Using the Lean approach to transform pharmacy services in an acute trust

Rationalising the way pharmacy services are delivered in a hospital trust releases capacity and improves turnaround times, says Brian Smith.

Royal Bolton Hospital NHS Foundation Trust serves a population of 285,000 and employs around 3,500 staff. The pharmacy department is based in a part of the hospital that was built in the early 1990s with a design that reflects a modular approach to systems. Outpatients, inpatients and discharge processes worked independently, while stores and distribution services were in the basement. The aseptic unit was part of the dispensary. Clinical pharmacy services were well developed with ward-based teams, the use of patients' own medicines and dispensing for discharge.

In response to increasing demands on the pharmacy service and to improve patient safety, the service underwent a major redesign in 2007. Integral to this was the upgrade of the pharmacy IT system to a web-based system (the Ascribe V9) capable of ward-based medicines management and the introduction of an automated pharmacy system (Rowa).

Both these major developments were seen as tools to develop services and not the endpoint of the development process. The benefits of patient-level IT and automation are documented1–4 and our goal was to put the patient at the centre of our service, eliminate waste and improve efficiency.

One key trigger point for this initiative is the target set by the Department of Health to reduce patient-safety incidents. Releasing pharmacy staff into the clinical area to manage medicines and influence prescribing has been shown to be effective in reducing adverse incidents with medicines.5,6

The Lean approach

It is 20 years since Lean was first launched in the West. It is based on, or is a development of the Toyota production system. Lean has been used in automotive and other production systems, including fields as diverse as construction, retail, IT, defence systems and healthcare. It allows people to review and improve their systems of work.

Bolton Hospitals NHS Foundation Trust is three years into its Lean transformation process and has developed the Bolton improving care system (BICS) to implement trustwide improvements. To embed the BICS approach, we developed a structured training programme. All 3,500 trust staff will receive green-level awareness training. A three-day bronze-level accreditation is followed by a two-week silver-level accreditation. After completing the silver accreditation, I have delivered green-level sessions to the pharmacy staff.

My divisional manager at Bolton has embraced Lean and has presented it to hundreds of staff. His presentation begins with a photograph of high jumper Dick Fosbury jumping over the bar backwards. Until the 1968 Olympics, all high jumpers had run up to the bar face first and jumped over that way. Fosbury jumped backwards, to ridicule initially, but the ridicule gave way to admiration when he broke the world record using this method. This demonstrates that while Lean may look ungainly at first, with perseverance, it works. The inclusive approach shown at Bolton is the only way Lean can be used in any organisation.

Myths about Lean

“You are not Japanese and we don’t make cars.” This initial response to Lean implementation is described in David Fillingham’s book ‘Lean healthcare — improving the patient’s experience’ (see “Further reading”). Further points dispelling myths about Lean include:

- Lean is not a recent management fad. Venetian shipbuilders used a version of it in the Middle Ages. Toyota has developed the system over 60 years.
- Lean is not about paring back to the bone and reducing the workforce. Successful Lean companies employ a no lay-offs policy, seeking to redeploy staff on new value-adding activity to expand the business.
Lean does not just work in manufacturing. It has been used successfully by service and retail organisations, such as Tesco.

Lean is not merely a toolbox of quality improvement technologies. The organisational culture and philosophy that surround it are equally vital.

Lean is not only for the technically minded. If it is to work everyone must be involved.

BICS has four “true north” goals. All the improvement work at Bolton refers back to these four principles, each applied equally:

- Improving health
- Providing the best care for patients
- Value for money for taxpayers and patients
- Pride and joy in work for staff

Placing the patient first means developing a thinking workforce. The removal of waste is not the ultimate goal but a means to improve benefits and services to the patient.

At the core of Lean is the process of prevention of waste, not just elimination of waste. All processes, including healthcare processes, have a large waste component: those steps in a process that do not create value as perceived by the end user, in our case the patient.

By preventing waste less time needs to be spent on problem-solving, reworking processes and inspection. Many hospital pharmacies are preventing waste by moving staff closer to patients, where we can stop problems before we have to rework them and spend time contacting prescribers. Medicines reconciliation processes require pharmacy staff in clinical areas to perform this work. This is from the electronic record and bedside locker.

Panel 1: Discharge prescription service before improvement

<table>
<thead>
<tr>
<th>Time</th>
<th>Process</th>
<th>Value added</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.30</td>
<td>Ward round begins</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>08.35</td>
<td>First patient told they can be discharged</td>
<td>Yes</td>
<td>10</td>
</tr>
<tr>
<td>08.35-10.45</td>
<td>Ward round continues</td>
<td>No</td>
<td>130</td>
</tr>
<tr>
<td>10.45-11.00</td>
<td>Junior doctor tea break</td>
<td>No</td>
<td>15</td>
</tr>
<tr>
<td>11.00-12.00</td>
<td>Junior doctor completes “urgent” duties</td>
<td>No</td>
<td>60</td>
</tr>
<tr>
<td>12.00-13.00</td>
<td>Junior doctor at lunch</td>
<td>No</td>
<td>60</td>
</tr>
<tr>
<td>13.00-14.00</td>
<td>Junior doctor protected teaching time</td>
<td>No</td>
<td>90</td>
</tr>
<tr>
<td>14.30-15.00</td>
<td>Return from teaching and ward catch-up</td>
<td>No</td>
<td>30</td>
</tr>
<tr>
<td>15.00-15.10</td>
<td>Junior doctor writes discharge prescription</td>
<td>No</td>
<td>10</td>
</tr>
<tr>
<td>15.10-16.00</td>
<td>Prescription waits for transfer to pharmacy</td>
<td>No</td>
<td>50</td>
</tr>
<tr>
<td>16.00-16.35</td>
<td>Prescription waits in queue in pharmacy</td>
<td>No</td>
<td>35</td>
</tr>
<tr>
<td>16.35-16.45</td>
<td>Dispensing process</td>
<td>Yes</td>
<td>10</td>
</tr>
<tr>
<td>16.45-16.50</td>
<td>Accuracy checking</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td>16.50-16.55</td>
<td>Completion processes (bagging, paperwork, prescription monitoring system)</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>16.55-17.30</td>
<td>Waiting for transport to ward</td>
<td>No</td>
<td>35</td>
</tr>
<tr>
<td>17.30-18.00</td>
<td>Porter’s round</td>
<td>No</td>
<td>30</td>
</tr>
<tr>
<td>18.00</td>
<td>Delivered to the ward</td>
<td>No</td>
<td>25</td>
</tr>
<tr>
<td>18.25</td>
<td>Waiting on ward</td>
<td>No</td>
<td>25</td>
</tr>
<tr>
<td>18.30</td>
<td>Patient leaves the ward</td>
<td>Yes</td>
<td>5</td>
</tr>
</tbody>
</table>

Panel 2: Future state of the discharge prescription service

<table>
<thead>
<tr>
<th>Time</th>
<th>Process</th>
<th>Value added</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.30</td>
<td>Ward round begins</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>8.35</td>
<td>First patient told they can be discharged</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td>8.35</td>
<td>Pharmacy team on the round check the patient’s electronic record and bedside locker</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>8.40</td>
<td>All medicines present and correct — discharge complete</td>
<td>Yes</td>
<td>5</td>
</tr>
</tbody>
</table>

Panel 3: Ideal state of the discharge prescription service

<table>
<thead>
<tr>
<th>Time</th>
<th>Process</th>
<th>Value added</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.30</td>
<td>Ward round begins</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>8.35</td>
<td>First patient told they can be discharged</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td>8.35-10.45</td>
<td>Pharmacy team on the round check the patient’s electronic record and bedside locker</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>8.40</td>
<td>Pharmacy team update electronic medication record and release supply order to the pharmacy system</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>8.40-8.45</td>
<td>Pharmacy automated system dispenses required medicine</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>8.45-9.00</td>
<td>Delivery to patient’s bedside by dedicated pharmacy staff</td>
<td>No</td>
<td>15</td>
</tr>
<tr>
<td>9.00-9.05</td>
<td>Medicines presented to the patient and discharge complete</td>
<td>Yes</td>
<td>5</td>
</tr>
</tbody>
</table>

Lean principles

Processes should be designed to flow (and eventually pull) so that individual steps follow logically. This allows steps that do not add value to be identified and eliminated. Value stream analysis is a method of identifying all steps in a process, how they interrelate and whether they add value.

A five-step process can be followed.

- **Step 1: Specify value** This is from the point of view of the patient.
- **Step 2: Identify the value stream** This must be mapped from the patient’s viewpoint, in the knowledge that processes are only as good as their weakest link.
- **Step 3: Eliminate waste and make value flow** This is done by never delaying a value-adding step by a non-value-adding step and by removing non-value adding steps. Non-value-adding steps may be necessary temporarily, but must be completed in conjunction with value-added steps.
- **Step 4: Generate pull** This means providing services when they are needed. One of the best examples of pull is the fast-food outlet, where services and staff can be flexible. Staff can multi-skill or change tasks to respond to service needs.
- **Step 5: Perfection** This needs the total involvement of the people doing the work (“those that do the work, improve the work”) and is possible by having gone through the previous steps methodically. It means continuously trying to eliminate waste to deliver the best possible quality.

The improvement process is continuous and even organisations with more than 60 years of experience, such as Toyota, still consider they have more work to do. In his recent address at the NHS Live conference, Donald Berwick, the president of the Institute for Healthcare Improvement, reminded us that the NHS, even at 60 years old, seems adolescent, immature and searching.
What is waste?
The possibility of waste can arise from a number of processes through injury to people, defective products or processes, excess or lack of equipment, overproduction, delays, unnecessary movement of people, transportation and processing of waste.

Injuries Injuries harm people. They may result from any health and safety risk that should have been picked up in a risk assessment.

Defects Defects are processes and results that are not right and need to be reworked. They can lead to failures at any point in the process, including reworking resulting from an incorrect dispensing process or a prescribing incident or an administration accident and link into the injuries category with respect to patients.

Inventory Inventory refers to stock, equipment and resources that are on hand to be worked. Waste can occur through overstocking. In a pharmacy setting this would mean trying to reduce stock to minimum levels by combining storage areas and managing reordering levels carefully.

Overproduction Overproduction means too much capacity or throughput. It relates mainly to capacity in pharmacy and the fact that our workload is rarely pulled through our systems. We have quiet periods and busy periods.

Waiting time Waiting time is the time taken for the process to deliver or to produce results. It can include all the time that processes are adding value, the non-value-adding steps and time spent waiting for processes to start. "Touch time" is the time in which the product is worked within the process and is significantly shorter than the full start-to-finish time.

Motion Motion refers to unnecessary human movement. Waste can occur within the process as a result of the physical design or location of the process.

Transportation Transportation is the movement of raw materials and end products. The biggest patient visible delay due to transportation issues relates to delivery of medicines into clinical areas, although there may be substantial transport and logistical issues managed before the dispensing process begins.

Processing waste Processing waste refers to the production or delivery of services that do not add value. Here we must consider the perspective of the patient, who might see no added value in professional supervision and final accuracy checking, if the process was designed to be mistake proof. Pokayoke (pronounced POH-kay YOH-kay) is Japanese for a process that either prevents an error or makes an error obvious at a glance.

According to the National Institute for Health and Clinical Excellence human beings usually make mistakes because the systems, tasks and processes they work within are poorly designed, while effective design can deliver products, services, processes and environments that are intuitive, simple to understand and use and less likely to lead to errors.

Traditional business systems tend to concentrate on improving the value-added steps in a process. In the value-stream analysis of most commercial (and healthcare) processes, 95 per cent of the process is waste because only 5 per cent adds value. Lean systems concentrate on and eliminate waste rather than exclusively trying to improve value-added steps. This can have a dramatic effect on the efficiency of the whole process.

An example of value-stream analysis
The traditional discharge prescription process (current state, Panel 1) assumes no use of patients' own drugs and no dispensing for discharge. It also assumes no distractions in the ward environment, such as medical emergencies or incidents. Value is looked at from the patient viewpoint so some processes we would consider essential are not identified as value added.

The total process takes just under 10 hours (595 minutes) with only 20 minutes of that adding value. Lean concentrates on this waste and how to eliminate most of the process that is waste. The first scenario (future state, Panel 2) shows that the process could be completed in 10 minutes, but still shows five minutes of non-value-added steps. The impact of these steps can be mitigated by carrying them out in parallel to the value-added steps.

The second Lean scenario (ideal state, Panel 3) describes a second ideal state where IT and automation systems are in place linked through a wireless network. This process again includes non-value-added steps in a 35-minute process with some non-value-added steps being carried out in parallel.

6S is the key
The key to Lean transformation is the use of 6S or six key activities starting with the letter S. M any texts refer to 5S, but following advice from Simpler, the consultants used locally, we have added safety to 5S (see Panel 4).

Sort Sorting involves removing everything from the workspace if possible, or at least all unnecessary equipment, archive material, waste and inventory. In the pharmacy setting, limiting the inventory means limiting drug stock. It is common practice that if a storage area exists, something will be stored in it whether it is needed or not.

Straighten Straightening is a simple process of improving the working environment by cleaning.

Safety Safety makes the process and environment safe for both patient and staff and change things that could cause injury, stress or overburden.

Standardise Standardisation includes the use of standard operating procedures (SOPs) and standard work. Standard work is more than the use of SOPs in that work is described in a way that key steps are described, monitored and assessed and staff understand exactly what their role is within the process.

These carrying out any process are the people who can best improve it. The use of visual controls (visual management) should make it possible for any team member to assess, at a glance, whether or not the process is working effectively.

Visual management tools could be as simple as green tags on equipment to show operational status or as complex as monitoring the total system. Examples of visual management in a complex system include the driver aids in a modern car, including the dials, gauges, warning lights and sounds we use without thinking.

Sustain Sustain The sustain activity must be included in normal daily work and involves assessment of the previous steps. Visually checking that processes have not reverted and that new systems are working effectively are the responsibilities of all team members but management must lead this with a "go and see" attitude.

The pharmacy department plan
The pharmacy redesign used two formal week-long events to plan the new department, the building work and the installation, and to develop services after installation. This was in addition to the normal building and technical planning processes managed by our internal estates project management, which ran alongside and influenced the de-
The reconfigured pharmacy department is open-plan and has adopted a unidirectional workflow system and visual management.
Workstations are clustered and at desk height to discourage staff movement

After process planning we went on to investigate how to use the extra capacity in our systems freed by the initial process changes. It led to the plan for ward-based medicines management.

**Outcome measures** One simple outcome measure for pharmacy is turnaround times. In September 2007, only 50 per cent of prescriptions were completed within an hour. In April 2008 this figure was over 90 per cent. This is a significant improvement and reflects the first steps in improving our efficiency. What it does not show is that improvement in turnaround has been accompanied by a reduction in overtime (because work is completed within the standard pharmacy hours) and an extension of ward-based systems. The efficiency savings and reduction of waste benefits have been invested back into the pharmacy service.

**Ward-based medicines management** Ward-based medicines management is where pharmacy staff reconcile and enter a patient’s medication history direct onto the pharmacy system with limited waste and further scope for process improvement.

The use of Lean techniques at Bolton Hospitals NHS Foundation Trust has allowed the rapid development of innovative solutions using integrated systems and technology. Further work will roll out these developments trust-wide.

The benefits of using a Lean approach in transforming pharmacy services include the involvement of the staff, the development of a team approach and successful outcomes. It is probable that the robot could have been installed without a Lean approach, but it is doubtful that the design would have been right, that the staff would have embraced the process or the project would have been delivered on time or on budget.

Patient safety issues during a major refit and redesign cannot be forgotten. Mistakes due to a disorganised work environment could have happened as the department operated from a building site and spent time firefighting problems. Using Lean, the process was organised and calm.

The second (continuing) phase of the process, to use the technology and the new and existing resources effectively to develop patient services, has benefited from the same approach.

We continue to use Lean methodology, particularly around financial savings targets, and continue the transformation process in pharmacy throughout the organisation and, with the participation of the local primary care trust, the local health economy.

**References**


**Further reading**