

LEAN Lab Implementation Improves Turnaround Times and Leads to Faster Results and More Confident Clinical Decision Making



Joseph Campos, Ph.D.
Director of the Microbiology and Molecular Diagnostics Laboratories
Children's National Medical Center

LEAN Lab Design is a service offered by bioMérieux in partnership with Guidon Performance Solutions. The service applies LEAN®/Six Sigma® principles to the microbiology lab. This service involves 3-5 days of observing the lab at its current state – the physical layout and the manner in which samples are processed. The deliverable is a roadmap outlining how the lab can improve processes to reduce waste and improve efficiency, while simultaneously increasing the quality of results and reducing errors.

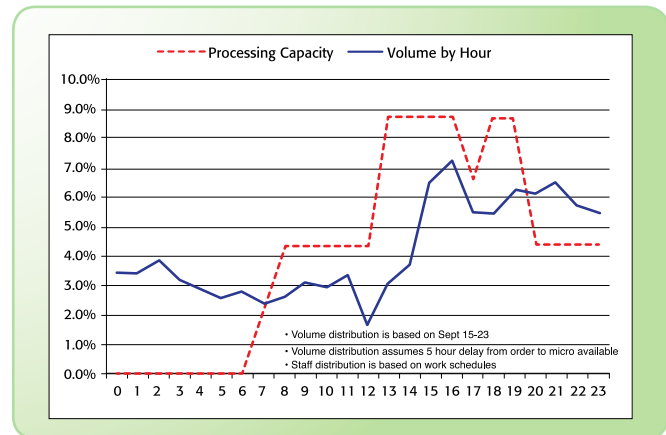
In 2009, The Children's National Medical Center (CNMC) partnered with bioMérieux-Guidon to apply the Lean/Six Sigma process to the hospital's microbiology lab. Two years later, the results on workflow, turnaround times (TATS), and patient outcomes have been dramatic.

What is the Value to the Patient?

According to data collected by bioMérieux, the vast majority (87%) of process time in the average U.S. hospital microbiology laboratory is not spent on "core value" activities. On average, 5% of process time is spent on backlog requests, 23% on extra work performed because of missing information, 27% waiting to complete the next "core value" step due to unavailable staffing or equipment, 4% spent on unnecessary motion (e.g., walking to the next task), 12.5% spent on review and quality assurance, 7% spent on call or log information, and nearly 10% spent on correcting quality issues.

The Intangible Value of the Microbiology Lab and How It Can Be Wasted

In the bioMérieux-Guidon LEAN Lab process, inefficiencies are defined as waste - but not in the traditional sense. This waste includes over-producing, work-in-process, transport, excess motion, inactivity, errors and rework, and over-processing. "In our approach, waste actually refers not to the true value proposition offered by the microbiology laboratory: its expertise, time, and capital," said Anne Beal, Manager Workflow Optimization Team at bioMérieux. "It's not a tangible thing, but the relationship of the laboratory as a resource and the members of the laboratory staff. This is not the kind of waste that ends up in a garbage can, but it is in a very real sense a missed opportunity to improve the core value of the microbiology laboratory."



GRAPH 1: Hourly Volume and Specimen Process Staff Capacity Distribution

For example, Graph 1 demonstrates "waste" because laboratory staffing isn't aligned with laboratory workload. This analysis was part of the "Kaizen Approach" used in bioMérieux and Guidon's review of the microbiology laboratory at CNMC.

Post-LEAN Staffing: Minimizing the Extreme Peaks and Valleys

Prior to the LEAN laboratory assessment, the microbiology laboratory at CNMC employed 11 FTEs plus a supervisor - and it still does. But thanks to our increased efficiency, the productivity of our staff has dramatically improved. The LEAN Laboratory assessment demonstrated that the microbiology laboratory had marked peaks and valleys of activity, which we needed to level off.

Spreading the Workload and Improving Morale

Pre-LEAN, we were essentially a day-shift laboratory, from 7:30am to 4pm, with almost all of our staff working that shift. As a result, the day shift began each morning with a backlog of new specimens and positive blood cultures from the previous night that needed to be processed. One of the most effective changes made after our LEAN assessment was to convert our microbiology laboratory to a 24-hour operation, Monday through Friday. By staffing both an evening shift (3:30pm to midnight) and a night shift (11:30pm to 8am) with two technologists, the day shift (7:30am to 4pm) arrives each morning to find the workload from the evening and night shifts has already been completed.

And, since that 8.5 hour day shift window often wasn't sufficient to complete the work, the pre-LEAN laboratory required a great deal of overtime. Those overtime hours have been markedly reduced by distributing the workload over a 24-hour period.

With four FTEs working the evening and night shifts post-LEAN, the laboratory is constantly processing new specimens and examining new cultures. Positive cultures are now identified and worked up during the evening and night shift hours and those results are made available to physicians immediately. There are still mild peaks and valleys of activity, but we have eliminated a great deal of wasted inactivity.

The reallocation of our 11 FTEs was just one step in our LEAN process. By redistributing our staffing to make it possible to process our workload across all three shifts, we made it possible to move automated molecular testing from our day shift-only Molecular Diagnostics laboratory to the Microbiology laboratory. This testing is now performed STAT as specimens arrive rather than waiting to be tested in batch mode. The improved TAT for automated molecular testing has been impressive.

In the pre-LEAN laboratory, all culture plate reading occurred during the day shift only. If growth was insufficient to permit culture workup, the culture media were placed back into the incubator for another 24 hours. Now, our cultures are examined for the first time after 16 hours of incubation, regardless of the time of day. If growth is insufficient for culture workup, the culture media are re-incubated for four hours and checked again. Very often, 16 hours of incubation is enough time to obtain adequate growth to inoculate identification and antimicrobial susceptibility tests. In our pre-LEAN laboratory, inoculation of identification and susceptibility tests from uncomplicated cultures often occurred 24 - 48 hours after specimen receipt. Currently, it usually happens within 16 hours, and almost always in less than 24 hours.

Redesign Focusing on Core Value Improvement

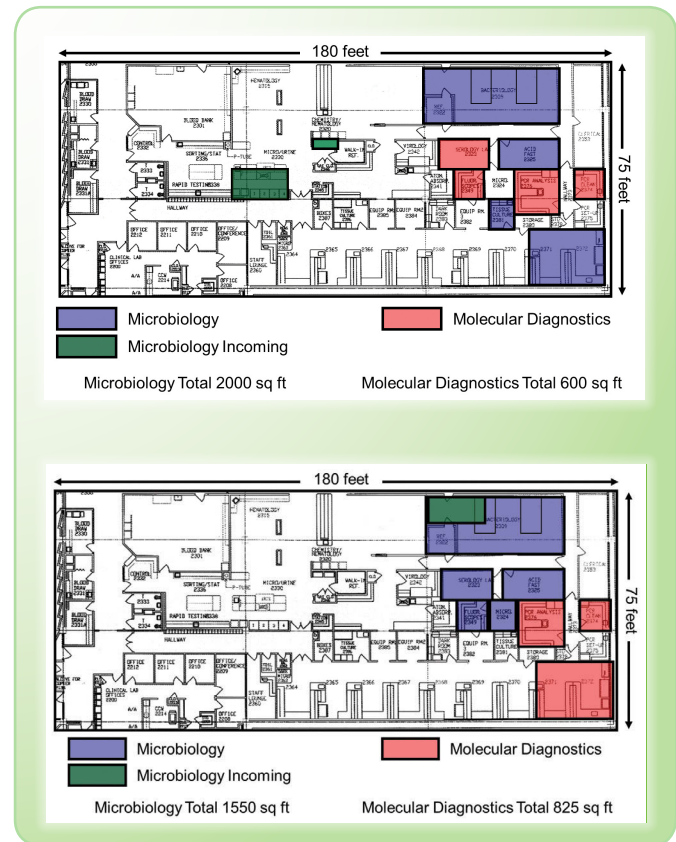
One of the other major changes resulting from the LEAN Laboratory assessment was better utilization of our laboratory floor space. Prior to the redesign, our Incoming area was a major laboratory thoroughfare, so you can imagine the chaos created by frequent walk-throughs in an area where our laboratory scientists needed to be very focused. Post-LEAN, our Incoming area is cellular in nature and is now much closer to our media storage cold room and our incubators, resulting in much less nonproductive walking.

The Law of Unintended Good Consequences

An unexpected benefit of distributing our workload over 24 hours derived from consolidation of our workstations. With fewer staff now working on our day shift, the microbiology laboratory actually needs less bench space since we eliminated

two of our four culture plate reading areas. By converting our classic virology testing to molecular testing, we eliminated two tissue culture hoods and a tissue culture incubator, freeing up valuable floor space. Even more floor space was recovered by instituting twice weekly, instead of once weekly, culture media shipments, enabling us to move refrigerated supplies from no longer needed floor-standing refrigerators to now empty shelves in our cold room. Some of the "new" floor space was used to house bioMérieux's PREVI® Isola automated plate streaking system. Not only does this award-winning device free up well-trained lab scientists from the chore of manually streaking culture plates, PREVI Isola has demonstrated that it provides better colony isolation, leading to fewer subculture plates during workups and faster results from identification and antimicrobial susceptibility tests.

As shown in Graph 2, the Molecular Diagnostics laboratory occupied many noncontiguous spaces in the Department of Laboratory Medicine prior to the LEAN redesign. That is because such a laboratory could not even be imagined when the hospital was built in the early 1970s and thus it was squeezed into existing "nooks and crannies" available in the Department. Now, the Molecular Diagnostics laboratory is more consolidated and has an additional 225 square feet.



GRAPH 2: Before (top) and after (below) lab layout at CNMC

The Ultimate Measure: Turnaround Times

We compared the TATs from identical six month periods: November 2009 to April 2010 (Pre-LEAN) and November 2010 to April 2011 (Post-LEAN). We confirmed that testing performed during these periods was comparable in nature and volume, and came from patients with similar demographics.

We have seen a significant improvement in TATs for positive cultures from all specimen types, including blood, stool, urine and more. We've gained, on average, a complete day in our positive culture TATs post-LEAN (Table 1). This is most profound early in the work week. Since the LEAN staffing changes had to be limited to weekdays, we've seen no improvement in TAT for specimens collected on Saturdays, and a slight improvement for those collected on Sundays.

TABLE 1: Days of the Week: Pre- and Post-LEAN Positive Culture TATS

Specimen Collection Day	Pre-LEAN Average TAT	POST-LEAN Average TAT
Monday	4.1 days	3.2 days
Tuesday	3.8 days	2.7 days
Wednesday	3.7 days	2.9 days

We analyzed the TAT improvements for patients located in our critical care areas, the pediatric and cardiac intensive care units (PICU and CICU), our emergency department (ED), and in our neonatal intensive care unit (NICU). Table 2 illustrates the improved TATs for positive cultures from these patients.

TABLE 2: Critical Care TAT Improvements by Department

Critical Care Department	Pre-LEAN Average TAT	POST-LEAN Average TAT
CICU	3.5 days	2.7 days
ED	3.2 days	2.8 days
NICU	2.7 days	2.6 days
PICU	2.9 days	2.3 days

Ultimately, physicians want to make sure they can make the best possible decisions based on their clinical expertise and the symptoms and clues they see in their patients. Often, they have to act before they have all the data at their fingertips because their patient is in critical condition. These time-to-results improvements that we've seen across the board from our microbiology lab are vitally important because they confirm when our physicians have made the right empiric decisions and their patients are being treated correctly, or they tell our physicians to change course and treat their patients differently. In the first case, our improved TATs have given us greater confidence that our patients are being cared for appropriately. In the second case, these saved hours or days can mean the difference between recovery and serious morbidity/mortality in a difficult-to-diagnose patient. ■

bioMérieux, Inc.
100 Rodolphe Street
Durham, NC 27712
U.S.A.
Tel: (800) 682 2666
Fax: (800) 968 9494

www.biomerieux-usa.com

