IHC Workflow Optimization Toolkit

Supplement to Presentation
Busting the Myth of the "Ideal" Workflow

Presented By: Ashley Troutman, MBA, HT(ASCP), QIHC, CLSSBB

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OVERVIEW

Every IHC laboratory is unique and given the daily challenges the laboratory faces, no two days are alike and there is no “perfect” workflow that can anticipate sudden workflow changes, both planned and unplanned. Therefore, the ideal workflow is likely not one that is concrete in nature but adaptable to accommodate the changing needs and challenges laboratories face.

Our guide aims to assist you in better understanding your current IHC process by identifying critical points in your current workflow. The tools provided in this guide will help you measure and improve the workflow at these critical points to help YOU determine the optimal workflow for YOUR lab not only for today, but how to assess and adapt to future changes for YOUR future workflow as well.

INSTRUCTIONS

1. Using pages 5 – 15 as your guide, complete YOUR high-level workflow assessment.
2. For each workflow tool, we have provided the following formats as applicable:
   a) Guide – explains how to use each tool
   b) Example – shows a completed version of the tool utilized
   c) Template – provides a blank worksheet to use for YOUR analysis
3. Common workflow analysis scenarios are provided on pages 35 – 37
4. For additional resources and information, please visit Knowledge Pathway

HIGH LEVEL QUESTIONS

What is the BEST way to get from what you receive to what you need?

What problem are you trying to solve?

- Faster TAT?
- Increased Volumes?
- Implementing new process/tests?
- Brand new lab?
- Moving to a new facility/location?
- Expansion/change of lab operation hours?
- Substantial change/implementation of additional technology?
  - Examples: LIS, specimen tracking, digital pathology

Need to gather USEFUL data to determine optimal workflow

Pre-IHC Process – Gather information needed to determine optimal workflow

- ❑ How do cases/arrive? *See IHC Volumes by Time worksheet*
  - ❑ Average batch size of _____ cases/slides at _____ time by _____ courier/transit type
- ❑ How do IHC orders arrive?
  - ❑ Fax
  - ❑ Phone
  - ❑ Paper Forms
  - ❑ LIS
  - ❑ LIS integrated to send orders directly to stainer(s)
  - ❑ Other _____
- ❑ Pre-IHC schedules
  - ❑ Tissue processing
  - ❑ Embedding
  - ❑ Sectioning

Today's Current IHC Workflow (How do you load your IHC stainer?)

- ❑ Batch – Usually for high volumes to correspond to batches of pre-IHC processes. Often utilizes cut-off times for orders
- ❑ Continuous – Often by case, works well for smaller, manageable volumes with flexible cut-off & turnaround times
- ❑ Single Slide – Typically best for STAT cases/situations

How do samples arrive at the IHC lab?

- ❑ Slides arrive already cut
  - ❑ How do cut slides arrive?
- ❑ Blocks arrive to be cut for testing
  - ❑ Who cuts blocks? Histology or IHC Dept?
- ❑ Controls?
  - ❑ Slides arrive with controls on same slide (ready for testing)
  - ❑ Slides arrive with space to add lab's in-house controls
  - ❑ Slides arrive with no space to add controls; controls must be run on separate slide (not ideal)

Test Volumes

- ❑ Average daily test volumes
- ❑ Average number of slides per case
- ❑ Maximum volume in the last 12 months
- ❑ Absolute maximum volume current resources allow

Resource Availability

- ❑ Staffing availability *See Staffing Availability worksheet*
- ❑ Instrument capacity availability *See IHC Cut-Off Times worksheet*

Other Considerations

- ❑ Tests where IHC is coordinated with testing in other departments such molecular tests (ISH, PCR, NGS, etc.)
- ❑ Labor/time for administrative work (filling out forms/logs, etc.)

Current IHC Volumes by Time – Spreadsheet Example & Template

Instructions

1. For your convenience, a spreadsheet template has been provided as a starting point/guide.
2. Double-click on the spreadsheet image to the right. This will open this information in Excel.
3. Make edits to the spreadsheet as needed and then save the spreadsheet to your computer.
4. To exit the spreadsheet after saving, just click on any area of the PowerPoint slide outside of the spreadsheet to return to the presentation.

# Cases/Slides	Arrival Time	Arrive via	Additional Info to Consider
100	8:20	Main Courier	Often late due to rush hour traffic
60	9:30	Dr. Smith	Majority of his orders at this time
10	10:00	Cytology	
80	11:00	Dr. John	
20	12:00	Main Courier	
150	13:00	Lab Courier	Delivery from oupatient facilities

Current IHC Staffing & Shifts – Spreadsheet Example & Template

Instructions

1. For your convenience, a spreadsheet template has been provided as a starting point/guide.
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Employee	Scheduled Shift Start	Scheduled Shift End	Additional Info to Consider
1 (WS)	6:00 AM	2:30 PM	
2 (AC)	7:00 AM	3:30 PM	
3 (AT)	9:00 AM	5:30 PM	Supervisor, may be at meetings
4 (KB)	1:00 PM	7:30 PM	
5 (TC)	1:00 PM	7:30 PM	
6 (BP)	2:00 PM	10:30 PM	

Current IHC Cut-Off Times – Spreadsheet Example & Template

Instructions

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IHC Cut Off Time	Scheduled IHC Start Time	Scheduled IHC End Time	Additional Info to Consider
12:00 PM	1:00 PM	4:00 PM	Morning AM orders by this time
3:00 PM	4:00 PM	7:00 PM	Majority of orders arrive at this time
7:00 PM	8:00 PM	Run Overnight	

You can compare IHC Cut-Off Times with IHC Volumes by Time Data for alignment

Please note that this list is not all inclusive, so please add workflow assessment factors needed for YOUR workflow

Labor/Time Preparing Staining Reagents

- ❑ Time spent preparing reagents for staining?
- ❑ Time spent on diluting antibodies or registering third party/outside antibodies?
- ❑ Time spent preparing bulk reagents?

Labor/Time Loading Slides

- ❑ Time spent creating labels & labeling slides (if applicable)?
- ❑ Time spent sorting your cases prior to loading?
- ❑ Time spent interacting with the instrument's computer to load slides and start your IHC run?
- ❑ Time spent waiting for instrument availability?

Labor/Time Loading Staining Reagents

- ❑ Time spent loading your staining reagents?
- ❑ Time spent waiting for reagent availability?

Labor/Time Addressing Bulk Reagents

- ❑ Time spent filling bulk reagents? Please note that this does not include preparation time (mentioned in earlier section)
- ❑ Time spent waiting to fill bulk reagents

Labor/Time Unloading Slides

- ❑ Time spent unloading your slides/cases from the instrument? Include time to remove staining "chambers" (e.g., Covertile, liquid coverslip)
- ❑ Time spent sorting cases after staining (e.g., prepare for distribution to pathologists)?

Labor/Time for Maintenance Tasks

- ❑ Time spent performing equipment maintenance tasks?
- ❑ Time spent for waste neutralization and/or disposal? May want to consider financial costs & employee safety/ergonomics in addition to time.

Labor/Time for Repeat Stains

- ❑ How many/what % of repeat IHC stains are due to instrument issues (e.g., sections fell off, inadequate/poor staining, etc.)?
- ❑ Time spent on repeat stains?

CURRENT WORKFLOW

For manual IHC workflow, it is still worthwhile noting this information to see if an automated solution may be worthwhile.

For semi-automated workflow, you can combine the two assessment forms

Labor/Time Preparing Staining Reagents

- ❑ Time spent preparing reagents for staining?
- ❑ Time spent diluting antibodies?
- ❑ Time spent diluting reagents?

Labor/Time Preparing Slides for Staining

- ❑ Time spent labeling slides (if applicable)?

Labor/Time Deparaffinization of Slides

- ❑ Time spent deparaffinizing slides

Labor/Time Performing Antigen Retrieval

- ❑ Manual/hands-on time spent performing antigen retrieval procedures
- ❑ Total antigen retrieval time (include reagent incubation, heat up and cool down times)

Labor/Time Staining Slides

- ❑ Manual/hands-on time spent staining slides. Include application of reagents and washing steps to remove applied reagents.
- ❑ Total staining time (including reagent incubation times)

Other Considerations

- ❑ Considerations for employee safety/ergonomics in addition to time.

Labor/Time for Repeat Stains

- ❑ How many/what % of repeat IHC stains are due to manual technical issues (e.g., improper reagent preparation, missed protocol step, etc.)?
- ❑ Time spent on repeat stains?

CURRENT WORKFLOW

- **Over-Production**

  Producing more than is necessary, leading to increased inventory

  - Example: Excess preparation of diluted antibodies

- **Waiting Time**

  Waiting for work to arrive

  - Example: Waiting for work from couriers stuck in traffic

- **Transportation**

  Unnecessary movement of product (not people)

  - Example: Carrying slides back/forth *See Spaghetti Diagram*

- **Over-processing**

  Doing more work than is necessary

  - Example: Cutting extra unstained slides that are never used

- **Inventory**

  Having enough product on hand to meet needs

  - Example: Having excess reagents taking up valuable storage space

- **Excessive Motion**

  Excess people movement

  - Example: Not keeping all items needed at microtomy within arms reach during task (forceps, blades, etc.)

- **Defects**

  Anything that requires Rework

  - Example: Repeat IHC staining

- **Talent**

  Underutilizing staff's skills, talent or knowledge

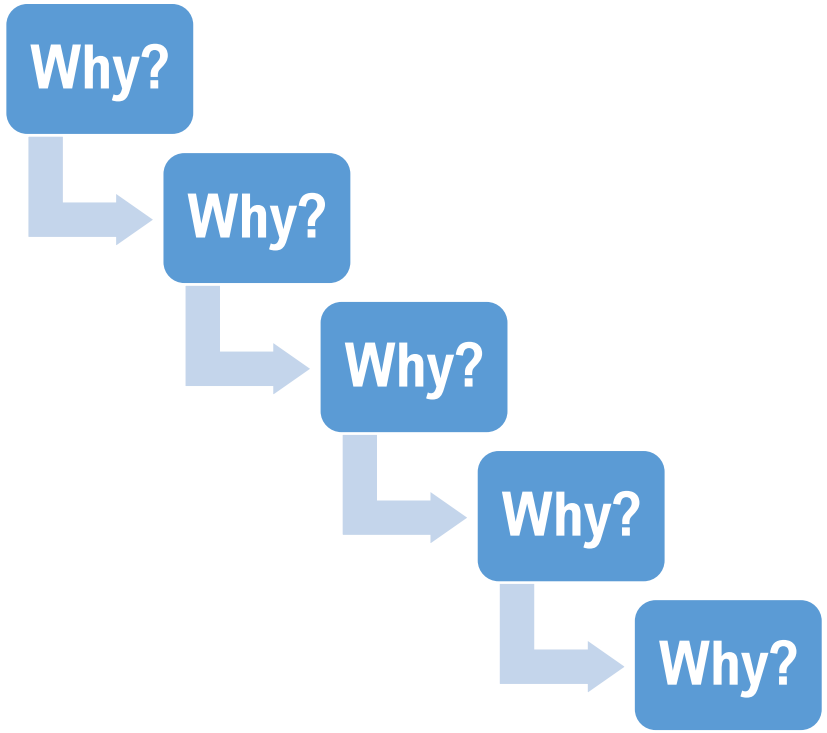
  - Example: Not doing annual staffing skill set analysis to look for win-win opportunities in the lab

Workflow Tool Examples Provided

- Root cause analysis
- Process mapping
- Pareto charts
- Spaghetti diagrams
- Impact matrix
- Custom Tools

When using these tools, remember to look at your workflow as an outsider would

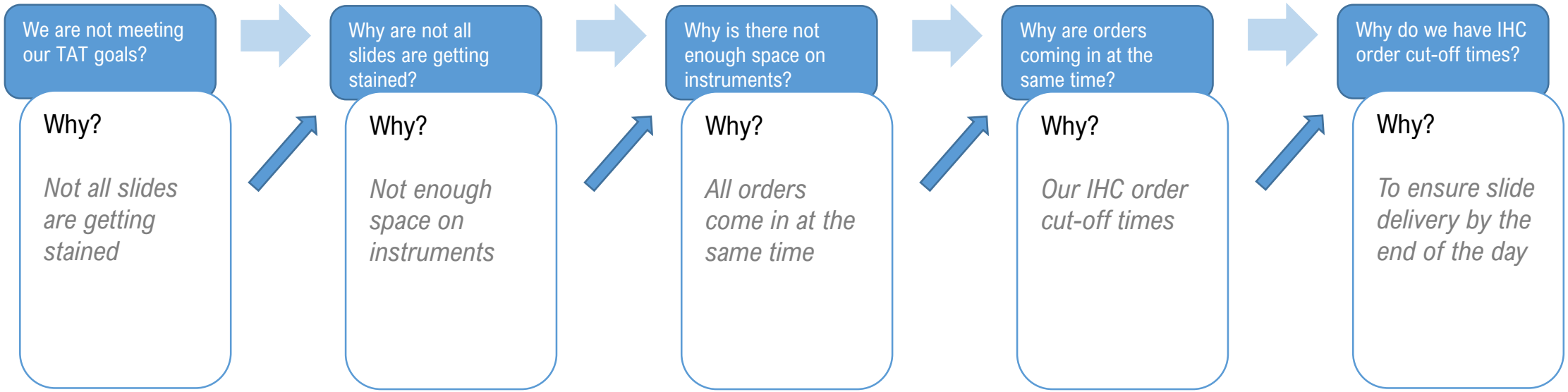
- Start with map of order through case assembly & note issues in workflow.
- For each issue, ask *"Why do we do it this way?"* at least 5 times
- The answer to each "Why?" question should lead to the next "Why?" question
- Keep asking "Why?" until the root cause is determined.



ROOT CAUSE ANALYSIS EXAMPLE

Flowchart of WHYs

- Start with map of IHC order through case assembly & note issues in workflow
- For each issue, ask “Why” at least 5 times



ROOT CAUSE ANALYSIS TEMPLATE

Flowchart of WHYs

- Start with map of IHC order through case assembly & note issues in workflow
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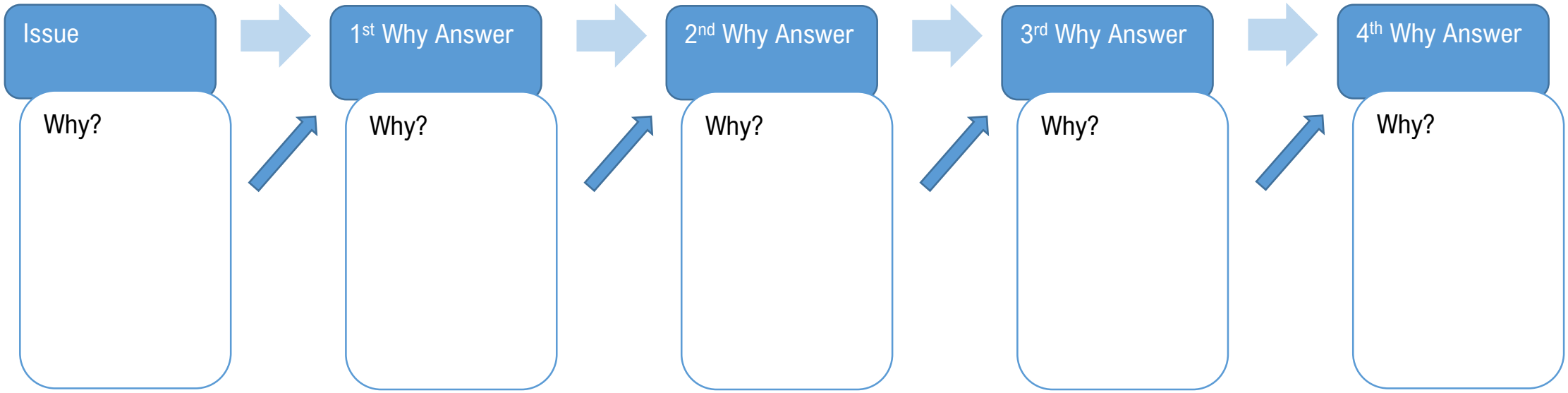
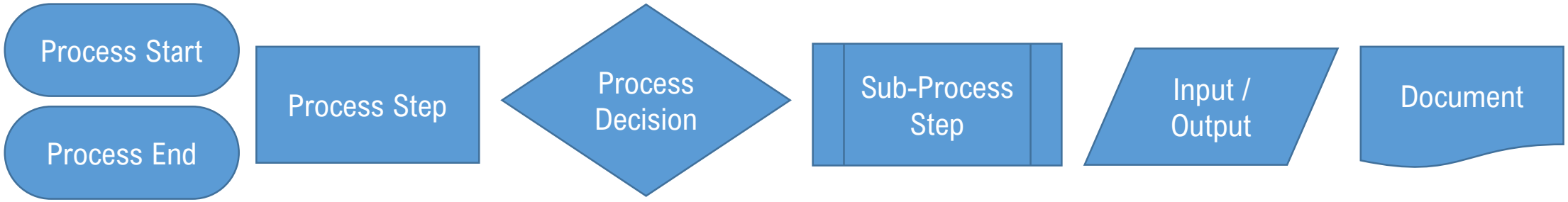


“Because we have always done it this way” is an ineffective answer for this tool

Map YOUR IHC Process

1. Indicate every step in the process
2. Draw arrows between each step
   - Include touch points
   - Include decision points
   - Include inputs & documents required
   - Can include outputs (optional)

Commonly used designations for classic process mapping are provided below

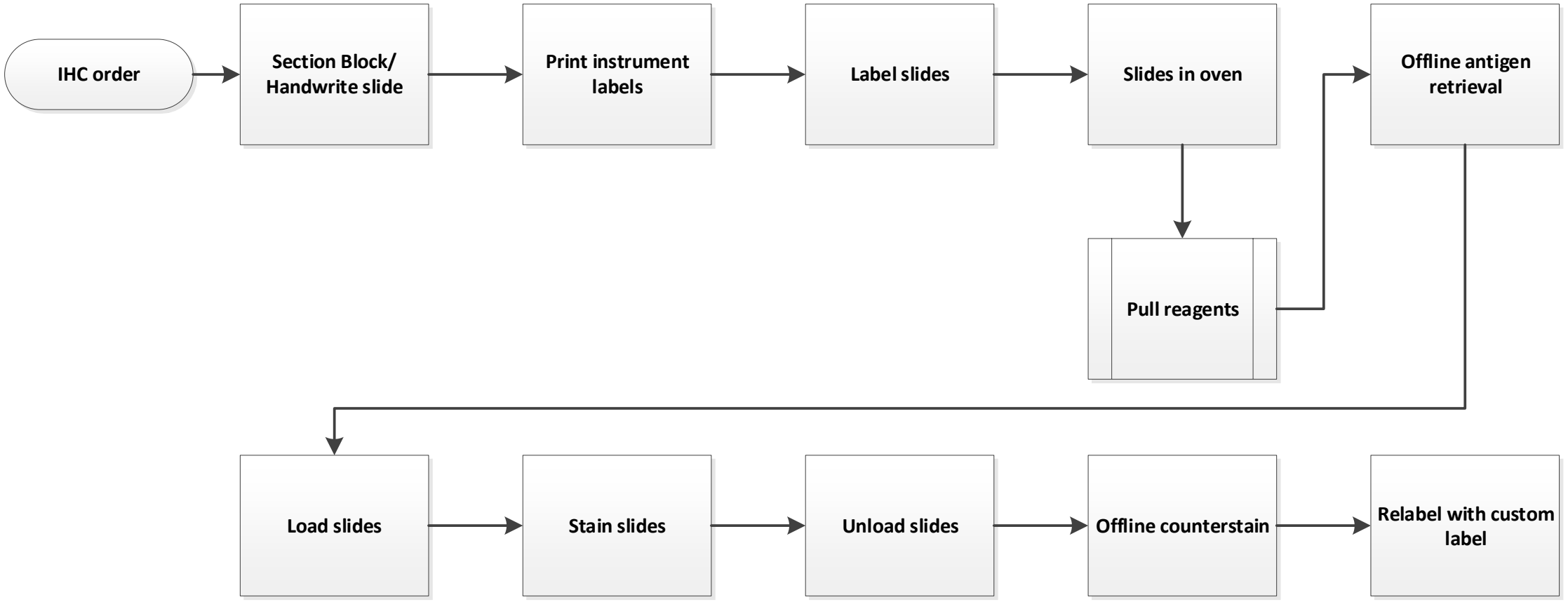


PROCESS MAP GUIDE (CONTINUED)

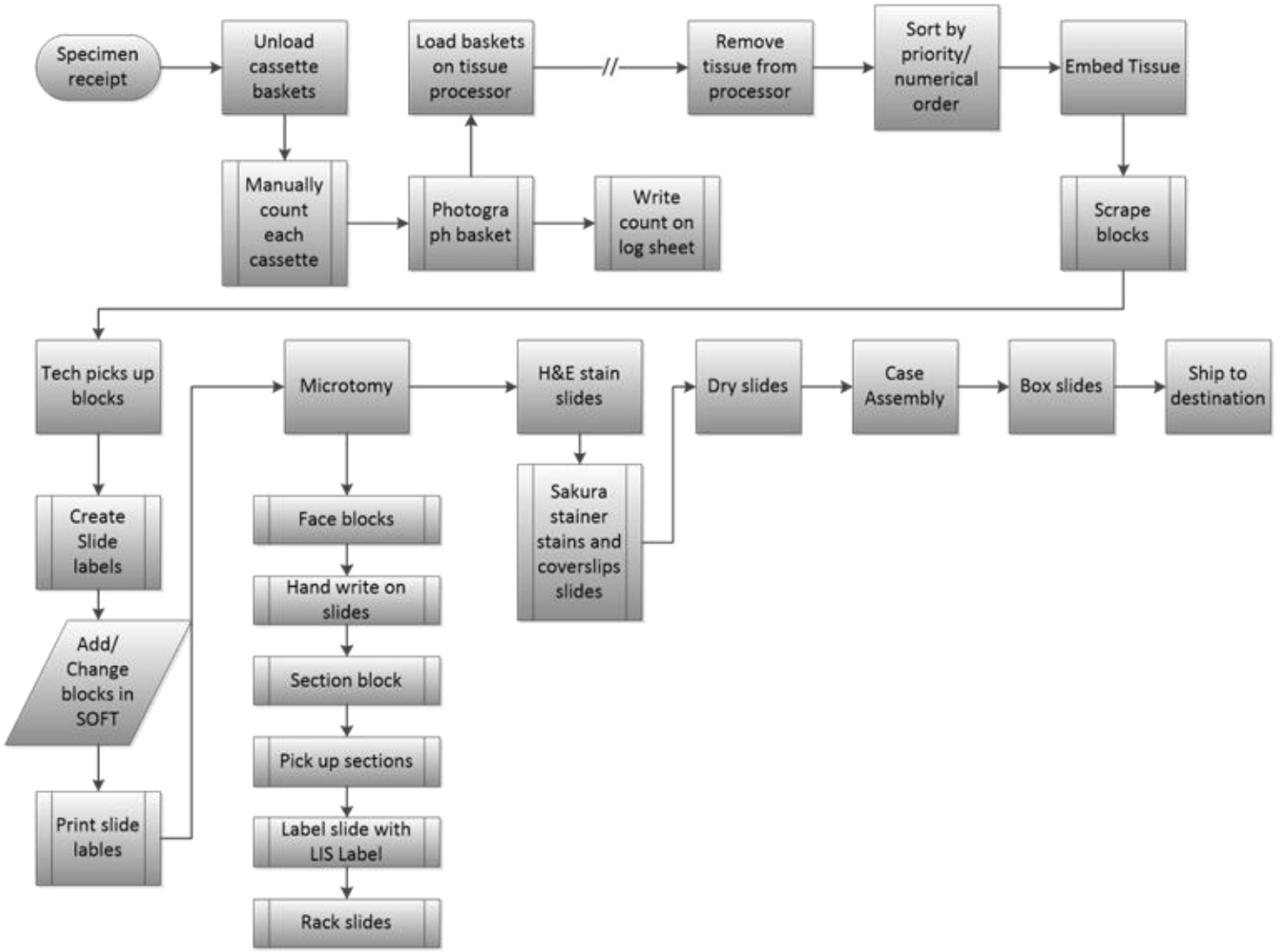
3. Once your process map for your current IHC workflow is completed, note wait times and problem areas.

4. Challenge the current IHC workflow process
   - Include areas where known alternatives exist
   - Have you explored these alternatives? Why/why not?

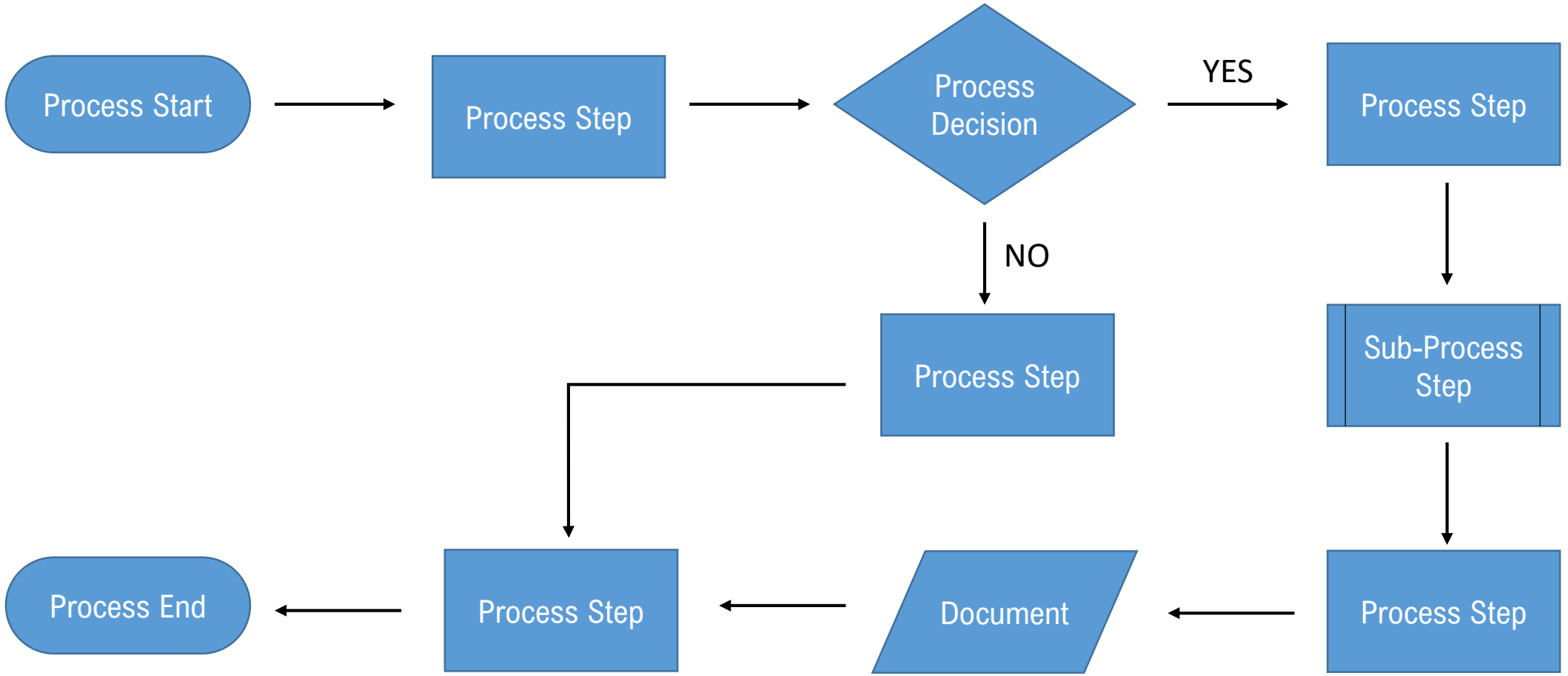
PROCESS MAP EXAMPLE #1



PROCESS MAP EXAMPLE #2



PROCESS MAP TEMPLATE



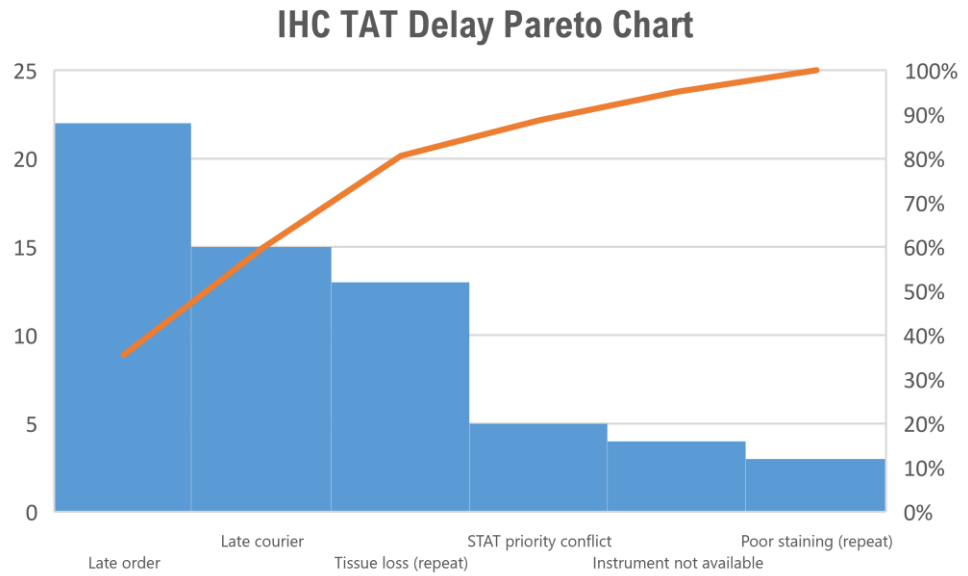
Instructions: Try mapping YOUR process (high level) using the shapes and arrows provided.
You can relabel, move, resize, and copy/paste these items as needed

PARETO CHART GUIDE

A pareto chart helps identify and prioritize issues to the critical few.

1. Collect the data of the issues noted.
2. Categorize the issues the best you can and the number of occurrences per timeframe.
3. Keep the issue categories at high level. There will be an opportunity to investigate the issues further using our other tools provided.
4. The Pareto chart prioritizes the issues (this is where the 80/20 rule comes from!)

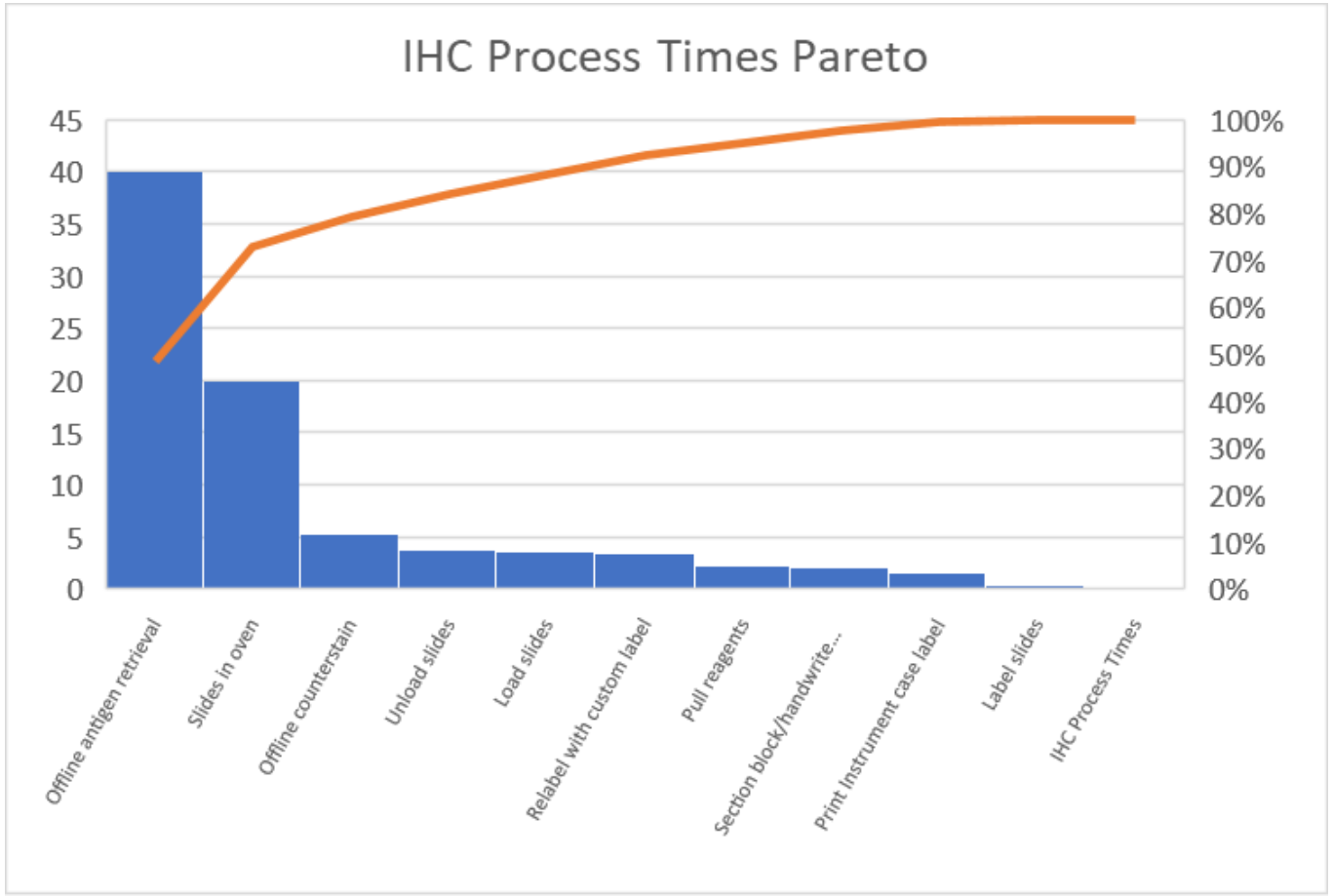
Issue (Delayed TAT)	Monthly Occurrences
Late order	22
Late courier	15
Tissue loss (repeat)	13
STAT priority conflict	5
Instrument not available	4
Poor staining (repeat)	3



PARETO CHART EXAMPLE

IHC Process Times	
Section block/handwrite slide	2.11
Print Instrument case label	1.52
Label slides	0.33
Sort slides by instrument	1.1
Slides in oven	20
Pull reagents	2.2
Offline antigen retrieval	40
Load slides	3.6
Stain slides	122.62
Unload slides	3.8
Offline counterstain	5.3
Relabel with custom label	3.4

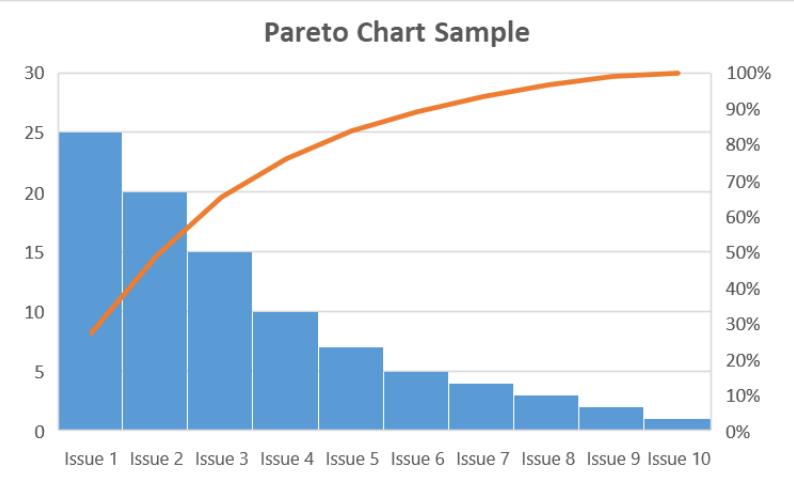
Note: “Stain slides” was removed from the chart for display purposes



PARETO CHART TEMPLATE

A pareto chart helps identify and prioritize issues to the critical few

1. List the issue categories from your analysis in the left column of chart below.
2. For each issue, list the number of occurrences in the right column of chart below.
3. To produce a Pareto chart in Excel:
   A. Sort data by occurrences in decreasing order
   B. Select/highlight the two columns
   C. Insert -> Recommended Charts -> Select chart that looks like graph format provided below



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Issue	Monthly Occurrences
Issue 1	25
Issue 2	20
Issue 3	15
Issue 4	10
Issue 5	7
Issue 6	5
Issue 7	4
Issue 8	3
Issue 9	2
Issue 10	1

SPAGHETTI DIAGRAM GUIDE

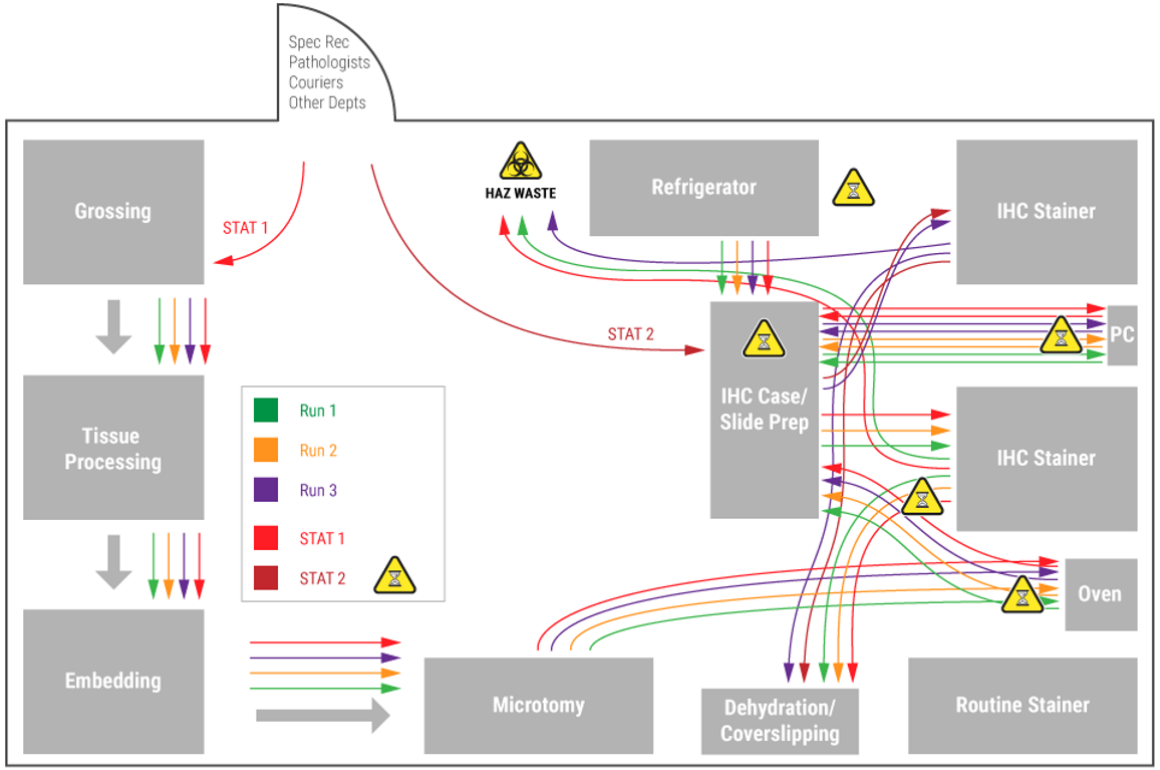
1. Map foot traffic when running IHC with the current workflow
2. Note bottlenecks, wait times, and areas of transportation waste
3. Identify opportunities to move/relocate items to decrease unnecessary transportation and/or optimize the flow of materials
4. Map foot traffic for improved workflow

Remember to map both your BEFORE and AFTER workflow states

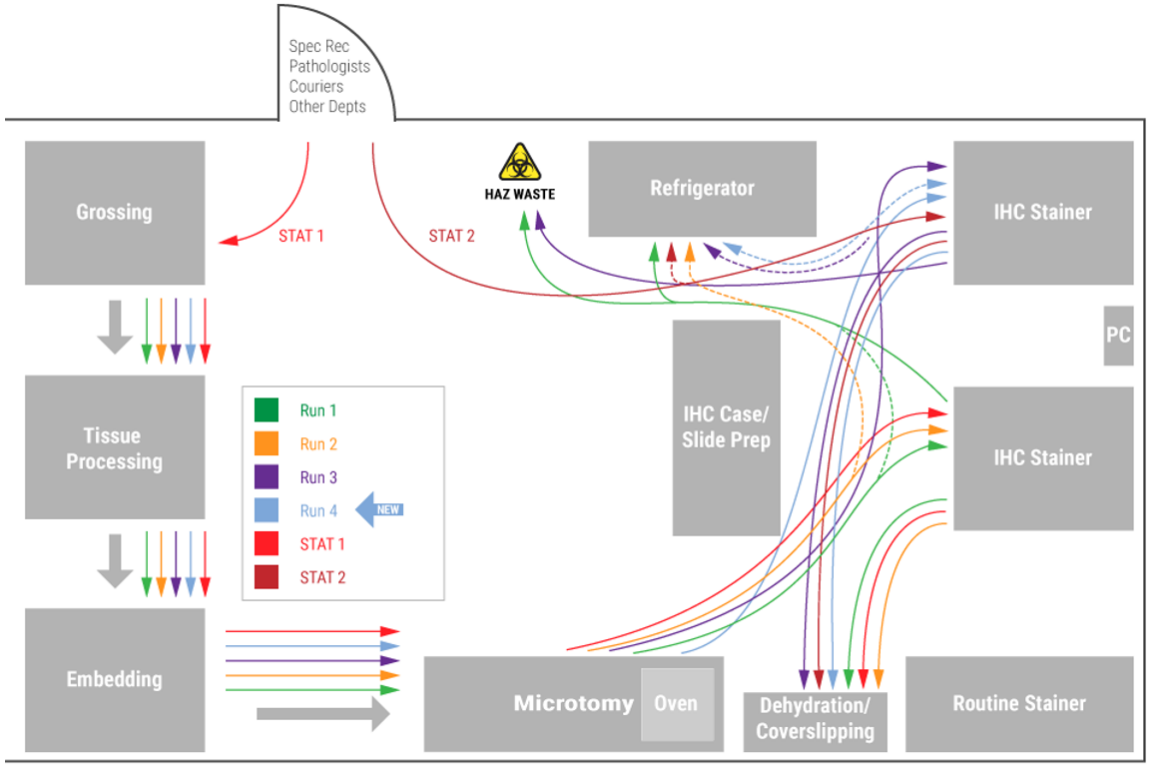
SPAGHETTI DIAGRAM EXAMPLE

Map foot traffic for IHC runs and note bottlenecks, wait times, and areas of transportation waste.
Remember to diagram the improved workflow too!

BEFORE



AFTER



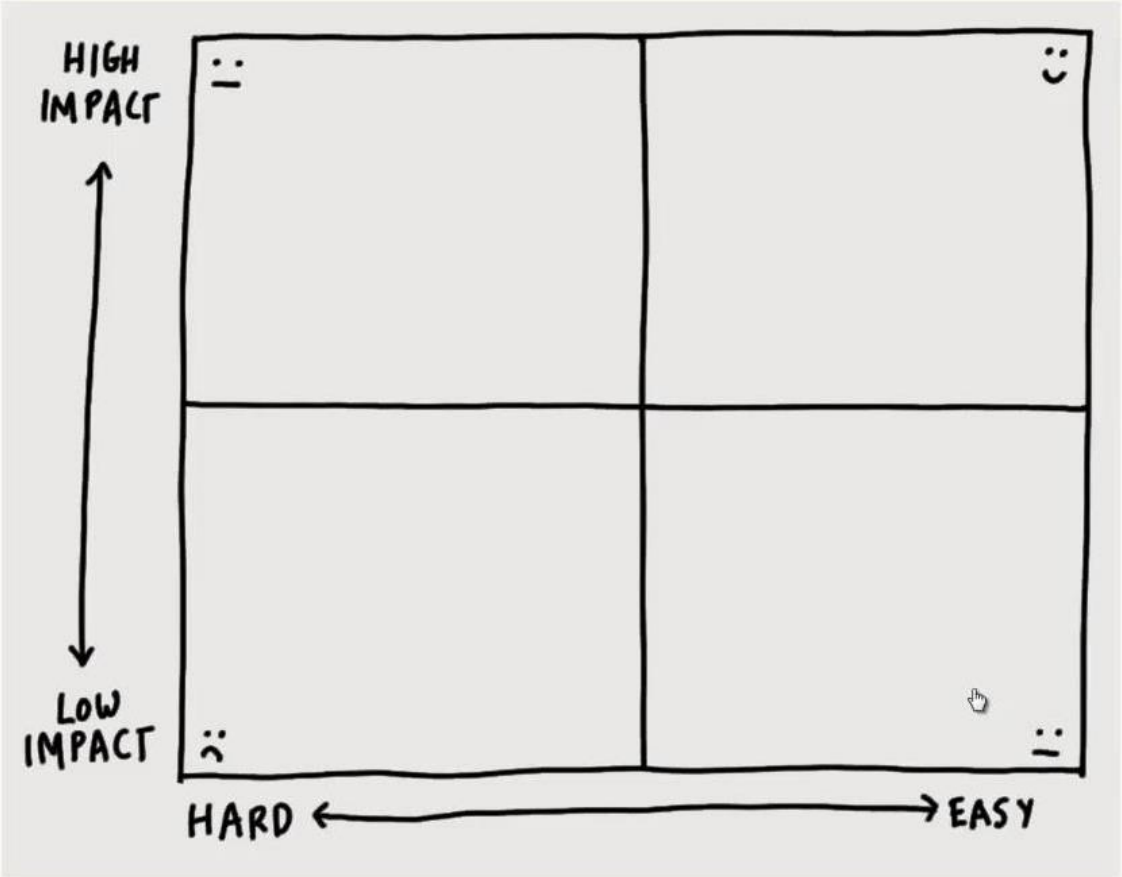
IMPACT MATRIX GUIDE

ROME WAS NOT BUILT IN A DAY!

Once you have your improvement projects determined, plot them on an impact matrix to assess effort vs impact.

Impact matrix ranks issues by several factors

- Overall impact to the lab
- Amount of work it takes to implement a solution



Impact Matrix Shows Effort vs Impact

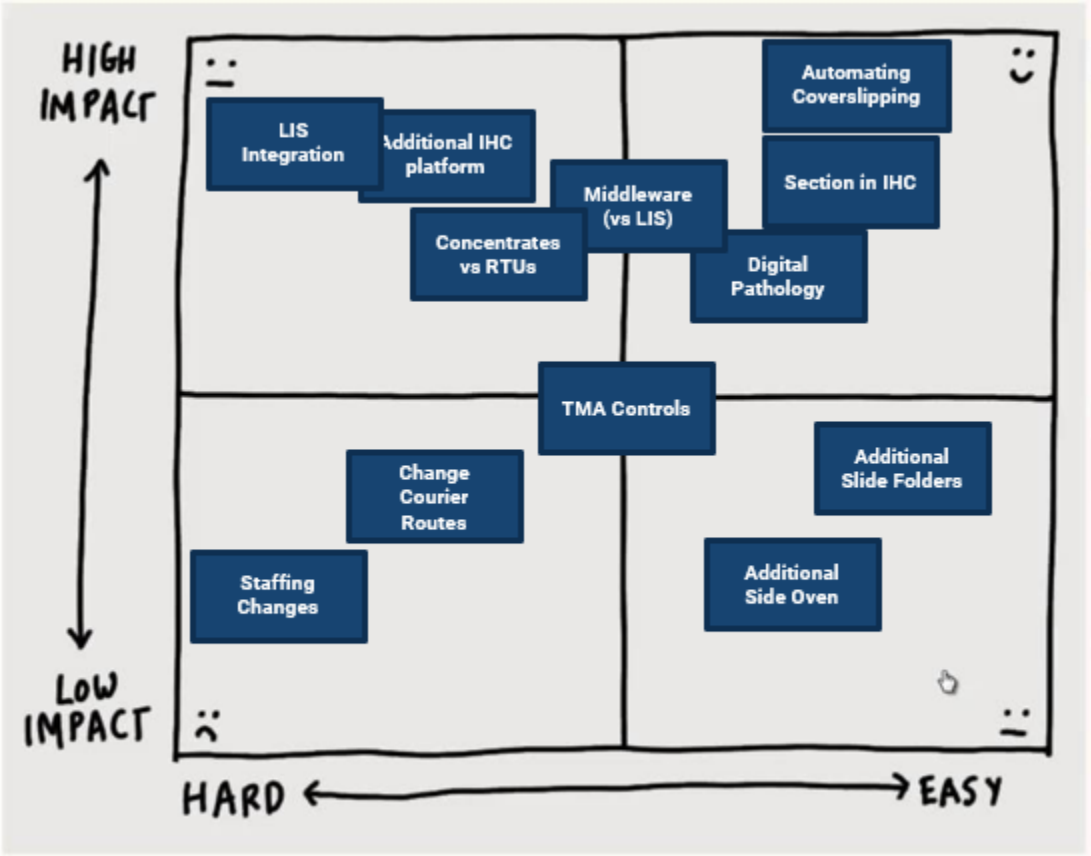
IMPACT MATRIX EXAMPLE

How Do You Eat an Elephant?

One Bite at a Time…

Impact matrix prioritizes your improvement project options by ranking them by the effort and impact.

- **Low impact, Difficult** = Consider passing on or postponing project
- **High impact, Difficult** = May require additional analysis to determine ranking
- **Low impact, Easy** = Consider implementing depending on impact (low hanging fruit, morale booster)
- **High impact, Easy** = Definitely implement, it's an easy win *(rare event so take advantage!)*



IMPACT MATRIX TEMPLATE

- **Low impact, Difficult** = Consider passing on or postponing project
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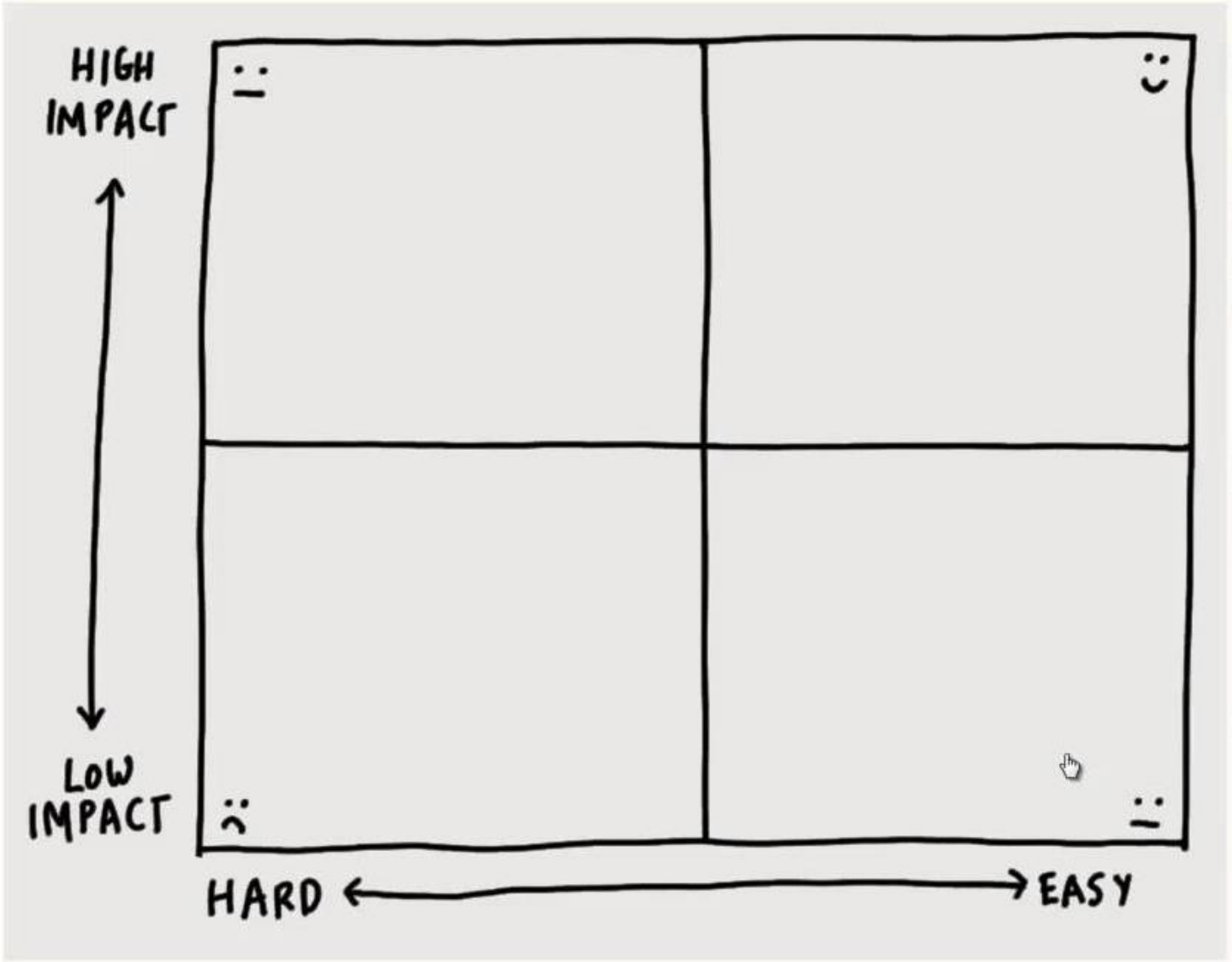


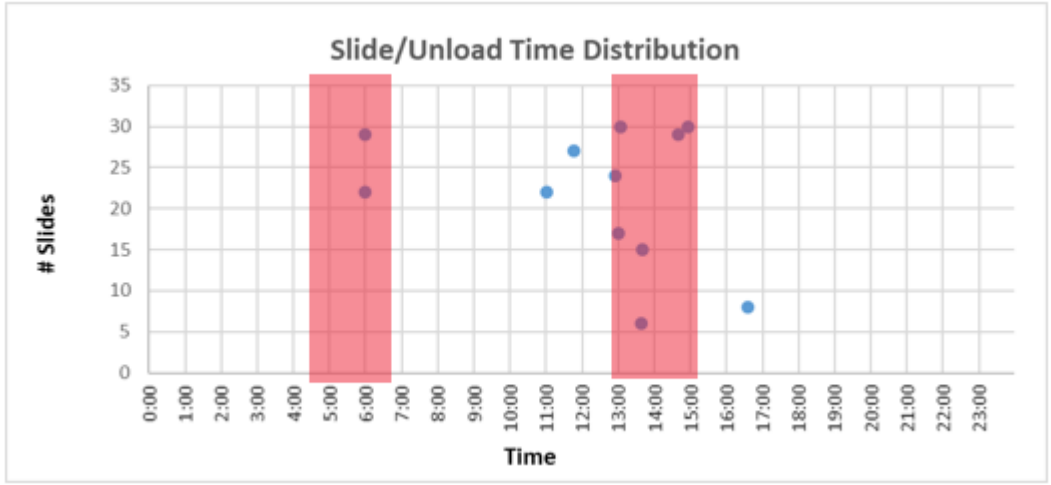
CUSTOM TOOLS GUIDE & EXAMPLE

You can create your own tools to capture and measure the information needed to best analyze YOUR workflow

Example

- This tool is a spreadsheet that captures IHC instrument slide volumes and run completion times
- This information can be used to manage appropriate staffing levels at different time points throughout the workday

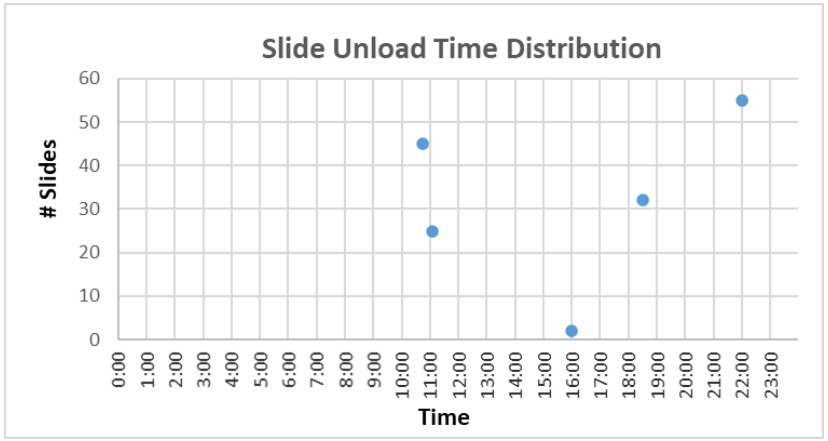
Date	Time Loaded	Stainer	Program	# Slides	Completion Time
3/15/2018	8:12	Arwen	Routine IHC	27	11:47
3/15/2018	7:25	Boromir	Red	22	11:02
3/15/2018	10:06	Legolas	ISH	8	16:36
3/15/2018	9:18	Gimli	Routine IHC	24	12:56
3/15/2018	9:33	Treebeard	Routine IHC	30	13:04
3/15/2018	9:57	Gandalf	Stat	6	13:38
3/15/2018	10:55	Frodo	Cytology	15	13:40
3/15/2018	11:08	Boromir	Routine IHC	29	14:41
3/15/2018	11:16	Arwen	Routine IHC	30	14:56
3/15/2018	11:27	Gandalf	Red	17	13:01
3/15/2018	17:30	Gimli	Delayed IHC	22	6:00
3/15/2018	17:35	Frodo	Delayed IHC	29	6:00



Custom Tools Spreadsheet Template

Provided is a Slide Unload Time Distribution spreadsheet tool.

- With this tool, you can compare unload times with staffing times or courier pickup times
- This spreadsheet can be customized for any slide volume versus time analysis



Date	Time Loaded	Stainer	Staining Protocol	# Slides	Unload Time
9/14/2021	8:15	Mickey	IHC	45	10:45
9/14/2021	11:30	Minnie	IHC	25	11:05
9/14/2021	13:30	Donald	IHC	80	15:00
9/14/2021	14:00	Daisy	STAT IHC	2	16:00
9/14/2021	16:00	Pluto	IHC	32	18:30
9/14/2021	19:00	Goofy	IHC	55	22:00

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No Existing Lab

What do you do when there is no staff, physical location, equipment, existing workflow to assess?

- Volume estimates are extremely important. Wrong information here can set you up for disaster.
- Focus on what you know; List known constraints
  - How much space will I have?
  - How will specimens arrive?
- Engage ALL stakeholders
- Not a "one size fits all" scenario

Current situation is changing, updates needed

This may be the most common change in workflow with varying degrees of change

- What's changing?
  - Additional volume expected
  - New technology or new process that can affect other processes
  - Lab operation hours
- Make adjustments for new equipment/ technology/process
- Relocation of existing furniture/equipment

Large Scale Overhaul

- Merger or acquisition
- Large scale expansion (lab added new, high-volume clients)
- Additional technology (specimen tracking system, LIS change, digital pathology, etc.)

➢A technique that sometimes works best for these scenarios is to start with how you would want your workflow to look in a perfect world and then work backwards.

KNOWLEDGE PATHWAY

We hope you found this information helpful. For additional information and resources, please go to:

https://www.leicabiosystems.com/knowledge-pathway/

Thank you for attending the webinar!

THANK YOU!