



LTS Global.  
Shape. Empower. Transform. Create

# Engineering Proactive Prediction Looking for Anomalies and Asking the Right Questions

From reactive laboratories to predictive decision systems

Wilhelm Boshoff  
Founder LTS (1998)

Transforming Labs.  
Empowering Futures.

# A familiar Monday morning



- TAT breach reported
- Clinicians already frustrated
- Analyzers 'within spec'
- Staffing 'according to plan'
- Volumes 'as expected'

Nothing failed, yet  
confidence is already gone



The wrong questions  
gets asked



What went  
wrong?



The right questions  
rarely does




Why didn't we see  
this coming?

The gap is where value is lost



# Labs are not short on data

They are short on early signals they trust enough to act on



Dashboards  
explain  
yesterday



KPIs  
justify  
last week



RCA  
defends  
last month

That is forensic management - not prediction



# Why Volume Value Stalls



Variance detected  
after impact



Reaction after  
confidence loss



Local optimization,  
system failure



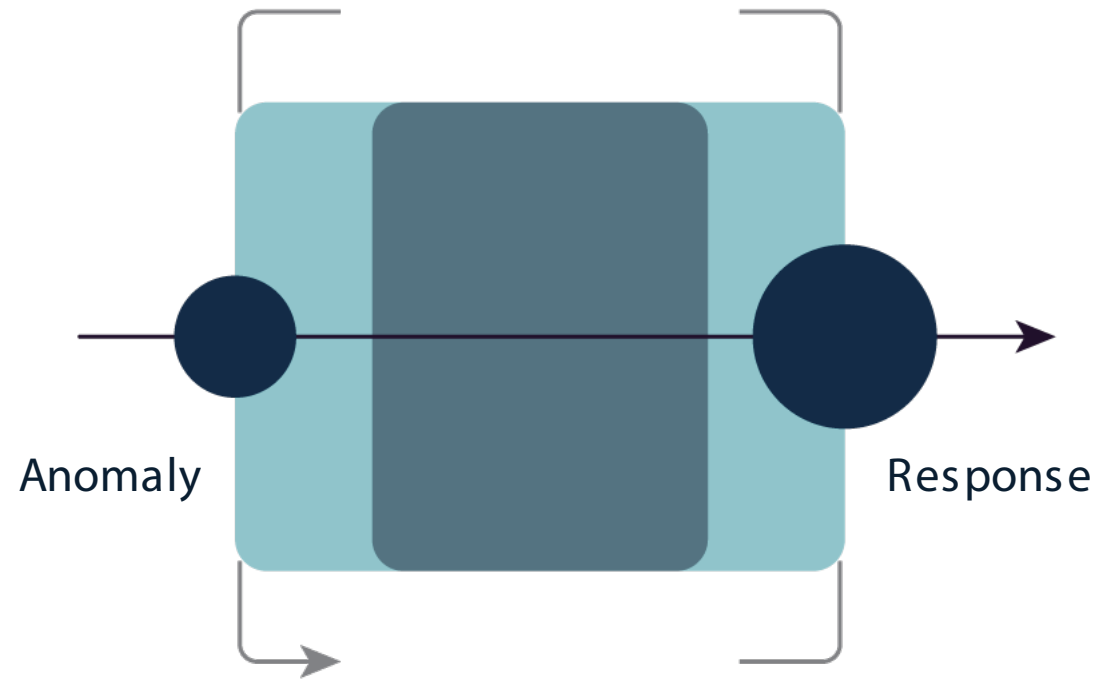
Averages hide  
instability

Value is lost before leadership knows there is a problem



# Reframing "Predictive"

Prediction is not about the future  
It is about decision timing



Value is created or destroyed between anomaly emergence and human response

# The Missing Engineering Layer



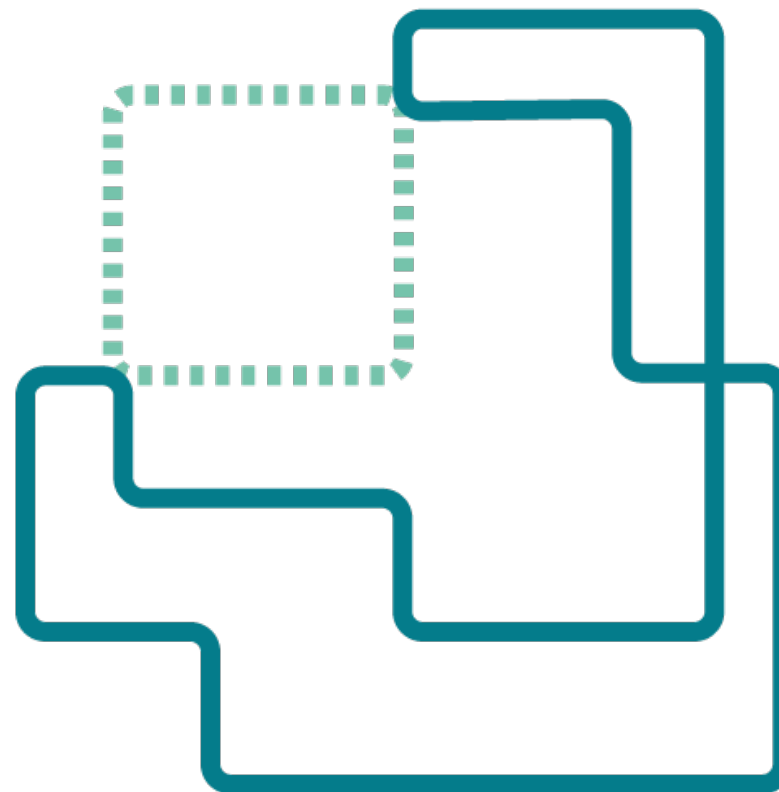
What most labs do

Strategy → KPIs → Accountability



What's missing

→ Engineered questions before failure





# Engineering Better Questions

A decision-engineering lens



- 1 Structures uncertainty
- 2 Aligns questions
- 3 Forces early signal detection
- 4 Enables confident intervention

# How Questions Must Change

Stage	Reactive Question	Predictive Question
Discover	What are our KPIs?	Where does variance first appear?
Diagnose	Why did TAT slip?	Which constraint is about to fail?
Design	What should we change?	Which lever shifts the system fastest?
Implement	Did it work?	Is the signal stabilizing?
Sustain	Are we compliant?	Are we drifting?

# 'Why Dashboards Are Late'



Confirm  
outcomes



Reinforce  
thresholds



Train  
reaction

They answer: Did we miss?  
They don't answer: Are we about to?



# Enabling Operational Pattern Recognition



Focus: Learning normal before flagging abnormal



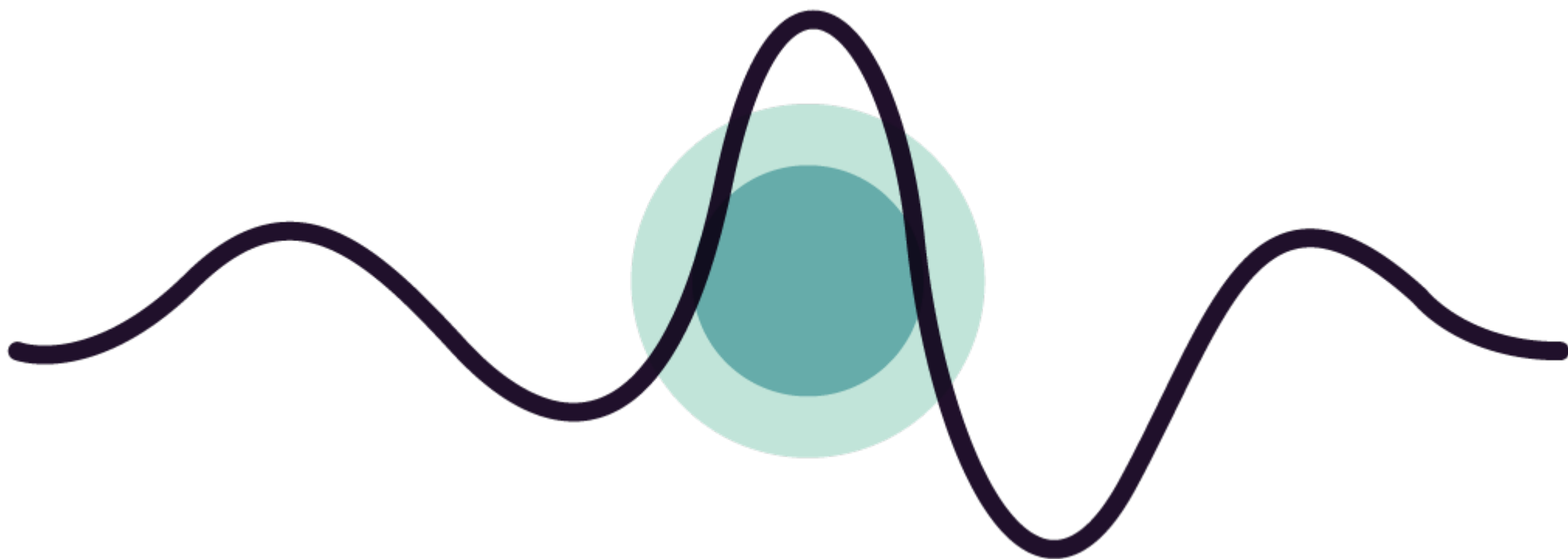
# What This Enables Operationally

Learns normal before flagging abnormal

Detects weak signals

Works on patterns, not averages

Surfaces questions, not alerts



# What This Looks Like in Practice

Multi-site laboratory network:

- KPIs were green
- Volumes stable
- Staffing appropriate

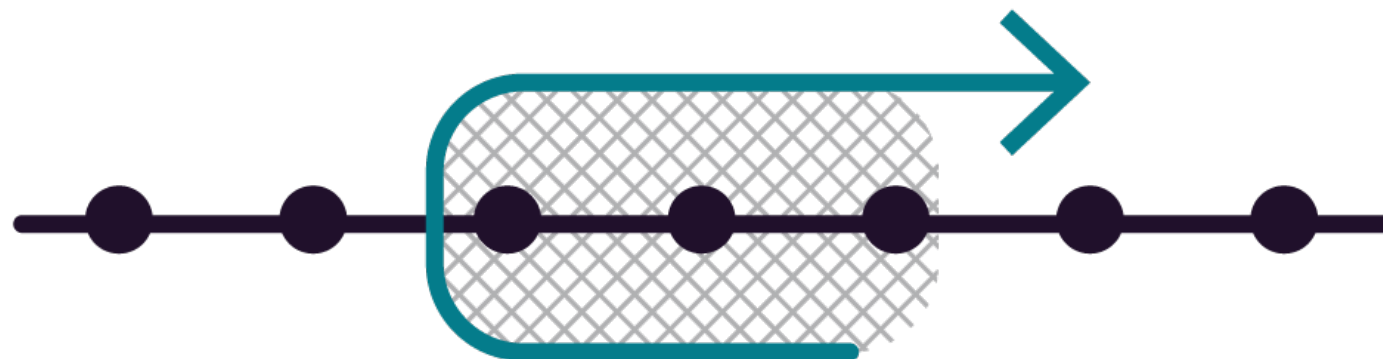
But variability patterns revealed:

Subtle shifts in analyzer utilization and staff handovers

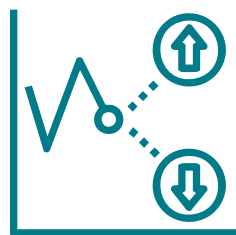
➔ patterns that preceded service failures by ~2 weeks

Intervention: Minor roster adjustments. Earlier load balancing

Result: No heroics. No escalation.  
No apology tour.



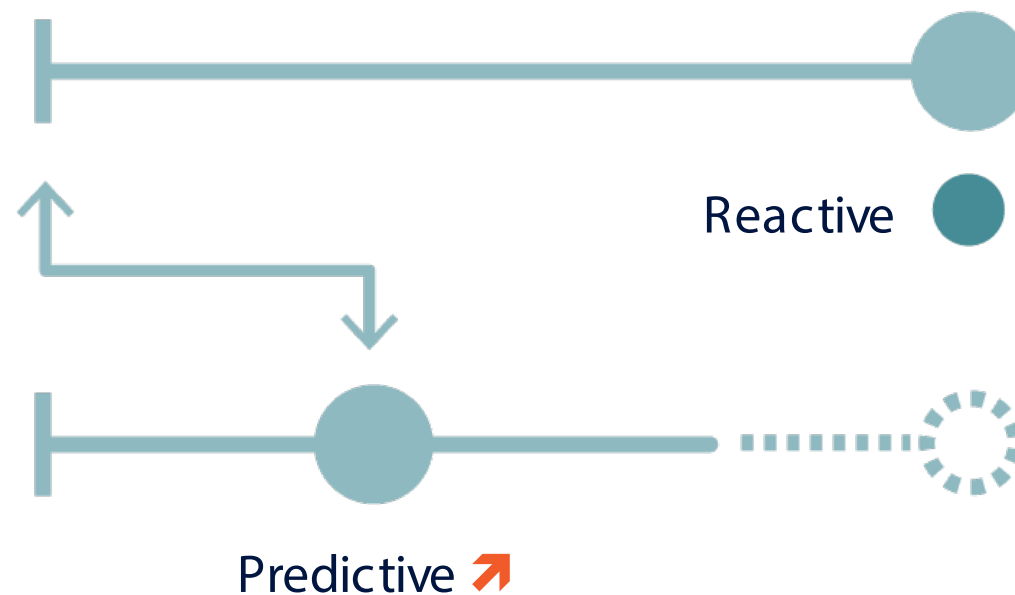
# Reactive vs Predictive Signals



Reactive:  
TAT breached  
yesterday 🔍



Predictive:  
Variability suggests a TAT breach in  
10 - 14 days if unchanged 🚩



Same data. Different decision.

# Why This Enables Value



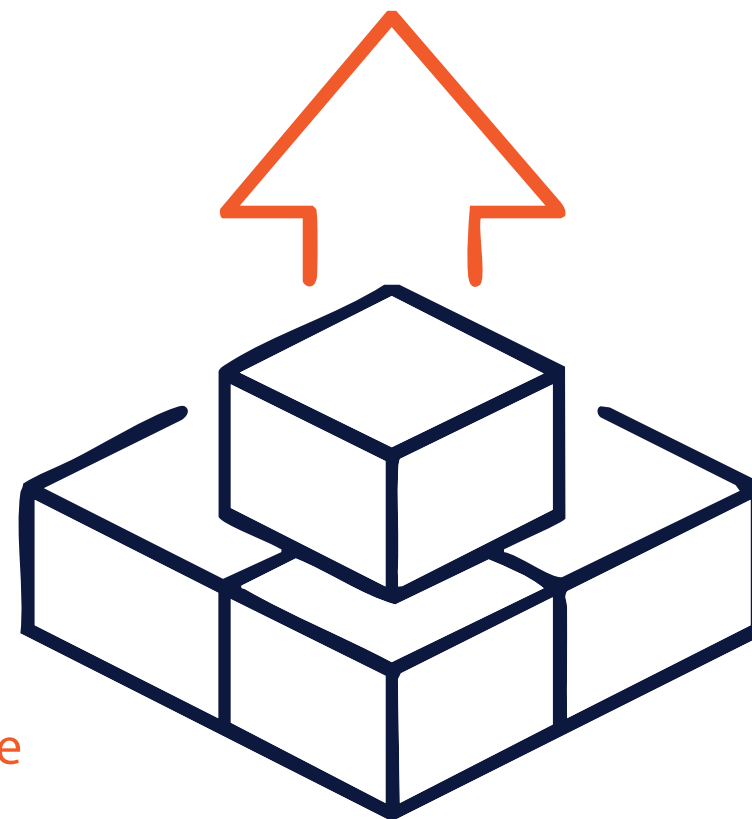


# Why This Matters for Clinical Lab 2.0

For Clinical Lab 2.0 and Project Santa Fe

- Value-based care requires operational stability
- Diagnostic stewardship requires predictable systems
- Population health requires confidence under uncertainty

Operational prediction is not an efficiency play - it is a prerequisite



# 'What Sticks'



Shared  
language



Early-warning  
signals



Learning  
systems

Not digitization - transformation



# The Difference



- ① Early intervention  
\_\_\_\_\_
- ② No emergency  
\_\_\_\_\_
- ③ No heroics  
\_\_\_\_\_
- ④ No apology tour

# The real shift

- Not faster testing
- Not bigger dashboards
- Not more AI
- **Earlier certainty - shared**



Value is lost long before failure is visible

# Typical Scenario

## Data Exists:

- Timestamps
- Workload volumes
- Analyzer utilization
- Staffing rosters
- Queues & handovers
- Repeat tests



Reactive Use

Averages  
Reports  
RCA

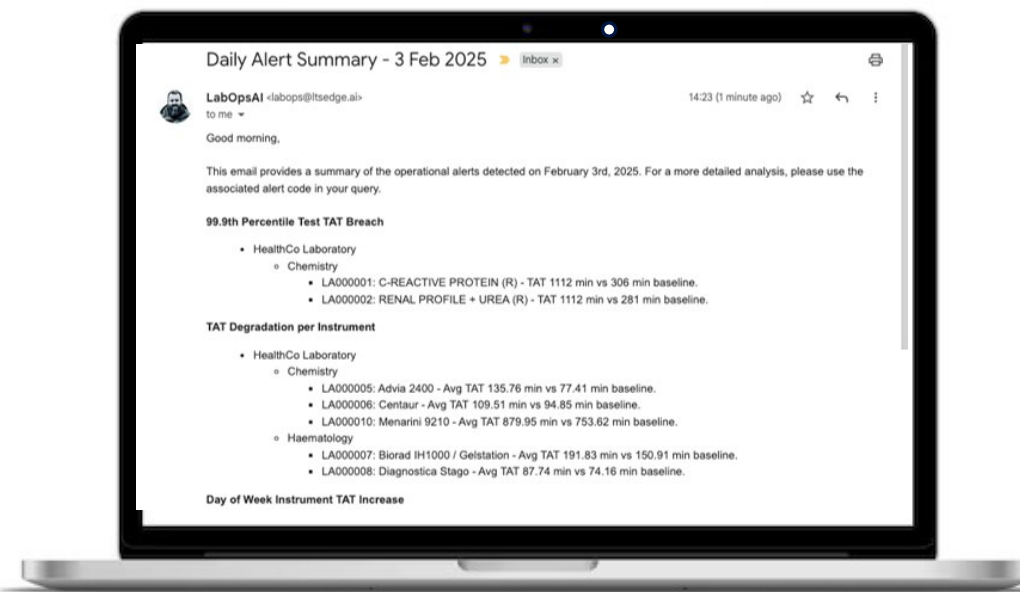
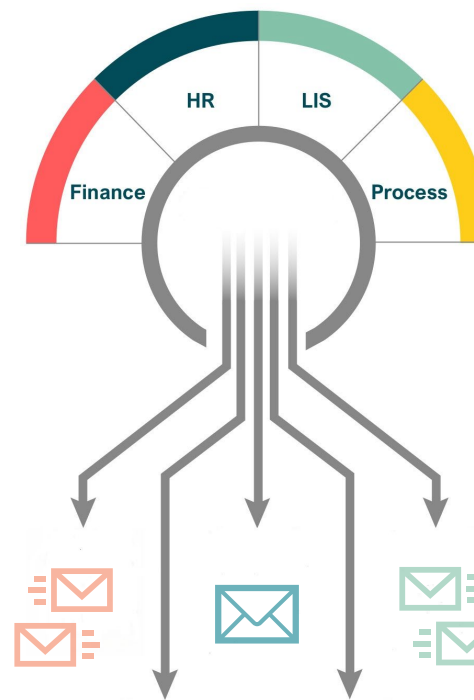
“What went wrong?”



Predictive Use

Patterns & Drift  
Variability  
Rate of Change

“What is emerging”



# Prompt 1

## Overall TAT degraded

Last week ave. significantly higher than 2-month baseline substantial slowdown in performance

## Progressive upward trend over 5-weeks

Possible operational challenges/increased workload

## Analysis: Systemic problem

Technology / operational setup / staffing / workload

## Key areas for further analysis

- Instrument maintenance logs & calibration records
- Staffing schedules & workload distribution

Can you please summarize the alerts received on the 3 Feb 2025 for the Advia 2400?

I will now retrieve the alerts for the Advia 2400 on February 3, 2025.

On February 3, 2025, the Advia 2400 instrument triggered several alerts indicating potential performance issues. Here's a summary of the alerts:

1. TAT Degradation per Instrument (LA000005) This alert indicates that the overall turnaround time (TAT) for the Advia 2400 has degraded. The average TAT for the last week was 135.76 minutes, which is significantly higher than the two-month baseline average of 77.41 minutes. This suggests a substantial slowdown in the instrument's performance.

2. TAT Trend per Instrument (LA000027) This alert indicates a concerning trend of increasing TAT for the Advia 2400 over the past five weeks. The average weekly TATs have progressively risen:

- Five weeks ago: 57.81 minutes
- Four weeks ago: 71.99 minutes
- Three weeks ago: 77.11 minutes
- Two weeks ago: 83.86 minutes
- Last week: 135.76 minutes

This consistent upward trend suggests a gradual and sustained degradation in the instrument's performance, which warrants further investigation. These alerts suggest that there might be specific operational challenges or increased workload on these days affecting the instrument's efficiency.

Analysis: The alerts collectively paint a picture of a significant and worsening performance issue with the Advia 2400. The overall TAT degradation, coupled with specific spikes on certain days and a clear increasing trend over several weeks, points to a systemic problem rather than an isolated incident. This could be related to the instrument's technology (e.g., maintenance, calibration, or impending breakdown), operational setup (e.g., processes, sample flow), or even staffing and workload distribution.

Key areas for further analysis:

- Investigate the instrument's maintenance logs and recent calibration records.
- Review staffing schedules and workload distribution for Tuesdays, Thursdays, and Fridays to identify any correlations with the increased TAT.

Possible follow-up questions:

- Can you provide a detailed breakdown of the types of tests processed by the Advia 2400 during the last week, and their individual TATs?
- What is the current maintenance schedule for the Advia 2400, and when was its last major service or calibration?

# Prompt 2

Volumes are not a contributing factor

Can you please check whether a potential increase in the volume of tests on the Advia 2400 can be contributed to the increase in TAT?

- Week 2025-01: 32,651 tests
- Week 2025-02: 34,649 tests
- Week 2025-03: 35,234 tests
- Week 2025-04: 32,519 tests

The volumes leading the volumes are relatively constant , my conclusion is that there is no substantial increase in test volumes and therefore this is not contributing to the elevated TAT.

# Prompt 3

Repeat tests can be the cause, but MORE INFORMATION is required

Do you think that repeat rates can be the cause for the TAT degradation on the Advia 2400?

DataLume

Yes, repeat rates, which are essentially retests, can absolutely be a significant cause for Turnaround Time (TAT) degradation on the Advia 2400. Each repeat test consumes additional instrument time, reagents, and staff resources, effectively extending the overall processing time for those samples and potentially creating bottlenecks.

To investigate this, I would need to understand how repeat tests are identified within your laboratory information system data. **Could you please provide more information on how repeat tests are logged?**

For instance:

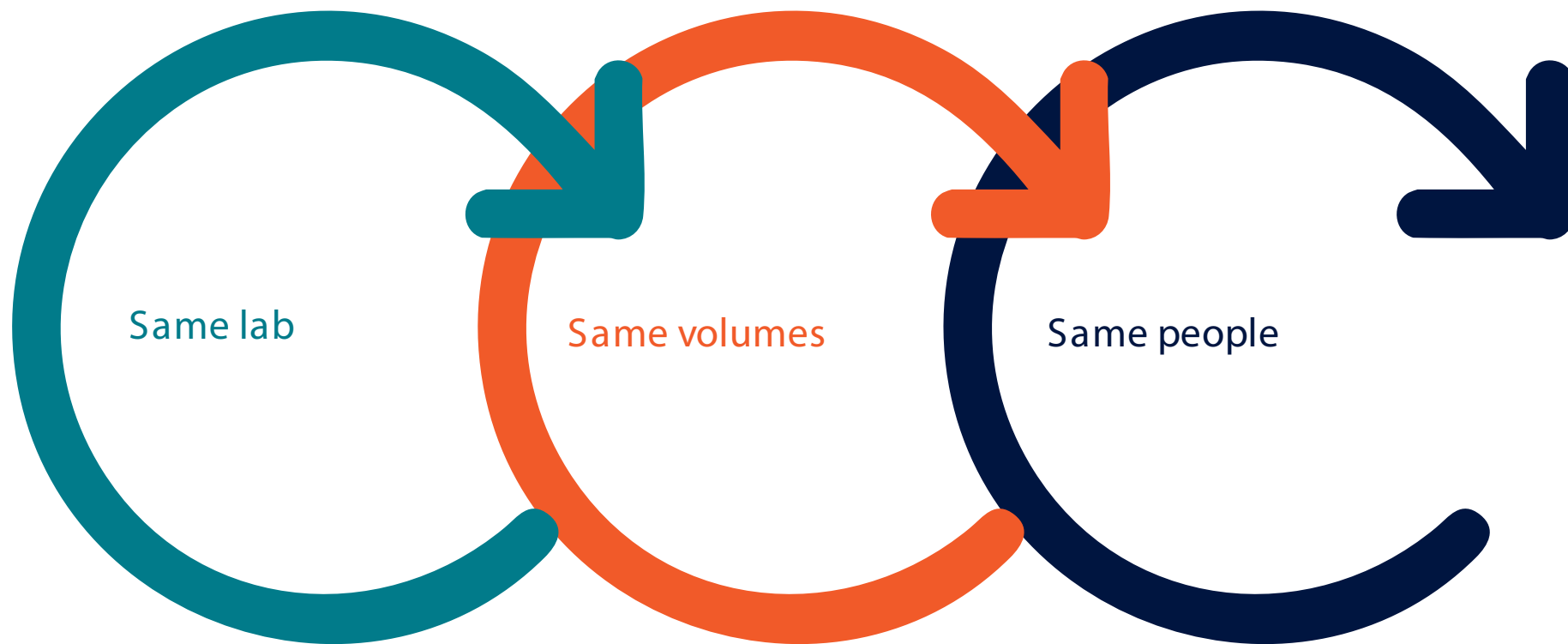
Is there a specific field or flag in the requests table that indicates a test is a repeat?

Are repeat tests assigned a different test name or test type?

Is there any other way to link a repeat test back to its original request?



# 'Back to Monday morning'



Different conversation: We saw this coming.

The background is a solid teal color. There are four white diagonal lines, two on the left and two on the right, each consisting of a thin line and a thicker line segment. The text is centered in the middle of the frame.

Thank You

THE END