

Getting lean not mean: morale, leadership, and integration issues surrounding lean in the laboratory

Original citation:

Getting lean not mean: morale, leadership, and integration issues surrounding LEAN in the laboratory: An interview with Dr. Joe Rutledge and Joanne Simpson. 2006. *Laboratory Errors and Patient Safety*. 2(5): 1-8.

Interview:

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Dr. Joe Rutledge and Ms. Joanne Simpson discuss their implementation of lean production principles in the clinical laboratory. Lean in the lab has been the focus of recent trade journal articles¹ as well as scientific articles in the peer-reviewed literature². When lean is well implemented, it leads to sustained quality improvements in laboratory services. This interview briefly covers lean basics for uninitiated readers, and then focuses on neglected topics including the effect of lean on staff morale, the leadership requirements of lean, and the integration of laboratory lean projects with lean projects in other medical services. The large-scale adoption of lean illustrates the principles of strong interventions that are frequently discussed in *LEPS* including standardization, elimination of steps, physical plant changes, and the involvement of leadership.

BACKGROUND:

LEPS: Can you tell us about where you work?

Rutledge and Simpson: Our medical center (www.seattlechildrens.org) is a 250-bed tertiary care children's hospital that is an important resource for medical care in the Pacific Northwest. The core section of the laboratory employs 50 FTE, and reports about 400,000 billable tests per year. Approximately 50% of the test volume is in the core laboratory.

LEPS: How are you defining "core lab"?

Rutledge and Simpson: The core lab performs nearly all the tests that can be ordered stat. It consists of specimen processing, phlebotomy, routine chemistry, hematology, and coagulation, but not microbiology or virology. The lean implementation discussed here focuses on improvements in preanalytic processes and the core lab.

LEPS: How are laboratory orders received and resulted?

Rutledge and Simpson: For inpatients, laboratory orders are received through a computerized physician order entry system and resulted electronically to the various hospital units. For outpatients, orders are received on paper requisitions and entered manually in the laboratory information system.

LEPS: What motivated the medical center to adopt lean methods and culture?

Rutledge and Simpson: In 2004, the medical center decided to adopt lean as its underlying method and culture. This was in response to state budget cuts, and the need to grow the hospital from 210 to 250 beds. The lean implementation started with some rapid training and small projects, and these projects achieved success. After these small successes, the hospital was ready for larger projects and the laboratory implementation of lean was one the first of these projects.

LEPS: What was your attitude regarding being the first large project?

Rutledge and Simpson: Our attitude was we needed to implement lean for survival. We were facing budget cuts, hospital expansion, and a front-end of the laboratory already at full capacity. We also had a strong desire to make our services more predictable to our users and to improve turnaround times, especially to the emergency department and intensive care units.

LEPS: How long has the lean project been going on?

Rutledge and Simpson: It started 18 months ago. The first 6 months were largely design and implementation. We have been living with the full lean concept, and the work cell it created for the last 12 months.

LEPS: Did hospital leadership give you special support for implementing lean since you were the first large project?

Rutledge and Simpson: Yes. The hospital administration was willing to pay for an experienced, full-time consultant from Ortho Clinical Diagnostics who worked beside us *in* the laboratory for 4 months. This greatly facilitated the learning and implementation of lean. In addition, the administration allowed us to remodel our space to conform to lean principles. In return for these investments, hospital administration expected us to improve services and absorb increases in test volume without increasing employees.

LEPS: Did you have the consultant train all 50 employees?

Rutledge and Simpson: We used a train the trainer approach where the consultant worked directly with the two of us and a team of six staff that we chose to implement lean. Some of these staff members are now the hospital's top experts in lean.

LEPS: What other training have you received?

Rutledge and Simpson: We regularly attend hospital meetings where lean projects are discussed. In addition, one of us (JR), did site visits to a Boeing airplane facility and a Saturn automobile plant that have implemented lean and has received many hours of in-house lean indoctrination.

LEPS: What did you learn at Boeing?

Rutledge: I went to a Boeing plant that flies out a new 737 airplane every 11 days. I expected that a plant producing planes this quickly would be chaotic, with people running around, and plenty of yelling and screaming. What I found instead was an organized and

quiet facility. There was surprisingly little movement. That is what lean looks like, and we observed the same transformation in our leaned core laboratory.

LEAN BASICS:

LEPS: There are a fair number of management principles underlying lean^{1,3}, and it is not our purpose to recapitulate all of them. We want to focus on those principles that our readers could apply to quality improvement without significant additional training. What are the most important aspects of lean that you want to teach our readers?

Rutledge and Simpson: Two important and related principles are the elimination of waste and the use of single-piece flow.

LEPS: Let's start with waste.

Rutledge and Simpson: Waste is defined as anything that does not add value to a service. We have briefly listed the some common categories of waste in the laboratory testing process in Table 1, along with examples.

Waste Categories	Laboratory Examples
Delays	<ul style="list-style-type: none"> • Between test order and sample draw, sample draw and arrival in lab, receipt in laboratory and processing, specimen processing and analysis • Delays related to using serum (requires clotting) rather than plasma • Analytic delays • Postanalytic delays in reporting results • Delay in retrieving results by care provider
Duplication	<ul style="list-style-type: none"> • Duplicate specimen collection and test orders
Correction	<ul style="list-style-type: none"> • Redraw due to suboptimal specimens (e.g., short draw, line contamination) • Redraw due to mislabeling • Repeating tests because of analytic error • Any other error leading to a corrected report
Motion/Steps	<ul style="list-style-type: none"> • Positioning the most commonly used analyzers far away from specimen processing • Using a multi-step manual assay, when an automated assay with fewer steps is readily available.

Inventory mismanagement	<ul style="list-style-type: none"> • Insufficient inventory • Too much inventory (e.g., reagents outdating before use)
Table 1. Common types of waste in the clinical laboratory	

LEPS: Tell us about single piece flow.

Rutledge and Simpson: Single piece flow is an approach to decreasing delays and other waste, and it is applicable to laboratory testing. There is no batching in single piece flow. A specimen is drawn and immediately transported to the laboratory, where it then moves through all phases of the testing process without waiting for other specimens.

LEPS: Why is batching a problem?

Rutledge and Simpson: Batching introduces delays. If a phlebotomist accumulates 20 specimens before transporting them to the laboratory, the first specimens drawn are significantly delayed before being transported. Similarly, if a tech waits for a large number of specimens to arrive at the centrifuge before running it, many of the specimens are sitting around waiting for the centrifuge. These delays add no value.

LEPS: Can single piece flow be used throughout the testing process?

Rutledge and Simpson: For many steps in the process, you can move to single piece flow, or to very small standardized batches, for example 2 specimens transported at a time.

LEPS: Is batching ever indicated?

Rutledge and Simpson: For hospital units that have restricted access, which is the case with our inpatient psychiatry unit, it is not feasible to draw specimens then transport them using single piece flow. In that unit, we draw all the specimens, and then transport them. Analytically, batching is reasonable when a particular test is rarely urgent and when running the instrument and controls would be too expensive and cumbersome to support single piece flow.

LEPS: Besides single piece flow, what are some of the other aspects of lean that have been of particular importance to you?

Rutledge and Simpson: It has been useful for us to focus on standardizing work and decreasing motion. We have become particularly good at using video to do time-motion studies that detect inefficiencies in motion.

LEPS: Can you give examples?

Rutledge and Simpson: A good example of standardization would be moving from 22 individually arranged phlebotomy trays to 6 standard ones. A good example of decreasing motion would be our arrangement of high volume work into a work cell. The work cell consists of two adjacent lines of instruments. One line is chemistry, and the other is hematology and coagulation, and the whole cell is in close proximity to the processing area. This arrangement has decreased the amount of distance a specimen traveled by 50% and it strongly supports single piece flow.

LEPS: What if a specimen in the work cell is problematic? Do all the specimens behind it get backed up?

Rutledge and Simpson: Problems of any sort are isolated, pulled from the specimen flow and assigned to a different technologist so that single piece flow can continue uninterrupted.

LEPS: Was it hard for technologists get used to keeping the specimens flowing, and not working on the problem specimen.

Rutledge and Simpson: Yes. Lean requires many changes in work habits.

LEPS: In your talks, you state that one of the most impressive aspects of lean is that it is data driven. What metrics do you use to monitor performance?

Rutledge and Simpson: Specimen collection to receipt in lab has to be less than 12 minutes, and we consistently achieve that. Once in the laboratory, we monitor the turnaround times (from receipt in the lab to resulting in the electronic medical record) for ionized calcium, prothrombin times (PT), urinalysis (UA), complete blood counts (CBCs) with and without differentials, and creatinine. The turnaround times are a functional measurement of how well the work cell is performing.

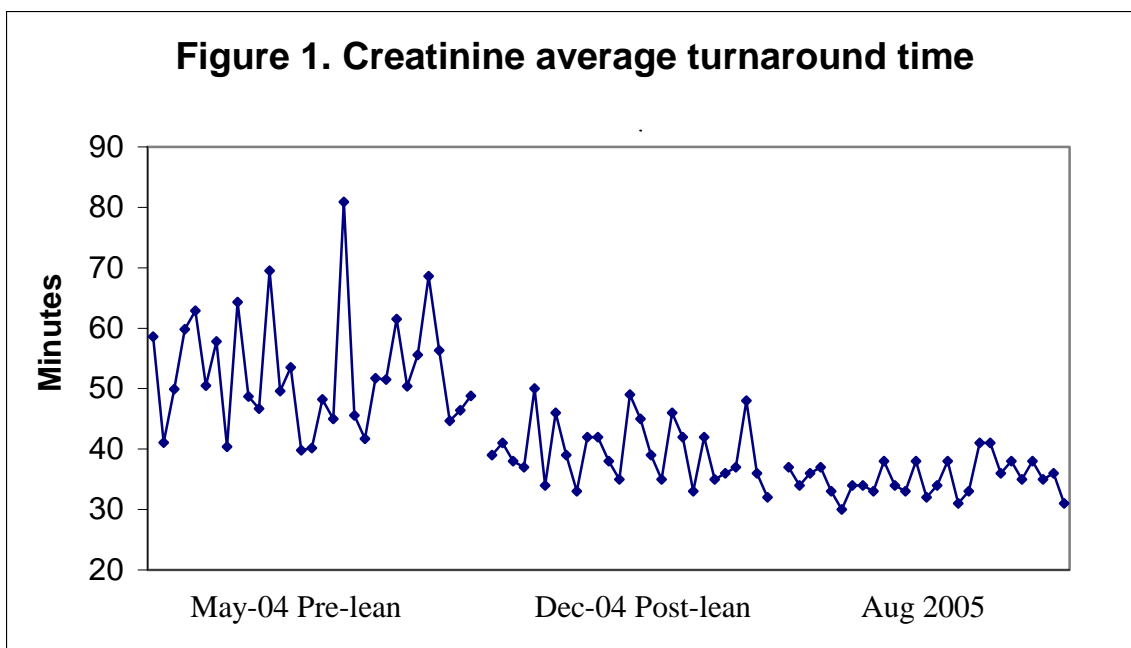
LEPS: Can you show us some sample results, pre-lean vs. post-lean?

Rutledge and Simpson: Turnaround times are shown in Table 2, which contrasts the pre-lean results with the results 15 months after we started the project. Typical results regarding sustainability are shown in Figure 1, which graphs creatinine turnaround time over time.

TEST	Before lean	% < Target	After lean (Oct 2005)	
	Avg (range)		Avg (range)	% ≤ Target
Ionized Calcium	11(1-99)	99%	8 (3-29)	100%
PT	37(9-170)	88%	24(15-46)	100%
UA	35(2-189)	85%	22 (3-78)	95%
CBC with ANC	31(3-190)	87%	23(3-107)	97%
CBC with Diff	62(7-323)	69%	40(7-107)	91%
Creatinine	54(9-152)	71%	35(10-97)	94%

Table 2. Turnaround times (minutes) before and after lean. The "Target" time is 60 min except for ionized calcium, which is 30 min.

PT=prothrombin time, UA=urinalysis, CBC = complete blood count, ANC = absolute neutrophil count, Diff = differential, min=minute.



LEPS: That is impressive. Was one of your goals to remove stats?

Rutledge and Simpson. Yes, and that has been accomplished.

LEPS: What was the reaction of the medical staff when you told them you were removing the stats?

Rutledge and Simpson: We did not tell the medical staff that we removed stats. They still think they are ordering the tests stat.

LEPS: That's fantastic, and mildly amusing. How did you manage that?

Rutledge and Simpson: We received few complaints about our service before the project and even fewer after the cell went live. Before lean, we treated as stats all orders from the intensive care unit, emergency department, or operating room, and orders from other locations labeled as stats. This is about 60% of our testing volume, and before lean, these specimens moved to the front of the line. Now, with lean, we achieve better results without moving stat specimens to the front of the line. That is the fruit of single piece flow, standard work, and the work cell.

INTEGRATING LEAN PROJECTS: GETTING OUT OF THE LAB SILO

LEPS: Some of the biggest improvements with lean come when lean projects get linked into one coherent whole⁴. Do you have any examples of this, or is it too early?

Rutledge and Simpson. This is the most exciting part about becoming a lean organization, rather than just a lean lab. A good example of the integration of lean projects is the gains that our hospital has made regarding the administration of total

parenteral nutrition (TPN). Before lean, the process took 70 steps and 12 hours from the time the patient was first rounded on until delivery of the TPN product to the bedside. After lean, the process takes 46 steps and 7 hours.

LEPS: What were some of the inefficiencies?

Rutledge and Simpson: The TPN order required coordination between a pharmacist, a dietician, and a physician, and they did not round together. It took a long time and many phone calls to agree on the order and get it out. Decisions depended on lab results, and lab results were often not available when the different care providers rounded on the patient. This produced even more delays. In addition, TPN orders were batched. The overall process was slow and error prone.

LEPS: What happened when lean principles were implemented?

Rutledge and Simpson: We implemented single piece flow for the whole process, which now looks like this:

1. Patient's specimen is collected
2. Specimen is brought to lab
3. Lab processes specimen and produces results
4. Care team, consisting of pharmacist, dietician, and physicians arrive at patient's bedside, analyze the clinical data including lab results, and come up with a TPN order.
5. TPN order is transmitted before care team moves to the next patient.
6. TPN product (which is manufactured off site) is delivered to hospital unit
7. TPN product is administered at patient's bedside.

The care team started rounding together, instead of separately, and handling the TPN orders in single piece flow fashion. We timed our single piece flow process to theirs so that lab results were available to the care team when they arrived at the patient's bedside. This integration required that our collection times and the care team's rounding schedule be predictable and consistent.

LEPS: That is beautiful. Womack and Jones⁴, refer to this as two groups, who were hitting individual lean notes, coming together to play a lean tune.

Rutledge and Simpson: The laboratory lean project, by itself, would produce modest improvements in the TPN service, as would the care team's project. Integrating the two lean projects gave dramatic quality improvements, and now this project is being rolled out throughout the hospital. In addition, we are participating in a similar integrated project to dramatically decrease the time it takes to administer medications, especially those requiring therapeutic drug levels.

STAFF AND LEADERSHIP ISSUES

LEPS: Tell us about some of the challenges related to gaining acceptance of lean among front line laboratory staff.

Rutledge and Simpson: At the beginning of the project, the biggest challenge was to communicate how worried we were about the future, without panicking the staff.

LEPS: Were you able to effectively communicate this to staff?

Rutledge and Simpson: No, and this was a big problem. We were *saying* to the staff that because of budget cuts in the face of hospital expansion "we needed to improve" and "things were not going to be OK if we stay with our current processes". But what the staff was *hearing* was that "staff are performing badly" and "staff needs to work faster".

LEPS: What role did being proactive have in this communication problem?

Rutledge and Simpson: It had a significant role. The problem with being proactive was that the staff was not feeling any of the pain, as it had not occurred yet. From their perspective, work was going well. They were not receiving complaints from the major users, like the emergency department. It was hard for them to imagine that we were entering a crisis, and looking back on it, their attitude makes sense.

LEPS: Strong interventions work best if there is a preceding culture change, but it is hard to get culture change, when work appears to be going well. In your case, you were off to a tough start, since the staff was not bought-in to the vision of the project.

Rutledge and Simpson: That is an understatement.

LEPS: And putting on the 20-20 vision goggles of hindsight, what would you have done differently to gain earlier buy-in by staff?

Rutledge and Simpson: If we had to do it again, we would start with some small, successful lean projects. A small project involving the emergency department would have been ideal. An early modest success on an inter-departmental project would have helped give the larger project more meaning and urgency. It would have helped the staff see, that even though they were not receiving many complaints, there was a need to change.

LEPS: How bad did morale get?

Rutledge and Simpson: After the first six-month period, which included the consultant, was over, and we were just starting to live with the work cell, the morale was the lowest we had ever seen. Staff members regularly came into complain. Some complained directly to hospital administration.

LEPS: So it is now 1 year after morale hit rock bottom. What is the morale like now?

Rutledge and Simpson: It has been a long journey, but we have made significant gains toward the morale we had before the lean project.

LEPS: Why has morale returned?

Rutledge and Simpson: There are several reasons, but the most important are:

- Issues are getting addressed. In the first few months of living with the work cell, we were running in place, now we are able to be proactive regarding many potential problems, and rapidly address existing problems.
- More of the staff has received training in lean, and so they are buying-in to the concept, and participating in improvements, rather than feeling like lean is being imposed on them.

- Lean works. The staff knows this, since we post our metrics daily. They also see it in other hospital units since our staff receive the hospital newsletter and attend oral reports from other units, where lean successes are shared.

LEPS: Does lean save money?

Rutledge and Simpson: Yes. Lean saves money by eliminating waste. Less people do more work in the same space because they are working more efficiently.

LEPS: Is lean mean? Did people lose their jobs?

Rutledge and Simpson: No jobs were eliminated. The hospital was expanding, but unable to add enough laboratory staff to meet the added testing volume. Lean allowed us to get the job done with existing staff, by eliminating waste.

LEPS: There have been cases of laboratories where lean implementation succeeded in the short run, but then failed because the gains were not sustainable. In these cases, the behavior of staff reverted from lean to pre-lean. Clearly, your facility is going to reach sustainability. What is the secret?

Rutledge and Simpson: There are several important factors for obtaining sustainability. The buy-in, and active participation of staff is certainly one of them.

LEPS: And what about the importance of leadership?

Rutledge and Simpson: Sustainability requires committed leadership with direct, visible involvement.

LEPS: Is this also the case at the other companies you visited?

Rutledge: It certainly was the case at Saturn. I was impressed with the implementation of lean at Saturn. They had achieved efficient automobile production, with only a few cars per month failing inspection. But they made even greater gains when they switched to a stronger leader, which occurred after my visit. That leadership change brought in an active leader who was on the production floor each day, and they improved further, achieving a near zero failure rate. I was told that the improvement was due to the presence of the new boss, not redesign.

LEPS: What is the effect on lean on the leadership?

Rutledge and Simpson: The project puts pressure to perform on the leadership. Lean requires that we get into the laboratory more frequently, and has trained us to view the laboratory with a new set of eyes. We detect waste that we would not have detected before.

CONCLUSIONS

LEPS: What is next for you?

Rutledge and Simpson: We want to keep improving the main work cell, but realistically, these improvements are going to be relatively modest. Therefore, we are shifting our focus to those laboratory areas where we might be able to make dramatic improvements, for example inventory management, microbiology and blood banking. In

addition, we want to continue to work on lean projects involving the integration of laboratory services with other services like pharmacy and radiology.

LEPS: We have some readers who are so busy that they just skip to the bottom of the article looking for some pearls. How about ending the interview with a take home message.

Rutledge and Simpson: Much of lean is common sense, but you have to apply it. The principles are: a place for everything and everything in its place, standardize your work, relentlessly cut out waste, and change systems to prevent errors from occurring. Do not let exceptions clog up the works. If there is something your lab could not achieve because of a perceived lack of time, use elimination of wasted time to accomplish it.

LEPS: Congratulations on your sustained success. Was this interview lean?

Rutledge and Simpson: This interview was neither lean nor mean, but we hope it helps your readers.

LEPS: OK everybody, let's get out there and root out some waste.

References

1. McDowell J. Getting the fat out of labs: how "leaning" can help labs cut waste and improve output. *Clin Lab News*. 2005; 31(3): 1.
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3. Liker JK. *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*. McGraw Hill, 2004.
4. Womack J, Jones DT. Beyond Toyota: How to root out waste and pursue perfection. *Harvard Business Review*. 1996; September 1, 1996. Reprint 96511.

Pull Quotes:

"In the face of budget cuts and hospital expansion, we needed to implement lean for survival."

"We did not tell the medical staff that we removed stats. They still think they are ordering the tests stat."

"Sustainability requires strong leadership"