Using Lean to Identify Process Improvement Opportunities and Improve Effectiveness of Transfusion Professionals

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INTRODUCTION

Healthcare reform is front and center in conversations both personal and political. Traditional thinking has not been successful in significantly increasing effectiveness of care or in reducing costs. In fact, healthcare costs in the U.S. are expected to reach another all-time high by 2025 at 25% of the GDP. Current spending on healthcare in the U.S. is double that of other developed countries with no better outcomes.

In the same way, reform is sought-after in most transfusion services. The business needs are similar, no matter the size of the facility, the continent, or the country in which the transfusion service is located. Those business needs include the requirement to reduce overall costs, increase efficiencies and capacity, enhance process effectiveness and service levels, eliminate redundancies and error potential, better manage and utilize blood products, and optimize intellectual capital.

Lean takes a value stream approach and looks at the continuum of processes that seek to add value to the care being provided to patients. Lean involves the creation of flow and the adherence to standardized work processes and visual management, such that there is relentless pursuit of the elimination of waste (or those activities that are non-value-adding) and continuous improvement. The Lean transformation process can dramatically impact any department and any organization. Lean certainly can transform the work practices that are encompassed within transfusion services and allow transfusion service professionals to focus on providing the right blood product to the right patient at the right time for the right reason and using the right processes.

METHODS

A number of transfusion services have applied Lean principles and tools to their core operations: order and specimen receipt and processing, pretransfusion and compatibility testing, blood product management, and blood component preparation, issue, administration and reconciliation. Their aim with the application of Lean was to identify process improvement opportunities and maximize labor capacity and expertise in order to provide: the right blood product, at the right time, for the right patient, for the right reason, using the right process.

The main Lean tools used to evaluate work processes were value stream maps, product and operator process flow analyses, and error potential analysis. Orders for testing or for blood products were analyzed and timed from the point of entry into the transfusion services until the end product or test result was released. Five action items were required:

- Define process steps within value stream
- Collect times for process steps and wait times between processes along value stream
- Develop information flow
- Create current state value stream map
- Perform value-added analysis of product flow and operator processes

Processes were evaluated for the percentage of value-added and non-value-added time and assessed for improvement opportunities to increase process flow, increase the percentage of value-added time, and eliminate non-value-added activities or waste. Processes were redesigned with Lean concepts in mind, in order to optimize inputs including the labor component and to reallocate that intellectual capital in order to enhance service levels and support more effective blood management and utilization.

RESULTS

Operations at fourteen sites among three countries were analyzed with Lean tools and thinking, to establish the base situation and identify areas for process focus and redesign. An example of one site's current state value stream map of pretransfusion testing is shown in **Figure 1**. The total cycle time for pretransfusion testing in this case was 1:36:37. 22 minutes of this total process time was due to wait times, or time that patient specimens were sitting, waiting to go to the next step in the pretransfusion testing process. The specimens were involved in some aspect of being processed or tested for 1:14:37 of the total time. Batching was observed throughout the testing process. What should have taken <35 minutes to test on the particular analyzer in use, took 50 minutes.

Figure 1. Transfusion Service
Current Value Stream: Pretransfusion Testing

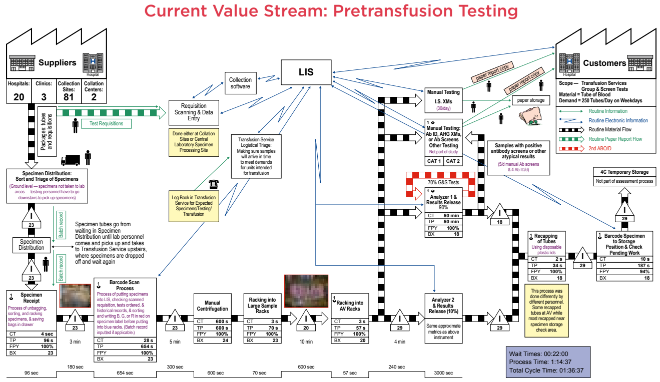
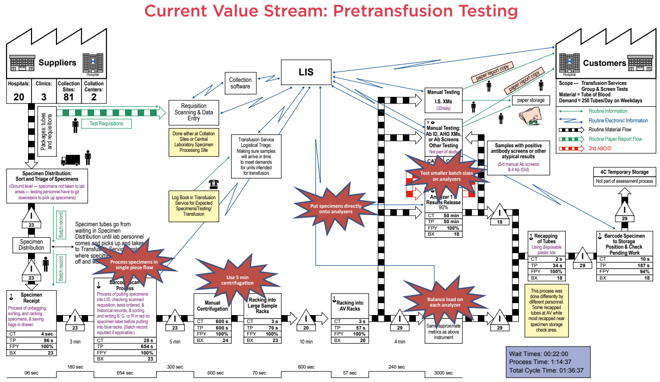


Figure 2 shows the kaizen or opportunity bursts in this same current state pretransfusion testing value stream. Those opportunities included:

- Processing patient specimens in single-piece versus batch mode
- Using a five-minute centrifugation of patient specimens versus 10 minutes
- Putting centrifuged specimens directly onto analyzers
- Flowing specimens in smaller batch sizes to analyzers
- Level-loading batch sizes on each analyzer

Figure 2. Transfusion Service
Current Value Stream: Pretransfusion Testing



These improvements projected a reduced cycle time from 1:36:37 to <47 minutes or a cycle time reduction of 53%.

Value-added time (VAT) analysis helped refine the projections into specific operator process redesign by understanding the percentage of value-added versus non-value-added activities. Videotaping and analysis were completed for the product process flow and for select operator processes involved with the entire value stream, from order and specimen receipt through verified test results and product issue.

Value-added activities were classified as anything that changed the fit, form or function of the raw material or product for the first time and was activity the patient wanted to pay for. All other activities were classified as one of the following categories of non-value-added activity:

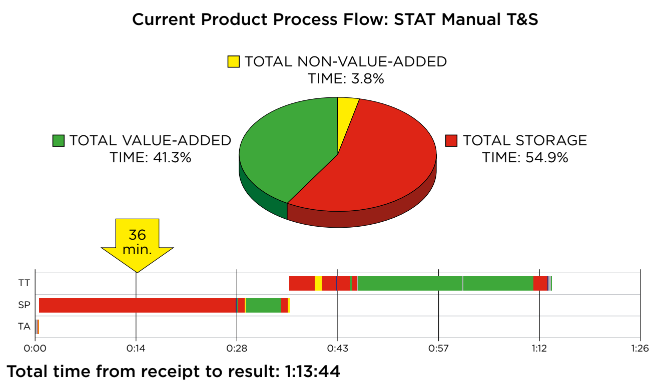
- Transportation
- Inspection
- Non-value-added processing
- Storage (waiting)

The activities of the operators supporting the various processes were evaluated and activities similarly classified as non-value-added or value-added. The non-value-added activities were further analyzed to understand exactly what operators had to do and where they had to travel to do get the supplies, raw materials and information to do their work as well as to do the work itself. Videotapes were invaluable for this purpose and allowed the breakdown of activities into categories, such as time spent:

- Walking
- Reaching to get reagents or tools
- Positioning, loading or unloading instruments or racks
- Computer data entry
- Manual work, such as labeling test tubes or re-capping specimen tubes
- Handling paper or doing paperwork
- Handling patient specimens or blood products
- Taking phone calls
- Inspecting forms, looking for specimens, rechecking test results, or checking blood donor units to be released

Figure 3 shows an example of the VAT analysis of a STAT T&S test, product process flow at one of the transfusion service sites. The perception at this site was that STAT T&Ss should be processed by a manual column agglutination method as that was faster than using an analyzer. The Lean product process flow VAT analysis showed that the total cycle time for the STAT T&S was 1:13:44. Specimens were in storage or waiting nearly 55% of the total time. These STAT specimens waited for 36 minutes before they ever reached the testing area, sitting on the specimen receipt counter, sitting in Styrofoam cups, sitting in racks, waiting

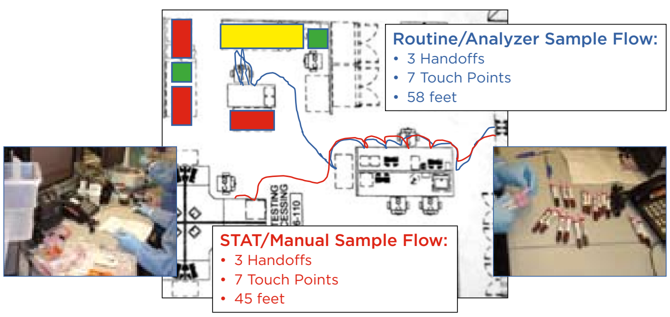
Figure 3. Specimen Flow: STAT Manual T&S



to go into the centrifuge, and sitting in the centrifuge after centrifugation was completed. In reality, the cycle time should have been and was redesigned to be 47 minutes from receipt to result.

Figure 4 shows the path of the samples, both the STAT tests and routine. These paths required multiple handoffs and touch points, which raise error potential.

Figure 4. Specimen Flow: T&S Testing



Operator walk patterns were also captured and distance and time analyzed as was VAT. **Figures 5 and 6** show examples of the VAT of operator processes: distribution and specimen and order processing, manual testing, and solid phase analyzer testing. Pure waste in these analyses represents time when the operator or operators were idle, such as waiting for printers to complete printing or waiting for an analyzer to complete cycling.

What these figures showed were opportunities to improve the processes by removing waste and optimizing labor units. For example, **Figure 5** represents the operator flow for the position responsible for receiving orders for blood products and test requests. 92% of the operation is some form of required waste and 8% was pure waste or idle time. Further breakdown of the required waste shows some important things:

- Nearly 32% of the time is spent handling paper or doing paperwork
- 12.6% of the time is spent walking

Redesign of work assignments resulted when the Lean work team asked questions about "Why there was so much paper?," and "Why so much time was spent walking when the main functions were at the receiving desk?"

Figure 6 shows an example of the VAT analysis of the operation of an automated testing instrument. What is shown in this graphic is that 54% of the operator time was spent with required waste activities, and 46% of the time represented pure waste or time when the operator was idle. In this situation and for several days in a row, the analyzer froze at the point results were ready to release, which necessitated re-starting the instrument and re-booting the instrument's computer. This required the operator to repeat the testing and babysit the instrument and resulted in 46% lost intellectual capacity and lost testing capacity. Instead of taking approximately one hour for a large batch of routine T&Ss to be tested, the process took >3 hours.

The breakdown of the required waste in **Figure 6** demonstrates the intensive operator activities that are required with this particular type of analyzer:

- 19% of the time spent inspecting various parts, the computer screen, and process steps
- 15.3% of the time spent positioning testing components and patient specimens
- 22.1% of the time spent with manual operations
- 7% of the time spent walking

Figure 5. Operator Process Flow: Distribution Operator Example

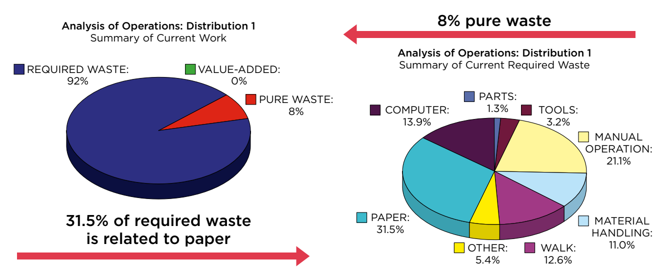
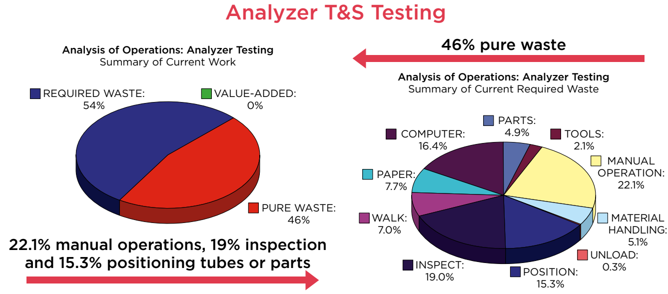


Figure 6. Operator Process Flow: Analyzer T&S Testing



RESULTS (continued)

In this case, the questions revolved around "Why do we have an analyzer in place that requires so much time to position parts, inspect, handle materials, and walk, let alone causes wasted labor units?"

Table 1 represents a composite summary of the improvements that were identified with Lean tools and thinking in 14 sites. Representative processes and projected ranges in time and labor unit savings are included in the table. Two of the 14 sites are in the process of implementing and measuring results; the other 12 sites have achieved their improvement projections. Turnaround times from sample receipt in the transfusion service to verified results were reduced by 11 to 39% for STAT request processes and 6 to 60% for routine test request processes. Labor unit savings were realized for the processes of specimen and order receipt (17 to 65%), manual testing (16 to 91%), automated testing (17 to 64%), and compatibility testing (27 to 36%). Most of these time reductions were achieved with:

- Co-location and organization of processes and disposables
- Creation of improved process and operator flow
- Implementation of standardized work and visual management controls
- Redesigned task assignments

In one site, some of the labor unit savings was reallocated, creating a full-time position to work with care givers for enhanced blood product utilization. Most of the other sites re-directed their saved labor units to support other transfusion service activities and quality efforts.

CONCLUSION

The application of Lean tools uncovered significant opportunities for process improvement. When coupled with the use of the automation, exponential improvements were identified and implemented with sustained success. In multiple instances, improvements have been realized for over 12 months and labor resources reallocated to transfusion utilization, quality programs, and safety operations. Average annualized cost savings in most of these sites has exceeded $190,000, not including savings from improved blood product inventory practices and utilization. All of these sites are now better positioned to meet their business needs, having transformed their processes with Lean thinking and tools.

These results are client specific, individual results may vary.

Table 1. Summary Table of Range of Time and Labor Percentage Reductions Using Lean Analysis in 14 Sites*

Category	Turnaround Time for STAT T&S	Turnaround Time for Routine T&S	Specimen/Order Receipt Processing & Issue	Manual T&S Testing	Automated T&S Testing	Compatibility Testing
Identified Range of % Reduction in Time or Labor Required	11 to 39%	6 to 60%	17 to 65%	16 to 91%	17 to 64%	27 to 36%

*2 of 14 sites are in process of implementing and measuring improvements

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