with users to implement a system of demand management which required the use of the ICE requesting system.

By ensuring that all of the users were using the electronic requesting system previous MRSA requests could be flagged so that clinical staff were aware that the test had already been requested.

Microbiology approached IT to request that a notification flag for MRSA be added to the system. The ICE system can query previous requests and display a message indicating when the test was last requested.

The user can make a clinical decision as to whether the test should be requested again or contact the laboratory for a result.

The microbiology department identified users that were not requesting tests electronically. The quality manager and the IT department then worked with these users to ensure that electronic requesting facilities were available.

### Measurable improvements and impact

The number of duplicate tests has reduced significantly over time and has now begun to level out at a screening rate more consistent with the number of patients.

At the peak of screening the department was processing 12,000 swabs for MRSA per month. The number of tests has now reduced to 7,000 per month. Based upon staff time, reagent costs and a positive rate of 1-2% with subsequent follow up investigations the department has saved up to £10,000 per month.

### How this improvement benefits patients

Patients have benefited as they have not been subjected to additional swabbing every time they are moved.

### How will this be sustained and what is the potential for the future?

The MRSA figures are monitored on a weekly basis. Microbiology provides data to the planning and development department to ensure that screening protocols are effective. Total numbers of tests are monitored monthly for unexpected increases in workload. Audits are done periodically to ensure that the electronic system is being used. As a result the numbers of MRSA tests have now decreased and are stable.

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# #11 [waste]

**Every process has waste. The foundation of Lean is the relentless pursuit and elimination of waste in all work activities.**

When we look at a process as a time line of activities, material (samples and consumables) and information (request cards and reports) whether in a value stream map or a process sequence chart, we see a significant percentage of waste. Often in excess of 90% of a sample journey is taken up by wasteful activity or waiting.

Some waste may be necessary within the current capability of the wider system the process operates within. For example, in microbiology, incubation periods to grow cultures and the transportation of samples to the laboratory.

A simple mnemonic exists to aid recall of nine wastes

## TIM A WOODS

### Transport

Material or information that is moved unnecessarily or repeatedly e.g. unnecessary movement of samples between benches or work areas.

### Inventory

Excess levels of stock in cupboards/store rooms, batches of specimens waiting to move to next step in process.

### Motion

Unnecessary walking, moving, bending or stretching e.g. equipment placed in the wrong location, unnecessary key strokes.

### Automation

Where technology is substituted to compensate for a poor or inefficient process.

### Waiting

Waiting for specimens, equipment or staff. Samples waiting to move to the next stage of the process.

### Overproduction

Producing something before it is required or producing more than is required e.g. unnecessary/inappropriate tests/batching specimens/tests/information.

### Over-processing

Duplication of data e.g. dual data entry, repeat testing, additional steps and checks that add no value to the process.

### Defects

Errors, omissions or anything not right first time e.g. poorly labelled specimens and requests, insufficient or illegible information.

### Skills utilisation

Unused employee skills e.g. highly qualified staff performing inappropriate tasks.

## WASTE COSTS MONEY AND ADDS TIME

## CASE STUDY

# Reducing the waste of walking to specimen reception

## Derby Hospitals NHS Foundation Trust

### Summary

Microbiology staff were making up to 70 trips a day to specimen reception to collect samples. Many trips were wasted as there were no samples ready for transfer into the laboratory.

The introduction of an intercom system has reduced trips to less than 30 per day.

### Understanding the problem

The team collected baseline data and calculated how many trips in total were made to sample reception. They also looked at how many of these trips involved taking samples back to be processed and how many were wasted time (no samples ready to collect).

The staff in specimen reception were feeling that they were constantly being pressurised for work. Being aware of colleagues waiting for work increased this pressure and they also experienced microbiology staff 'taking over' and trying to do the work themselves. This was leading to uneasy feelings between departments.

Communication between the departments was not effective.

### How the changes were implemented

An intercom system was in place but not being utilised to its full potential. It was decided that it could be used to inform the microbiology laboratory when samples are ready for collection.

Staff in specimen reception now call the microbiology laboratory to let them know when they put the first batch of completed work in a trolley.

They continue to fill the trolley with work until a microbiology colleague comes to collect.

The microbiology staff collect the trolley when they are ready for the work and this has created a pull system.

### Measurable improvements and impact

The intercom system was trialled for a two week period to ensure it was fit for purpose. After evaluation the amount of staff movement had reduced by 50%.

The 50% reduction in movement equates to four hours of Medical Laboratory Assistant time saved per week which is valued at approximately £2,200 per annum.

### How will this be sustained and what is the potential for the future?

Using the intercom was successful and is now standard work.

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## CASE STUDY

# Reducing overproduction on the genito-urinary (GU) bench in microbiology

Kettering General Hospital NHS Foundation Trust

### Summary

Combining the culturing of all genital swabs (instead of separating them into different sites e.g. vaginal or cervical swabs) has reduced waste, streamlined work flow and reduced duplication of tests and sensitivities.

An initial check by a qualified member of staff has enabled the Medical laboratory Assistant (MLA) staff to process samples to a high degree of quality and start the work sooner. This has resulted in staff cost savings and allowed a more even flow of work throughout the working day.

### Understanding the problem

The setting up and reading of genital cultures was originally split into either routine vaginal swabs or cervical/penile/postop/postnatal swabs.

This meant that data entry, paper forms, identification tests and sensitivities were often duplicated.

### How the changes were implemented

New stickers were produced with several different designs tried. The final design included features that helped spectacle wearers to differentiate sample types whilst doing the microscopy without glasses.

A list of the various samples and their culture requirements was taken from the Standard Operating Procedure and displayed in the sorting area as a visual guide to the procedure.

Samples are now processed together, plating up to two swabs from a single patient onto one culture plate. This is reducing waste of paper, photocopying, data entry errors, time, consumables and sensitivities.

Each request form has a sticker attached with details of the culture plates required and this is signed by a Biomedical Scientist (BMS). After this checking step, samples are processed by an MLA in the knowledge that the correct processes are carried out.

Culturing is started sooner in the day which enables a smoother work flow.

Culturing swabs from the same patient on one culture plate ensures more consistency of reporting and saves consumables and time.

Request forms are retained adjacent to the process ensuring quicker and more consistent data entry.

A checking step of the culture plates before their incubation, ensures they have been inoculated. This has prevented later rework which delays results.

### Measurable improvements and impact

The new method required an extra checking step (using the stickers) but subsequent culturing could be carried out by a Band 2 MLA instead of a Band 5/6 BMS and therefore became more efficient.

Time saved per year on reporting is 33.8 hours which equates to £566.

Time saved per year on reading cultures is 39 hours which equates to £652.

Total time saved p.a. is 72.8 hours of a BMS time worth £1,208.

### How will this be sustained and what is the potential for the future?

Changes have become standard work.

The team are moving on to look at combining GU culture and faeces benches for reading plates using one BMS instead of the current two.

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## CASE STUDY

### Skill mix changes

#### Kettering General Hospital NHS Foundation Trust

##### Summary

In the microbiology department the urine sensitivity tests were performed by a Band 5 Biomedical Scientist (BMS).

It was decided that this process could be performed by a Band 2 Medical Laboratory Assistant (MLA).

With the correct training and supervision, no loss of quality would be experienced but financial savings could be made.

##### Understanding the problem

During a review of staff skills it was established that time spent by a Band 5/6 BMS setting up sensitivity tests on urinary pathogens could be better utilised.

After initial plate reading, this task does not require interpretive skills.

##### How the changes were implemented

It was agreed that with the correct training and monitoring sensitivities could be more efficiently performed by a Band 2 MLA.

The BMS devised a system of marking colonies that were to have further tests, and labelling the required sensitivity agar plates.

Standardised inoculum technique was followed and zone sizes obtained are of excellent quality.

##### Measurable improvements and impact

The Biomedical Scientists benefit from having less bench work to do and therefore more time to plan work and perform other job role appropriate tasks.

The MLA staff were able to expand their role in the laboratory and learn new skills.

The changes meant that approx 2 hours of work each weekday (Monday to Friday) were done by a Band 2 instead of a Band 5.

The value difference between a B5 and a B2 for 2 hours per day is £3340.80 per annum.

##### Key learning

The present workflow was popular from the start.

Additional suggestions that the BMS reading the urine cultures could enter the results directly onto the LIMS initially proved unsuccessful within the current system. Further work in the future is needed in this area.

##### How will this be sustained and what is the potential for the future?

The department team are considering the movement of similar work in other areas in the laboratory to MLA colleagues.

This system of working could be transferred to sensitivity testing on other benches e.g. Swabs bench or MRSA screening.

##### Contact

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## CASE STUDY

# Skill mix changes for booking in

## University Hospitals of Leicester NHS Trust

### Summary

Pre-registration of request forms for urine samples has been moved from the laboratory staff to registration staff improving speed and efficiency and contributing to a reduction in turnaround time (TAT).

The movement of the process to the registration staff not only showed a time saving but it also reduced the cost of the process as it is now done at Band 2 rather than Bands 4, 5, 6 and 7.

### Understanding the problem

A gemba walk following a urine specimen through the process revealed that the pre-registration (known locally as ICEing) of the request forms was taking too long.

Time was being wasted logging on to a PC, and then on to ICE and then logging off after each batch. The staff grades doing this ranged from Band 2 to Band 7. The registration process was then completed later in the process by the registration staff.

The team were keen to ensure tasks are completed by the appropriate grades of staff.

### How the changes were implemented

The hypothesis was that moving the 'ICE' part of the process to the registration staff would remove wasted time as they would already be logged into the necessary programmes and could complete the whole registration process at once.

Timings were taken for both processes to evidence the case for moving the process.

The change was discussed with the registration staff. As they were involved in the timings they could clearly see that the change would make the process much leaner and was definitely an improvement. The small amount of extra work taken on by them was offset by the time saved in the lab.

### Measurable improvements and impact

	LAB BMA/BMS	Office BMA
Time taken to ICE a form	5.7 Seconds	2.3 Seconds

TOTAL SAVING PER ANNUM = 96 hours. Costed at Band 4 this equates to £1,390.08 although the task was being done by Bands 5, 6 and 7 at times.

### Key learning

The team has learned that small changes are not difficult to make and can be implemented swiftly providing there is sufficient evidence of the benefits to be achieved

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## CASE STUDY

# Improving sample filing

## University Hospitals of Leicester NHS Trust

### Summary

Samples are no longer transported unnecessarily or sorted into numerical order before filing.

### Understanding the problem

Once samples had been tested they were transferred to a storage tray and placed temporarily in the cold room. They would later be returned to the bench where they were sorted into numerical order and placed in another tray. These would then be stored in the freezer.

Samples were sorted into numerical order for filing approximately three times a day and the process would take, on average, five minutes each time. Staff and samples were also travelling nearly 50 metres for this process.

The process was observed and measured including the use of spaghetti mapping to evidence the waste in the process.

Root cause analysis revealed the reason for the sorting was that the team had never before questioned the practice - "we've always done it this way".

### How the changes were implemented

It was proposed at a morning huddle that samples no longer be sorted and instead should just be filed according to the rack batches they were tested in. The change was implemented for an agreed trial period.

At the end of the trial further measurements were taken to evidence whether an improvement had been achieved.

### Measurable improvements and impact

Removing the intermediate transfer of samples and then the sorting into numerical order has reduced staff and sample movement by over 18 metres. It has also eliminated five minutes of wasted staff time, three times a day, which adds up to 75 minutes saved per week.

75 minutes of Band 2 staff time per week adds up to almost £595 per annum.

### Key learning

It is important to look at the end-to-end process and to implement changes in all areas that may have been overlooked previously.

Even if a change seems small, lots of small changes can add up to have a greater effect.

### How this improvement benefits patients

Although sample filing is a small part of the CT/GC testing process and does not directly involve the patients or user, the overall aim was to free up staff time so that resources could be better used to improve the virology service.

### How will this be sustained and what is the potential for the future?

The new process has been tested and evidenced as successful. Standard operating procedures have been updated and all staff have been trained in the new standard work.

Turnaround time data continues to be monitored to identify any further opportunity for improvement.

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## CASE STUDY

# Removing over-processing in X,V and XV factor application

University Hospitals of Leicester NHS Trust

### Summary

For the identification of Haemophilus sp. X, V and XV discs are applied to an inoculated nutrient agar media plate.

The discs were purchased in small capped containers and applied using forceps. Changing to the use of a disc dispenser saves time.

### Understanding the problem

A common complaint from staff in BSAC was the way in which discs were being applied to the inoculated nutrient agar plates. All other discs (i.e antibiotic discs) were applied using disc dispensers. Each inoculated media plate required a BMA 4 or BMS to take 3 separate discs using forceps and apply them in turn to the plate.

The main issue was the amount of time it took to first uncap all the containers and then locate and sterilise a pair of forceps to place each disc individually.

Other problems encountered were that occasionally the discs were placed too close together resulting in the need for the test to be repeated.

### How the changes were implemented

Each step of the disc application process was timed and the baseline data was transferred to a Process Sequence chart.

The hypothesis was to buy the discs in cartridge form and apply them using a disc dispenser to save time and standardise the process.

A new process using a disc dispenser was timed and the data transferred to the process sequence chart.

Prices for the two different processes revealed that for each set of three discs a saving of 9.5p per test could be made with a move to the dispenser method.

### Measurable improvements and impact

The study showed that the number of steps was reduced by half in the new method and also the time taken to apply the discs to a batch of 16 plates was reduced by 307 seconds.

As a result of using a dispenser the discs are the correct distance apart every time improving the quality of the test.

The purchase price for the discs in cartridge form was cheaper releasing an actual saving of £433 per annum.

The data below shows the savings made when a Band 4 carries out the application of discs.

Costs	Baseline	New	Difference
Process Staff Costs	£1.64	£0.31	£1.33 saved
Other Costs	£3.84	£2.39	£1.45 saved
Per Item Cost	£0.34	£0.17	£0.17 per item saved
Annual Cost	£1,424.80	£702.00	£722.80 saved overall

### Key learning

Staff were very receptive to the idea, as it was clear from the work done to prove the hypothesis that the new method of disc application would save a lot of time and improve quality.

### How will this be sustained and what is the potential for the future?

New Standard Operating Procedures to include visual standard work sheets will support sustainability

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# #12 [root cause analysis]

“The important thing is not to stop questioning”

**Albert Einstein**

Effective analysis is crucial for finding and understanding the many potential causes of a problem. From those potential causes it is necessary to narrow the field and focus on the most significant ones.

Principles for root cause analysis are:

- 1. Do not allow analysis to be clouded by preconceived ideas of a problem's cause. Assumptions are likely to lead to poor workarounds rather than true resolution**
- 2. Do not depend on data alone to find the cause. Go to the location of the process and observe**
- 3. Analysis continues until it is certain that the true root cause(s) has been discovered – use the Five Whys technique**
- 4. In nearly all situations there are multiple causes of a problem – fishbone diagrams aid the analysis of each under the headings of Man, Method, Material, Machine and Environment**
- 5. The goal is to identify problem causes that can be corrected by the problem solver avoiding passing responsibility elsewhere**

Once the root cause is established, a sense check can be performed by working backwards from the root cause to the problem statement saying “therefore” between each “why” statement.

The root cause is rarely obvious and often the countermeasure cannot be implemented immediately as it must be tested and evaluated. Therefore, in the short term you may need to consider putting a containment or work around in place to prevent the problem from reoccurring until the countermeasure has been implemented.

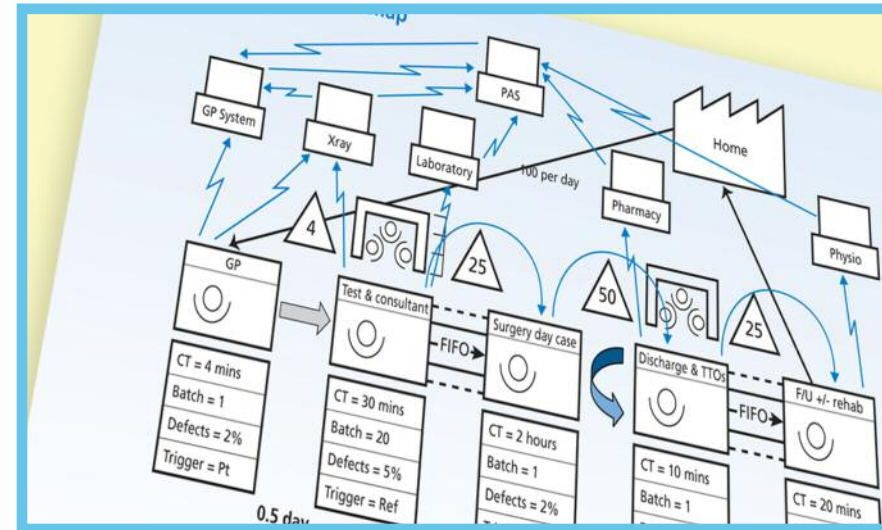
# #13 [future state mapping]

Once the problems with the current state map are identified, a new VSM, the future state map, can be created. A future state should be a process that eliminates waste while improving quality and customer response (shortening the overall lead time).

## Approaches to future state mapping

There are at least three ways to draw future state value stream maps:

1. **'Begin with the end'** - envision the ideal state where you assume anything is possible in terms of resource, equipment and IT utilisation and work your way back to an interim implementation time line such as 6 or 12 months.
2. **'Incremental approach'** - analysis of the current state value stream map will identify non value add steps that can be eliminated along with value add steps that can be either combined, simplified or re-sequenced to achieve the future state whilst bringing equipment closer together, reducing error rates or backlogs.
3. **'Recipe approach'** - follow a set of pre-agreed questions, examples of which follow:
  - what is the Takt time ('heart beat') of your current state versus future state?
  - how can we flow work with fewer interruptions?
  - where will supermarket pull systems be utilised?
  - at what single point in the pathway does production get triggered? (eg an analyser with a set pace and capacity)
  - how often will we check our performance against customer needs?
  - which steps create value and which steps are waste?
  - how do we control interruptions to the work, and how will work be triggered and prioritised?
  - how will we level the workload and/or different activities?



## Implementing the future state - move from 'seeing' to 'doing'

To implement these concepts effectively, it is necessary to apply process improvements such as increasing process yield or productivity, reducing defects, increasing value add time, reducing changeover time, and eliminating wasted time/motion (or other wastes) within the processes.

A structured brainstorming session will often identify key process improvements that would contribute to a Lean value stream.

Begin the implementation process as soon as possible by tying in implementation to a business objective. Ensure your future state is split into "loops" of process flow, normally the main stages of your value stream. Produce a 'value stream plan' of what to do, by when, always evaluating progress against targets. A3 thinking should be applied to each problem or improvement opportunity.

**Good processes are designed with a few, very simple principles in mind**

- Focus on value-add. For each step ensure that it is adding value from the customer's perspective. Many steps in a process add no value, and most time in a process is spent with nothing happening at all. Getting everyone to understand and focus on value is key to good process design.
- The time for any individual work item being processed to move from the start to the end of the process should be as short as possible. Elimination of waiting time in a process should be one of the key concerns. The quicker the process, the better managed and more reliable it has to be. Reducing cycle times forces you to make all sorts of other process improvements.
- Batching should be avoided wherever possible. Making one item wait for another may appear to increase the efficiency of an individual process step, but it slows down the process overall and leads to the consumption of extra resource.
- Doing anything before it is required by the next step in the process is over-production and should be avoided. Having one step go too quickly or start too early just leads to work in progress, waiting, the need for storage and the need for waste activities to manage the queue. Having people doing nothing on that process step is better than having produced lots of output that will not be used immediately.
- No duplication of activity. In many processes we see the same steps being done again and again, either due to poor reliability, lack of knowledge of what is going on elsewhere, or lack of confidence in the other parties involved in the process. Duplication should be eliminated, usually by improving the quality of the initial process step.



## CASE STUDY

# Involving staff in laboratory redesign

## Chesterfield Royal Hospital NHS Foundation Trust

### Summary

This case study describes how staff involvement in laboratory redesign can be achieved through use of the 2P (Process Preparation) planning tool.

### Understanding the problem

The Microbiology core Lean project team wanted to find a way to involve all staff in improvement efforts.

Spaghetti mapping of the laboratory processes showed room for improvement in the laboratory design and layout.

### How the changes were implemented

Staff were invited to an improvement event where they worked in four teams that represented all staff grades and included a Team manager responsible for the work area.

Following a Lean refresher and 2P training, each team analysed the requirements for their allocated work cell and shared their findings with the other teams.

The requirements included every aspect of the work such as numbers of staff, consumables and equipment.

Each team then created a laboratory design that incorporated the principles of Lean flow cells taking into consideration constraints such as the building structure.

One of the teams created a new specimen sorting cell within the new design.

Each of the teams produced a scaled plan and these were displayed within the department for all staff to review and discuss at huddles.

A spreadsheet was created for staff to score the plans and make individual comments. The scores were weighted according to importance and marked out of five against a set of questions following Lean principles. Each plan was awarded a total score and ranked in order.

A second improvement day was held to review the scores and comments and the winner announced. The Lean core team then developed a project implementation plan for the design.

### Measurable improvements and impact

Staff interest and engagement in Lean improvement was achieved.

The plans for the laboratory are expected to achieve efficiency savings due to waste reduction and Lean design of the future work processes.

### Key learning

The involvement of staff in the redesign of the laboratory has ensured that the expertise of the staff that do the work has been incorporated into the design.

The implementation is expected to be smoother because the staff have thought through the details and are satisfied with the redesign principles.

### How will this be sustained and what is the potential for the future?

The redesign is not yet fully implemented. The scheme will be measured against baseline data upon completion.

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# #14 [flow and pull]

## Base lining your service

Flow is about how work items move from the start to the end of a process.

The ideal state is that the sample moves from each value step to the next without delay from the point where it is collected until the result is with the clinician.

Process flow should be supported by the minimum possible resource with consumables made available at the point of need in the precise quantity required.

To achieve this ideal state, specimens would have to flow through the process one at a time with no transport, excess inventory, defects, rework or equipment break downs.

We can move our processes towards this ideal by application of standard methods of working (Chapter 18) with minimal variation, reorganise work environments using 5S (Chapter 16) and continually seek to reduce waste.

Flow is difficult because it doesn't fit with the natural way humans think. We tend to organise things into batches because we think it is more efficient. The principles of a Lean process are easier to grasp if you see them and participate in the process yourself in the form of practical exercises to demonstrate principles.

In single piece flow documents and specimens are handled less, use less space and are completed in less time without staff working any harder or faster. Whilst this is not entirely achievable in end to end laboratory processes, this document contains examples of single piece flow in use within processes. Batch size reduction has also been proven to deliver time savings.

Lean thinking suggests that where a process cannot flow, pull should be used as the next best alternative.

## Pull

### Where we cannot flow, pull

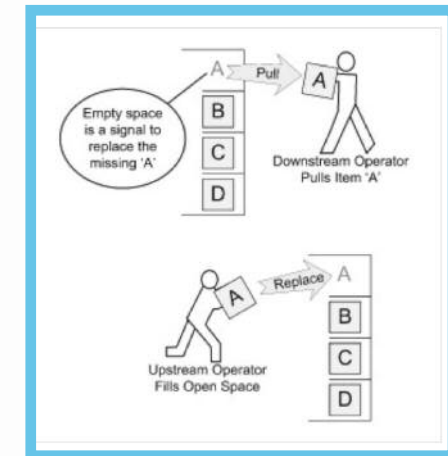
A 'pull' system is exactly what it sounds like. The production of a product or system is driven by the demand from the customer (or the next step in the process), not from forecasts or previous performance.

The core difference between a push system and a pull system is the process trigger. A push system uses a schedule based on prediction of demand. A pull system responds to real-world demand (or orders) and forces the upstream process to respond.

Work should be pulled through the process rather than pushed. Demand from downstream should define activity upstream. Most processes are designed as push processes. This is generally because they are easier to manage and do not rely on any real communications between the stages. Changing processes to work in 'pull' mode is a key part of moving to Lean.

Visual management systems, IT systems or the breaking down of functional boundaries can facilitate this, but it can also be one of the hardest principles to apply.

One of the most common examples of a pull system is a supermarket where only the specified amount of a product is placed on a shelf. When the product level runs low, the empty space acts as a signal for the stockperson to replenish the product.



In a laboratory the pull system should be driven by the customer (user/patient) demand which signals all the activities upstream to build or replenish what has been used. Upstream activities are not initiated until a signal from the steps downstream is received. Instead of building up an excess of samples at any step in the process, work should be performed only when the sample is required downstream – a “take one, make one” system.

In some testing pathways equipment determines the number of samples that should be prepared for processing. Unpacking every sample received in a delivery is pointless if they will then wait several hours before the processor can be reloaded.

When successfully implemented, pull systems result in fewer inventories (bottlenecks) through increased productivity, reduced floor space and faster processing of specimens.

## CASE STUDY

# Small batch sizes improve specimen flow and reduce the time taken to report negative UF100 results

Sherwood Forest Hospitals NHS Foundation Trust

### Summary

Sample flow was poor with backlogs of specimens often waiting to be processed.

The introduction of small batch sizes has improved sample flow resulting in no daily backlog and happier staff. The time taken to report a negative urine result from the UF100 analyser has significantly decreased.

### Understanding the problem

A value stream map and process sequence chart were completed to identify areas of waste and non-value adding steps. Several improvement opportunities were identified:

- Urine samples sorted in the reception area were placed into large 60 litre boxes for processing. Batch sizes could be as large as the number of samples the box could hold (up to 150 specimens)
- Staff bringing samples from reception would often place them on top of the earlier specimens in the box that were waiting to be processed. This resulted in later specimens being processed before earlier ones
- The Medical Laboratory Assistant (MLA) responsible for registration could be waiting for their colleague to process the specimens before having any work to do
- Racks of specimens were observed queuing on the UF100 waiting to be analysed and at other times the UF100 would sit idle
- Results from the UF100 could often be delayed as the request forms had not been registered

- Communication between the MLA staff and the Biomedical Scientist (BMS) on the section was sometimes poor which also caused a delay in the authorisation of UF100 results.

### How the changes were implemented

MLA staff decided on an optimal batch size of between 1 and 30 specimens. This enabled one MLA (instead of the usual two) to process the batch of urine specimens and register all of the request forms by the time the urines had finished on the analyser.

Other benefits were that the UF100 was not overloaded with specimens waiting for long periods of time to be analysed and by the time the results were ready on the UF100 analyser the request forms had been registered on the Laboratory Information Management System (LIMS) for the results to be transferred to the patient record.

To facilitate the smaller batch sizes and to ensure that specimens are processed on a "first in first out" basis, smaller 16 litre boxes have been purchased and labelled (Urines 1,2,3,4 etc) to identify which order the batches need to be processed in.

### Measurable improvements and impact

**Before** – turnaround time varied from 50 minutes to 4 hours 30 minutes.

**After** - turnaround times average 10 minutes.

MLA staff working on the urine section report feeling more relaxed and that they are now able to get all samples processed on the day of receipt. They actually enjoy working in the area even though they are now working on their own.

The potential cost saving based on taking a B3 WTE out of the process is £21,162. In this case the MLA was required to relieve pressures in other parts of the department and enabled the department to move to a seven day service.

### Key learning

Small batch sizes maintain 'first in first out' and requires less staff time.

### How this improvement benefits patients

Negative results are available earlier to clinicians. Having these results enables them to discharge patients, allows surgery to go ahead as planned and also patients' antibiotic treatment may be stopped if prescribed for a possible urinary tract infection.

### How will this be sustained and what is the potential for the future?

Turnaround times are continuously monitored to ensure improvements are sustained. Small batch sizes have been implemented in other areas in the department

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## CASE STUDY

# Automation to reduce resources and turnaround time

## Northampton General Hospital NHS Trust

### Summary

Introduction of automation has reduced turnaround times for processing urines with sensitivities from 48 hours down to 24 hours.

### Understanding the problem

Pre-November 2011 Northampton General Hospital was investigating urinary tract infections using automated microscopy analysis, followed by manual culture and BSAC sensitivities. Although approximately 40% of all urines received by the department were reported as negative, positive urines would take approximately 48 hours for culture and BSAC altogether. In particular, approximately 5% of all samples would require further antibiotic susceptibility testing; this would have taken approximately 72 hours in these cases.

The laboratory introduced automation with the intention of reducing turnaround times and to release staff for other processes.

The semi-automated laboratory method for the microbiological examination of urine samples, aids the diagnosis of urinary tract infections. The semi-automated system comprises an automated reader and sample analyser, as well as dispensing aid with 96 LED template, a multiple sample inoculator, 96 well format pre-poured media plates for bacterial identification and antibiotic susceptibility testing.

### How the changes were implemented

The equipment chosen was simple to implement and the preliminary setup took one day. The current process for microscopy was evaluated and deemed to be optimal in combination with the new system. Training of both BMS and BSW staff was conducted in conjunction with the supplier to ensure that the staff were fully competent. The equipment requires approximately 3 metres of bench space and is fully manoeuvrable.

### Measurable improvements and impact

TAT for urine analysis is reduced from 48 hours to 24 hours.

Samples are still processed as per the original method for automated microscopy however; positive samples are then processed using the automated system. Samples are processed in batches of 96 samples combining semi-automated culture and sensitivity testing at the same time.

Plates are read after 18 hours incubation ensuring approximately 80% are reported within 24 hours.

Approximately 97% of urine samples requiring further work for antibiotic susceptibility testing or ancillary testing are reported within 48 hours.

Although the system drives batch testing, the TAT's improve as a direct result of culture and sensitivity testing being performed simultaneously.

The new equipment has enabled the laboratory to reduce the total staff time spent on processing urine samples for microbiological analysis. Data evidences that the change in method has resulted in an approximate 70% reduction in processing time of urine samples for culture.

2.5 hours of BMS time has been released per day which is valued at approximately £2700. The time saved is being invested elsewhere in the laboratory.

The laboratory has offset the cost of introducing the new equipment (PA) with cost reductions achieved as a result of this change.

The quantity of media purchased for processing urines manually and by BSAC methods has reduced by approximately 70% resulting in a large cost reduction.

The laboratory has also experienced a cost reduction associated with disposal and wastage of media as less volume is disposed of.

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## CASE STUDY

# Small batch working in the urine process

University Hospitals of Leicester NHS Trust

### Summary

A complete review of the urine process from arrival in the laboratory to reporting of negative microscopy was undertaken.

Batches of 10 samples were piloted, timed, reviewed and embedded. 5S was applied to achieve the ideal bench layout to support the improved process.

The laboratory computer system (iLAB) was investigated and is now used to generate work file enquiry lists for samples requiring culture which eliminated several checking and sorting steps.

### Understanding the problem

A value stream map (VSM) and process sequence charts (PSC) for the urines process identified several points where samples waited before moving onto the next part of the process.

The process was slow and used biomedical scientist (BMS) time rather than being managed by more appropriate biomedical assistant (BMA) colleagues.

Automated urine microscopy is performed by two UF100s. The equipment generated a list of urines which, according to a preset algorithm, needed to be cultured. There are certain patient groups for whom samples are cultured regardless of the UF100 result - for example, certain age groups, renal patients, certain immunological status and pregnant women.

The process included a sorting stage before samples were loaded to the UF100 during which samples were separated into batches of 20 and between those patient groups that would definitely require culture and those that would be decided by the UF100. The request forms were then checked by a BMS to make sure that none of the patient groups had been missed. The work was done in batches of 20 because the racks used take 20 samples and the process had always been done in this way.

### How the changes were implemented

One of the earliest improvements was to move the pre-analytical processes closer to the urine bench.

This presented an opportunity to 5S the whole bench. Due to workload, this was undertaken in small chunks and involved as many of the staff as possible. The process was an ever evolving one, so labeling and shadowboxing to standardise the workstations was not complete until close to the end of the review when it was confirmed that each step was carried out in the most appropriate place for both the process and the staff.

A ten piece flow system was tested with timings taken and compared to the old 20 piece flow.

The pre-analytical sorting and checking steps for urines requiring culture were made highly visible by the PSC and it was obvious that this was one of the steps which, if eliminated, would both speed up the process and make it much more user friendly for the staff.

Discussion with staff from another laboratory with the same computer system revealed that they were able to generate work lists which would negate the sorting and checking.

Not only does this enable the removal of the sorting and checking steps, the generated lists have also streamlined the culturing process.

### Measurable improvements and impact

The movement to working in batches of 10 has made the process flow much more smoothly and samples move through the end to end process more quickly.

Registration of smaller batches has proven to be popular as 10 feels to be less of a chore than 20.

Time to process a batch of 20 urines = 15 minutes  
Time to process a batch of 10 Urines = 7 minutes  
2 batches of 10 = 14 minutes.

The total impact of all changes made across the urines process has so far improved process efficiency by 34% with 12 steps having been removed and 569 minutes (including waiting time) removed for every 20 samples

### **Key learning**

10 piece flow smooths the work flow through the busy afternoon times.

Using the computer system to generate the culture list is a huge improvement, both in terms of efficiency and staff satisfaction.

The best lesson was to learn from others and if something has been done before, don't try and do the same thing from scratch.

### **How will this be sustained and what is the potential for the future?**

New standard operating procedures to incorporate visual standard work sheets will support sustainability of the new standard work.

Work needs to be done on sustainability of 5S work to embed it in to the culture in the lab.

### **Contact**

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## CASE STUDY

# Reducing overprocessing in specimen reception

## Derby Hospitals NHS Foundation Trust

### Summary

Improving the flow of microbiology samples and reducing the wait time in pathology reception has been achieved by removing a sample sorting step completely from the process.

### Understanding the problem

Whilst mapping the process for MRSA samples the value stream map (VSM) clearly showed waste and delays whilst the samples underwent three sorting steps to separate them by sample type and investigations requested.

Samples were often building up at the sorting steps which required laboratory staff to assist main reception staff. The laboratory experienced peaks and troughs in work as a result with samples carrying over to the following day.

Observation revealed that samples were being sorted three times in specimen reception.

### Sort 1

Samples received mixed with chemistry samples. Samples separated between chemistry and microbiology.

### Sort 2

Microbiology samples sorted between 3 boxes – urines, swabs, 'other'.

### Sort 3

Further sort by bench e.g. swabs box sorted between MRSA, vaginal, cervical, GUM.

### How the changes were implemented

Two trials for sorting the specimens were conducted for one week each and the results measured.

#### Trial 1

Removal of the microbiology box at step 1 – samples sorted between chemistry and straight to the 3 microbiology boxes at step 2

#### Trial 2

Removal of the step 2 sort with the microbiology box from step 1 then being sorted by bench

### Measurable improvements and impact

Both new sorting methods produced equal results but the staff clearly had a preference for trial 1.

Prior to the improvement microbiology staff were spending 17% of their time in reception labelling samples.

After the improvement this has reduced to <1%.

Few or no samples are left for processing at the end of the day.

### Key learning

Involving staff at each stage of an improvement gives them a sense of ownership which leads to sustainability

### How this improvement benefits patients

Samples are now processed and sent to the microbiology lab the same day that they are received.

### How will this be sustained and what is the potential for the future?

The work area in specimen reception has been changed to provide more space and an additional computer terminal for data entry.

The improvement has sustained as the staff were involved in the design of the new sorting system.

### Contact

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## CASE STUDY

# Improving the flow of urines processing

## Nottingham University Hospitals NHS Trust

### Summary

Improvements to the process for urines from receipt to UF100 processing have reduced turnaround times without any additional resource within an environment of increasing work loads.

### Understanding the problem

The Microbiology Department at Nottingham University NHS Trust deals with over 600 urine specimens a day received from inpatients and General Practitioners (GP).

Significant pressure is being placed on the laboratory staff to support an increasing workload. These conditions were starting to have a negative effect on morale.

A3 thinking provided the team with a focused approach to measurement and root cause analysis and the identification of improvement opportunities including:

- Staff morale “the place is very stressful come the end of the day”
- Spaghetti mapping highlighted different pathways for the sample and request card
- Multiple sorting
- Variation in the flow of samples to the analysers.

As a consequence:

- Turnaround times (TAT) for GP samples was approximately 5 hours (median 3.1 hours)
- Overnight storage of some samples resulted in a TAT c. 25 hours
- TAT for inpatient samples was between <4hrs and 7 hours (median 3.1 hours).

### How the changes were implemented

Every member of the core Lean team undertook a “go see” exercise to experience first hand what was happening in the process.

This meant the Lean team fully understood the issues which were apparent in the data, and also encouraged laboratory staff to support suggested changes which they could see were based on the time spent working with them.

This was additionally supported by the provision of Lean awareness training for all laboratory staff.

Changes made included:

- Slowing the process down to match the pace of the automated analyser. Having tested the principles of flow and pull during their Lean training the team tested working in batches of 10 at a pace that ensured the two analysers were working continuously but poured samples were not “queuing” and results were not building up awaiting attention

- Moving the sample sort between GP and hospital (prioritised) to specimen reception
- 5S work area - bench and cupboards reorganised with cupboard doors removed. All areas labelled and taped to aid standard work and prompt replenishment of consumables
- Removal of pre-labelling of UF100 tubes - labelling is now done as part of one piece flow
- Removal of a demographic check which required BMS staff to check every request card against the laboratory system before any results were released.

Senior colleagues spent half a day working at the urines bench both to fully understand the process and also to help break down communication barriers having a significant impact on engagement.

### Measurable improvements and impact

Measurement confirmed the multiple improvements to the process resulted in:

- Increased staff morale - “process runs more smoothly and calmly”
- Removal of wasteful steps which have improved flow with a removal of excessive checking (demo-checking) has reduced the processing time for negative samples by 43% (from 2.3 hours to 1.3 hours)
- Smoother flow of samples being processed

- GP median TAT reduced by 45% (mean TAT reduced by 29%)
- Inpatient median TAT reduced by 23% (mean TAT reduced by 23%)
- Overall, TAT for all negative samples has been reduced by 45% (median 3.1 hours to 1.7 hours).

The number of samples processed via the automated analyser (UF100) has increased by 11%.

### **Key learning**

Identifying the right core team members who are able to contribute to the team effort and work in isolation on allocated responsibilities.

Weekly Lean drop in sessions were held to enable staff to raise concerns and questions and to increase their knowledge and understanding.

The core team has evolved to reflect the changes being worked on. Appropriate colleagues are invited to join the team to continually develop individuals and the overall team capability in improvement.

### **Contact**

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## CASE STUDY

# Achieving flow of work in HVS microscopy

## Northampton General Hospital NHS Trust

### Summary

A system of tag working was introduced to share the workload between available Biomedical Scientists (BMS) at the beginning of the day.

Once the first BMS has read their allocation, they alert the next BMS and so on.

### Understanding the problem

Large numbers of HVS microscopies were being left for the on-call member of staff. They were allocated to the BMS2 on swabs bench but were placed at the end of the standard work, and there was often not enough time during the day to complete them.

A solution was required that would minimise disruption to individual members of staff during the day and to prevent the on-call person from having to read a day's worth of HVS microscopies.

A backlog of work resulted in an increase in turnaround time which impacted on patients.

### How the changes were implemented

Once the problem was identified a suggestion was offered to the team.

A couple of minutes at the morning huddle is taken to identify the number of HVS microscopies and to divide them amongst available staff.

A trial was run to see if it would make an improvement to the service. Results showed that the HVS microscopies were being read during the day.

Data was used to evidence that the trial was beneficial to the laboratory staff and users of the service before the process became the new standard work.

### Measurable improvements and impact

HVS microscopies are read earlier in the day reducing turnaround times meaning patients/doctors can receive results faster and can begin treatment earlier.

The average turnaround time has reduced from 16.5 hours to 7.2 hours - a reduction of 56%

### How will this be sustained and what is the potential for the future?

Training more BMS band 5's to read HVS microscopies, to reduce further the number that an individual reads each day.

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# #15 [takt time]

**Takt time is the rate at which units of work must be completed to meet customer demand.**

It is calculated as the total available work time per day / shift (in minutes) divided by required daily output quantity (e.g. number of samples).

### Takt time calculation

$$\text{Takt time} = \frac{\text{Net work time available in minutes per shift, week or month}}{\text{Demand per shift, week or month}}$$

Once takt is calculated it can be used to determine the capacity required to complete each task.

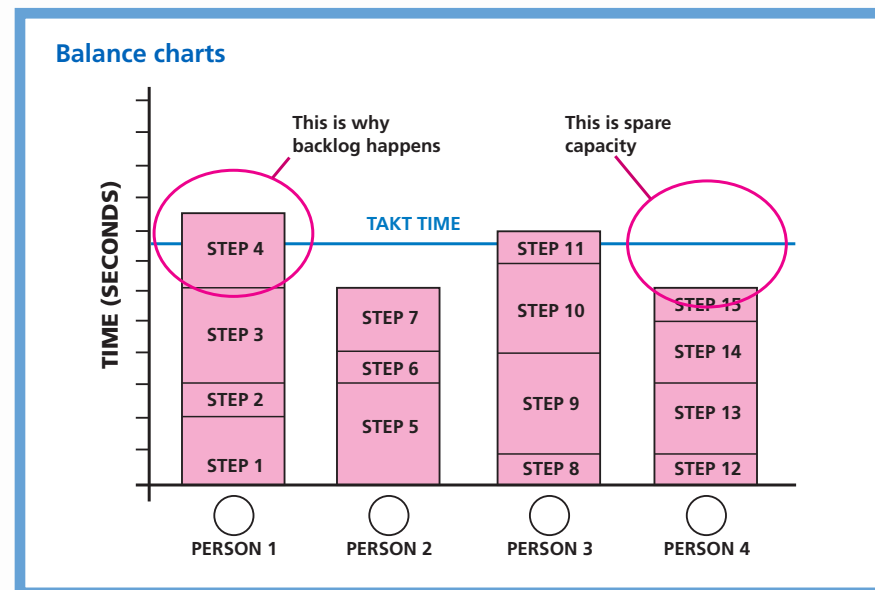
### Using takt to calculate booking in staff

$$\text{Number of staff} = \frac{\text{Booking in} = 180 \text{ seconds}}{\text{Takt time} = 152 \text{ seconds}}$$

**i.e. if a request form needs to be completed at a rate of 1 every 152 seconds and booking takes 180 seconds we need 1.2 WTE to book in**

Process steps can be mapped against takt to show where steps are required to bring each process within takt time. For example:

- Removing waste
- Removing tasks to different parts of the process
- Balancing workload between staff – eg two staff at a process that takes 50 seconds will complete one sample every 25 seconds.



A word of caution – takt is challenging to achieve where equipment has a fixed capacity and operating time (for example, a UF100 that takes a maximum number of samples at a time and can only be loaded every X minutes).

It becomes more appropriate initially to match the pace of the preceding processes to keep the equipment working to maximum capacity although longer term improvement may involve moving to smaller batch equipment.

## CASE STUDY

# Relocating a task to balance workloads

## Northampton General Hospital NHS Trust

### Summary

It was necessary to change mycology processing practice from a single task to an integrated one due to a continual build-up of unprocessed samples.

Incorporation of mycology samples with wound swabs, using standard work practice, allowed for daily processing to be achieved.

The improvement was achieved without extra staff and without extending the working day.

Mycology turnaround times are longer due to the nature of the sample type but with daily processing only the minimum time is taken to get a result to the patient.

### Understanding the problem

Mycology samples were not being processed in a timely manner due to inappropriate staff allocation to the task.

The staff member on stores duty had previously been responsible for managing the mycology task as an 'add-on' to their duties which they were expected to complete 'sometime in the afternoon'.

This didn't always happen and as a result a backlog in excess of 160 samples had built up.

Mycology samples already have an extended turnaround time due to the incubation process and this was only exacerbated by the back log meaning patients were not getting results within an appropriate time scale.

### How the changes were implemented

Mycology samples were integrated with wound swabs.

The small amount of equipment required was relocated to the wound swab bench and mycology samples are added to wound swab racks at reception.

Training time was required but overall resources were reduced as no extra individual staff member was required for the task.

### Measurable improvements and impact

The mycology samples are processed in flow with the wound swabs and do not incur noticeably extra time for staff working at this bench.

The turnaround time for samples was reduced and the back log was eliminated. Samples that had previously waited for two weeks due to a backlog are now turned around in 48 hours.

Patients receive results in a timely manner and can commence with an appropriate treatment plan where necessary.

### How will this be sustained and what is the potential for the future?

Incorporation of samples that require a similar/same process technique was a successful move.

Free space made by relocating mycology was a benefit as other processes could use the space more effectively.

The unsuccessful aspect was that this wasn't done sooner, but subsequently this has been used as a lesson to tackle other 'single task' issues in other areas of the laboratory.

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## CASE STUDY

# Moving sample registration into real time

## University Hospitals of Leicester NHS Trust

### Summary

As part of efforts to improve the urines process, the team identified the need for real time registration of the request forms.

Bio Medical Assistant (BMA) registration staff were asked to move into the laboratory so that there could be an exchange of skills between them and BMA laboratory staff.

### Understanding the problem

Baseline data revealed variation in turnaround time for request cards from arrival to registration.

Request forms were registered by the BMA registration staff in an office area. They were often treated as a low priority, sometimes not being done until the day after receipt. This delayed negative result reports being released with a potential for delaying diagnosis for the patient.

Most of the registration BMAs had no experience in laboratory work.

At the same time that this change was being made in Bacteriology, an improvement team was working to achieve the same real-time registration of forms for chlamydia testing.

### How the changes were implemented

An improvement team drawn from all roles in the laboratory followed a Plan, Do, Check, Act (PDCA) cycle.

Using baseline data, the plan to move the registration of forms to the laboratory for both virology and bacteriology was shared with all staff. The registration BMAs were asked to choose between the two areas as part of the "Do" phase of the test cycle.

There were a number of concerns about the integration in to Bacteriology so as a half way step, it was decided to move the booking in and registration of blood cultures in to the office. This facilitated training of registration BMA staff in a laboratory process that was perceived as 'clean' and was received positively.

Communication was essential and meetings were held to discuss concerns raised by the staff. It was important that all staff understood the change was being made on the basis of data. It was also part of a PDCA cycle that meant the change would be reversed if unsuccessful.

Time was invested to ensure that work stations within the laboratory were fit for purpose and in response to requests from the team the office supervisor drew up rotas so that staff knew where they were expected to be and when.

### Measurable improvements and impact

**Before** – negative results took up to 48 hours to release.

**After** – TAT reduced to 3 hours.

In addition to the improvement in turnaround times for patients and users, the staff have said:

"It's much quicker - there doesn't seem to have been much impact on the other work in the office and we don't come in to a big pile of urine forms in the morning waiting to be done."

"It's been good to learn other things apart from registration."

"It's been much better than we thought and it doesn't seem to have had any effect on the other work."

### Key learning

The process for discussing change with the staff took longer than the whole team felt was necessary. It would have been better had the integration taken place sooner. This could have been achieved with more direct proactive management.

Once the move took place - the registration staff took charge of their rota which works well.

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# #16 [5S]

- **5S means the workplace is clean and safe - a place for everything and everything is in its place**
- **5S is the starting point for implementing improvements to a process**
- **To ensure your gains are sustainable, you must start with a firm foundation**
- **Its strength is contingent upon the employees and organisation being committed to maintaining it.**

### Top tip

Unless you are working in a small area don't undertake 5S for the whole department at once. You will overwhelm everyone and you will risk shuffling unnecessary items around, rather than eliminating them. Before you start the 5S process determine the boundary of the area you are addressing. Do not 5S another individual's workspace unless they are undertaking it with you!

5S is one of the foundations for Lean as it:

- **Reduces waste**
- **Means less searching and decreases walking and motion**
- **Reduces downtime, accidents and mistakes**
- **Improves flow**
- **Makes better use of space.**

It is also a precursor to other tools such as:

- **Pull systems/inventory replenishment**
- **Standardised work**
- **Setup reduction**
- **Mistake-proofing.**

**5S stands for:**

### **SORT**

- Start in one area and scrutinise every item
- Separate and remove clutter and items not needed in the workspace
- Discuss removal of items with all staff involved
- Use appropriate disposal, decontamination, environmental and safety procedures
- Items that cannot be immediately removed should be tagged for later removal.

### **SET IN ORDER/ STRAIGHTEN**

- Arrange and organise all items to minimise movement
- Items used together should be kept together
- Use labels, tape, floor markings, signs, and shadow boards
- Shared items should be kept at a central location
- "Everything in its place" frees up time for cleaning.

### **SHINE (AND INSPECT)**

- Clean the area, workspace, storage, equipment, etc. and inspect for warning signs of breakdowns
- Ensure you identify individual responsibilities for cleaning to eliminate 'no man's land.'
- Cleaning the work area is like bathing. It relieves stress and strain, removes sweat and dirt, and prepares the body for the next day
- We must keep the work place neat enough for visual identifiers to be effective in uncovering hidden problems.

### STANDARDISE

- Identify an area to store 5S supplies (cleaning supplies, labels, coloured tape, boxes and other necessary items)
- Schedule time and responsibility for restoring work area to proper condition regularly
- Develop a system that enables everyone in the workplace to see problems when they occur.

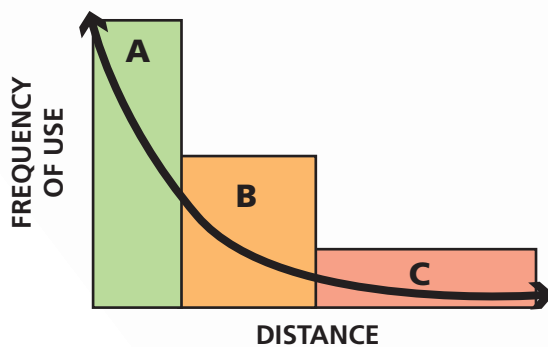
### SUSTAIN

- Audit the area regularly and expand 5S activity to other areas
- To maintain discipline, practice and repeat until it becomes a way of life - good habits are hard to establish
- Commitment and discipline toward housekeeping are essential first steps toward being world class.

### Why use 5S at all:

- A clean workplace indicates a quality product and process. Dust and dirt cause product contamination and potential health hazards
- Creates a safer work area
- Gains space, removes waste and shortens travel distances
- Visually shows what is required or is out of place and so saves time not searching for items
- More efficient to find items and documents (silhouettes/labels/shadow marking).

Use this graph and table as a general guide for deciding where to store items.



Frequency of utilisation	Class	Keep within aims reach	Keep in local location	Keep within aims reach
Daily or several times a day	A	YES	MAYBE	NO
Weekly	B	MAYBE	YES	NO
Monthly or quarterly	C	NO	NO	YES



## CASE STUDY

# '5S' saves time in the category 3 room

## Kettering General Hospital NHS Foundation Trust

### Summary

Walking the specimen pathway showed the category 3 room to be cluttered.

Reorganisation and rationalisation of the workflow in the room was achieved by application of 5S and spaghetti mapping with process timings.

Improvements enable colleagues to work more efficiently with more time to carry out routine tasks including cleaning/maintenance of equipment.

### Understanding the problem

The category 3 room is a busy, isolated room located outside the main Microbiology laboratory. It is a small space with limited storage that had become cluttered over time with excess stock and surplus equipment. The room needed to be reorganised and stock items stored elsewhere in an appropriate place.

Multiple stock locations resulted in poor stock rotation and stock locations would often be found to be empty.

Safe working in the category 3 room requires the staff member to wear additional personal protective equipment (surgical gown and gloves). To replenish reduced stock items the operator had to un-gown/glove, walk to the appropriate stores area and re-gown/glove on return to continue working. This was a waste of working time.

Request forms for all samples processed for Mycobacterial culture were stored in the category 3 room in an old filing cabinet. The system in use resulted in non-standard work as some records were also kept in the main laboratory with duplicate/photocopied forms being kept in one or both places. Time was being wasted trying to locate the request forms to match them up with the final reference laboratory reports.

The lack of standard workflow in the room increased the workload of the biomedical scientist (BMS) and basic housekeeping tasks such as cleaning equipment could be overlooked.

### How the changes were implemented

Spaghetti mapping was used to identify the waste of motion. Once unnecessary journeys were identified, timings and distances were measured and recorded.

Plans of the room layout were drawn with the current state and proposed improvements to the layout. This made it easier to visualise the problems and possible changes to discuss with staff who were given the opportunity to contribute their ideas and challenges.

5S principles (Sort, Set in order, Shine, Standardise and Sustain) were applied.

All shelves and drawers have been labelled. Everything has its place and it is easy to identify if something is missing. Areas have been designated for the storage of stock for a particular task (e.g. TB culturing stock and routine respiratory culture stock are stored in separate areas.)

Excess motion has been reduced through the production of a stock inventory list. This has focused staff to make a stock take before leaving the category 3 room to replenish stock.

The inventory list also has recommended levels of stock required for a routine days work.

The filing system used to store request forms has been reorganised to make it simpler so that only the current/active request forms are stored in the category 3 room. Forms for samples that have been sent to the reference laboratory are all stored in the 'send away' area of the main laboratory. This has saved time in trying to locate forms.

Discussion with the staff also highlighted possible manual handling issues that were easily corrected (e.g. reducing the distance that the safety cabinet cover was carried).

Cleaning record sheets are now used to record when the equipment and floors have been cleaned and unnecessary items have been removed from the room.

**Measurable improvements and impact**

Stock rotation and control has been improved with media now used before it is out of date.

Motion around and out of the Category 3 room has been reduced and the time saved reinvested in value work.

Staff find working in the area easier as evidenced by their comments:

- “The room is much better organised now”
- “Less time is spent each day refilling shelves”
- “The work is more standardised now”

The number of journeys around and out of the category 3 room was measured using spaghetti diagrams.

The time spent walking to and from the category 3 room to the laboratory was recorded.

On an average day several journeys may be made to each of the destinations although this varied with individuals.

Based on making one journey to each destination per day 36.5 hours of BMS time is saved per year which is valued at approximately £780.

**Key learning**

Consult staff who work in the area concerned – they are best placed to know what works and what doesn’t.

The ideal solution on paper is not always the best solution in practice – but it’s a good place to start!

Be prepared to revise plans – better to make a small change and evolve solutions to find the best way than wait for a ‘silver bullet’.

**How will this be sustained and what is the potential for the future?**

The stock levels in the room are still monitored using the inventory sheet.

All the proposed changes came about through discussion with staff members to enable and encourage them to take more pride in the appearance of the room.

Benches and equipment are regularly cleaned, all maintenance records are up to date and regularly checked as part of the health and safety audits.

Future plans for the category 3 room include a best practice guide with standardised work practices to use staff time most efficiently. This has been used in other areas of the laboratory with good results (e.g. urine bench and serology).

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	Route taken	
	Main corridor	Through chemistry
Cat 3 room to microbiology cold room and return	44 seconds	80 seconds
Cat 3 room to microbiology main laboratory and return	82 seconds	66 seconds
Cat 3 room to immunology cold room and return	70 seconds	
Cat 3 room to pathology stores to and return	142 seconds	

## CASE STUDY

# Stock control in chlamydia and gonorrhoea testing

University Hospitals of Leicester NHS Trust

### Summary

Improvements to stock storage and ordering has facilitated turnaround time reduction and prevented delays due to under or inefficient ordering of testing kits.

### Understanding the problem

Inadequate and inefficient stock control has had a major impact upon the testing service provided and has prevented the department from meeting turnaround times required in the chlamydia testing process.

Stock was stored in four to five different areas making stock control and stock rotation difficult.

Delivery time for stock takes 3 to 5 working days once orders have been authorised. The stock ordering process demands that:

- Any order up to the value of £5,000 is authorised by the pathology stores
- Orders valued between £5,000 and £10,000 are signed off by the Deputy General Manager
- Orders valued in excess of £10,000 are signed by the Pathology General Manager.

The automated equipment kit orders regularly exceed £5,000.

Authorisation can take anything from 5 to 10 working days. This waiting time is in addition to the delivery time.

### How the changes were implemented

- A minimum stock level was identified - by looking at how much stock is required during the period of time taken from the start of the ordering process to deliver date
- A visual reminder was used to ensure that the stock level was checked and ordered on a regular basis
- Regular weekly stock checks were then implemented
- Storage of reagent and consumables for chlamydia testing was reorganised into fewer, more accessible areas, keeping like-with-like, making stock checks and stock control simpler and easier for everyone
- Orders for stock are now requested in small batches to keep the value below £5,000 to eliminate the need for a senior manager to authorise the request reducing the ordering process time.

### Measurable improvements and impact

The improvements put in place have improved stock management and improved process efficiency.

Stock and storage areas are better managed.

Cost savings will be achieved through more efficient stock control which will prevent kits from expiring. Availability of stock supports achievement of turnaround targets.

### How will this be sustained and what is the potential for the future?

The team would like to be able to further reduce the storage space required and have all the stock in just one area.

Issues that are currently being tackled include raising the ordering limit of the pathology service manager, reducing authorising times and improving delivery times.

Further planned changes include use of visual aids in stock management and development of a system to eliminate the weekly stock count.

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# #17 [visual management]

Visual management is everywhere, from traffic lights, to the numbers on the front of buses, petrol indicator lights in cars, a water level on a kettle, or a cricket scoreboard.

These visual indicators allow us to easily understand the situation and take action where necessary.

Visual management is one of the Lean techniques designed to allow anyone entering a work place, including those unfamiliar with the processes, to quickly see and understand the standard operating procedures and current status of the operation at a glance.

Pictures, diagrams and photographs of processes are the easiest way to remove any of the ambiguity the written word can create.

Visual management allows teams to:

- **Understand and indicate work priorities**
- **Confirm the current performance status (usually daily)**
- **Identify the flow of work and what is (or isn't) being done**
- **Identify when something is going wrong or veering away from standard**
- **Demonstrate the agreed standards of work**
- **Communicate to all staff and users what performance measures are in place**
- **Demonstrate all the elements required for safe and effective work**
- **Provide real time feedback to everyone involved in the process.**

There are two types of visual management:

- **'Visual display' is the provision of information**
- **'Visual control' is associated with an action**

Both provide the maximum amount of information at the place where the work is done. There is no need to leave the working environment or interrogate a spread sheet, information system or database, or ask numerous questions.

Visual management provides knowledge and certainty and makes our life, and those of our patients, safer.

Visual display (information) examples include:

- Shadow boards / boxes to visibly store items frequently required at the point of use
- Standard operating procedure standard work sheets
- Skills and training boards to indicate staff competence and development needs
- Quality charts
- Performance charts (dashboard metrics based on KPI's)
- Status of the process against standard work.

Visual control (action) examples include:

- Visual process indicators for jobs in progress, productivity, output, lead time etc
- Maximum work-in-progress levels shown to prevent over-production
- Real time production status boards
- Kanban (pull system)visual signals
- Safety warnings
- Precaution information.

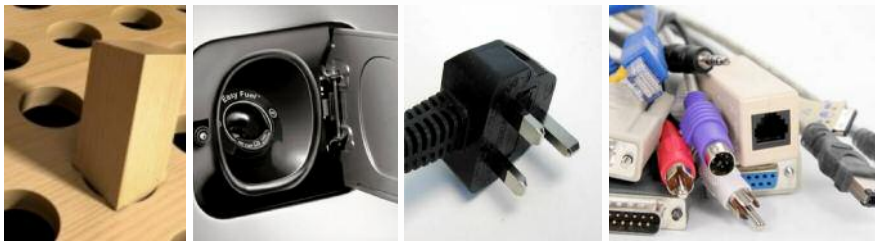
Further examples of visual management across pathology are available in a Visual Management Catalogue on our website at:

[www.improvement.nhs.uk/diagnostics/lean](http://www.improvement.nhs.uk/diagnostics/lean)

**Mistake proofing with visual management 'quality at the source'.**

We all know you can't put a square peg in a round hole – this is essentially mistake proofing..

Mistake proofing means that errors cannot escape to the next stage of the process.



A number of mistake proofing examples exist in everyday life.:

- The UK 3 pin plug cannot be inserted into the electrical socket incorrectly.
- PC cabling is easy to set up as each cable is colour coded and / or formed to match only the socket required.
- Fuelling a car is protected by three mistake-proofing devices:
  - Fuel pipe insert on some car models prevent incorrect fuelling
  - Fuel cap tether prevents the motorist from driving away without the cap
  - Fuel caps are fitted with a ratchet to signal proper tightness and prevent over-tightening.

Examples of mistake proofing in health care include the implementation of bar coding, order-communications (electronic requesting and reporting), and robotic pharmacies. These are technologically sophisticated examples of mistake-proofing, which are effective responses to human error but are very complex and expensive to implement.

They are not typical of the majority of mistake-proofing approaches, which should be based on simplicity and ingenuity.

Some difficulties in adoption and implementation in healthcare include:

- Reluctance to adopt examples developed else where
- Culture and processes that depend on individuals, not on systems
- Lack of consistent processes
- Medical applications that focus more on information counter-measures
- Legal liability and discoverability.

# CASE STUDY

## Visual management supporting improvement in microbiology

### Kettering General Hospital NHS Foundation Trust

#### Summary

Visual management is a very effective way of displaying messages or instructions in ways that are easily understood and followed, without the need for large amounts of text.

A process or set of instructions can become more memorable if displayed in a visual manner.

#### Understanding the problem

As part of the NHS Improvement programme laboratory staff were introduced to various tools and techniques used in Lean management.

Visual management was one of the areas that the staff were encouraged to use.

Too much text information displayed on notice boards or in operating procedures can be difficult to assimilate.

Some areas of the laboratory were considered untidy and required reorganisation.

#### How the changes were implemented

At laboratory meetings, and through the introduction of a suggestion (or niggles) board staff were asked for their ideas regarding areas that could benefit from visual aids.

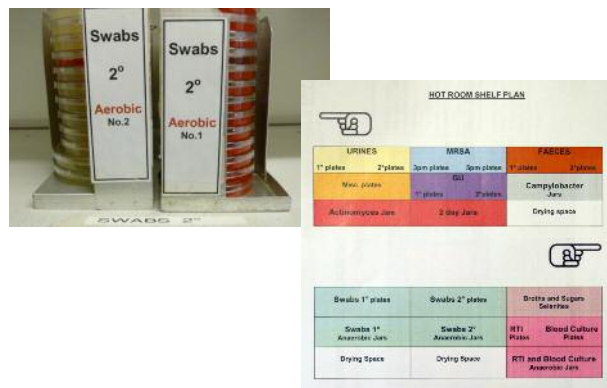
It was important that staff were involved in the decision processes as they knew best where improvement was needed. Ideas were then discussed by the core Lean team to progress.

Some of the implemented suggestions were:

1) Stock shelves were untidy and items could run out - clear labels were attached to make it obvious when something required replenishment



2) A plan of the hot room incubator was displayed on the outer door to ensure that plate racks were always put in the same places each day.



3) Drawers used for storage of sugars were disorganised causing confusion because the arrangement varied each time stock was replenished. This was eliminated by using a fixed plan layout.

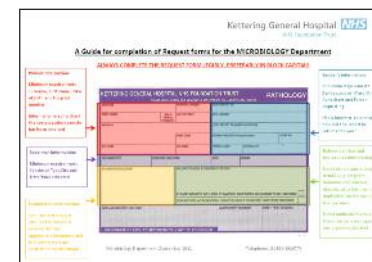
4) Kanbans were used to indicate when the centrifuge equipment was available for cleaning.



5) A visual guide for wards was used to reduce multiple test requests received with single forms and samples.



6) A guide for request form and sample labeling was produced to reduce defects.



### **Measurable improvements and impact**

Stock items on shelves are kept in order. It is now easy to see when items needed replacing, which is done in a timely manner. There has been a reduction in waste with more efficient stock rotation.

Time and staff frustration has been reduced when looking for items.

Equipment cleaning schedules have become more efficient.

Multiple urine requests on single forms and specimens were reduced by 100%.

Staff were asked to feedback on the impact and effect of visual management:

"The laboratory is now better laid out and we don't spend so much time looking for missing items."

"Time is saved looking for racks and anaerobic jars in the incubators, now you know exactly where to find them each day."

### **Key learning**

Simple ideas are often very successful and should not be overlooked.

All levels of staff should be consulted.

Stock labeling could be more detailed with stock product codes and minimum required levels.

### **How will this be sustained and what is the potential for the future?**

Staff have been able to maintain the systems because they all benefit from the changes.

A tidy working environment can improve efficiency, staff morale and reduce frustrations.

The microbiology request form guide has been redesigned and distribution will soon be extended to most GPs and hospital wards.

Visual management ideas are now considered whenever new standard operating procedures are written. A well designed diagram is often better than a paragraph of description.

Other areas of the laboratory where stock is stored could benefit from Kanban type labels to indicate catalogue numbers and minimum levels.

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# #18 [standard work]

## What is standard work?

Standard work refers to the most efficient work combination that can be put together. A work combination is the mix of people, processes, information, materials and systems/machines that come together to enable completion of a work process.

It is worth noting that standard work does not mean work standards. You will already have work standards e.g. standard operating procedures (SOPs), but they do not ensure standard work.

Standard work creates a reliable and repeatable process, which ensures that safety, quality and productivity are maintained at high levels. It doesn't eliminate the need for judgment.

Healthcare has made great strides in accepting evidenced based practice and standardising much of the work, and yet the task of creating job instruction sheets for each activity seems overwhelming.

There are already SOPs, so why is more detailed instruction required? Healthcare has many complicated processes, some necessary, some perhaps not so. The first step to eliminating defects is to simplify and eliminate unnecessary steps in a process. Detailed, at point of use instruction sheets for high-risk, problem prone tasks are important to ensure quality and patient safety.

Standard work is about creating the best possible work method, with the least amount of 'waste' to produce the best quality result to:

- Maximise quality and safety
- Reduce variation
- Produce a reliable and repeatable process.

**Consistent Method = Consistent Results**

## The three components of standardised work

### 1. Takt time

This is the rate at which units of work (e.g. test results) must be produced to meet customer demand (see chapter 15).

### 2. Working sequence

This is the series of steps that is the best way of completing a process. This should be a logical sequence and be as simple and concise as possible. Process sequence charts (PSC) can be used to determine steps (waste) that can be removed, simplified, combined or reordered.

### 3. Standard 'work in process' inventory

This is the minimum amount of work-in-progress (WIP) (e.g. request forms, specimens to be processed, plates to be read) that must be held at or between your work processes for smooth completion of a work sequence (e.g. test result).

These three components can be documented on a standard work chart and all members of staff involved with the process should be trained in how to apply each element.

By following standard work, consistent results can be achieved and problems can be identified and resolved quickly.

Examples of standard work in microbiology include visual algorithms indicating how to effectively test urines



### **Making standard work flexible – using a pull system**

Standard work allows the practice of just-in-time processing. This means maintaining little or no WIP by using a 'pull' system. In a pull system, each process step supplies the downstream process step with forms, samples, plates etc, at the right time, in the right quantity.

Visibility and communication of what is expected and when it should be available alongside what is actually received is key to this 'processing' system. Planned re-order (kanban) points should be set to fit with daily capacity. Small buffers of work can be used to balance workload requirements of the next process, and are used in a first-in, first-out flow.

This method of levelling work flow takes out variation in productivity and improves the predictability of process performance (e.g. turnaround times). Its effectiveness can be monitored using statistical process control charts. It also gives teams a consistent plan and delivers on-time, uniform specimen volumes from upstream laboratory processes. If however you operate with high errors or machine downtime it will be challenging to master a level schedule.

## CASE STUDY

# Visual aids for standard work

## North Lincolnshire & Goole Hospitals NHS Foundation Trust

### Summary

Single sheet visual aids with text outlining the key parts of the process, supported by photographs are a key element in the standardisation of working practices within the laboratory as well as being a useful day to day 'aide memoire' for staff at the bench.

### Understanding the problem

The team identified the need to introduce visual aids at the benches in the laboratory to reduce variation between staff practices.

### How the changes were implemented

Process sequence charts were produced for each workbench which provided initial summaries of the key parts of each process.

The first draft A4 laminated aids proved to have insufficient space for photographs and an A3 format was produced.

For each bench a single aid was produced for the set up (Medical Laboratory Assistant (MLA) aspect of the work and one or two for the reading (Biomedical Scientist (BMS) depending on the complexity of the process.

Finalised aids were colour printed, laminated and displayed at the appropriate bench.

### Measurable improvements and impact

Whilst this is a new practice, staff report the visual aids helpful both for standard working and for training purposes.

### Key learning

An accurate summary of the key elements of each process is essential.

Experienced, senior laboratory staff are required to review the early drafts of the Standard Work Processes and a compromise has to be found between keeping the text brief whilst still conveying the key parts of the process. Photographs are particularly useful where text may be ambiguous.

It is important to establish a consistency of approach on the level of detail in the texts across the various benches.

### How this improvement benefits patients

Standard procedures in the department assure quality of specimen handling

### How will this be sustained and what is the potential for the future?

Work is ongoing to complete the aids for all the main benches in the laboratory.

Although time consuming to produce initially they can then be reviewed and amended relatively easily to reflect any improvements to practice on a particular bench.

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## CASE STUDY

# An approach to agreeing standard work in respiratory PCR

University Hospitals of Leicester NHS Trust

### Summary

The process for investigating respiratory samples by PCR (Polymerase Chain Reaction) was reviewed and standardised using a short and focused 'Rapid Improvement Event' (RIE) type approach.

All staff were involved to discuss and agree the 'best way we know how, now' to ensure the process was completed in exactly the same way by everyone.

Standardising processes is the first step in process improvement. Knowing exactly how a process is completed enables improvement opportunities to be identified and worked through.

### Understanding the problem

The virology team observations and conversations with staff revealed variation in the application of the Standard Operating Procedure (SOP).

Flow charts prepared in August 2011 weren't being adhered to. Inappropriate tests were being applied to some samples. Some samples were being delayed whilst the team waited for consultant advice.

Due to the need to process the samples at weekends and also cover vacancies some staff could be performing this process infrequently so there was a need for a 'quick guide' to jog memories.

In the past errors have occurred due to staff not following SOPs and this has resulted in amended patient reports being issued.

The team found variation in the time different staff took to prepare and extract samples for PCR.

The process is complex and the SOPs are electronic, so they were rarely referred to at the bench where there are no computers.

The team had seen how visual work instructions were being used in other laboratories and felt this approach would support standardisation.

### How the changes were implemented

A decision was made to gather all Virology Molecular staff together. The session was very enthusiastically supported with suggestions and input from everyone and a shared ownership of the outputs.

The team discussed the process in detail, capturing steps on post it notes and moving them around until they had created a map of the process that all were agreed on.

The process maps were used to create work element sheets which were passed around all staff to check and provide feedback. They were also tested on people who knew nothing about the process to check understanding and clarity. Each work element sheet included photographs for absolute clarity.

Feedback recommended further breakdown and simplification of steps to remove possible ambiguity.

Completed work element sheets will be built into the SOPs and made available at the benches where the work takes place.

The approach used meant that the team went from the mapping meeting to preparation of the work element sheets for staff approval in five days.

### Measurable improvements and impact

Using the standard work, samples are ready for extraction by 10am which ensures they can be tested and resulted the same day. Previously samples could be delayed until 11:30 which would threaten same day delivery. The extraction can now be performed confidently and competently by a Biomedical Assistant (BMA) releasing the band 4 and Biomedical Scientist (BMS) for more complex processes

Generally the grade of staff performing the nucleic extraction part of the process was band 4 and above.

Having a visual SOP will support the training of band 2 staff and the department will have confidence in them performing this process. This will be saving of £752 - £2,803 per annum.

### **Key learning**

The level of involvement of all staff in the process appears to have been the critical success factor, well worth the time investment to get a quick improvement. Standard work has been developed which is owned by the team rather than by the person who wrote it.

The RIE approach highlighted particular areas of variation that could be standardised very simply. For example by purchasing an inexpensive timer to ensure that the time to heat a reagent was standardised.

### **How will this be sustained and what is the potential for the future?**

The visual SOPs are complete and discussions on going with the quality manager to manage the incorporation of the visuals into controlled SOPs.

Having standardised this process the laboratory team will continue to apply the methodology to other processes.

Staff involved in the process will also present their work outside the laboratory, sharing experiences with Trust colleagues.

Work is ongoing with the consultants to agree algorithms for testing protocols to speed up the process and remove further variation.

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# #19 [work cell design]

## What is a work cell?

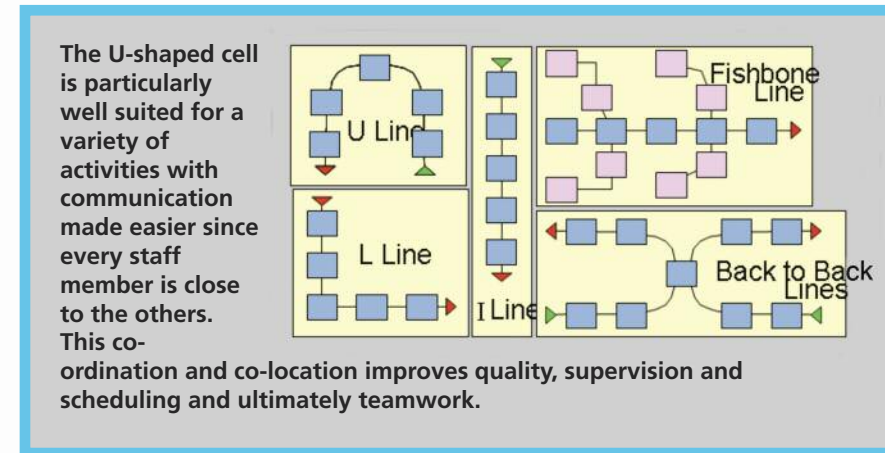
An ideal work cell is a self-contained arrangement of equipment, resources and workstations / laboratory benches that follow the sequence of processes for a given product (e.g. sample type - swabs, urine etc). Often, this arrangement takes a U-shaped form with the staff member or sample moving from station to station, until ending the sequence of processes near the beginning step for the next piece or batch. This supports continuous flow and minimises wasteful transportation, motion and delay.

## Implementing continuous flow work cells

1. **Decide which work-types (e.g. urines, swabs, MRSA etc) will go into your cells.**
2. **Calculate takt time (see chapter 15 e.g. downstream process demands one unit every 40 seconds).**
3. **Determine and then document all work elements having calculated the time required for processing one work item.**
4. **Determine whether your equipment is capable of meeting takt time.**
5. **Create a layout based on one staff member being able to perform all work elements to ensure least possible space is used (less walking, movement, and waste) U-shaped cells, S-shaped etc.**
6. **Balance the cell by determining how many staff members are needed to meet takt time.**
7. **Determine how work elements will be divided among the staff members.**

## Benefits of work cells

The successful implementation of Lean work cells involves much more than an efficient layout. Work cells bring order to an often haphazard layout and facilitate efficient workflow, allowing organisations to move away from the traditional batch and queue principles of processing products to one-piece flow.



In addition, proper functioning of Lean work cells necessitates the development of standardised work procedures and changes to inventory management which frees up working floor space, reduces the costs of inventories, increases throughput and dramatically reduces lead time (TAT's) as processes flow without the need to transport work items and consumables. Ideally, equipment is located close enough that any transportation takes seconds rather than minutes with minimum delay. Visual management is also greatly improved as the state of work progress is clear with communication and decision-making made easier should unplanned work appear.

Essentially, an effective work cell does not create additional stress and burden for staff members, but instead allows them to accomplish more while exerting less physical effort. Staff members are provided with a more pleasant work experience with improved staff morale whilst reducing lead times (TAT).

# #20 [key enablers<sup>to</sup>specimen flow]

**Previous work in pathology has demonstrated that in every department there are key enablers to improvement.**

Key enablers are changes which, where implemented, are proven to make a significant impact on the process and therefore support clinical pathways and patient experience.

The changes that follow have been developed to reflect learning in microbiology and across pathology services and are under continuing review by the East Midlands sites.

All parts of the process are covered. Changes should be implemented in a planned and structured way with data to evidence improvement.

A number of case studies evidence the impact of these changes.

Following further testing, a Microbiology Service Assessment Tool will be developed and made available on our website. The tool will enable all services to assess their service and access guidance on what further changes can be recommended.

PRE PRE-ANALYTICAL		
1	Establish standard visual protocols for users to ensure appropriate testing.	To reduce inappropriate demand.
2	Engage directly with users to understand their needs, educate in appropriate testing, sample taking and date and time collection metrics.	To ensure partnership working meets needs of users and labs. Starts measurement of the end to end sample pathway.
3	Simplify and standardise request forms.	To ensure correct demographics are recorded and specimens are not returned for correction or because hand writing is illegible - get it right first time!
4	Use and encourage the development of electronic requesting for every specimen.	To ensure correct demographics are recorded. Specimens are not returned for correction or because hand writing is illegible - get it right first time! Build in "rules" to influence clinical decision making when requesting tests.
5	Engage directly with users to agree a 'right first time' approach to sample and request card labelling.	To promote safety by reducing the opportunity for error and waste from defect management.
6	Establish multiple and regular routes of transportation by van, porter and air tube systems. Utilise laboratory air tube systems for delivery of all suitable specimens to laboratory. Investigate packaging options to expand use of the pods.	To maximised the integrity of the sample. To reduce the impact of batching. To ensure timely testing and availability of result. To support earlier patient treatment and intervention.
7	Send specimens to laboratory as soon as they have been taken. Do not allow samples to wait for a 'batch' to accumulate.	To ensure timely testing and availability of results. To support levelling of sample volumes reduce the impact on equipment and staff.

**PRE-ANALYTICAL - SAMPLE RECEIPT AND SAMPLE PROCESSING**

<b>1</b>	Reduce batch sizes to a minimum.	Instinct tells us batch processing 'feels' quicker and is more efficient. Small batches will immediately reduce your TAT- use SPC to prove it.
<b>2</b>	Ensure <b>appropriate</b> staff are trained in the use of relevant patient administration (PAS) and lab systems (LIMS) and are able to use its full capability.	To enable the correct information to be entered onto the information system.
<b>3</b>	Implement an acceptance policy for inappropriate samples.	To reduce inappropriate testing.
<b>4</b>	Implement an acceptance policy for defective samples and request cards where patient identity and/or sample viability are in question.	To improve quality and safety whilst eliminating time spent by staff dealing with omissions and mistakes, logging returns, telephoning etc.
<b>5</b>	Implement standardised defect coding for reporting errors back to users.	Provides visibility to users and enables identification of sources and root cause analysis of errors.

### SAMPLE PROCESSING

- |   |  |   |
|---|--|---|
| 1 | Treat all specimens with equal importance - remove 'urgent' stream(s).   | Time is saved by eliminating the sorting and classifying of samples   |
| 2 | Utilise minimum batch sizes.   | Instinct tells us batch processing 'feels' quicker, this will immediately reduce your TAT - use SPC to prove it.  |
| 3 | Examine all quality control procedures to ensure checks are at the appropriate point in the process to identify and remove the root cause. | Quality improves – no errors are forwarded to next step in the process.   |
| 4 | Real time registration - samples are registered in small batches before processing.  | Results can be released immediately the test is complete improving clinical effectiveness and patient experience. |

### REPORTING

- |   |   |  |
|---|---|--|
| 1 | Implement standard reporting templates. | Increased efficiency for laboratory and ease of interpretation by users. |
|---|---|--|



ALL AREAS		
1	Initiate five minute daily meetings (huddles) with all staff around the information board.	Enables staff to review progress against expectation and encourages 'stop to fix' culture. Improves engagement.
2	Establish end to end measurement of the process capturing: <ul style="list-style-type: none"> <li>• date and time the clinician produces the request form</li> <li>• date and time the specimen is taken/collected</li> <li>• date and time the specimen arrives in the requestor's local lab</li> <li>• date and time the specimen arrives in the processing lab</li> <li>• date and time the result is available to the clinical user.</li> </ul>	To understand the patient experience and sample journey. To enable root cause analysis of delays and flow blockers.
3	Initiate weekly/monthly performance review meetings with representation from all laboratory areas, consultant teams, clinicians, users and commissioners etc.	To review weekly/monthly performance reporting and lateral pathway impacts. This improves communication across pathway boundaries and allows for issues / escalations to be resolved quickly.
4	Send out monthly reports and newsletters communicating current TAT, achievements, issues etc.	To improve communication, promote your improvement work, and delivery against guaranteed and predictable TAT's for users.
5	Introduce area-by-area visual management showing volumes of samples received (demand), processed (activity) and work left to do.	Improves productivity. Progress is visible and motivating. Important to engage staff in identifying issues and solutions.
6	Introduce a staff ideas and information board.	Essential to provide a feedback loop explaining what is happening with suggestions made.

<b>ALL AREAS (CONTINUED)</b>		
<b>7</b>	Identify protected 'quiet' time. Provide nominated contact points for colleagues and users to field enquiries.	Enables focused and uninterrupted effort to improve quality and efficiency.
<b>8</b>	Develop user engagement and education policies and procedures.	Ensure users understand laboratory requirements for quality samples and request forms to reduce time spent managing defects.
<b>9</b>	Establish Kanban systems ( pull system) for stock management and ordering systems.	Keeps stock levels at an appropriate level introducing a trigger mechanism for reordering.
<b>10</b>	5S all areas.	To improve space utilisation and establish standard work for all procedures.
<b>11</b>	Establish visual A3 standard work sheets for all standard operating procedures	To minimise variation in the process and reduce the opportunity for error

## CASE STUDY

# First in, first out handling of chlamydia samples

University Hospitals of Leicester NHS Trust

### Summary

The removal of a sorting step means samples are tested on a first in, first out basis. Variation in sample turnaround times has been reduced and staff time saved

### Understanding the problem

The turnaround time required for Chlamydia samples was often breached.

Samples were sorted up to five times before being booked in:

1. In the main lab
2. When the box reached Virology
3. When the box reached the Chlamydia bench
4. At the bench, sorted into different request types - CT (Chlamydia trachomatis) or CT/GC (Neisseria gonorrhoea)
5. At the bench into form types - handwritten, Chlamydia Screening Office (CSO) and ICE/ICM.

Priority was being given to processing quick samples, rather than those that had been waiting the longest which caused varying cycle times.

Measurement confirmed that a batch of 35 Genitourinary Medicine (GUM) urine samples took approximately 6 minutes 15 seconds to book in, whereas a rack of 35 Chlamydia Screening Office (CSO) urines took an additional 7 minutes 19 seconds and required an additional 63 metres of staff movement which meant they were often left to one side whilst faster samples were prioritised.

Root cause analysis revealed that the final sorting stages were introduced to enable processing on equipment that is no longer in use. When new equipment was installed the process was not changed.

### How the changes were implemented

A3 Thinking was used to fully understand the problem, the current state and the root cause before planning improvements to the process.

Once the root cause was identified the sorting step was removed as there was no longer any reason for it and samples could be handled first in first out.

This process was also relocated within the laboratory to improve efficiency.

The virology team visited Leicester GUM to discuss issues and agree improvements to the system. GUM agreed to send throat and rectal swabs in Viper sample diluent, removing the step of separating them from the regular swabs and having to take them to a cabinet to further process. They also agreed to check the levels on the urines within the collection device to ensure it was within the required levels before they were sent, again reducing the amount of extra processing needed and making sure they don't get put to one side.

### Measurable improvements and impact

Removing the sorting activity removed 11 minutes for every 100 samples. With an annual workload of nearly 70,000 samples this has released 17.7 days of BMA time per year (valued at £4757 pa) for value add tasks.

February TAT – 7 days  
March TAT – 10 days  
Post changes – 4 days

### Key learning

Concern about and resistance to change should not be underestimated. Daily meetings provide the necessary vehicle for involving everyone and ensuring concerns are raised and dealt with immediately they arise.

### How will this be sustained and what is the potential for the future?

The new process has been tested and evidenced as successful. Standard operating procedures have been updated and all staff have been trained in the new standard work which is available visually at the work bench

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## CASE STUDY

# Removing a checking step to reduce turnaround times

Nottingham University Hospitals NHS Trust

### Summary

Removing a checking step that was delaying result issue and adding no value to the process has reduced the time patients wait for results and released staff time.

### Understanding the problem

During measurement of the pre-Lean urines pathway, delays of several hours between result generation and final authorisation were identified.

Walking the pathway revealed that samples were often not registered until after processing. A further delay was added as results were not released until every request form was double checked against the computer record (known as demographic checking). Both tasks were often avoided until the end of the day so that large batches accumulated making them even more onerous.

Biomedical Scientists (BMS) were asked to record the number of corrections made during demographic checking. Simple forms were generated to make this data collection as straightforward as possible. The data was collated and presented to the relevant senior management meetings before any changes were made.

### How the changes were implemented

The demographic checking review highlighted that <1% of urines records were corrected, and the majority of these corrections would not affect the receipt of a patient's result.

Further audit evidenced that errors were escaping the demographic check.

The decision was made that the checking step was not adding sufficient value to the process and that it would be more appropriate to focus on small batch, right first time registration completed in real time with specimen processing.

The removal of this extra check for high-volume sections (urines & MRSA) was an early outcome in the Lean project, and was very well received by staff.

### Measurable improvements and impact

Approximately 220 hours of BMS time per year has been released in the urines process alone which is valued at approximately £4,700.

### How will this be sustained and what is the potential for the future?

Demographic checking was a disliked task so there is no movement to reintroduce it. However, the message 'right first time' is emphasised regularly, and audits of registration corrections are carried out to ensure that this continues.

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## CASE STUDY

# Reducing 'split' samples

## Kettering General Hospital NHS Foundation Trust

### Summary

The Microbiology department was receiving single urine samples with microscopy, culture and sensitivity (M,C&S) and protein / creatinine ratio (PCR) requests on the same form.

A poster was created asking users who need both tests to provide two samples with two request forms.

### Understanding the problem

A3 thinking was used to guide the team to fully investigate the problem, its root cause(s) and potential countermeasures

Urine samples that arrived in microbiology requesting PCR as well as M,C&S had to be:

- decanted into a second container (with the associated risk of spillage)
- labelled with the patient's details (risking transcription errors)
- transported to the appropriate department (waste of transport and delaying processing).

There was a particular problem with urines from the ante-natal service.

The improvement opportunity was raised by the staff doing the extra work i.e. the MLAs sorting and processing the urines. Their suggestion was put on the department's niggles board and actioned by the Lean team members.

### How the changes were implemented

The department recognised that the ante-natal clinics and wards would not necessarily know that this practice was causing the laboratory a problem so a decision was made to visit them to discuss the issue.

A poster was designed for them to display in their own appropriate work areas as a reminder.

### Measurable improvements and impact

The number of urine samples requiring a 'split' reduced to zero.

This saved time for members of staff, enabled tests to be carried out in a more timely manner and removed the potential for error and spillage.

Based on 11 samples per week this equates to 12 hours of MLA time per annum which is valued at approx £130.

### Key learning

It was really efficient to actually visit and/or speak to people directly and explain the problem.

They had no idea that their routine practice was causing an issue but when informed they were extremely helpful and positive.

### How will this be sustained and what is the potential for the future?

The improvement has been adopted by another laboratory within the SHA with a much larger workload.

Whilst they had been looking to achieve improvements in the same process, they had not considered looking at the source of the samples and asking users to support a change to the process.

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## CASE STUDY

# Accurate recording of date and time of receipt of specimens

## Sherwood Forest Hospitals NHS Foundation Trust

### Summary

Clinical Pathology Accreditation standard E5.1 (c) had previously been met by completing an annual audit to ensure specimens are being processed within a timely manner once received within the department with no significant delays between the specimen being taken and received.

The department wanted to find a way to accurately record the date and time of receipt for every sample without adding to staff workloads.

### Understanding the problem

Prior to the change the date and time a sample was received was recorded on the laboratory information management system (LIMS) as the date and time that the request forms were registered. This was not a true reflection of actual receipt time.

An audit was undertaken to establish how much staff time would be required to date/time stamp every specimen that was received. There were 2 key findings to the audit:

1. It took on average 14 seconds to date/time stamp each specimen. Therefore the times stamped on the specimens were not an accurate recording of the date/time that the specimens were received in the department.

2. Taking into account the time it takes to date/time stamp each specimen and the number of specimens received per day on average it would take 4 hours a day of staff time to date/time stamp all specimens. At Band 2 grade (0.53 whole time equivalent) this would be a cost of £9,916.

### How the changes were implemented

The team decided to expand upon a simple system already implemented in the Pathology central reception 'drop off' area following some earlier Lean work.

A sheet lists all expected GP van run deliveries for each day and what time they are due. When the van driver delivers their run they sign the transport box in and record the time of delivery.

The record sheet was amended to also record the transport box number that has been delivered.

When the MLA comes to empty the transport boxes they refer to the sheet for the appropriate box number and record the time of receipt onto small laminated cards which are put into the boxes that the specimens from that run are sorted into.

One van run is sorted at a time with each van run being sorted into separate boxes. This process also creates small batch sizes for the sections to process.

Deliveries received from the Porter are sorted in the same way with staff referring to the time that the porter

has recorded on a laminated card at delivery which they place into the box that they leave the specimens in.

When the specimens are labelled and processed the laminated card is kept with the request forms from the batch. The recorded time of receipt is then used when the request forms are registered onto the LIMS for an accurate input of time of receipt.

Electronically requested specimens are processed in the same way but the laminated card is kept with the specimens for registration, as no request forms are received.

### Measurable improvements and impact

The department is now able to accurately monitor time of receipt to ensure that specimens are not only being received within a suitable time frame from being taken but also processed within a timely manner after receipt within the department.

### How will this be sustained and what is the potential for the future?

This practice is now standard work and is currently in the process of being rolled out to the Blood Sciences department.

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# #22 [additional information]

## **NHS Improvement - Diagnostics**

[www.improvement.nhs.uk/diagnostics](http://www.improvement.nhs.uk/diagnostics)

For access to:

- Pathology case studies
- Bringing Lean to Life
- First steps toward quality improvement: A simple guide to improving services.

## **NHS Improvement System**

[www.improvement.nhs.uk/improvementsystem](http://www.improvement.nhs.uk/improvementsystem)

For access to:

- Free access to SPC, capacity and demand and PCS tools
- Webinars covering Lean topics.

Contact: [support@improvement.nhs.uk](mailto:support@improvement.nhs.uk) for your password.

## **The Lean Enterprise Academy**

[www.leanuk.org](http://www.leanuk.org)

## **Useful reading – Lean**

### **A3 Problem Solving for Healthcare** - Cindy Jimmerson

ISBN 978-1-56327-358-2

Demonstrates how to use A3 to problem solve. Contains practical examples from USA healthcare that can be easily translated to UK.

### **Value Stream Mapping for Healthcare Made Easy** - Cindy Jimmerson

ISBN 978-1-4200-7852-7

Demonstrates why value stream maps are a fundamental component in applying Lean.

### **Lean Healthcare – Improving the patient's experience** - David Fillingham

ISBN 978 -1- 904235-56-9

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### **The Gold Mine** - Freddy and Michael Ballé

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