Pull vs. Push:

Managing Batch Size to Optimize Productivity and Quality in Your Lab

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Background

- **Steve Stone**, Managing Director, Argent Global Services
- Process-Engineering and Management Consulting firm
- Argent pioneered many engineering services for the Diagnostics Industry - 19-years Health Care experience
- Skill Set & Methodology include:
  - Industrial Engineering
  - Lean Enterprise & Six Sigma
  - Data Collection & Information Gathering
  - Facility Design & Layout
  - Management Tools & Software

Today

What We Will Learn:

- Begin to understand the Lean concepts that can manage batch sizes and improve productivity in the laboratory

Key Objectives:

- Understand how Lean experts view the laboratory and how to see workflow opportunities
- Discuss how Pull and Push systems can impact laboratory productivity
- Discuss the Lean concepts that can manage batch sizes and encourage continuous flow in the laboratory
- Share examples of Lean tools in action

The Set Up

What is a Batch?

Anything done in a group

- Accessioning specimens
- Centrifuging
- Transporting specimens
- Testing
- Paperwork: billing, coding, registration

Most work in the lab is done in some sort of a batch

Does It Matter?

Why are we concerned with batch sizes?

Large batches can result in:

- Longer wait times
- FIFO concerns
- Extra handling
- Lost or damages specimens

Small batches can result in:

- Extra travel and motion
- Unbalanced work
- Extra setup time

What Does Lean Mean?

Defining Lean

A systematic approach to identifying and eliminating waste through continuous improvement by flowing the product or service at the pull of the customer in pursuit of perfection

Key Points

Points of the Lean Definition that tie into our talk today

- *Remove waste*
- *Flow (continuous flow)*
- *Pull*
- *Customer*
- These points are key aspects of Lean in traditional settings (manufacturing)
- Health care still struggles with continuous flow, batching and pull

Who is the Customer?

Lean is customer-focused

- We understand who the external customer is
- Lean concepts work best when you recognize the internal customer
  - Next step or person in the process

Wastes

There are seven wastes of Lean, but let's focus on the wastes that are closely related to inefficient batch sizes

- Waiting
- Overproduction
- Inventory
- Transportation & Motion

Waste: Waiting

Waiting

Definition:

Periods of Inactivity

- Large batches can lead to increased waiting.
- A specimen waiting for something to happen to it is non-value added time & pure waste

Example: Waiting

The picture on the left is specimens waiting for CT/NG testing and the picture on the right is of imaged slides ready for screening.

Waste: Overproduction

Overproduction

Definition:

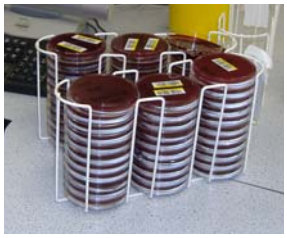
Continued production when you should have stopped

- Large batches
- Processing more, earlier or faster than is actually required by the customer (typically internal)
- Underproduction can also be waste (batch too small)

Example: Overproduction

Microbiology

- **Small Batch** = *Underproduction* = excessive setup and changeover. Retrieving media and supplies.
- **Large Batch** = *Overproduction* = issues with organization, motion and ergonomics, cumbersome and error-prone.



Waste: Inventory

Inventory

Definition:

Excess Work In Process (WIP), materials, supplies or reagents

- Related to overproduction, too much work in process will result in large batches and queues/waiting.

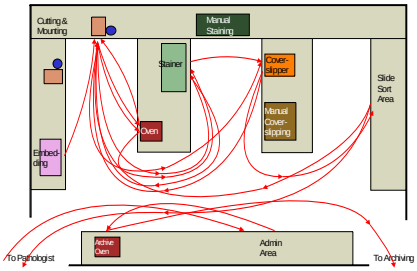
Waste: Transportation & Motion

Transportation:

- The movement of specimens, paperwork or supplies

Motion

- The movement of people



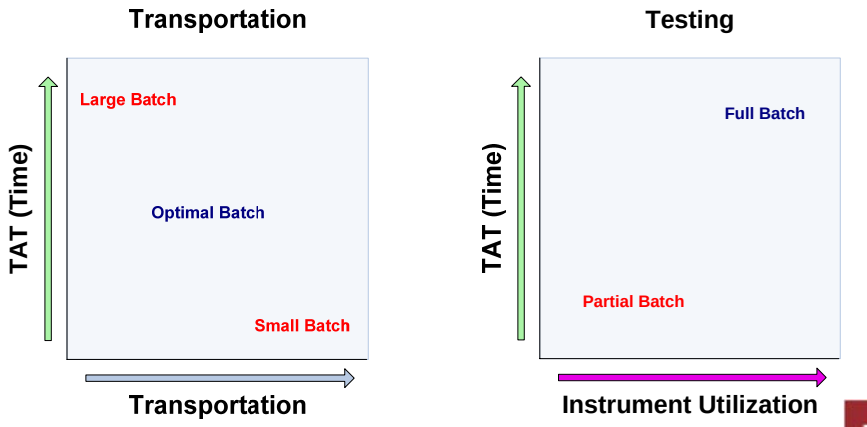
- Batches that are too small can lead to excessive transport and motion
- Departmentalization and long distances encourages larger batches

Determining Batch Sizes

- Set attainable and realistic batch sizes for the environment
- Based upon:
  - TAT goals
  - Arrival patterns
  - Instrument cycle times
  - Capacity of instruments, racks and trays
  - Travel distances
  - Staffing & resources
  - Kits and testing configurations

Determining Batch Size

- Use charts to visualize the give and take



Pacemaker

- The pacemaker is the one step in the process could logically sets the batch
- Potential Pacemakers:
  - Molecular = Kit size
  - Clinical = Instrument rack size
  - Histology = Ice tray for blocks / Folder
  - Cytology = Folder / Stainer rack
  - Micro = Plate racks / trays

Batch Perceptions

- Bigger is not always better
- There is a common perception that getting more done at one time is more productive
- Lab personnel frequently tell us…
  - Would like instruments with larger batches
  - Would like bigger centrifuges
  - Would like stainers with larger batches

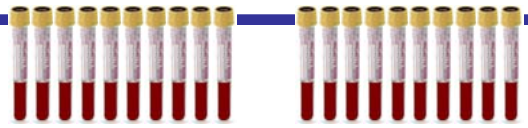
Example

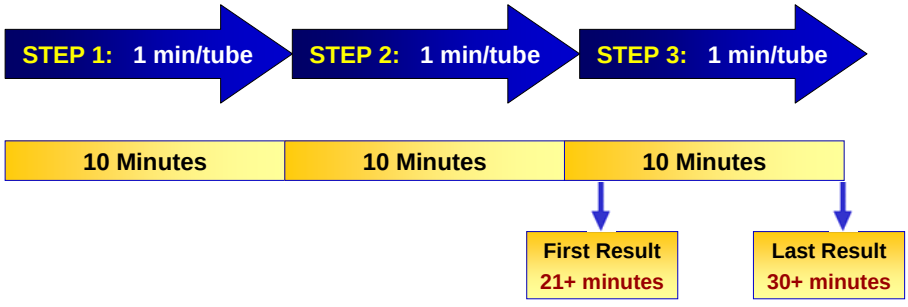
- Smaller centrifuges

Batch Size Reduction

- Traditional Lean teaches single-piece flow
- Laboratories operate best with some level of batch processing
- There is merit to single-piece flow, so the goal for labs is smaller, but optimal, batch sizes

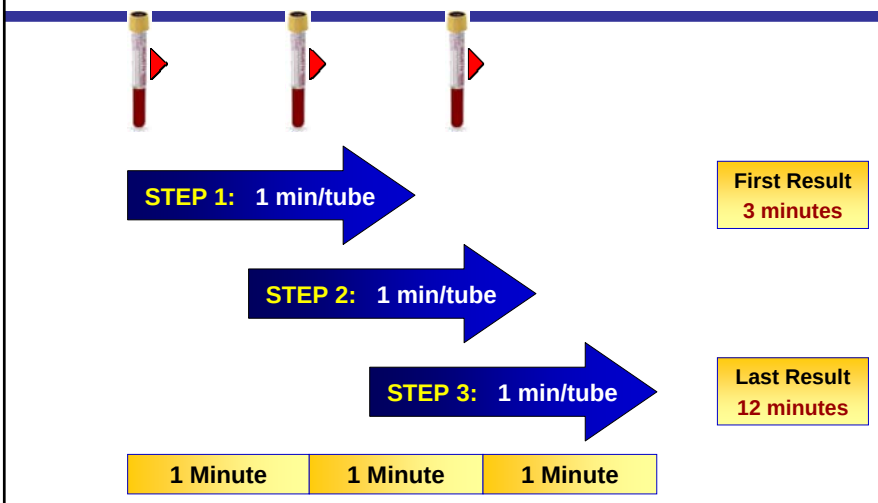
Large Batch & Queue Processing





Process Lead Time = 30 minutes for all 10 tubes

Small Batch Processing



Process Lead Time = 12 minutes for all 10 tubes

How?

How can we facilitate and manage smaller batches?

1. Better Layouts
2. Visual Controls
3. Pull Systems
4. Continuous Flow
5. Balanced Work
6. Equipment & Automation

Layout

- Optimal layouts will help manage batch sizes, continuous flow and pull systems

What is optimal:

– Open, few barriers

– Good visibility, line-of-sight

– Close proximity, short travel distances

Visual Controls

- Use visual controls to manage batch sizes and flow
- They are signals for moving specimens
- Both the rack and the tape are visual controls

Kanban Signals

- Kanban Signals are utilized to control batch and queue sizes.
- A Kanban can be anything
  - A full rack
  - A full tub
  - Taped-off area on the bench
  - A card system

Pull Systems

Push →

- You produce as much as you want at your own pace. Typically go until you run out of work.

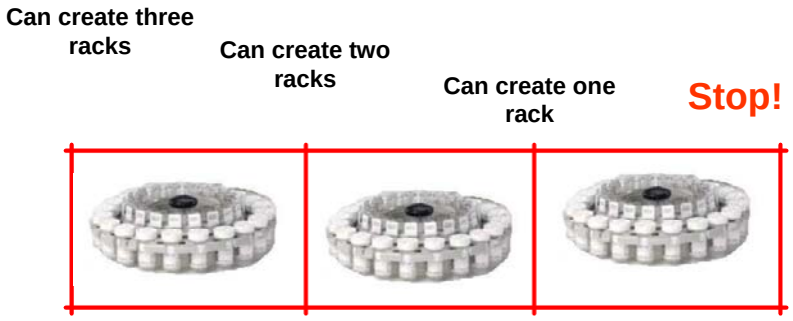
Pull ←

- You only produce as much as the next station can handle. You may stop working when there are still samples available.

There are not many reasons to create more work than the next step can complete

Example: Pull Systems

- Use visual controls to ensure that work is pulled and not pushed.
- Taped-off lines can create an easy Kanban.



Continuous Flow

- Continuous flow is the act of moving a product through the production process from start to finish without stopping
- In pure continuous flow, the cycle time equals the lead time, as the product never sits in a queue waiting to be worked on
- You probably won't achieve perfect continuous flow, but the goal is to get as close as possible

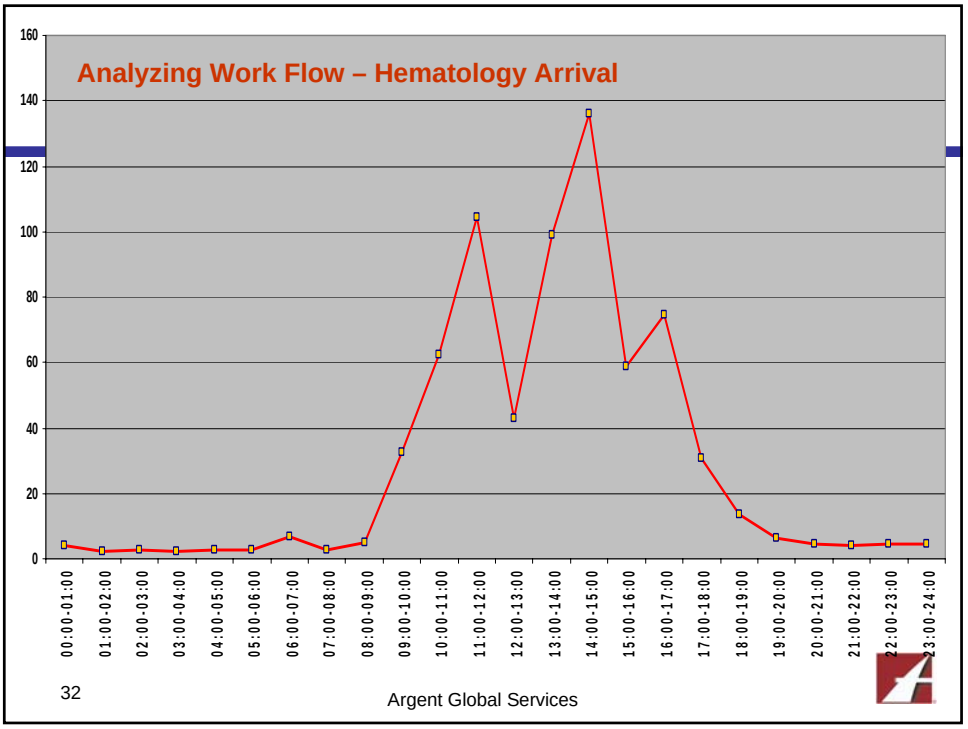
Continuous Flow Example

The Rules:

- CBC analyzer utilizes a rack of ten tubes.
- At receiving, when a rack is full (10 tubes), the rack is transported to the analyzer.
- Goal: tubes out of receiving in less than 8 minutes.

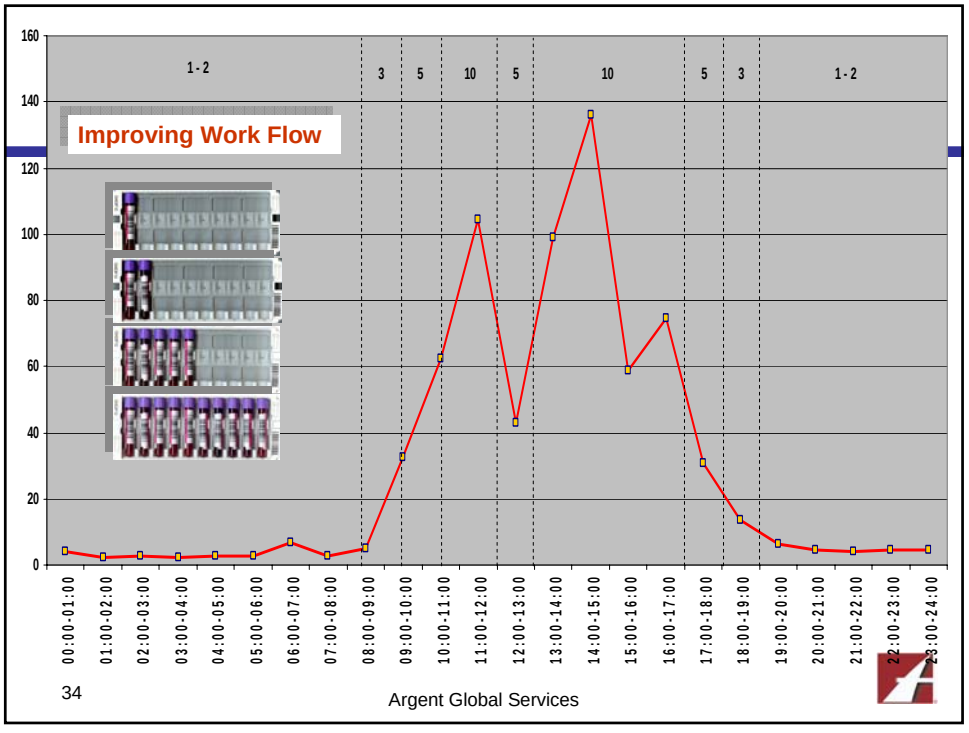
The issue:

- Specimen arrival patterns are not always conducive for the current procedure.
- Procedures are designed for busy periods.
- Chance of missing TAT goals during slow periods.



Improving Work Flow

Samples Received Per Hour	Time to Fill Rack of 10 Samples (mins)	Rack Processing Sample Limit
10	60	1
15	40	1
20	30	2
30	20	3
40	15	5
50	12	5
100	6	10
150	4	10



Improving Work Flow

Time of Day	Process Samples Per Rack	
08:00 – 11:00		3 - 5
11:00 – 12:30		10
12:30 – 13:30		3 - 5
13:30 – 17:30		10
17:30 – 19:00		3 - 5
19:00 – 08:00		1 - 2

STAT
Any Time

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Balanced Work

- To manage batches and queues, process stations will need to be balanced
- Balanced work requires the process stations to be in pace and harmony
- How is this accomplished?
  - Shift work elements
  - Utilize multiple work stations
  - Standardize batches across work areas

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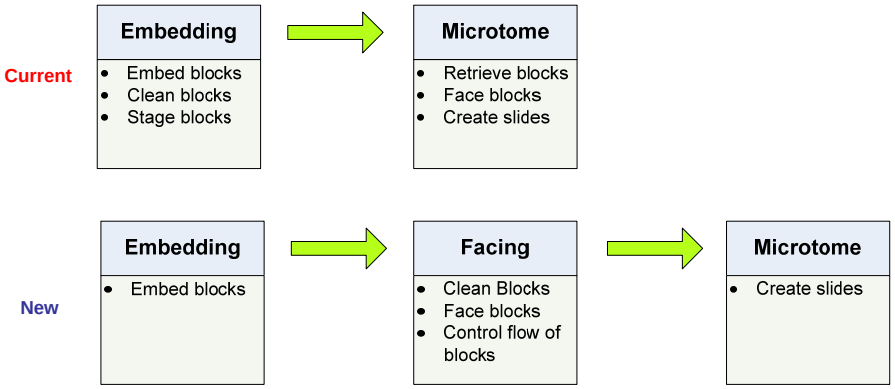
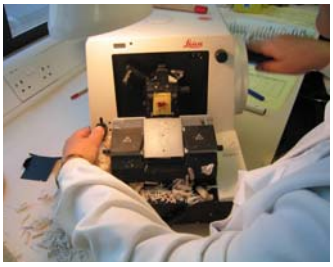
Balanced Work

Balancing work across histology



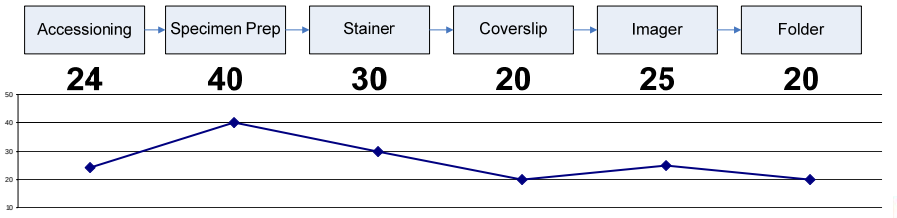
Example: Facing Station



- All block facing done at one Facing Station.
- This balances the work at the Microtome Stations by reducing paraffin waste, blade changes, batch sizes, handling steps and re-icing.
- Provides control point for work being fed to Microtomy; work based on demand of Microtome stations – Pull system.

Equipment & Automation

- Must always consider automation when setting batch sizes
- Automation may be the pacemaker
- Well intended automation can also create batch and flow issues – Cytology Example



Getting it Done

Setting batch sizes

- Good way to set batch sizes is through experimentation and testing
  - Kaizen events work well
  - Value Stream Maps help you see the workflow from beginning to end
  - Discuss the factors then run tests

Conclusions

- Consider the goals of Lean when examining your batch sizes
- Do not overlook the Pacemaker
- Bigger is not always better
- There may be a better way
- Experiment and measure the results

Training Thoughts

Remember…

"Learning is not compulsory, neither is survival"

- W. Edwards Deming

End of presentation

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