Continuous Flow Applications in Clinical Lab Operations: Identification, Implementation and Effectiveness

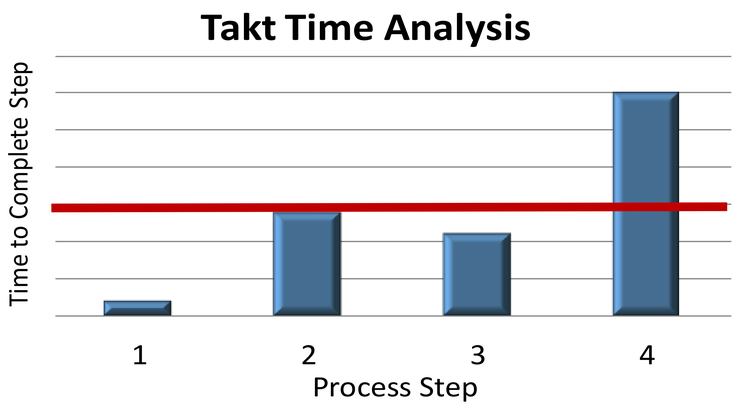
James W. Everest
IDEXX Laboratories

One IDEXX Drive
Westbrook, Maine 04092
207-556-8674

Abstract

In clinical laboratory settings, legacy operational processes that are traditionally specialist driven are often challenged by increasing volume, shrinking turnaround time windows and organizational strategies. Coupled with multi-step processes, this specialist driven approach promotes handoffs, growing amounts of work in process (WIP) and imbalanced task complexities that result in countless operational issues. Employing Little's Law to drive process improvement can yield numerous benefits.

By shifting our focus from TAT failure rates to a cycle time metric and addressing impedance to success, we were able to alleviate WIP issues and create a more flexible and predictable process. Application of Little's Law and continuous flow techniques alleviated tempo and hand-off issues, cut our cycle times in half and led to productivity improvements. Feedback also indicates employees are far less stressed and have more time for cross-training throughout the lab.



Introduction

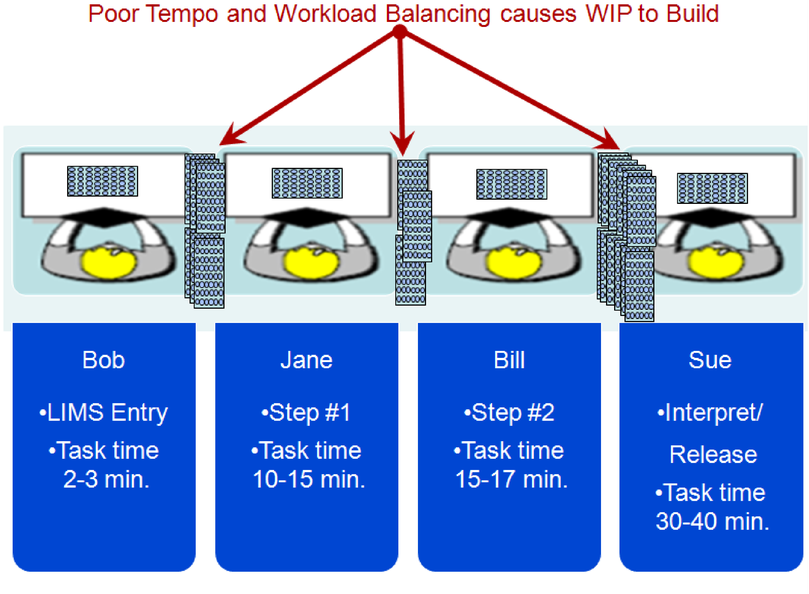
Little's Law highlights a proportional relationship between cycle times (the amount of time that it takes for something to work its way through a process), the level of WIP and the exit rate of a given process. It has been applied in many industries over the last century, and employing this theory in a clinical laboratory setting can have many advantages. **Traditionally, labs have multi-step, imbalanced processes that often involve costly elements (i.e. hand-offs, QC checks, varying task complexity, underutilization, etc) that lead to increasing levels of WIP.** Through the effective application of Little's Law, one can move towards ***Continuous Flow***.

Methods

Through a modeling exercise, estimated cycle time of a process can be calculated based on the amount of WIP divided by the Exit Rate or:

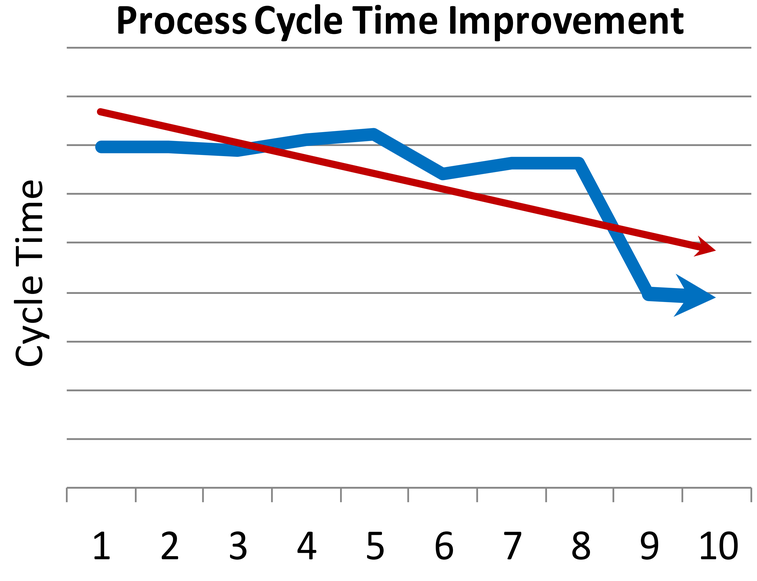
$$Cycle\ Time = \frac{WIP}{Exit\ Rate}$$

When there is a high amount of WIP, it means that samples are waiting for value to be added. In such an environment, flow from the sample's perspective cannot be described as continuous. Instead, continuous flow is a product centric strategy that can aid in limiting WIP and optimizing cycle time. It highlights people centric conveniences and redirects the focus to the product and the process. **In a continuous flow operation, an operator begins with a single piece or an optimized batch of product / samples at the initial step of a process and carries the batch through a series of value add transformations until the product is completed.** It facilitates the optimization of exit rate, by simply placing sole ownership on the operator and minimizes the need for hand offs; inspections, QC redundancies and other non-value add (NVA) steps in a process. Continuous flow also limits WIP.



Results

Data suggests that stabilizing exit rate and limiting WIP in a laboratory, which if applied correctly in a multi-stage process, will yield a significant reduction in cycle times, while increasing throughput and process predictability. Indirectly, this higher throughput often translates to higher capacity, and lower operating expenses. The cross training required leads to a highly trained and more flexible workforce. Feedback from employees shows a significant reduction in employee stress as well as possible effects on long term ergonomic issues.



Conclusions

Since shifting our focus from TAT to cycle time, continuous flow has had a favorable effect on TAT and customer satisfaction. We continue to see profound improvements following Kaizen events. Some departmental cycle times have been cut in half, while customer demand continues to grow and TAT failure rates continue to drop. **Over the past year we have rolled out a national initiative and continue to look for opportunities in various departments.**

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