

# Tulare County Public Health Lab's Lean Journey

## Lean tools combined with Orchard's laboratory information solutions add value and reduce waste

Tulare County Public Health Laboratory (TCPHL) received an exciting grant, administered through the Association of Public Health Laboratories (APHL), to implement Lean practices that improve laboratory efficiency. As part of its Lean toolkit, it selected Orchard Software's laboratory information solutions to help streamline its processes, eliminate waste, and add value to its customers. Combining Lean concepts with a strong IT solution has achieved measurable improvements in quality and cost savings at TCPHL.

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## Introduction

### APHL Grant to Implement Lean

Tulare County Public Health Laboratory (TCPHL) is one of four labs receiving an exciting grant administered through the Association of Public Health Laboratories (APHL) to implement Lean practices. Lean is a quality improvement process that systematically looks at processes to eliminate waste and identify ways to improve sustainability. APHL promotes this initiative with the goal of encouraging projects that are geared toward improving lab sustainability across the country.

### About Tulare County Public Health Lab

TCPHL, located in Tulare, California, rests in a 6,750-square foot building built in 1992. The lab is connected to a 1920s-era building that served as the county hospital and now houses local government offices and a health clinic. In 2005, the lab gained a new BSL-3 suite and negative-air-pressure anteroom to accommodate high-risk agents and rapid bioterrorism rule-out or confirmation. TCPHL is responsible for supporting public health programs, testing in support of outbreak investigations, surveillance, and public health emergencies in Tulare County and the surrounding regions in conjunction with the California Department of Public Health (CDPH) and the Centers for Disease Control and Prevention (CDC).

Denise Lopez, MS, PHM, Laboratory Manager, and Environmental Laboratory Accreditation Program Director for water testing, oversees Tulare's lab, with consultation services provided by Robin Purves, MS, PHM. They employ three milk technicians, two lab assistants, one office assistant, and five public health microbiologists (PHM), including dual-licensed PHM/clinical laboratory scientists (see Figure 1).



Figure 1: TCPHL Staff

TCPHL has a solid reputation in its area, annually performing approximately 42,000 tests with a budget of \$1.1 million, with their highest volume in dairy testing. The lab also performs drinking water, chlamydia/gonorrhea, TB, and HIV testing. Most remarkable is the broad diversity of services provided by such a small staff. They are able to accomplish this because their staff members are highly cross-trained in challenging specialties (i.e., bacteriology, parasitology, mycobacteriology, molecular diagnostics, serology, and mycology). Although very successful, Tulare plans to become even more efficient in providing outstanding service and has readily embraced the Lean challenge.



## Lean Training & Certification Requirements

### Lean Boot Camp Graduates

Fifteen public health lab professionals from across the country attended a two-week Lean “boot camp,” where they were introduced to the basics of Lean and had an opportunity to work through simulated Lean exercises using Lean tools. During boot camp, three of the 15 were selected to be financially supported to go on to become Certified Lean leaders and Tulare County was one of those selected. This year-long certification process was done in conjunction with a contracted Lean consultant from Becton, Dickinson and Company and support from APHL. During the course of the boot camp and certification process, participants learned strategies for developing a Lean culture, such as managing change, running effective meetings, engaging and empowering workers, managing resistors, and using Lean tools.

During the initial year of Lean implementation, participants are required to charter and complete at least three projects, using all their Lean tools at least once. At the end of the project, results are presented to their company’s executive steering committee to complete the certification process. But that is certainly not the end of the Lean journey. Lean is an ongoing work towards improvement—the beginning of a new culture.

### Six Projects Underway

Although the requirement was to tackle three projects, TCPHL is in the process of six projects (see Figure 2), each touched by the LIS in one way or another. The lab will use Lean tools such as spaghetti diagrams, value stream mapping, brown papers, and more to delve into each of the project categories. Quality improvement is monitored throughout, targeting the reduction of “up-front” errors that can have significant downstream effects, such as wrong specimen collected, incomplete test order information, data entry errors, and so on.



Figure 2: TCPHL's Six Lean Projects

## Orchard's Lean Lab Solutions

### Orchard Harvest LIS & Orchard Copia as Lean Tools

What is unique about TCPHL's Lean journey is that, in addition to the Lean tools, they simultaneously implemented Orchard® Harvest™ LIS and Orchard® Copia® as additional quality improvement tools to boost Lean success. Prior to Harvest LIS and Copia implementation, TCPHL worked with a rudimentary 12-year-old LIS that had only basic functionality and no structured data fields, therefore no significant ability to mine data. For example, in order to pull a report, manual paper counts typed into a spreadsheet were the only option, creating quite a burden for staff and limiting the quantity and quality of service that could be provided.

Now that the first year of the Lean journey is complete, APHL urges TCPHL to share their story, using the data as an example to help and encourage other public health labs. Ideally, it will be able to present the metrics in such a way that another lab can take the data and generalize it to learn what they would potentially save by implementing Lean processes. For example, if your 20% pre-implementation error rate reduced to 1% post-Lean along with a 20% personnel cost reduction, labs can extrapolate those values into their own facilities. These results, tied to revenue, are very compelling. By being more efficient, labs can do more or do what they are currently doing with less. “Our lab services are multidimensional; we do a little bit of everything, so every public health laboratory will be able to identify with at least some of what we do. Our system also has to operate within all applicable regulations, with multiple internal instrument interfaces and three external HL7 interfaces, so this showcases the functionality of Harvest LIS and Copia,” says Lopez.

## Overview of Project Results Impacted by Harvest LIS & Copia Installation

Because of the implementation of Orchard's lab solutions, TCPHL was able to monitor specific metrics, comparing before and after LIS installation as part of its Lean study to determine how much efficiency and cost savings were gained by implementing the Lean process. Orchard's lab information solutions provide Tulare with ways to be more efficient and increase their quality of service. They are tracking the amount of personnel time saved, dollars saved, and how both time and dollars have been redirected to value-added tasks.

Still in its early stages, the ongoing Lean project at TCPHL, in conjunction with Orchard's lab solutions, has been able to save its facility and clients more than \$35,000, extrapolated annually. In addition, they have reduced paper use due to LIS-related activities by more than 50 pounds per year. A more in-depth review of each project follows, but installation of Harvest LIS and Copia has thus far had a direct measurable impact on each of the four projects listed below:

### Test Ordering

TCPHL was able to reduce test ordering time by up to 80%, resulting in savings (or redirection of labor) of approximately \$4,000 per year, just for one ordering location. Each ordering location will benefit in a similar way as they move from paper to electronic ordering. TCPHL has been able to reduce the use of paper requisitions by 70%, and that number continues to improve.

### Specimen Accessioning

Tulare increased their specimen accessioning capacity by 95% for samples electronically submitted by clients, equating to savings (or redirection of labor) of \$11,475 annually. This increase in capacity translates to 100,000 samples in the same amount of time that it previously took to accession 15,000. This has huge implications for increasing surge capacity during public health emergencies.

### Data Mining

The cost of data mining decreased by an average of 92% per report, resulting in overall savings (or redirection of labor) of more than \$6,000 annually. Previously, creating a billing report cost \$13 as compared to \$5 using the new system. Reports such as turnaround time (TAT) and rejection rate that were previously as high as \$76 per report because of the manual labor involved, now are projected to cost \$0.

## Reporting

By auto-faxing reports, TCPHL was able to save more than \$2,500 each year in redirected labor. In addition, the total amount of paper used by the lab for reports has been reduced by 100%, as paper reports are no longer generated in-house. This reflects a 20% reduction in all paper use by the lab annually.

## Lean Culture

### Lean is Not an Acronym

Lean is a culture—a way of thinking supported by a team-based approach, with particular attention paid to the exact needs of a product's or service's customer and an eye on efficiency. Developed by Taiichi Ohno in the 1950s for the manufacturing process, Lean focuses on low-tech improvements first—the elimination of waste through the systematic changing of practices. A key concept is making sure that Lean works for you and not the other way around. “The preconception is that Lean is this box that you have to squeeze into, but this is not the case,” shares Lopez. “I made staff a promise that everything we do in the name of Lean will have demonstrated value. If something is not working for us, we'll change it. We will never jump through meaningless hoops and call it Lean.”

According to Lopez, the key to a Lean process is making a process easy to do the correct way. In other words, if there is a right way to do something, make that the easiest way. “If a process is convoluted, or if workers are all expected to memorize how to do it, they will do their best, but the results will be inconsistent,” explains Lopez. “When the right way is made easy to remember, using tools like visual process controls (signs and labels) and standard work (detailed instructions that are easy to update and access), then workers can spend energy thinking about how to improve the process rather than spending energy trying to memorize the current way to do it.” This makes it easier to incorporate new improvement ideas and still have the process well understood at any given time by all staff members. This is essential to ensuring staff are being given the tools to succeed with continuous improvement.

At TCPHL, processes were carefully reviewed, looking for areas to streamline before bringing in the added functionality of Harvest LIS and Copia. “If you systematically identify ways that you can improve your processes by changing your practices before you just throw an IT solution at it, it's going to go much better. Focus on the quality of your process first, and then layer an IT solution on top of it rather than the opposite,” says Lopez.

### Volunteers Add to Lean Culture

TCPHL was able to bring in 11 student volunteers and an intern to help with the Lean project. This turned out to be an added boon to the overall team-based culture imperative to Lean success. In collaboration with California State University, Fresno, the volunteers contributed more than 150 hours of service and had the opportunity to learn firsthand about the important role our public health laboratories play in the health of our communities.

The eager students worked with the microbiologists much like personal assistants—taking notes, entering data into spreadsheets—and one was motivated to pursue a career in the field of public health. On the other hand, the lab staff at TCPHL, in spending time with the students, had an opportunity to share their knowledge and to nurture and teach the students, which consequently made them “elevate their game.” The students’ hard work was invaluable to the project and supported the culture that Lean intends to cultivate. To read more about the student volunteer contribution from *Lab Matters*, visit [http://digital.aphl.org/display\\_article.php?id=1860427&id\\_issue=233346](http://digital.aphl.org/display_article.php?id=1860427&id_issue=233346).

### Voice of the Customer/Hot Button List

An integral part of Lean thinking focuses on maximizing customer service while minimizing waste. In order to do this, you have to clearly define who your customers are and what they value then only use resources in areas that maximize service to those customers (see Figure 3). The challenge is to do this systematically. “Voice of the customer” is the concept of clearly identifying your customers and getting to the heart of what they really need by asking questions and helping to clarify what you can offer to best meet those needs.

The number one cause of waste and ineffective service comes from incorrect assumptions, so it is imperative to find out what the customer’s true needs are. “For example, our paper order requisitions did not change often because it was difficult to control the versions being used and we assumed that if a provider or our health officer needed something to be changed, they would ask,” explains Lopez. “We found out through Lean that is rarely the case. Usually, the customer will suffer in silence or go elsewhere for service without saying a word.” Lean helps you be vigilant for opportunities to identify where customer value actually lies; the Lean tools allow you to shift your resources to more closely align with customer value.



**Voice of the Customer**

- Who are the customers?
  - External
    - The Public
    - Our Clients
    - Our Partners
  - Internal
    - Other Agency Departments
    - Our bosses
    - Our direct reports
    - Each other
- Advocacy/Inquiry – explore assumptions, get to the heart of it
- The lens through which we view our systems and processes

Figure 4: TCPHL's Voice of the Customer

### Eliminating Waste

What constitutes waste in the laboratory? The acronym used to remember eight common forms of waste is TIM WOODS (see Figure 4). There are a multitude of possible areas where waste can occur, starting with specimen transport. In a referral lab situation that involves courier routes, it is virtually impossible to transport specimens as soon they are collected; instead, they are transported in batches, which inevitably creates a certain amount of delay.



Another common area of waste is in overprocessing—staff members check and recheck information that has already been verified or forms are completed with duplicate information from other forms. Lean looks to reduce these types of redundancies because it recognizes the value of preventing problems. Specimen processing defects, such as improper data entry, can get passed down the line and reported out, thereby reducing overall product quality. Or, if the error is caught, time is wasted in correction and documentation.

Handoffs are another major area of waste. For example, when a task is completed and the product (specimen) goes to someone else for the next step, this is an area of potential waste and an opportunity for a defect or error to occur. Therefore, minimizing handoffs can also eliminate waste.

Other waste-driving issues are listed in Figure 5. “With Lean, teams learn to work together to come up with solutions rather than relying on management to decree changes. The people that do the work are the experts in the current process and are best equipped to come up with the best solutions,” says Lopez. “By recognizing them as the experts that they are, and empowering them to take ownership and make positive changes to the work they do, Lean helps us recognize and implement improvement ideas as quickly as possible.”

<b>T</b>	<b>Transport</b>
<b>I</b>	<b>Inventory</b>
<b>M</b>	<b>Motion</b>
<b>W</b>	<b>Waiting</b>
<b>O</b>	<b>Over-processing</b>
<b>O</b>	<b>Over-production</b>
<b>D</b>	<b>Defects</b>
<b>S</b>	<b>Skills underutilized</b>

Figure 4: Tim Woods Waste Acronym

<b>Incapable processes</b> (process does not work for all circumstances, is not visible to all, etc.)
<b>Lack of standard work</b> (process is not well understood by all, changes are difficult to communicate)
<b>Lack of training</b> (workers are not given the tools to be successful when performing the process)
<b>Poor communication</b> (information that the worker needs is not readily available at the time needed)
<b>Silos</b> (knowledge is “hoarded,” absence of certain workers means a process may not get done)
<b>Improper focus</b> (when things go wrong, focus is on “who” rather than “why,” errors/problems are not readily brought forward and incapable processes stay incapable)
<b>Poor control of supply quantity and quality</b> (items are tossed because they have expired)
<b>Lack of workspace organization</b> (driven by personal preferences rather than best workflow)
<b>Ineffective performance measurements</b> (focus on individuals rather than process improvements)
<b>Poor planning/scheduling</b> (no batch control or single piece flow)

### Value-added vs. Non-valued Added

Part of listening to the voice of the customer and eliminating waste entails carefully considering which tasks add value and which are non-value adding. Setting up the lab’s work processes (or standard work) in a way that makes sure each step adds value to the customer’s true needs is crucial in a Lean lab operation.

Figure 5: Issues That Can Create Waste

## Managing Change—Developing a Teamwork Culture

There is a common misconception about change—that when a necessary change is made, if it is a good one, things will immediately “get better.” However, in reality, when change takes place, everything initially takes longer because the process is completely different than before and everyone has to adjust. This can lead to a decrease in employee morale. If change is managed well, employees are given tools to succeed along with opportunities to see the potential in the new process through examples and small wins. Making it clear to employees that things are not going back the way they were also sets them up for success in moving forward and performing the new process well. Then productivity will finally begin to increase.

Moving through each stage can occur as a group, but it can also occur on an individual level, with some moving forward faster than others. In addition, the severity of the time deficit will depend on the magnitude of the change. The initial slump in productivity and morale is known as the “valley of despair.” Lopez communicated to staff that this will likely happen over the course of the implementation of Lean and the LIS switch. Staff members kept an eye out for anyone who was having a difficult time moving out of what they referred to as “pity city,” the lowest point in the valley. Being aware of this and preparing staff for it is an important part of managing change. Initially, even though the staff at TCPHL went into the Lean project with a willing and accepting attitude, Lopez knew that it would take a long time to actually “win their hearts” and establish credibility.

### *A Culture of Teamwork & Practices*



***We each want to be treated with respect...***

...so as a team we value treating each other with respect.

***We believe that the service we provide is important...***

...so we prove that by viewing our efforts through the eye of the customer.

***We acknowledge that our customers expect our decisions to be based on evidence, not on opinions or personal preference...***

...so we stay focused on improving our processes, not about “me.”

***We appreciate the freedom to choose...***

...so we each take turns volunteering for tasks/teams so they do not have to be assigned.

***We value each person's time...***

...so we agree to follow meeting standards.

***We want the best results as quickly as possible...***

...so we thank those with the courage to voice different opinions so we can evaluate the evidence from their perspective.

***We want to be heard...***

...so we encourage those that express concerns one-on-one, to have the courage to share with the team instead.

...in case others have the same concern.

...so they can be addressed.

...because they will be thanked by the team if they do so.

Figure 6: TCPHL Team Principles & Practices

As a starting point, they sat down together and developed their team's principles and practices (see Figure 6). Through the course of Lean, they are embracing these principles and have truly developed a culture of teamwork that involves mutual respect and a lot of "thank yous" between one another.

Differing opinions are not only accepted but are encouraged, leading to an environment where no one is afraid to speak up. Team members appreciate when their opinions are listened to, so they willingly and openly listen to opinions from others. At TCPHL, it took time to build trust in this crucial dynamic. To keep it lighthearted and fun, Lopez made them a promise. If she did not remember to thank them each time they voiced a difference of opinion in a group setting, they would be given a gift card to make up for it. "Cultivating an engaging team environment where each member feels valued and heard comes down to trust," says Lopez. "Trust takes time and consistency and can be undone in an instant, with one broken promise or derisive comment, especially from a supervisor. Trust is one of the things that can't be rushed or fast-tracked, but it's worth the painstaking investment. A team simply can't function well without it."

## Lean Tools

### Executive Steering Committee (ESC)

To ensure a smooth flow through its Lean journey, TCPHL has an executive committee charged with oversight. This level of management is in place to prevent and remove potential roadblocks in the way of Lean progress, to keep the ESC informed and allow them opportunities to provide feedback and direction, and to allow staff to see that their efforts are being recognized.

<i>Lean Daily Management Systems</i>
Huddle Meetings
PVD (Primary Visual Display) Boards
PDCA (Plan, Do, Check, Act/Adjust)
Hot Button List/Voice of Customer
Radar Charts
Kaizen

### Lean Daily Management Systems (LDMS)

The specific combination of helpful Lean tools can vary from project to project. However, there are several ongoing Lean tools used as part of a daily management plan (see Figure 7).

#### Huddle Meetings

One of the most effective communication tools in the Lean toolbox is the daily 10-minute huddle meeting. Meeting daily gives the team an opportunity to discuss ideas, review procedure changes or updates, discuss inventory or supplies, review any current public health event that may impact their workload or supply needs (such as the recent Ebola concern), etc.

Figure 7: Lean Daily Management Systems

Huddle meetings at TCPHL have helped the team develop a better appreciation for one another. For introverted personality types, speaking in front of a group can be uncomfortable. The frequency and consistency of huddle meetings makes it a powerful tool for shaping the team environment and building and maintaining trust. They bring everyone together in a neutral setting to discuss lab issues, not individual issues, and give everyone a platform for consistent, positive team interaction.

Huddle meetings also allow supervisors to take the “pulse” of the staff, e.g., see who is busy, who may need help, etc., on a daily basis. “We discuss the customer, processes, and systems. If there is a problem, we never ask, ‘Who?’; instead, we always start with, ‘Why?’” explains Lopez. “This is because Lean emphasizes that the process is the problem and the people are the solution. The only reason we ever single one person out in a huddle meeting is for a thank you. This allows us to maintain our principles and practices and supports our teamwork culture.”

### Primary Visual Display (PVD) Boards

A PVD board, around which huddle meetings center, is similar to a dashboard used to display ongoing lab projects. The board is used for everything from today's concerns to a 10-year vision list, and it changes on an ongoing, as-needed basis. New successes, upcoming training, inspections, new ideas, and hot button items are all updated on the board as changes take place.

### Radar Charts

Radar charts are an ongoing tracking and documentation tool for long-term goals and 10-year vision. The categories range from items such as cleaning, organizing, and huddle meetings, up to more acute topics such as safety, error proofing, and customer service. There are five potential ascending performance levels:

1. Leaving
2. Learning
3. Leading
4. Inspiring
5. World-class.

TCPHL has rated itself in each category and targeted areas for improvement over the course of the year. Each year, they rate themselves across all categories again, and this tracks long-term progress in these important areas

### Kaizen Groups

Kaizen, Japanese for “good change,” refers to continuous quality improvement, a concept most laboratories are familiar with. Ideas for improvement are encouraged and discussed in the huddle meetings. From there, Kaizen groups are developed to follow through on an idea. Kaizen is the Lean term for a mini project and anyone can volunteer to be in a Kaizen group, even if they do not do the process themselves. Kaizen is a way to capture valuable metrics for an improvement project, to recognize those who worked on it, and to ensure the project stays centered on Lean principles.



## More Lean Tools

Which Lean tools are used will vary from project to project. The section below has a short synopsis of some of the tools used for the six projects in place at TCPHL:

### Standard Work

Standard work is a document that describes, in detail, the most efficient way to perform a process while preventing errors. It is designed to be in step-by-step format, not paragraphs, for ease of use and clarity. Standard work can be created for anything as long as it is worth the effort to create and properly maintain. It is important to note that standard work should never contradict an official policy or procedure; it should always complement and clarify it. Also, standard work must be readily visible. Rather than compiling in a binder as is characteristic of most procedure manuals, standard work must be kept at the work space, preferably displayed.

Standard work is used to ensure that best practices are being followed and is intended to lower the threshold of time and energy required to cross-train staff. It makes training faster, makes it easier to switch positions quickly, breaks down silos, makes knowledge accessible, and reduces knowledge hoarding. Having standard work in place encourages cross-training and reduces the anxiety associated with learning something new.

Standard work is extremely helpful, but there is a factor critical to it being used successfully—it must be easy to update. “If standard work is not easy to update, it won’t get done. This was one of my earliest Lean implementation mistakes,” explains Lopez. “We really needed standard work in order for staff to keep up with the evolving specimen accessioning workflow as we optimized our new LIS. I thought that if everyone saw the value in the standard work, they would do the work to update it. However, since it was easier to grab a Post-it and slap it on the page, the standard work became full of Post-its and no one took ownership to update the actual electronic document. I realized that if I could make it easier to update the electronic document than it is to slap a Post-it on the hard copy, the problem would be solved.” They discovered a way to do just that, using numbered desktop shortcuts on specimen accessioning workstations that lead to the standard work of the corresponding number on a shared drive. With track changes preset on all documents, all staff needs to do now is click on the shortcut, type in their proposed change, and hit print. Changes are discussed at the next huddle meeting to get consensus before accepting the changes in the document. It works beautifully and the staff appreciates that the focus is on improving the processes, rather than blaming the people.

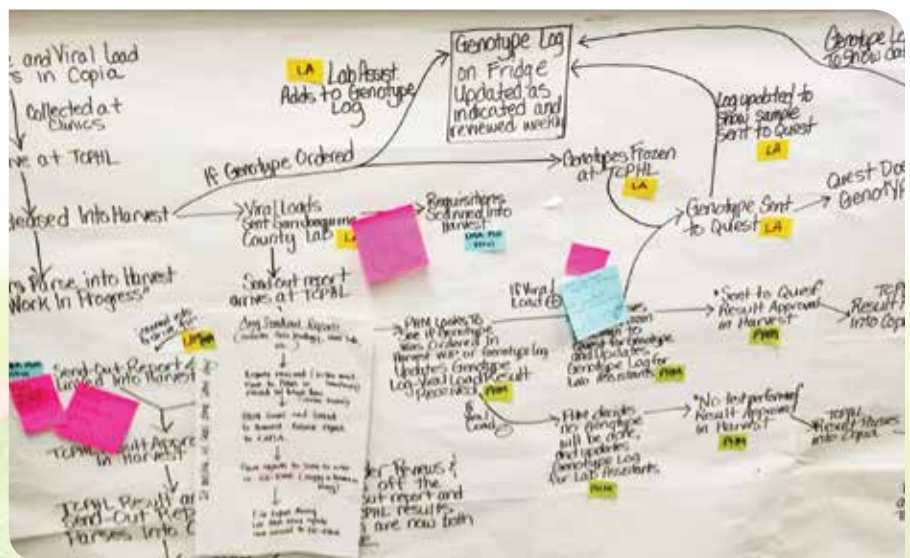


Figure 8: Informal VSM at TCPHL

## RACI Chart

The acronym RACI stands for Responsible, Accountable, Consulted, and Informed. A RACI chart is helpful for tasks that need clarification of roles and responsibilities. The chart defines who is responsible for a certain task, who is accountable to make sure it gets done, who to consult if there are issues or problems, and who to inform of any issues. RACI charts are used to improve accountability and communication.

## Value Stream Map

A value stream map (VSM) is a drawing or mapping of the current state of a process that can subsequently be used to improve that process and to map out a better process (see Figure 8). VSMs can be formal or informal.

## Brown Paper

In a VSM, when you identify a problem area, you use a brown paper to “zoom in” and take a closer look at not only the process but how each person performs it. This is used to identify best practices and create standard work, which eliminates waste.

## Visual Process Controls (Poka-yoke)

Visual or visible process controls are used as a tool to make the right way the easy way. These visual cues are part of poka-yoke, which means “mistake-proofing.” This refers to applying a technique that makes it difficult to make a mistake. Visual process controls are a great tool and can usually be implemented with very little effort. For example, TCPHL uses three different loops that correspond to sample types to plate microbiology cultures. To make the proper loop selection easier for the lab assistants who are plating the cultures, visual process controls were put in place. Brown tape is wrapped around the handle of the loop used for plating stool and yellow tape around the handle of the loop used for urine, so that when staff reaches for a loop, the right choice is the easy choice.

## Single piece Flow (Batch Control)

Single piece flow is widely used in manufacturing settings, but can be more challenging to achieve in lab settings. Random access instruments and their benefits are a perfect example of single piece flow in a lab. Anytime you are able to minimize batching, the time a sample sits waiting to be tested is dramatically decreased, as is turn-around time. Even if true single piece flow cannot be achieved due to courier scheduling issues, equipment restrictions, etc., minimizing batch size can still contribute to positive results.

### KanBan

On this date: 5/9/14

I notified this person: ROXANNE

to re-order this amount: 2 CASES

of this item. My initials: DL

- Improve communication
- Save time
- Prevent duplicate orders
- Alert to the need for follow-up

Figure 9: Kanban Communication at TCPHL

### Material Management (Kanban)

Kanban is a scheduling system tool used to facilitate just-in-time (JIT) production, wherein proper limits are established for inventory to avoid excess. Excess inventory leads to wasted storage space and wasted reagents due to expiration. TCPHL continues to improve their communication in regards to material management or inventory (see Figure 9).

### Spaghetti Diagrams

Spaghetti diagrams are used to track and map movement in order to identify wasted motion. If there is too much motion required to perform a process, there is likely room for improvement in how the workspace is organized to make it more intuitive. For example, if you use supplies from a cabinet located around a corner three times and you walk to that cabinet three times to collect the supplies throughout the process, you can track that movement on the spaghetti diagram and then establish your new workflow to move those items closer, thereby eliminating steps. Figure 10 demonstrates an example of a spaghetti diagram for steps taken to fax reports at TCPHL prior to LIS implementation. When excess steps are used, there is also a factor of wasted time that can be measured and tracked.

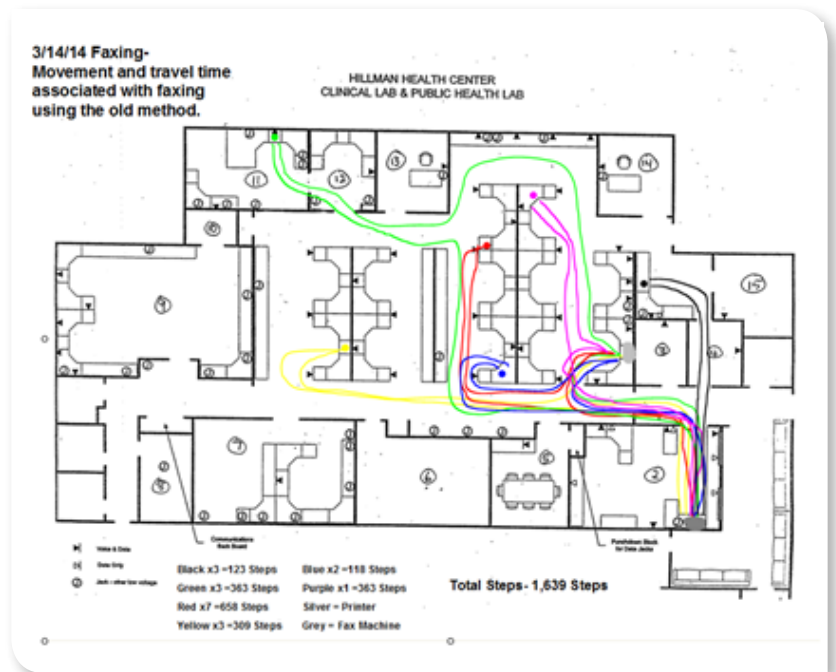


Figure 10: TCPHL Faxing Spaghetti Diagram

### 5S

The five “Ss” in 5S are sort, shine, set in order, standardize, and sustain (see Figure 11). 5S is a process that is used to clean out and reorganize a workspace. It focuses on organizing the workspace in a way that helps technicians do the work correctly rather than being a product of personal preferences or a random accumulation of items added on over time.

### Blitz

In Lean terminology, a blitz is major change that you cannot easily reverse. For TCPHL, implementation of Harvest LIS and Copia was its blitz move. Other examples would include major construction or replacing an analyzer—situations where the effort required to “undo” the change makes it impractical. A blitz can be an exciting and refreshing change, but also requires a well-thought-out strategy for implementation, often with preceding pilot projects.



Figure 11: 5S Diagram



## Project Charter

Each project undertaken at TCPHL started with a project charter, which is an overview of the project plan. For each of its six projects, it started by defining the customers, the specific scope of the project, and the project objectives. Figure 12 outlines some of the common project plan concepts and project objectives that were common to all six projects.

## Project 1: Test Ordering

The paper-based test ordering procedure in place at TCPHL prior to LIS

implementation was a clear example of waste via underutilization of skills, reduced quality of data, and redundancies. In comparing the VSMs before and after (see Figure 13), the time spent ordering per sample decreased from eight minutes per sample to five minutes per sample (clinical lab) and from 15 minutes down to 11 minutes for the medical assistants (MAs).

Project Plan	Project Objectives
Fully understand the customer's needs	Eliminate waste
Fully understand the current process	Add customer value
Identify differences (value vs. non-value added)	Improve communication
Identify opportunities to add value	Improve accountability
Identify opportunities to eliminate waste	Increase capacity at TCPHL
Implement these strategies effectively	
Ensure clear communication throughout	
Set up a process for ongoing improvement	

Figure 12: TCPHL Project Plan & Objectives

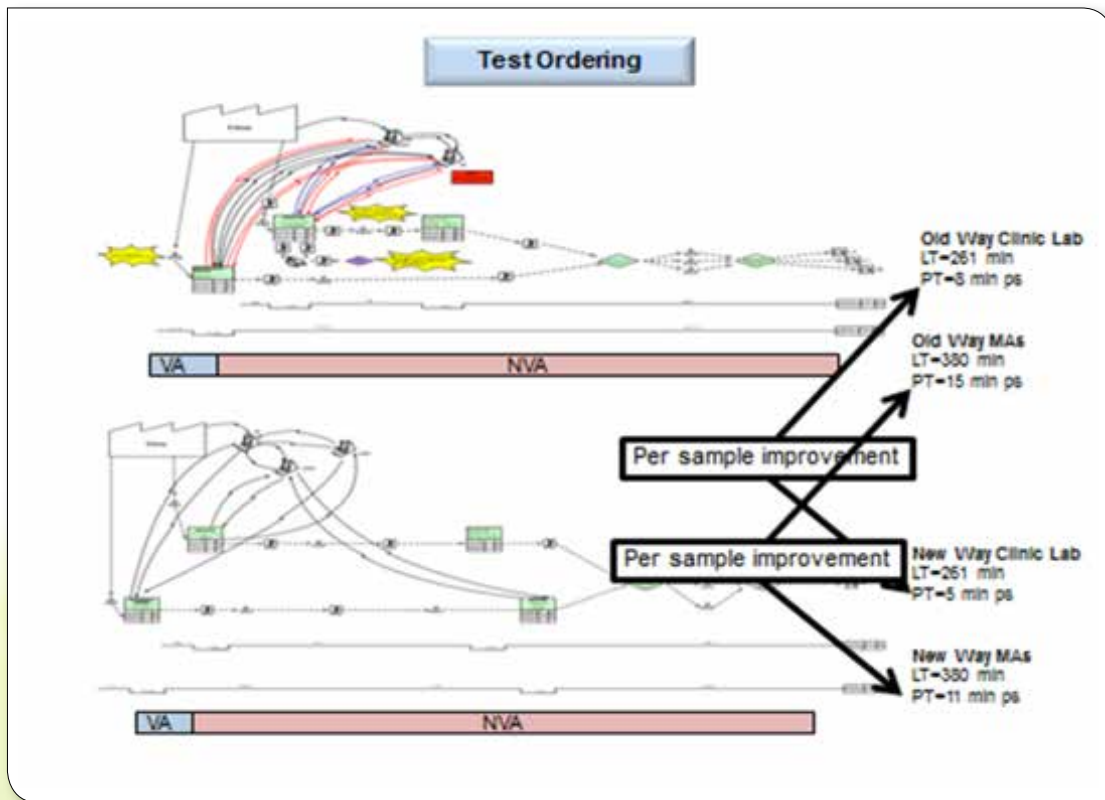


Figure 13: TCPHL Test Ordering VSMs



In Figure 14, you can see that this corresponds to a 38% improvement in clinical lab and a 27% improvement for the MAs, who had the added task of entering sample types. The total ordering process for orders placed by the clinical lab reduced by 75% and for orders placed by the MAs, an 80% time reduction was achieved. Overall, prior to Lean implementation and LIS integration, the staff spent a combined average of 72 minutes per day filling out paper requisitions. They were able to reduce this to 16 minutes per day with the LIS interface. This translated to approximately \$4,000 per year in labor that can be used to deliver services rather than fill out paperwork. This is only an example of one ordering location. Each of TCPHL's clients will achieve comparable benefits as it moves to electronic ordering.

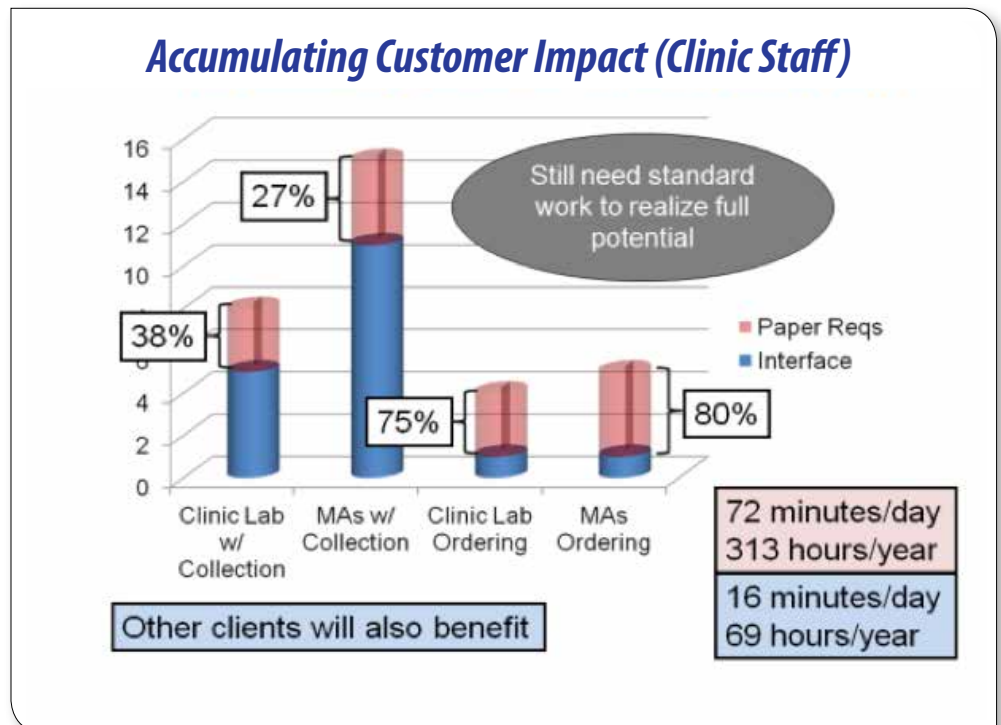


Figure 14: TCPHL Customer Impact for Test Ordering

## Project 2: Specimen Accessioning

Figure 15 represents the most compelling of the VSMs, demonstrating the potential for a 95% increase in accessioning capacity. The value stream at the top represents the previous process. In this scenario, specimens arrived and were sorted according to their storage requirements (frozen, refrigerated, etc.). Step two was entering data into the LIS. Next, labels were printed and set aside. The processor then went to the next specimen. Once the batch was completed, staff would affix the labels, place the requisitions

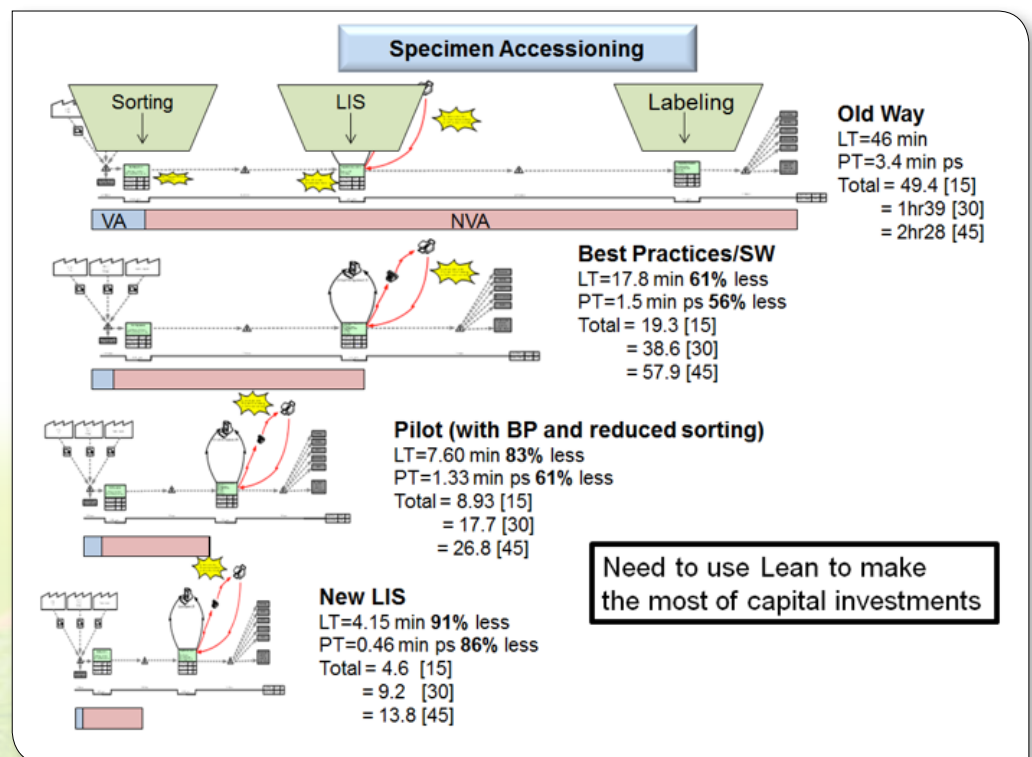
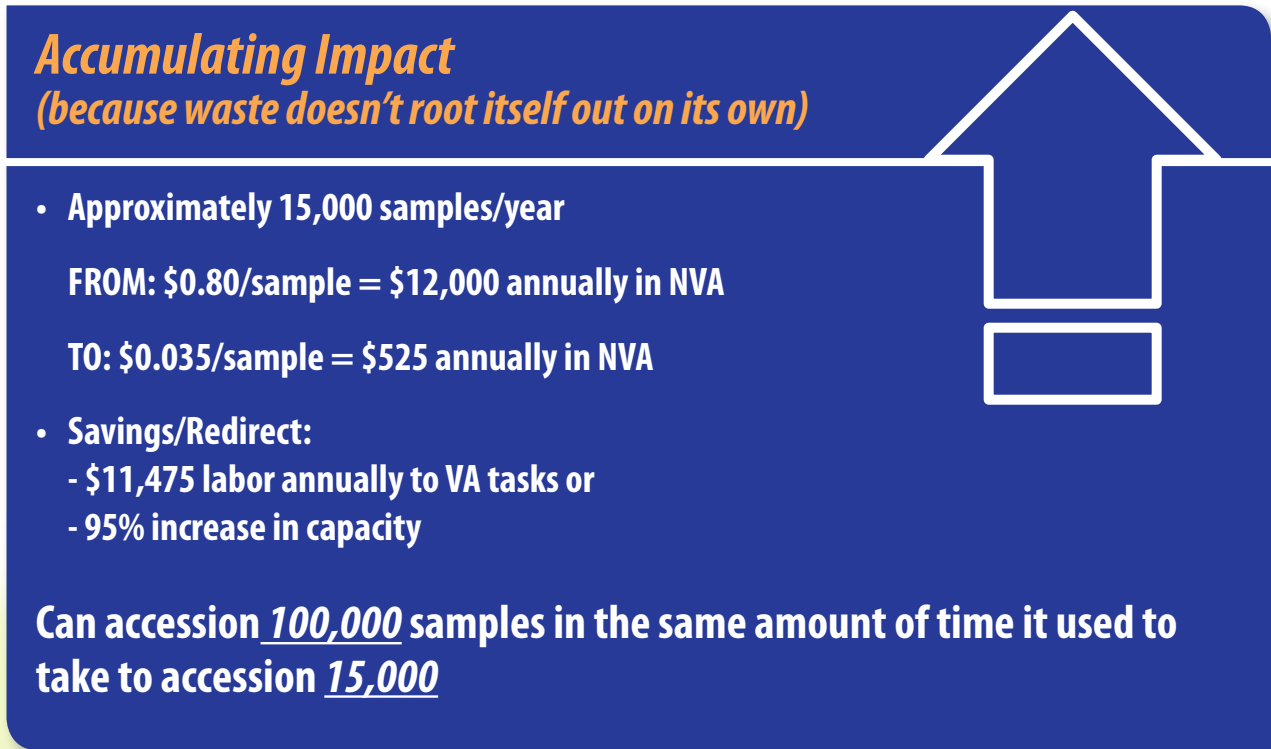


Figure 15: TCPHL VSM for Specimen Accessioning

in a pile, and place the specimens in the rack. Using this method, it took 50 minutes to accession 15 specimens. Forty-six minutes of that was made up of lead time (waste), time that the specimens just sat waiting for the next step. It became clear as TCPHL mapped the process that a brown paper would be useful to zoom in and take a closer look at certain steps. The brown paper allowed it to see that there were two main areas for improvement: batch size and overprocessing. Batch size was controlled by making the process to affix the label happen immediately rather than waiting until the end. This eliminated the pile-up and reduced the batch size at that step from 15 to one.

Overprocessing is a common source of waste in an environment such as a lab filled with detail-oriented personalities and strict regulations. What differentiates overprocessing from good attention to detail is when the time spent begins to outweigh the measured benefit. Standard work helped to reduce overprocessing in the specimen accessioning process while raising the consistent quality of work. By controlling batch size and reducing overprocessing, TCPHL was able to decrease lead time (LT) by 61% and process time (PT) by 56%. For 15 samples (with no defects), the accessioning time decreased from 50 minutes to 20 minutes.

However, the most significant improvements resulted from implementation of Harvest LIS and Copia.



**Accumulating Impact**  
*(because waste doesn't root itself out on its own)*

- **Approximately 15,000 samples/year**  
**FROM: \$0.80/sample = \$12,000 annually in NVA**  
**TO: \$0.035/sample = \$525 annually in NVA**
- **Savings/Redirect:**
  - \$11,475 labor annually to VA tasks or
  - 95% increase in capacity

**Can accession 100,000 samples in the same amount of time it used to take to accession 15,000**

Figure 16: TCPHL Specimen Accessioning Impact

Before the installation of Harvest LIS and Copia, it took TCPHL, on average, 3.4 minutes per sample from receipt until it was ready to test. After the LIS install, combined with the process improvements, that was reduced to less than 30 seconds per sample. This is because, when the sample is received, staff no longer has to type information from paper requisitions into the LIS. Instead, all that is left to do is scan the bar code, check for data and sample quality, and release the specimen for testing.

With the combination of Orchard's lab systems and the Lean tools, TCPHL is capable of accessioning 100,000 samples in the same amount of time it took to do 15,000. This is a 95% increase in capacity in the specimen accessioning area (see Figure 16). "Implementation of the LIS addressed many of our issues. A great number of steps were simply eliminated by addition of the LIS; the resulting improvements have been extremely good, but more needs to be done before we can reach the full potential of that 95%," remarks Lopez. As in every Lean project, TCPHL is continuing to improve by working on training in its clinics to reduce defects, develop standard work, and resolve interface needs.

### Project 3: Inventory Management

The inventory management project was used to identify waste due to poor inventory control. TCPHL looked at space, expiration dates, accessibility, and communication as related to inventory. In addition to the Lean daily management tools, it used 5S and material management (Kanban) tools to improve inventory management. There were seven Kaizen projects aimed at eliminating unnecessary inventory and reducing waste that as of the end of August 2014 had resulted in an annual savings of \$13,000, equal to 5% of their supply budget.

### Project 4: Data Mining

One of the areas where Orchard's laboratory solutions are able to make the largest impact is in data mining improvements. Prior to Lean and Harvest LIS implementation, cumulative reports were very time consuming and cost prohibitive to create. Each report generated had an extremely high production cost, equating to ineffective service and poor quality of data. Also, with reports taking such a long time to create, by the time the report information was gathered, the data would be outdated and thus no longer helpful.

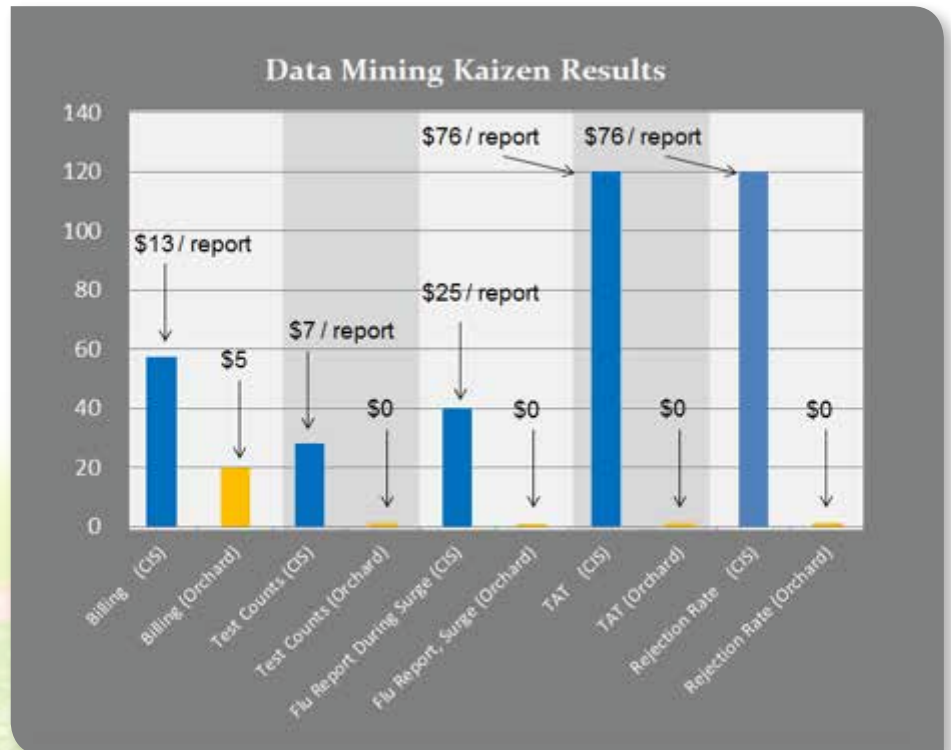


Figure 17: Improved Cost of Reports

Figure 17 displays the cost of various data mining reports, comparing the old technology with the new LIS. **Previously, creating a billing report cost \$13 in staff time, compared to \$5 using the new system. Reports such as TAT and rejection rate that were as high as \$76 per report because of the manual labor involved are now projected to cost \$0.** With Orchard's systems, the cost is negligible because after initial report creation, subsequent reports can be set to automatically compile the data and deliver the report at the scheduled time and location. Having access to this data has allowed TCPHL the ability to make better-informed decisions and develop strategies for operational shifts, such as surge events.

"Prior to Harvest LIS, report quality was very low, scheduled reports were unavailable, and we used to spend from \$7 up to \$190 of staff time on reports. The peak \$190 report was a report requested by an important agency on rabies that took hours of staff time to compile and create the spread sheet," remarks Lopez. "Lean standard work plus Harvest LIS has greatly improved our cost of on-demand reports. After Lean and the new LIS technology, the cost of scheduled reports is \$0, and the average cost of on-demand reports is \$1.25," she continues. Additionally, the 30 hours Lopez spent herself annually working on reports has been completely eliminated.

These efforts have resulted in overall savings or redirection of labor of more than \$6,000 annually. In addition, this project has resulted in more effective service and increased customer value. Regular reports are available for the epidemiologist; TCPHL can track customer ordering trends, volume fluctuation, reportable disease counts, and infectious disease trends—all in a much more cost-efficient manner.

### Project 5: Communication During Surge

Another project in the works that is important to every public health lab is the handling of communication during a surge. In the public health world, a surge is a sudden increase in testing volume due to a particular public health need. For example, when the H1N1 influenza pandemic took place, the testing volume went from one sample per week at TCPHL to 50 samples per day. Maximum normal operating capacity at TCPHL is approximately 25 samples per day so in a surge situation, samples have to be triaged to ensure the highest priority samples get tested first. Triage criteria are directed by the health officer, and in the case of influenza, include factors such as ICU patients, pregnant women, etc.

In order to properly triage samples, the correct information has to be collected from the hospital. Fields of information that were only optional in times of routine surveillance become mandatory in surge situations. Without an adaptable LIS/outreach tool, it is difficult to change these requirements on the fly to quickly communicate their updated importance. TCPHL has already successfully piloted the functionality to be able to quickly change which fields are required in Copia. "When we are not in surge we don't want to have too many required fields because it becomes onerous and can be a barrier to participation in surveillance. However, during surge we must have the information to enable triage, and this was nearly impossible to communicate or enforce with paper requisitions. If the required data is missing on a paper requisition, it wastes everyone's valuable time to track it down by phone calls in the middle of a public health emergency," explains Lopez. "Instead, now we can change required fields as needed in Copia, and will have the required information every time."



Orchard Copia offers additional ways to enhance TCPHL's communication. For example, messages can be posted regarding expiration of collection kits supplied by the lab. Also, during a public health emergency, the current policy for Ebola testing can be posted for users as they log into Copia, eliminating the need to contact each client with this information. Eliminating paper requisitions and having orders placed in Copia will also allow for the addition of valuable, relevant test order information, such as specimen collection and transport instructions. Anytime a static format, such as a digital file or hard copy, is used to push out information, document control becomes an issue when updates are needed. In addition, this information may be misplaced or lost by the client and it becomes easier for clients to pick up the phone rather than locate and sift through a document to find what they need. There is a huge benefit to the dynamic exchange of timely information that Copia provides, where the information a client needs is presented to them by the LIS, right at the time they need it. This can include information such as current collection and transport instructions for the test they are ordering. In addition, information can be updated in Copia without having to worry about older versions of the information floating around.

### Project 6: Reporting

If you are familiar with a spaghetti diagram, you can appreciate the layout in Figure 18, with the left diagram representing the path taken in the course of a day in order to manually fax reports. The right diagram represents the path after LIS implementation; there is no path at all—zero steps involved—because Copia allows the lab to auto-fax right out of the system. **Prior to the faxing solution, 15 minutes per day of public health microbiologist time was wasted just walking back and forth to the fax machine. This has equated to savings of more than \$2,500 per year.**

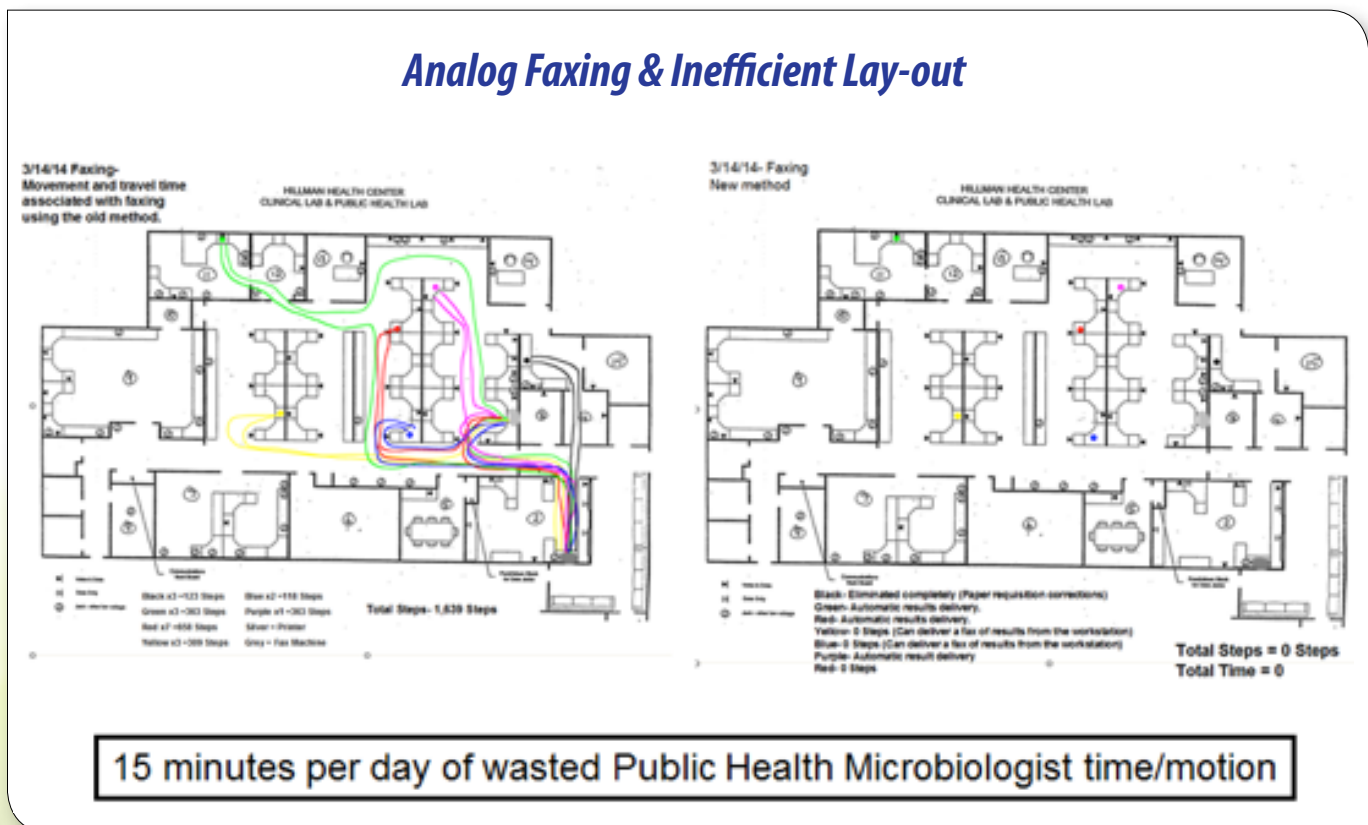


Figure 18: TCPHL Spaghetti Diagram for Faxing Before & After Harvest LIS & Copia Install

## Tremendous Progress Made

Lean is a mindset that uses select methods, tools, and strategies to establish checks across the board that help workers easily remember what they are supposed to do every step of the way. Many Lean concepts seem like common sense, but despite that, doing things the correct way does not always happen. One of Lean's strengths is that it has a basis in common sense; this makes it easier for everyone to buy into the idea. Lean helps you take a step back and become more strategic about your processes.

Lopez and the staff at TCPHL liked the idea of Lean right from the start, but they admit they had no idea how they could possibly find the time to put it into practice, particularly alongside adoption of a new LIS. Yet now that they are deep into the process, they are all glad they accepted the challenge and are already feeling the benefits of a strong team culture and the satisfaction of knowing they are providing top-notch customer service.

With the winning combination of Lean and an advanced Orchard LIS/outreach solution, TCPHL has already made tremendous measurable advancements, such as reduction in time spent during test ordering and specimen accessioning, and substantial savings in creating reports and auto-faxing (see Figure 19). In addition to those calculable achievements, they have made other improvements that are harder to measure, but no less significant. TCPHL has aligned the lab's goals with the vision, mission, values, and strategy of the organization. They are educating and motivating student volunteers, fostering an interest in the field of public health. And, looking forward, they intend to continue to share ideas and successes with other public health labs to strengthen the overall quality of the public health network.

### Improvements Made Using Lean with Harvest LIS & Copia

Reduced **test ordering** time by 75%-80%, resulting in potential savings of more than \$10,400 annually

Increased **specimen accessioning** capacity by 95%, equating to savings (or redirection of labor) of \$11,475 annually

Decreased cost of **data mining** by an average of 92% per report, leading to annual savings of over \$5,500

Saved more than \$2,000 annually by auto-faxing **reports**

Figure 19: Improvements Due to Lean & Orchard's LIS Solutions



## Positive about the Possibilities

Lean is all about continuous quality improvement, so TCPHL is at the beginning of its journey. Tulare's lab professionals are looking forward to the possibilities and opportunities as they continue to streamline their processes. They want to be able to provide outstanding service to all of their partners in the most effective way possible, and adopting Lean, together with a strong lab IT solution, has given them a great start.

## Notes

Read more about Tulare's efforts on page 30 of APHL's [Lab Matters Fall 2013](#).

### *LEAN Implementation Team Members*

- Consultant from BD: Patrick Maul
- APHL: Cathy Johnson, Pandora Ray, Karen Breckenridge
- LEAN leader colleagues scattered across the country
- County:
  - Executive Steering Committee
  - HHSA Director, Dr. Cheryl Duerksen
    - HHSA Public Health Director, Jason Britt
    - HHSA Deputy Director of Health Operations, Karen Elliott
  - County Health Officer, Dr. Karen Haught
  - Lab Director, Robin Purves
- Lab Staff:
  - 3 Milk Techs
  - 2 Lab Assistants
  - 1 Office Assistant
  - 5 PHMs
  - 1 Lab Manager
- IT Support
- External Partners:
  - 10 Student Volunteers
  - Orchard Software



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