VCU Health

Lab Quality Confab
Process Improvement Institute

Putting Analytics to Useful Work, both in the lab and in Collaborations with Caregivers: Successes, Some Setbacks and Lessons Learned

10/15/2019

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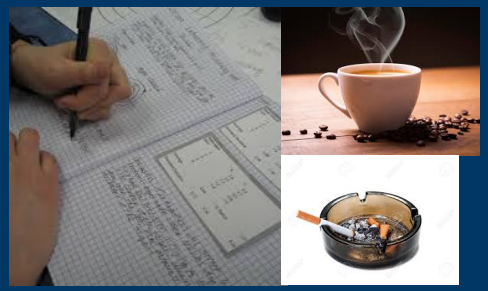
VCU Health System
Medical College of Virginia
Richmond, VA

Disclosures

Scientific Advisory Activities

- ThermoFisher Scientific
- Becton Dickinson
- GeneCapture
- Quidel

Laboratory Result Reporting Before EMRs



Result recording

Record sorting

Record Storage

Chart Review

Record Delivery

VCUHealth

Enter the Electronic Medical Records!

Medical College of Virginia

- First EMR – 1979
- First LIS – 1983
  - Not for Microbiology though

So everything got way better right?

VCU Health

10/15/2019

What is the Problem?

Information Overload

"Data asphyxiation"
-William van Winkle

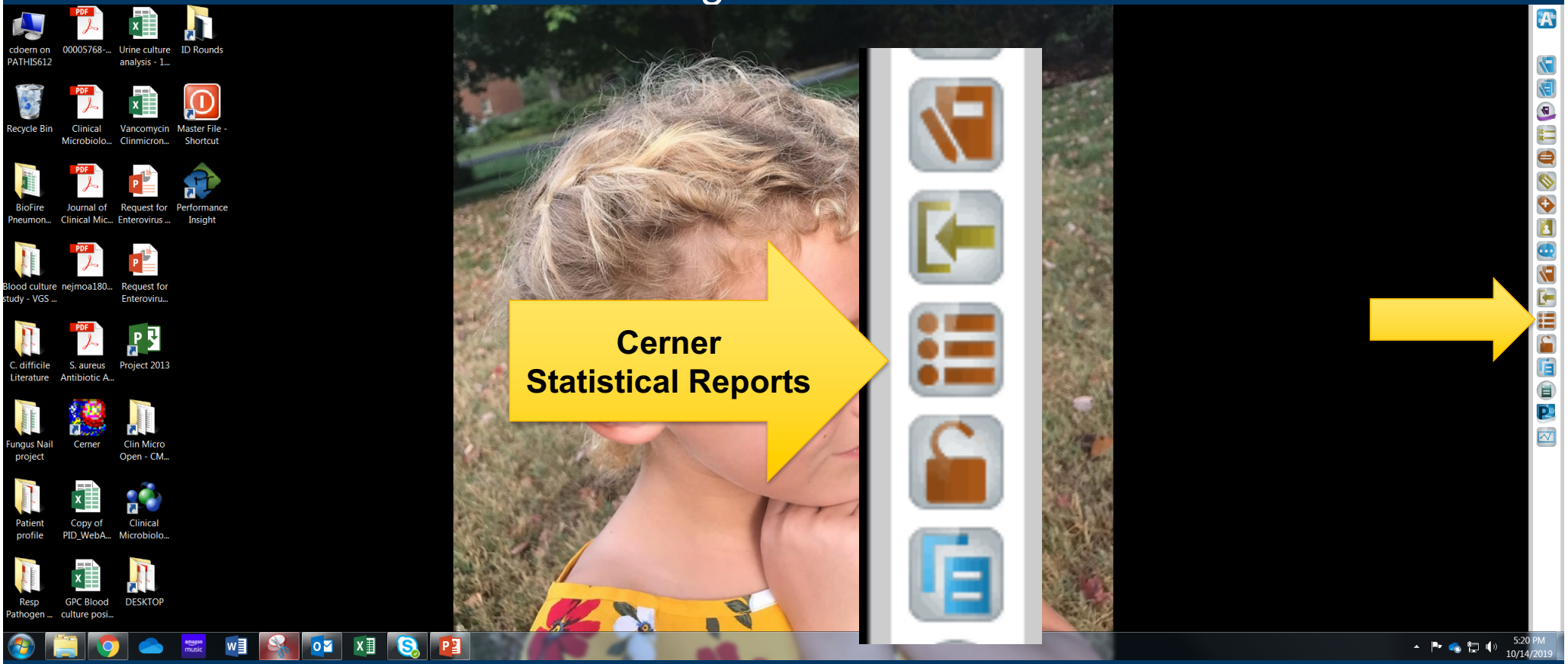
"Cognitive Overload"
-Eric Schmidt

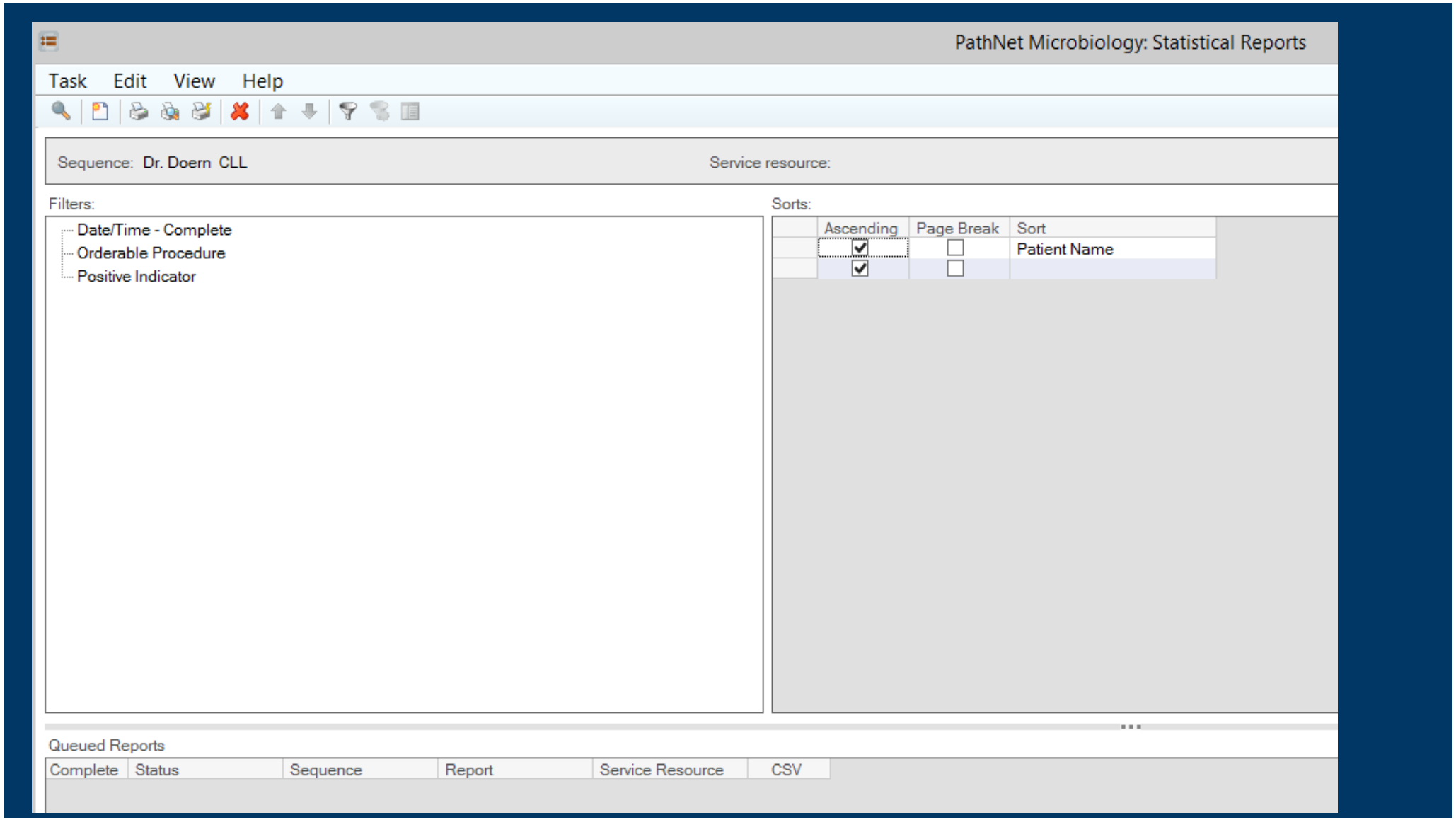
"Information Fatigue Syndrome"
- David Lewis

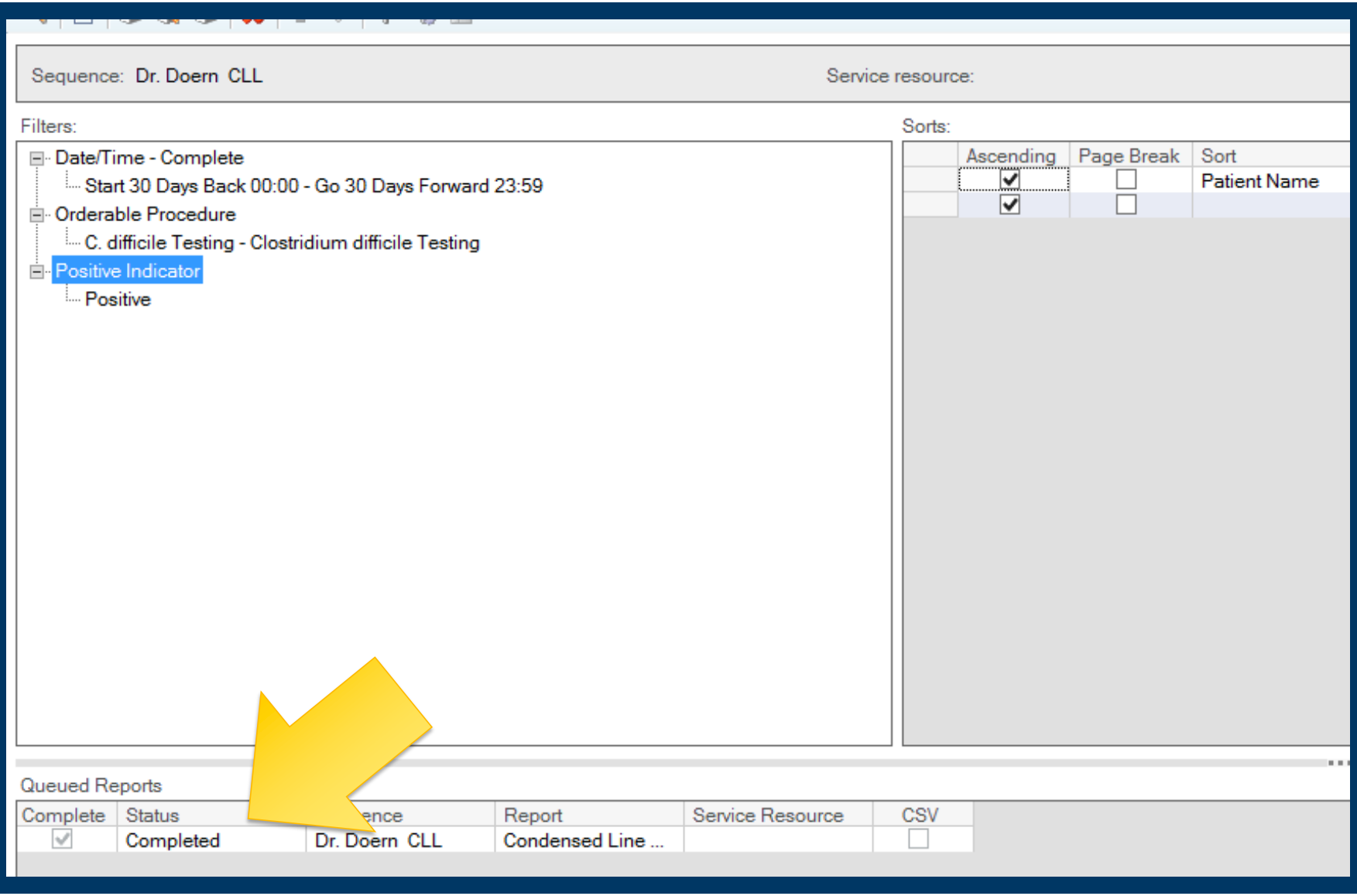
"Data Smog"
- David Shenk

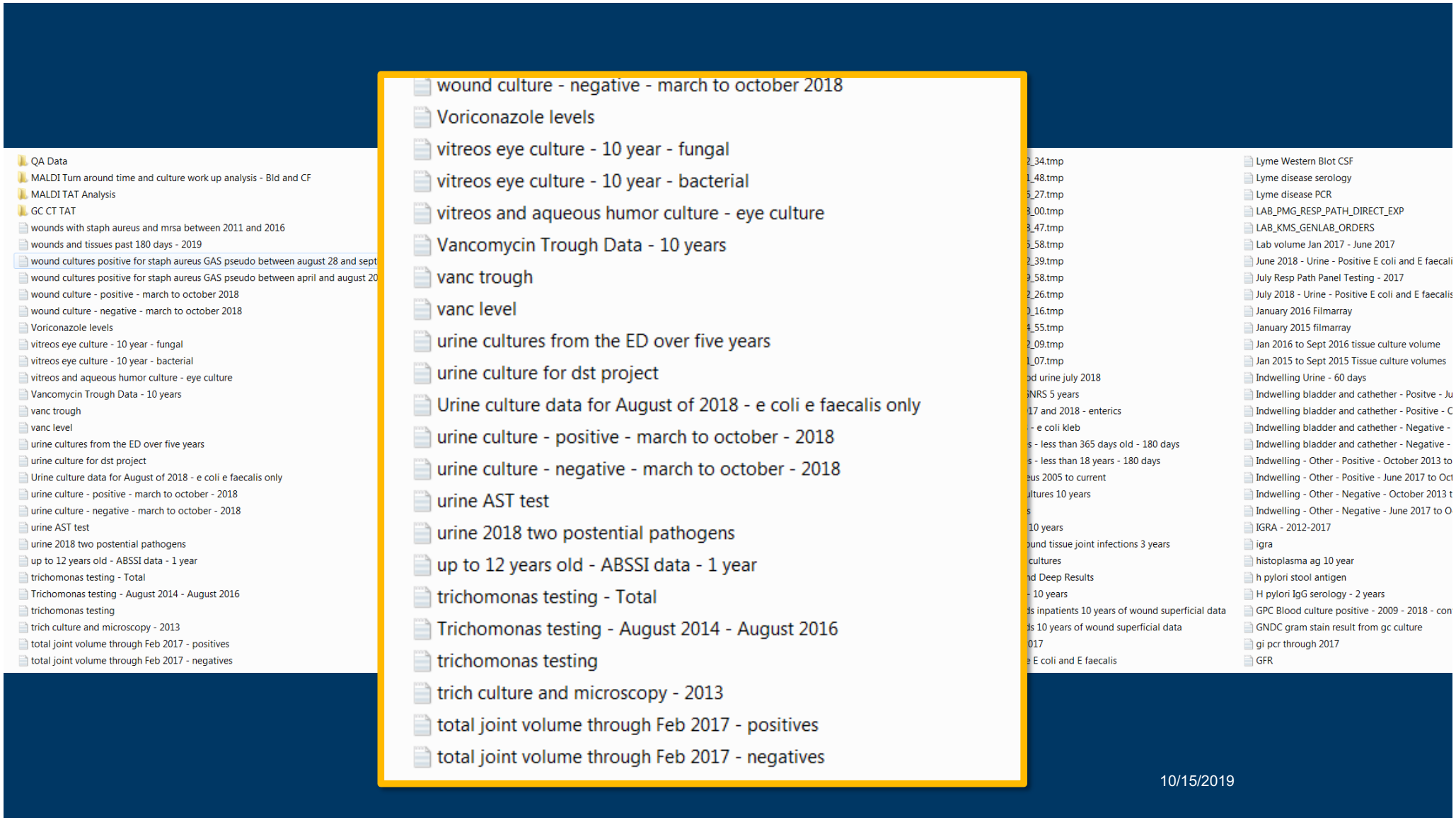
"Time Famine"
- Leslie Perlow

What tools do we have to manage all this data?




PathNet Microbiology: Statistical Reports
Task
Edit
View
Help
Sequence: Dr. Doern CLL
Service resource:
Filters:
Date/Time - Complete
Orderable Procedure
Positive Indicator
Sorts:
Ascending
Page Break
Sort
Patient Name
Queued Reports
Complete
Status
Sequence
Report
Service Resource
CSV


Sequence: Dr. Doern CLL
Service resource:
Filters:
Date/Time - Complete
Start 30 Days Back 00:00 - Go 30 Days Forward 23:59
Orderable Procedure
C. difficile Testing - Clostridium difficile Testing
Positive Indicator
Positive
Sorts:
Ascending
Page Break
Sort
Patient Name
Queued Reports
Complete
Status
ence
Report
Service Resource
CSV
Completed
Dr. Doern CLL
Condensed Line ...


QA Data
MALDI Turn around time and culture work up analysis - Bld and CF
MALDI TAT Analysis
GC CT TAT
wounds with staph aureus and mrsa between 2011 and 2016
wounds and tissues past 180 days - 2019
wound cultures positive for staph aureus GAS pseudo between august 28 and sept
wound cultures positive for staph aureus GAS pseudo between april and august 20
wound culture - positive - march to october 2018
wound culture - negative - march to october 2018
Voriconazole levels
vitreos eye culture - 10 year - fungal
vitreos eye culture - 10 year - bacterial
vitreos and aqueous humor culture - eye culture
Vancomycin Trough Data - 10 years
vanc trough
vanc level
urine cultures from the ED over five years
urine culture for dst project
Urine culture data for August of 2018 - e coli e faecalis only
urine culture - positive - march to october - 2018
urine culture - negative - march to october - 2018
urine AST test
urine 2018 two postential pathogens
up to 12 years old - ABSSI data - 1 year
trichomonas testing - Total
Trichomonas testing - August 2014 - August 2016
trichomonas testing
trich culture and microscopy - 2013
total joint volume through Feb 2017 - positives
total joint volume through Feb 2017 - negatives
wound culture - negative - march to october 2018
Voriconazole levels
vitreos eye culture - 10 year - fungal
vitreos eye culture - 10 year - bacterial
vitreos and aqueous humor culture - eye culture
Vancomycin Trough Data - 10 years
vanc trough
vanc level
urine cultures from the ED over five years
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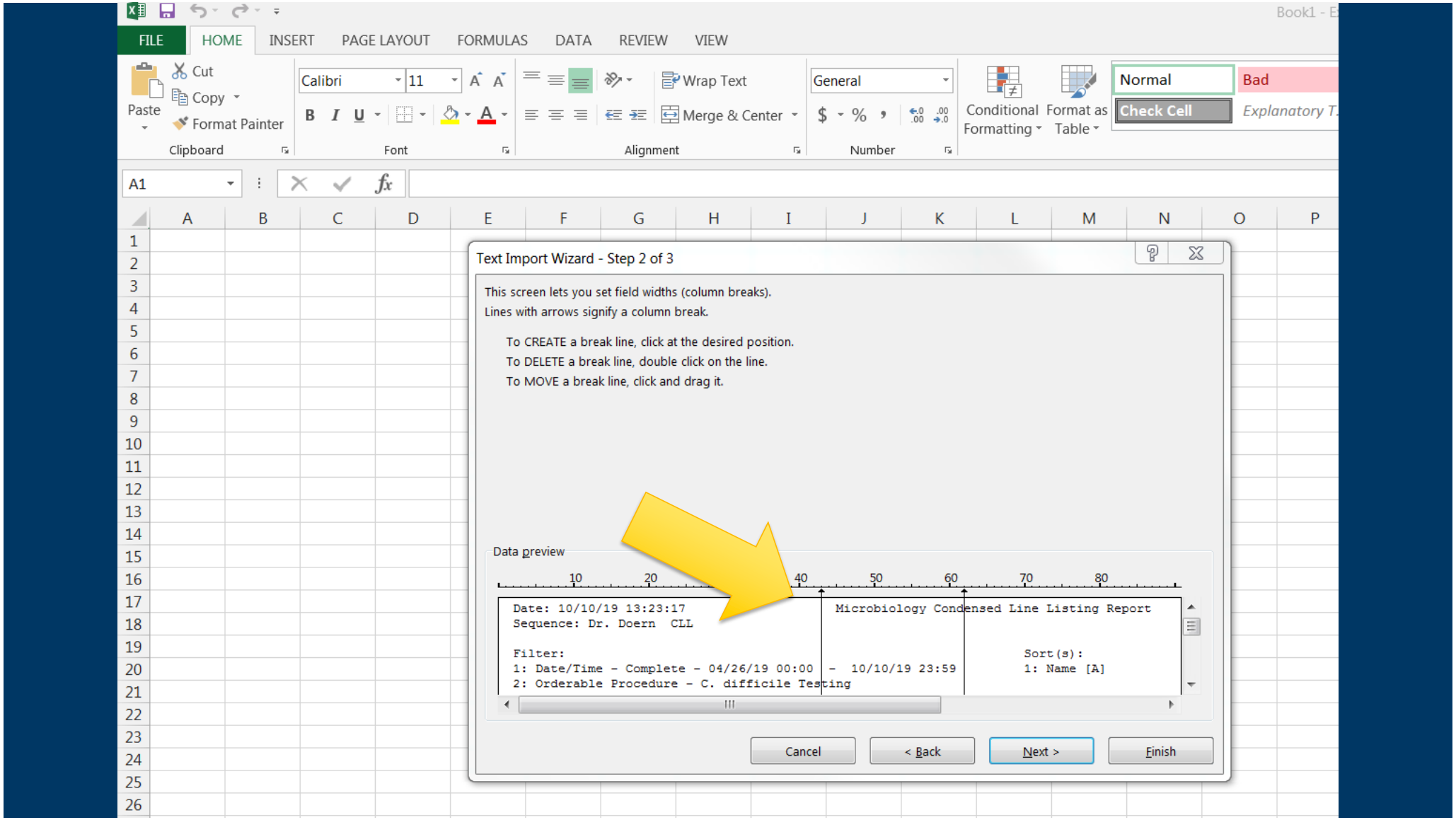
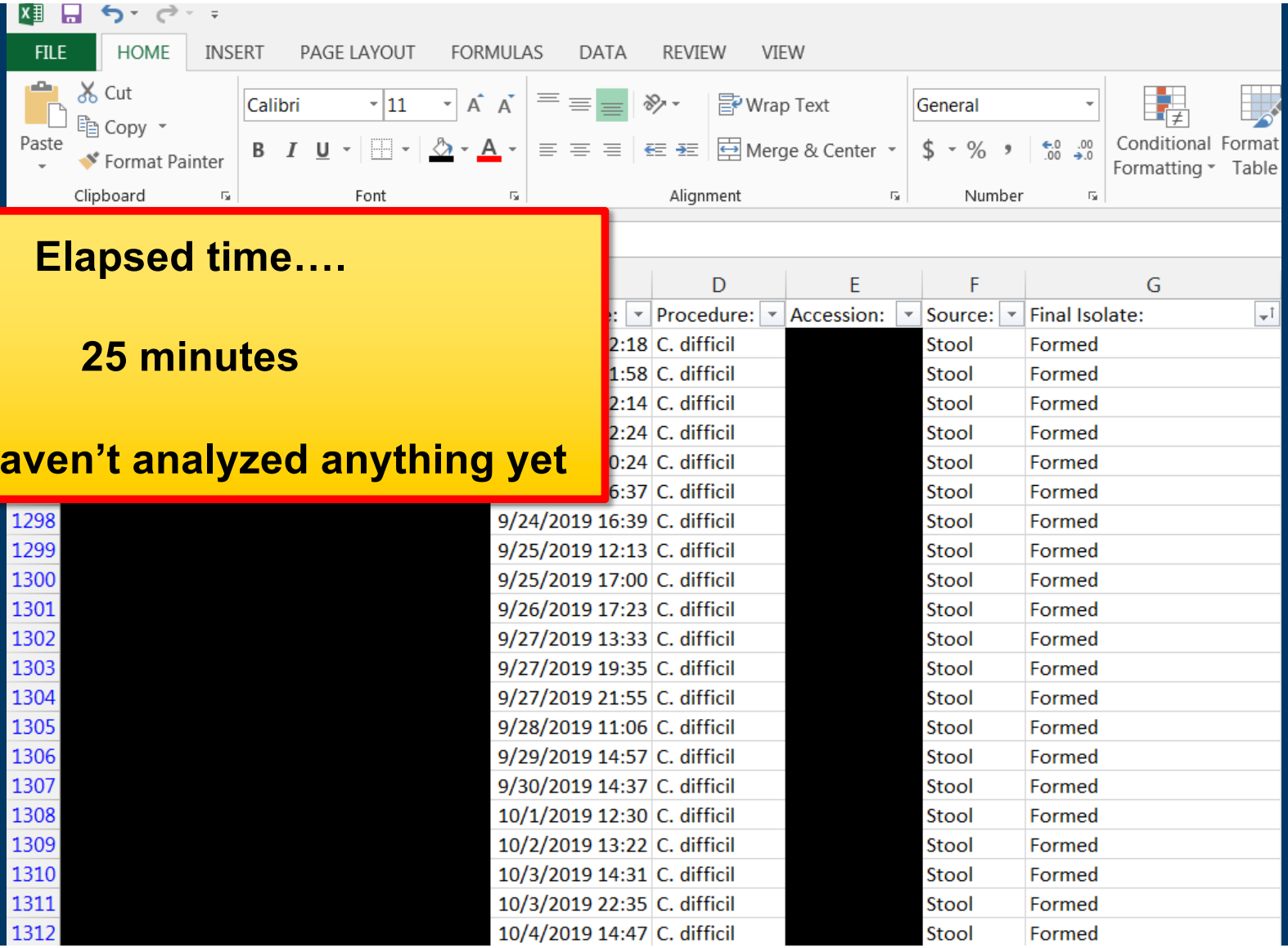
urine 2018 two postential pathogens
up to 12 years old - ABSSI data - 1 year
trichomonas testing - Total
Trichomonas testing - August 2014 - August 2016
trichomonas testing
trich culture and microscopy - 2013
total joint volume through Feb 2017 - positives
total joint volume through Feb 2017 - negatives
Lyme Western Blot CSF
Lyme disease serology
Lyme disease PCR
LAB_PMG_RESP_PATH_DIRECT_EXP
LAB_KMS_GENLAB_ORDERS
Lab volume Jan 2017 - June 2017
June 2018 - Urine - Positive E coli and E faecali
July Resp Path Panel Testing - 2017
July 2018 - Urine - Positive E coli and E faecalis
January 2016 Filmarray
January 2015 filmarray
Jan 2016 to Sept 2016 tissue culture volume
Jan 2015 to Sept 2015 Tissue culture volumes
Indwelling Urine - 60 days
Indwelling bladder and cathether - Positve - Ju
Indwelling bladder and cathether - Positive - C
Indwelling bladder and cathether - Negative -
Indwelling bladder and cathether - Negative -
Indwelling - Other - Positive - October 2013 to
Indwelling - Other - Positive - June 2017 to Oct
Indwelling - Other - Negative - October 2013 t
Indwelling - Other - Negative - June 2017 to O
IGRA - 2012-2017
igra
histoplasma ag 10 year
h pylori stool antigen
H pylori IgG serology - 2 years
GPC Blood culture positive - 2009 - 2018 - con
GNDC gram stain result from gc culture
gi pcr through 2017
GFR


Book1 - E
FILE
HOME
INSERT
PAGE LAYOUT
FORMULAS
DATA
REVIEW
VIEW
Paste
Cut
Copy
Format Painter
Clipboard
Calibri
11
Font
Wrap Text
Merge & Center
Alignment
General
Number
Conditional Formatting
Format as Table
Normal
Bad
Check Cell
Explanatory T...
A1
Text Import Wizard - Step 2 of 3
This screen lets you set field widths (column breaks).
Lines with arrows signify a column break.
To CREATE a break line, click at the desired position.
To DELETE a break line, double click on the line.
To MOVE a break line, click and drag it.
Data preview
10
20
40
50
60
70
80
Date: 10/10/19 13:23:17
Microbiology Condensed Line Listing Report
Sequence: Dr. Doern CLL
Filter:
Sort(s):
1: Date/Time - Complete - 04/26/19 00:00 - 10/10/19 23:59
1: Name [A]
2: Orderable Procedure - C. difficile Testing
Cancel
< Back
Next >
Finish

Elapsed time….

25 minutes

And we haven't analyzed anything yet



			D	E	F	G
		:	Procedure:	Accession:	Source:	Final Isolate:
		2:18	C. difficil	[redacted]	Stool	Formed
		1:58	C. difficil		Stool	Formed
		2:14	C. difficil		Stool	Formed
		2:24	C. difficil		Stool	Formed
		0:24	C. difficil		Stool	Formed
		6:37	C. difficil		Stool	Formed
1298	[redacted]	9/24/2019 16:39	C. difficil		Stool	Formed
1299		9/25/2019 12:13	C. difficil		Stool	Formed
1300		9/25/2019 17:00	C. difficil		Stool	Formed
1301		9/26/2019 17:23	C. difficil		Stool	Formed
1302		9/27/2019 13:33	C. difficil		Stool	Formed
1303		9/27/2019 19:35	C. difficil		Stool	Formed
1304		9/27/2019 21:55	C. difficil		Stool	Formed
1305		9/28/2019 11:06	C. difficil		Stool	Formed
1306		9/29/2019 14:57	C. difficil		Stool	Formed
1307		9/30/2019 14:37	C. difficil		Stool	Formed
1308		10/1/2019 12:30	C. difficil		Stool	Formed
1309		10/2/2019 13:22	C. difficil		Stool	Formed
1310		10/3/2019 14:31	C. difficil		Stool	Formed
1311		10/3/2019 22:35	C. difficil		Stool	Formed
1312		10/4/2019 14:47	C. difficil		Stool	Formed

Data are essential to directing a Microbiology laboratory!

So it's totally worth it!

I've always believed this…but it's hard

Workflow decisions

Assess test utilization

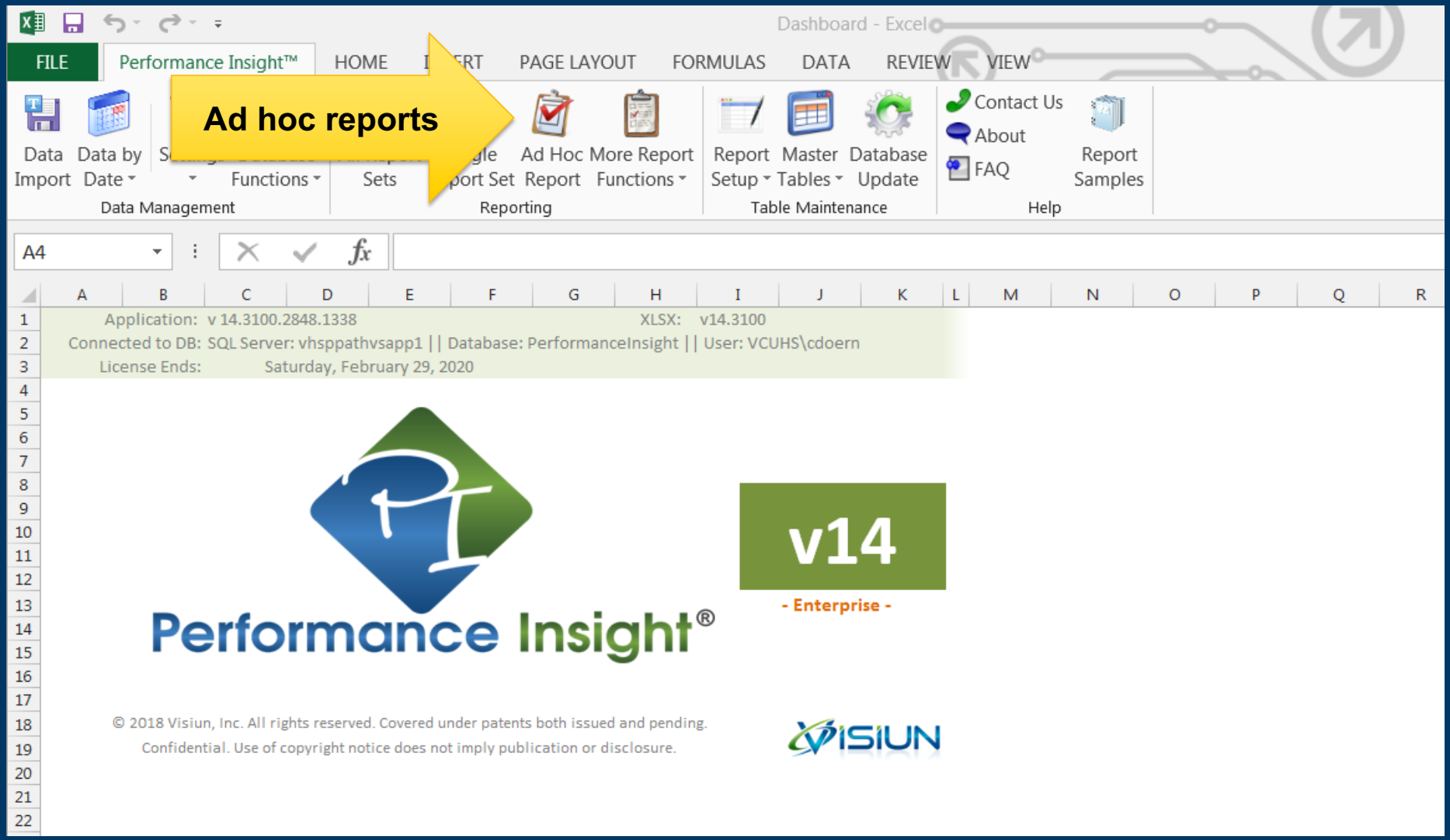
Address perceptions with reality

And many many more

And then everything changed!

What is it?

A simple and easy to use, Excel-based, analytics platform that pulls data from the laboratory information system (LIS).


Dashboard - Excel
FILE
Performance Insight™
HOME
PAGE LAYOUT
FORMULAS
DATA
REVIEW
VIEW
Ad hoc reports
Data Import
Data by Date
Functions
Data Management
Sets
Ad Hoc Report
More Report Functions
Reporting
Report Setup
Master Tables
Database Update
Table Maintenance
Contact Us
About
FAQ
Report Samples
Help
A4
Application: v 14.3100.2848.1338
XLSX: v14.3100
Connected to DB: SQL Server: vhsppathvsapp1 || Database: PerformanceInsight || User: VCUHS\cdoern
License Ends: Saturday, February 29, 2020
Performance Insight®
v14
- Enterprise -
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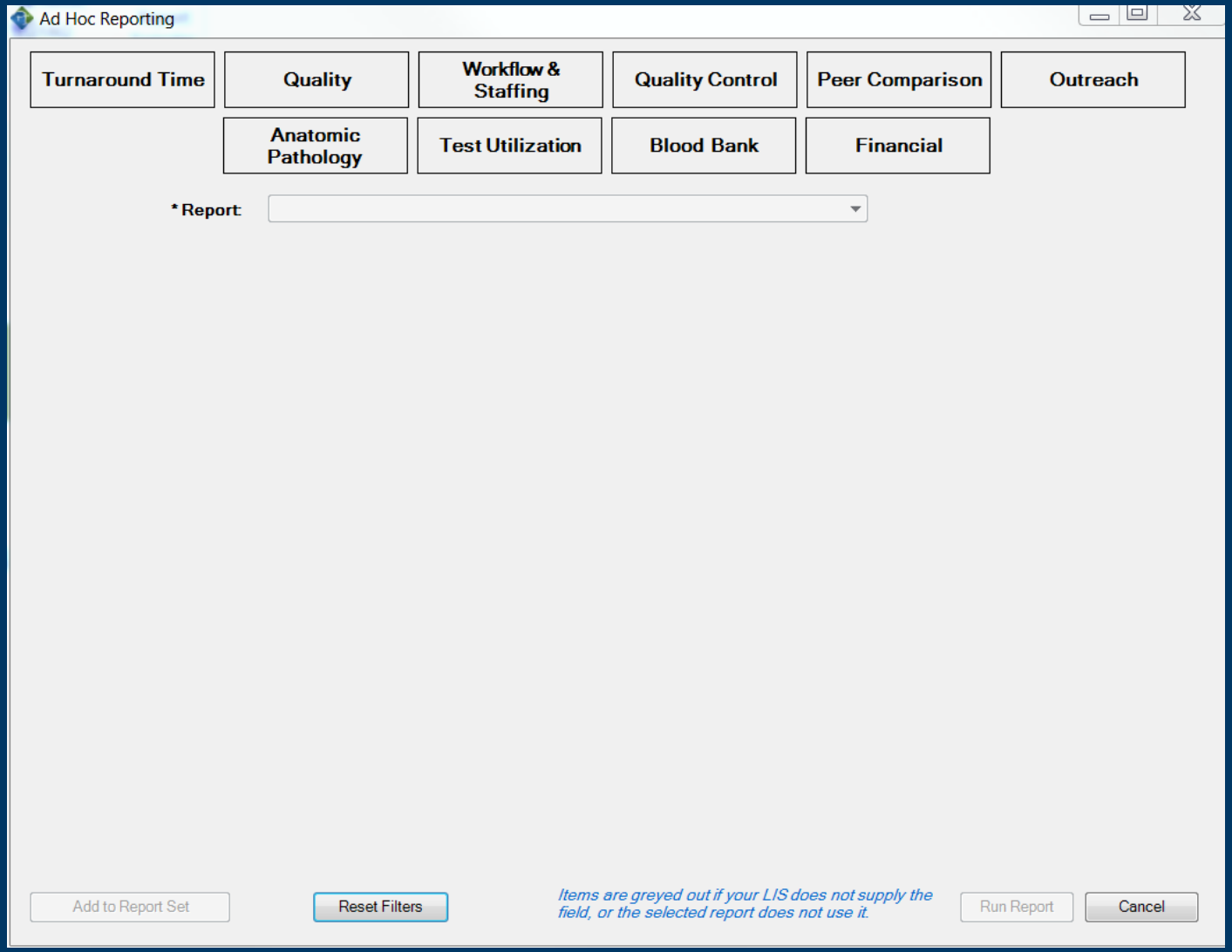
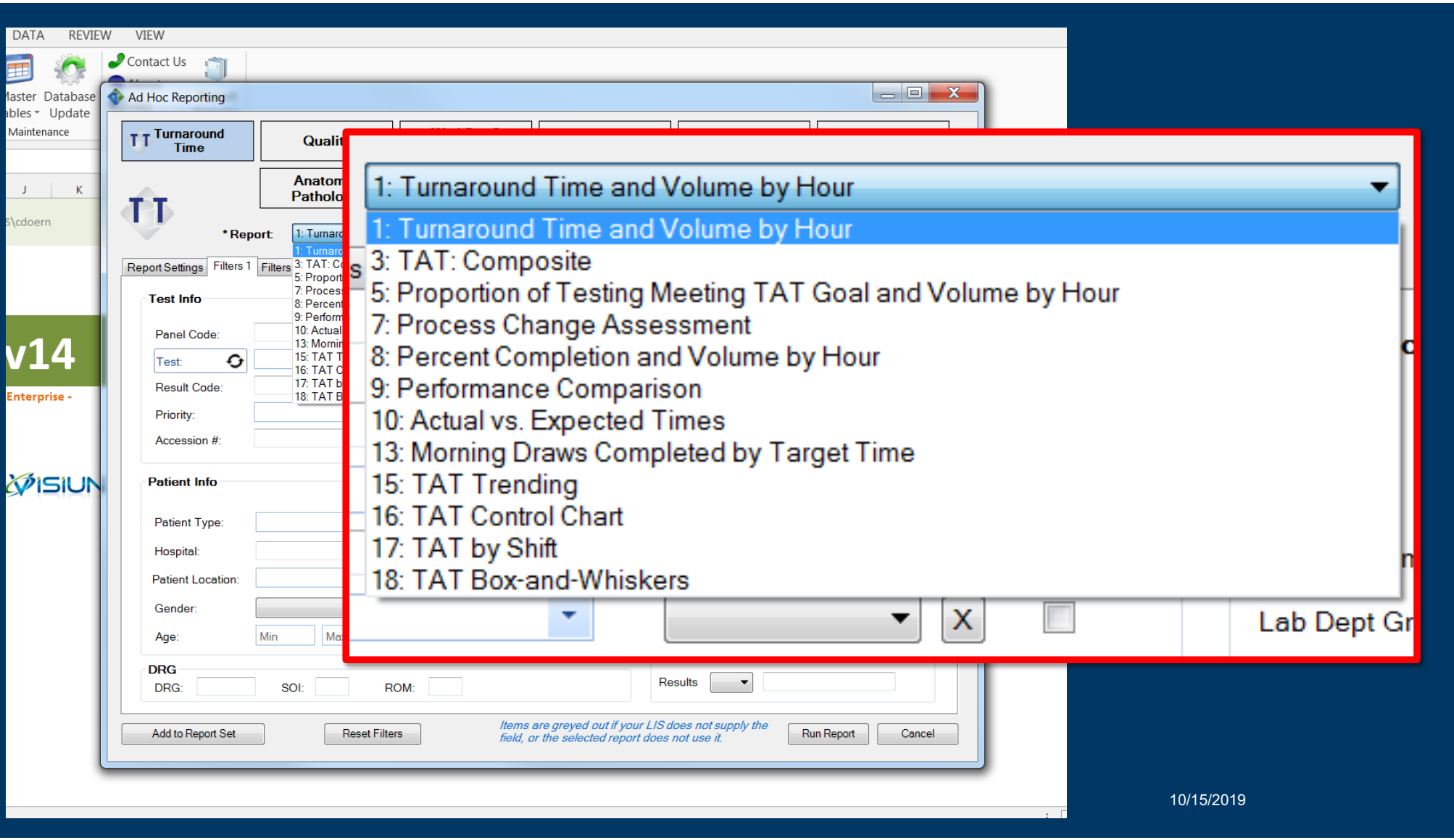
VISIUN


Ad Hoc Reporting
Turnaround Time
Quality
Workflow & Staffing
Quality Control
Peer Comparison
Outreach
Anatomic Pathology
Test Utilization
Blood Bank
Financial
* Report:
Add to Report Set
Reset Filters
Items are greyed out if your LIS does not supply the field, or the selected report does not use it.
Run Report
Cancel


DATA
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VIEW
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Maintenance
Ad Hoc Reporting
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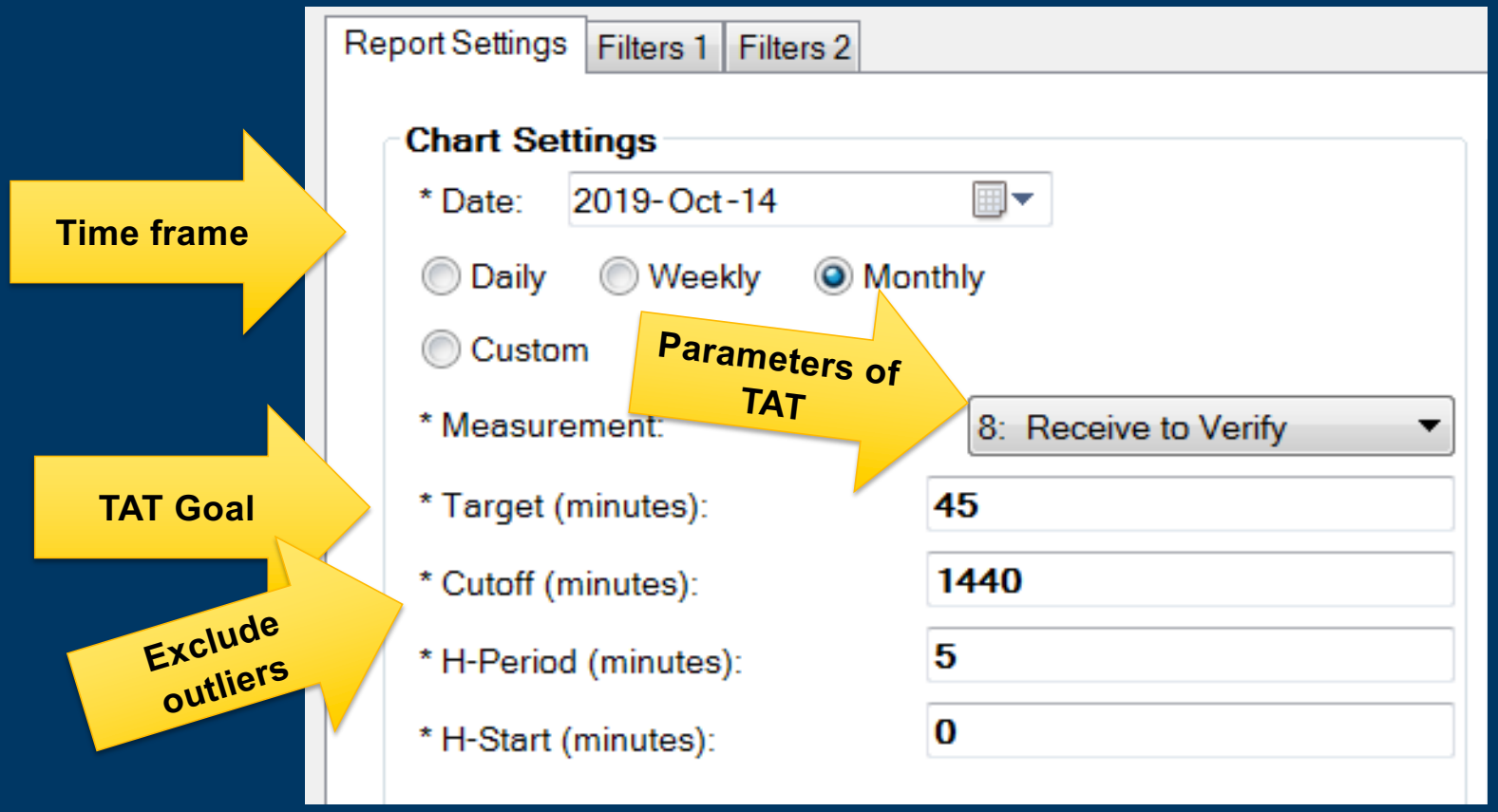
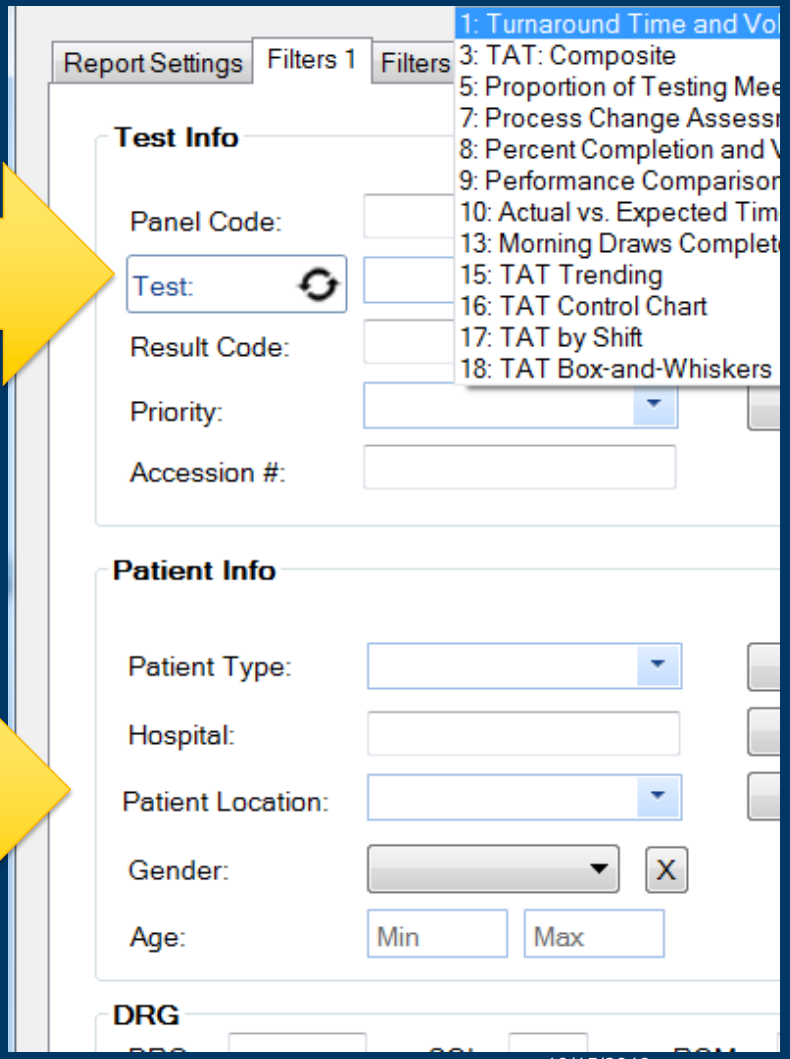
* Report:
1: Turnarc
Report Settings
Filters 1
Filters
Test Info
Panel Code:
Test:
Result Code:
Priority:
Accession #:
Patient Info
Patient Type:
Hospital:
Patient Location:
Gender:
Age:
Min
DRG
DRG:
SOI:
ROM:
Results
Add to Report Set
Reset Filters
Items are greyed out if your LIS does not supply the field, or the selected report does not use it.
Run Report
Cancel
1: Turnaround Time and Volume by Hour
1: Turnaround Time and Volume by Hour
3: TAT: Composite
5: Proportion of Testing Meeting TAT Goal and Volume by Hour
7: Process Change Assessment
8: Percent Completion and Volume by Hour
9: Performance Comparison
10: Actual vs. Expected Times
13: Morning Draws Completed by Target Time
15: TAT Trending
16: TAT Control Chart
17: TAT by Shift
18: TAT Box-and-Whiskers
Lab Dept Gr
v14
Enterprise -

Set filters


Report Settings
Filters 1
Filters 2
Chart Settings
* Date:
2019-Oct-14
Daily
Weekly
Monthly
Custom
* Measurement:
8: Receive to Verify
* Target (minutes):
45
* Cutoff (minutes):
1440
* H-Period (minutes):
5
* H-Start (minutes):
0
Time frame
Parameters of TAT
TAT Goal
Exclude outliers

Test selection

Specific patient locations

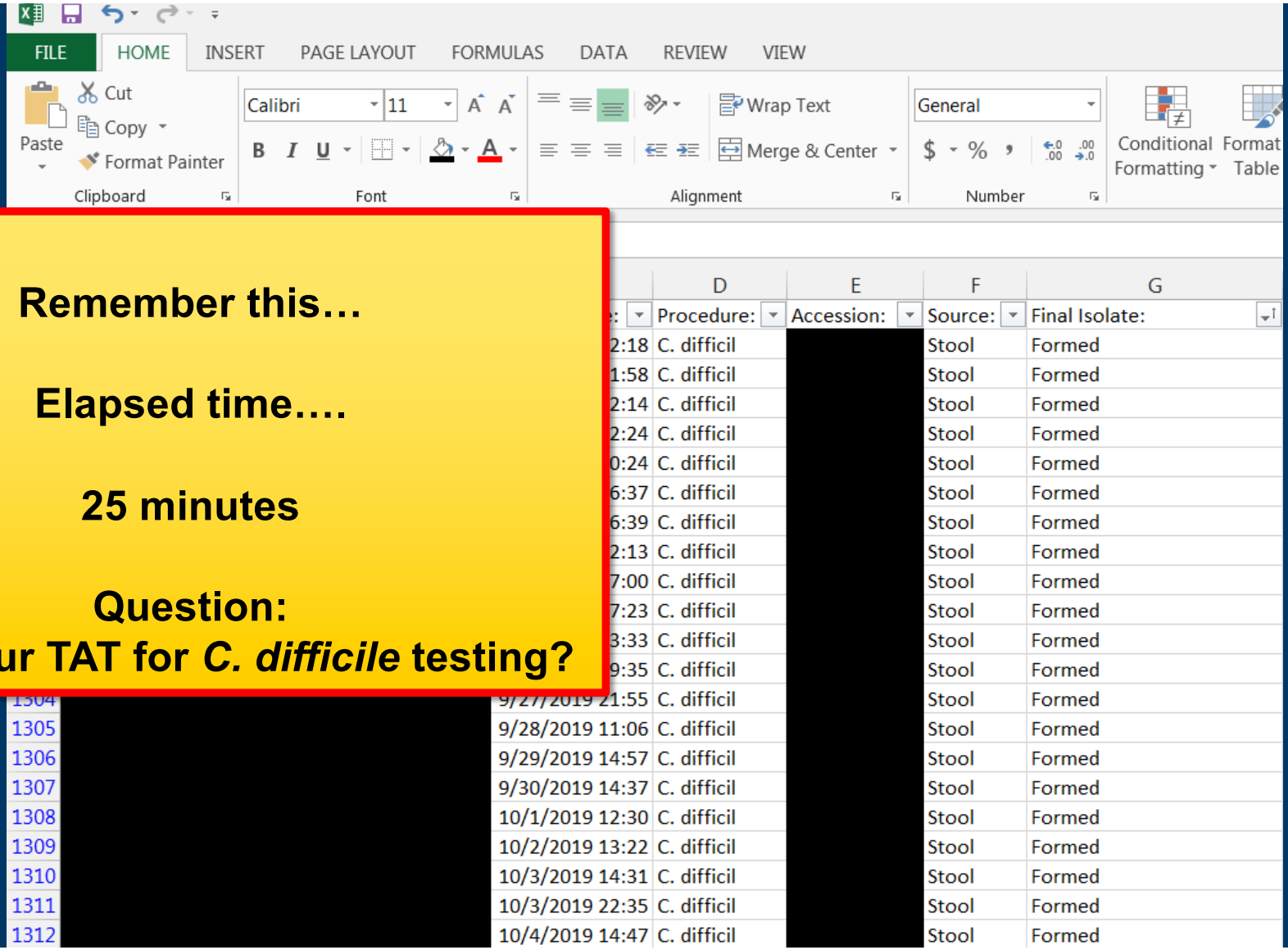


Remember this…

Elapsed time….

25 minutes

Question:
What is our TAT for *C. difficile* testing?



C. difficile Testing

Measurement: Receive to Verify

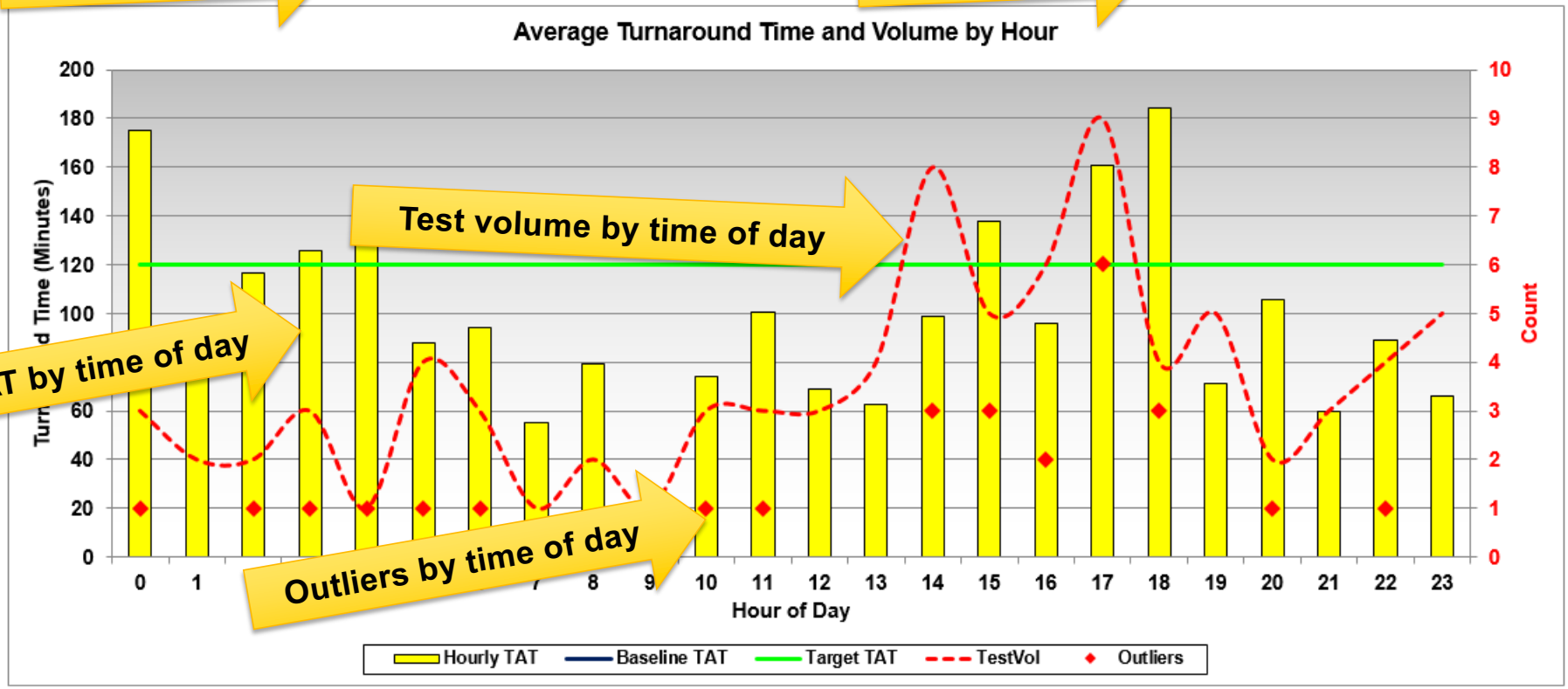
In-lab TAT

Target TAT 120 m

103-minute TAT

31.4% outliers

Performance Summary	Turnaround Time (minutes)						Outliers (above target)		
	Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	n	% of Total	Current vs:
Target	120.0	86%	120.0	74%	120.0	152%			
Baseline (N/A)									
	103.7		88.2				27	31.4%	



Physician concern

Why are your *C. difficile* test results taking so long to come back?

What is the total *C. difficile* TAT?

In lab TAT = ~1.5 hrs

Criteria

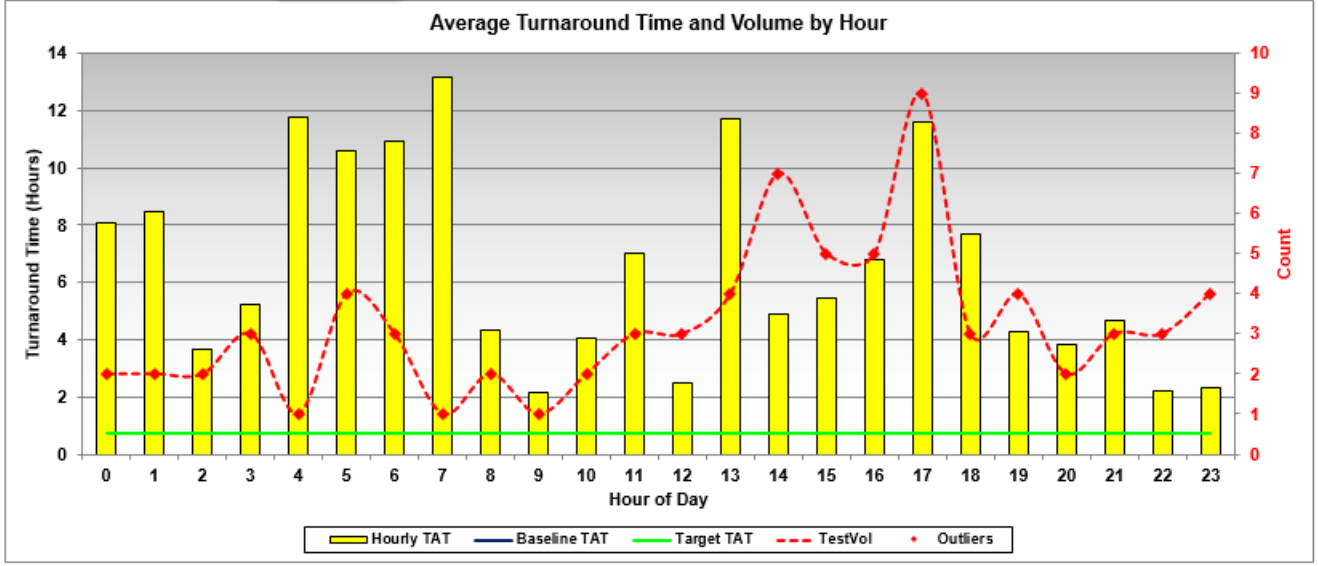
Test: C. difficile Testing

Count: 78

Activity Being Counted: Tests

Measurement: Order to Verify

Performance Summary	Turnaround Time (Hours)						Outliers (above target)		
	Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	n	% of Total	Current vs:
Target	0.8	903%	0.8	633%	0.8	1813%			
Baseline (N/A)									
October 2019	6.8		4.7		13.6		78	####	



Let's start with some simple questions.

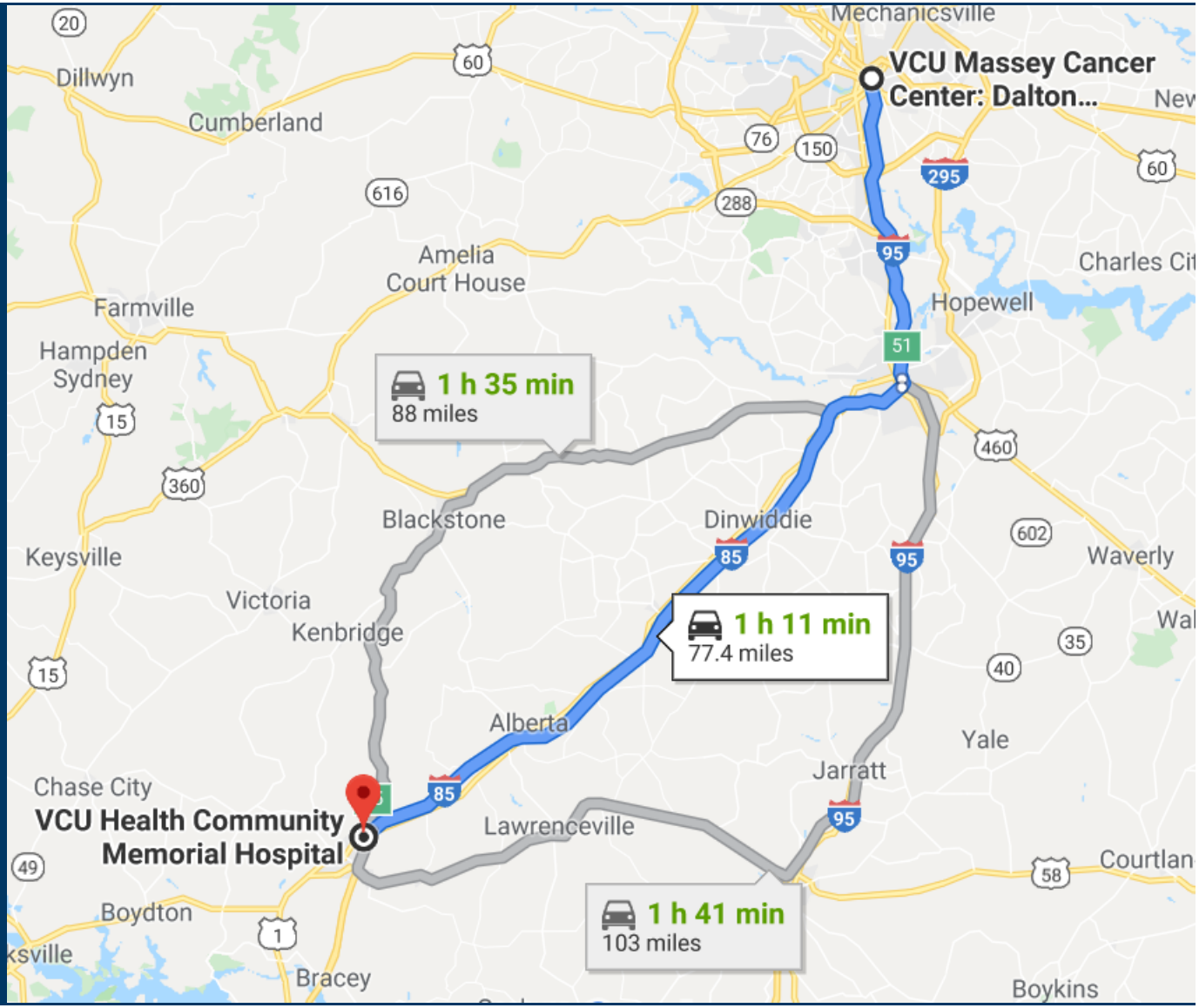
How long to the components of a laboratory test take?

1. Transport = collect to receipt
2. Analysis = receipt to verify
3. Total analysis time experienced by provider = collect to verify

The following data was generated in <10 minutes

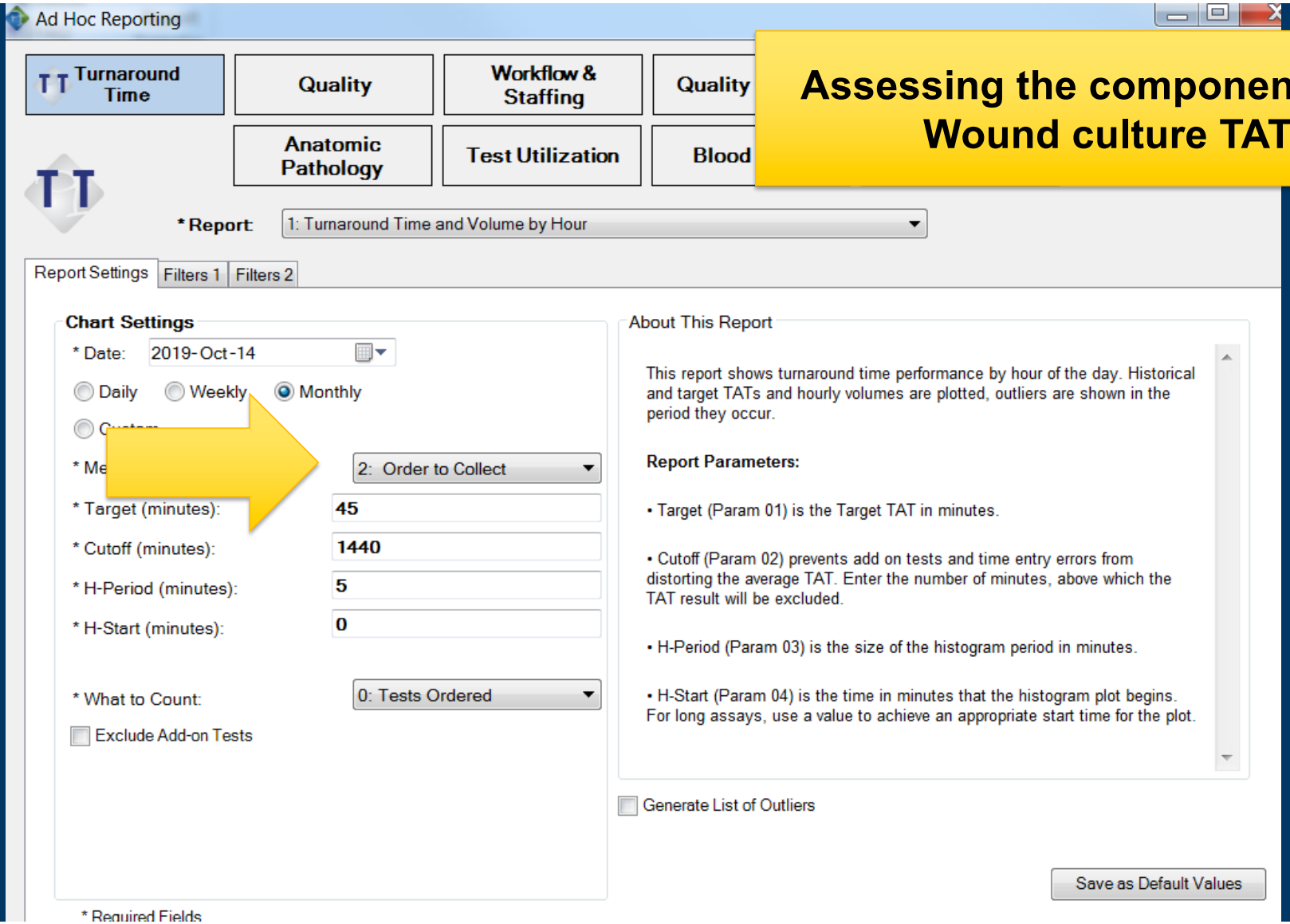
Wound Cultures

- Includes both anaerobic and aerobic bacterial culture.
- Anaerobes are fastidious and require rapid transport to maintain organism viability.
- Transport time is critical.



VCU Health

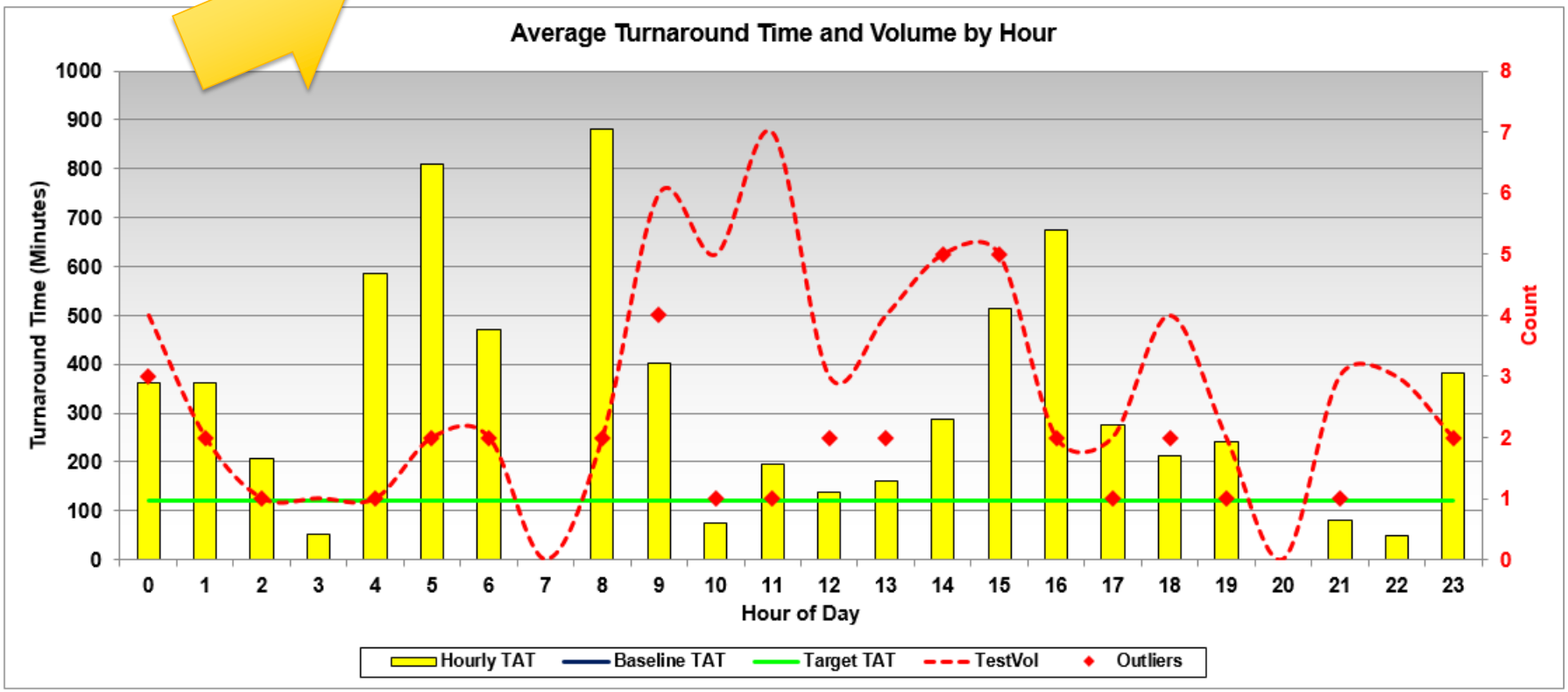
Assessing the components of a Wound culture TAT



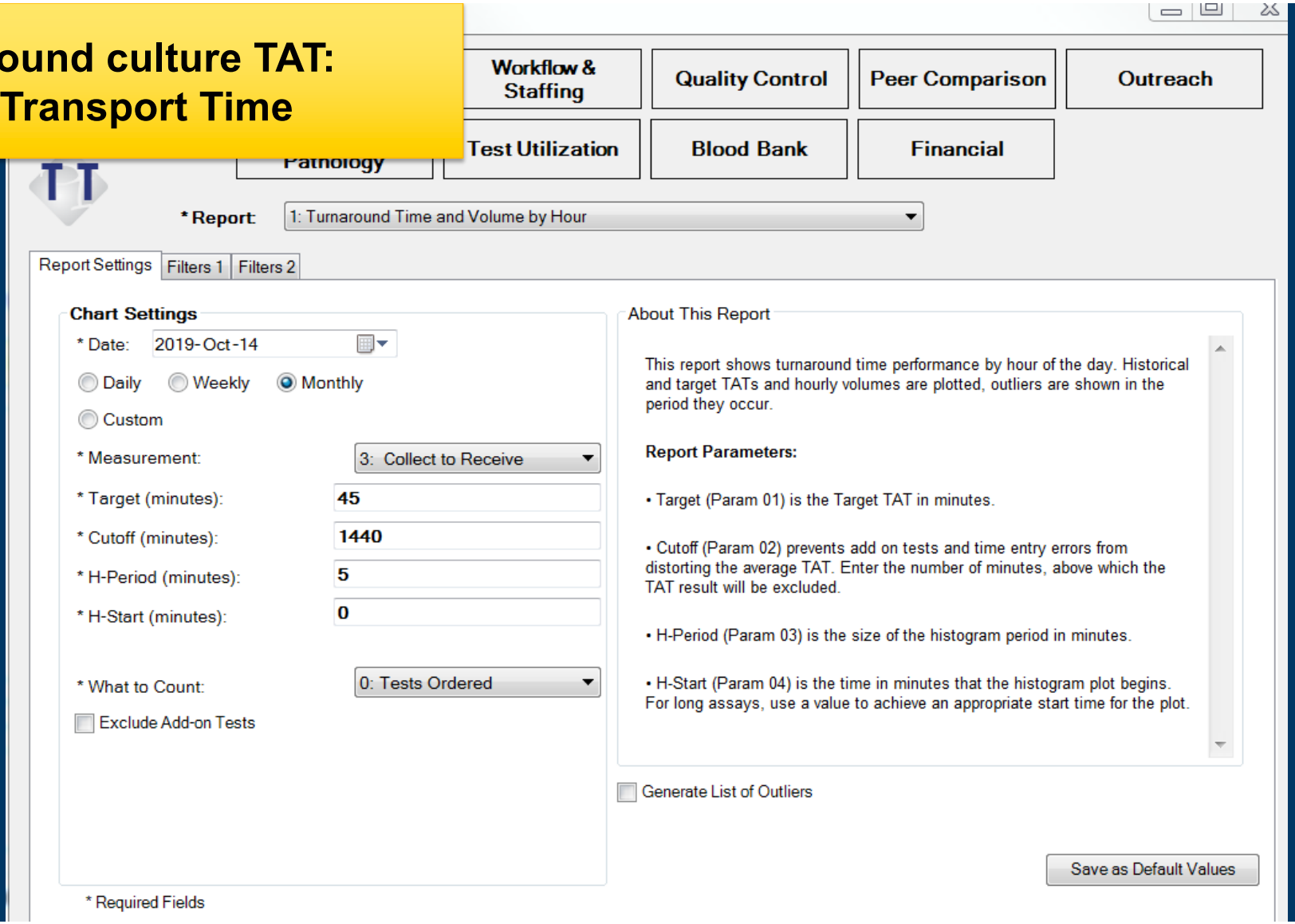
Assessing the components of a Wound culture TAT

Measurement: Order to Collect

	Turnaround Time (minutes)						Outliers (above target)	
		Current vs:	Median	Current vs:	90% Completion	Current vs:	n	% of Total
Target	120.0	257%	120.0	136%	120.0	676%		Current vs:
Baseline (N/A)								
October 2019	307.9		163.2		810.7		42	61.8%



Wound culture TAT: Transport Time



Wound culture TAT:
Transport Time from Rural Hospital

1 year of culture from CMH

Criteria
Test: Wound Deep
Patient Loc: CMH ED
Count: 38
Being Counted: Tests
Measurement: Collect to Receive

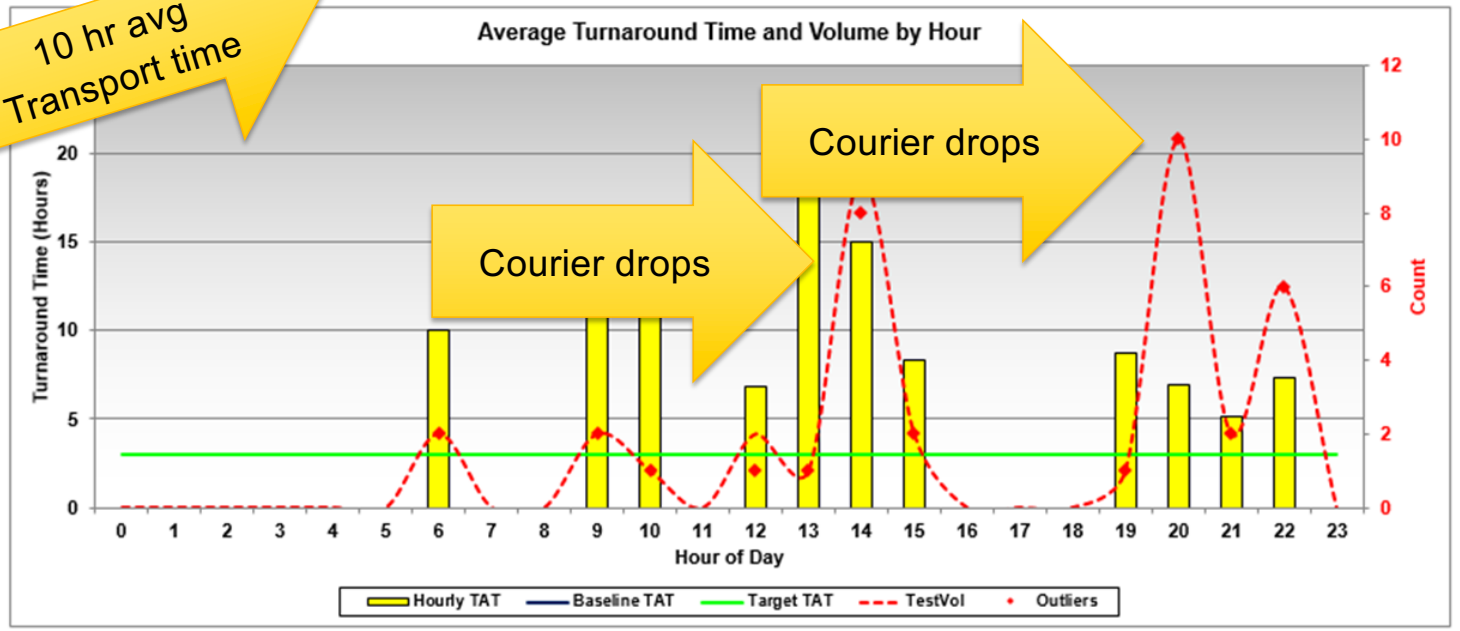
Performance Summary

	Turnaround Time (Hours) Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	Outliers (above target) n	% of Total	Current vs:
Target	3.0	332%	3.0	290%	3.0	605%			
Baseline (NA									
Mon, Oct 1, 20	10.0		8.7		18.2		36	94.7%	

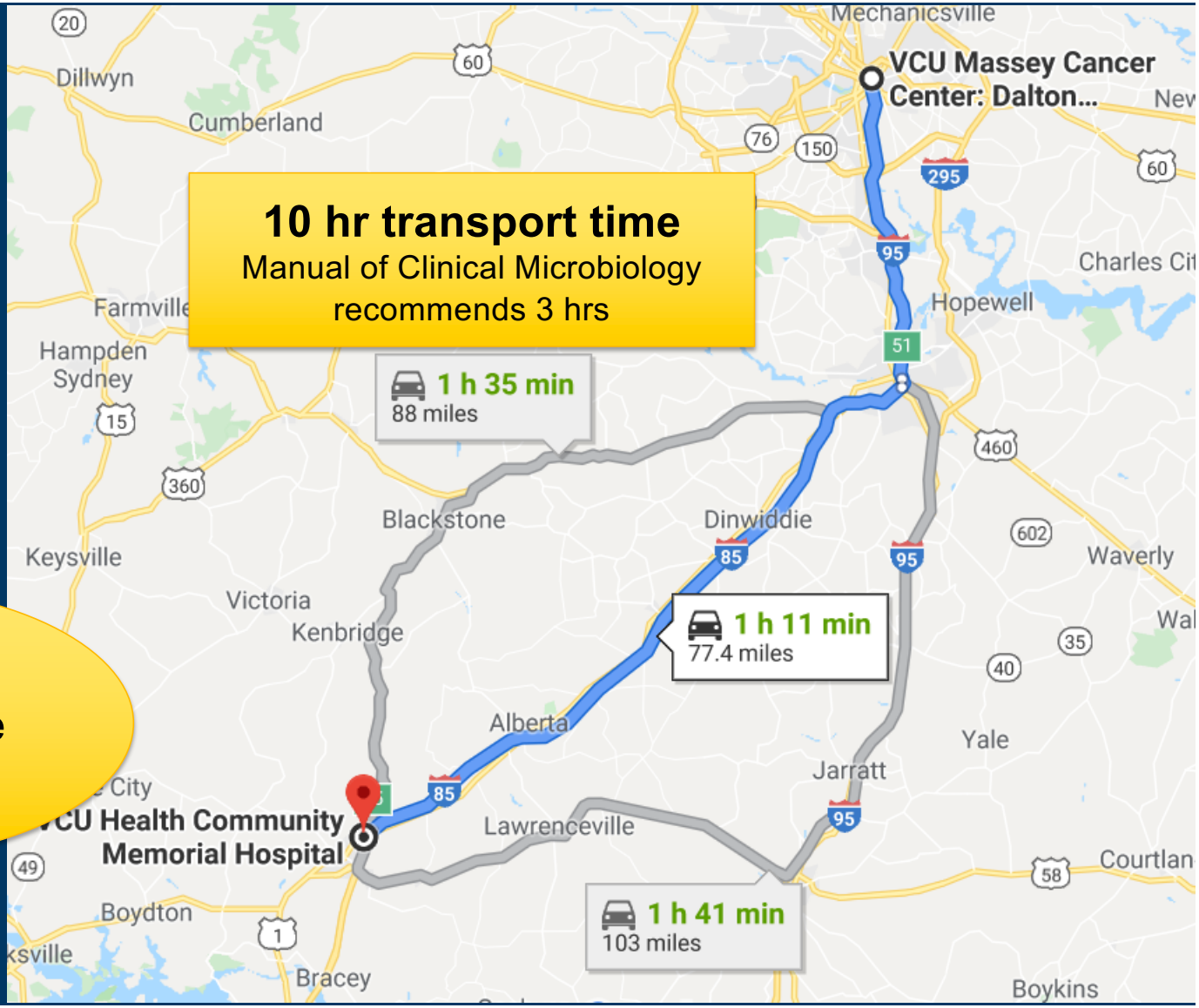
10 hr avg Transport time

Courier drops

Courier drops



Wound Cultures



What about transport on the main campus?

VCUHealth

VCUHS Main Campus Data

102.2 hr transport time

VCUHealth

Report Type: 01

Turnaround Time and Volume by Hour

Performance Insight®

Receive Date	Mon, Oct 1, 2018 to Mon, Oct 14, 2019

Criteria

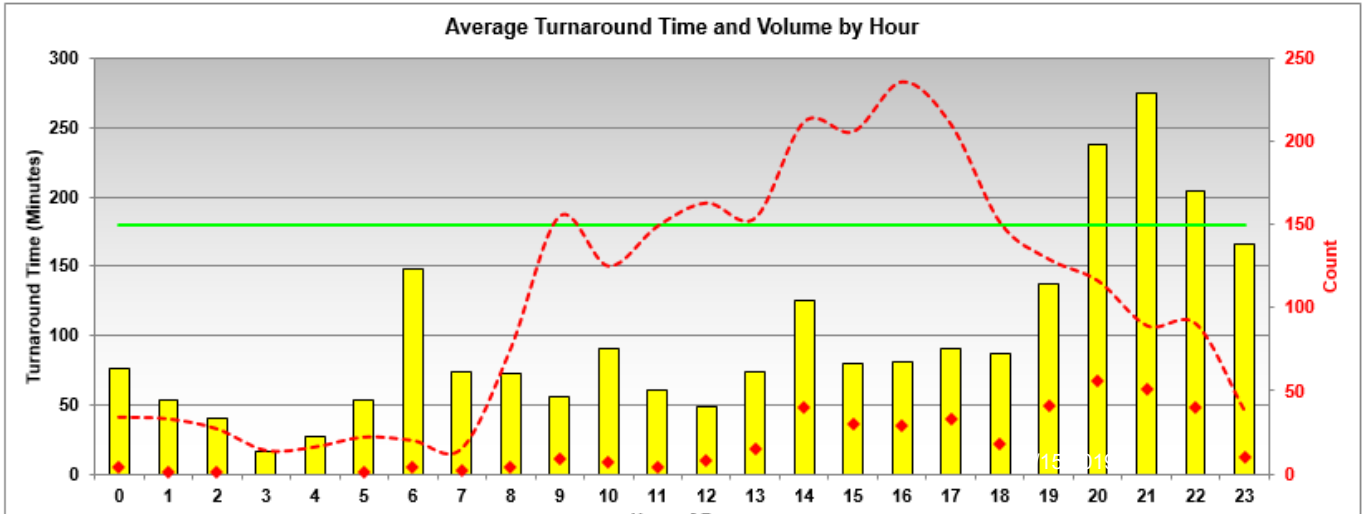
Test: Wound Deep

Count: 2,478

Activity Being Counted: Tests

Measurement: Collect to Receive

Performance Summary	Turnaround Time (minutes)						Outliers (above target)		
	Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	n	% of Total	Current vs:
Target	180.0	57%	180.0	15%	180.0	181%			
Baseline (N/A)									
Mon, Oct 1, 2018 to Mon, (	102.2		27.5		326.3		408	16.5%	



So this looks bad…does it matter?

Let me stop and say this…

I believe the centralized laboratory model is the downfall of good microbiology.

My bias…

I want these data to show that it is worse for CMH patients to send us their microbiology rather than do it themselves.

How could we investigate this issue?

Delayed turnaround times? Delays in optimized therapy?
Inferior results such as falsely negative cultures?

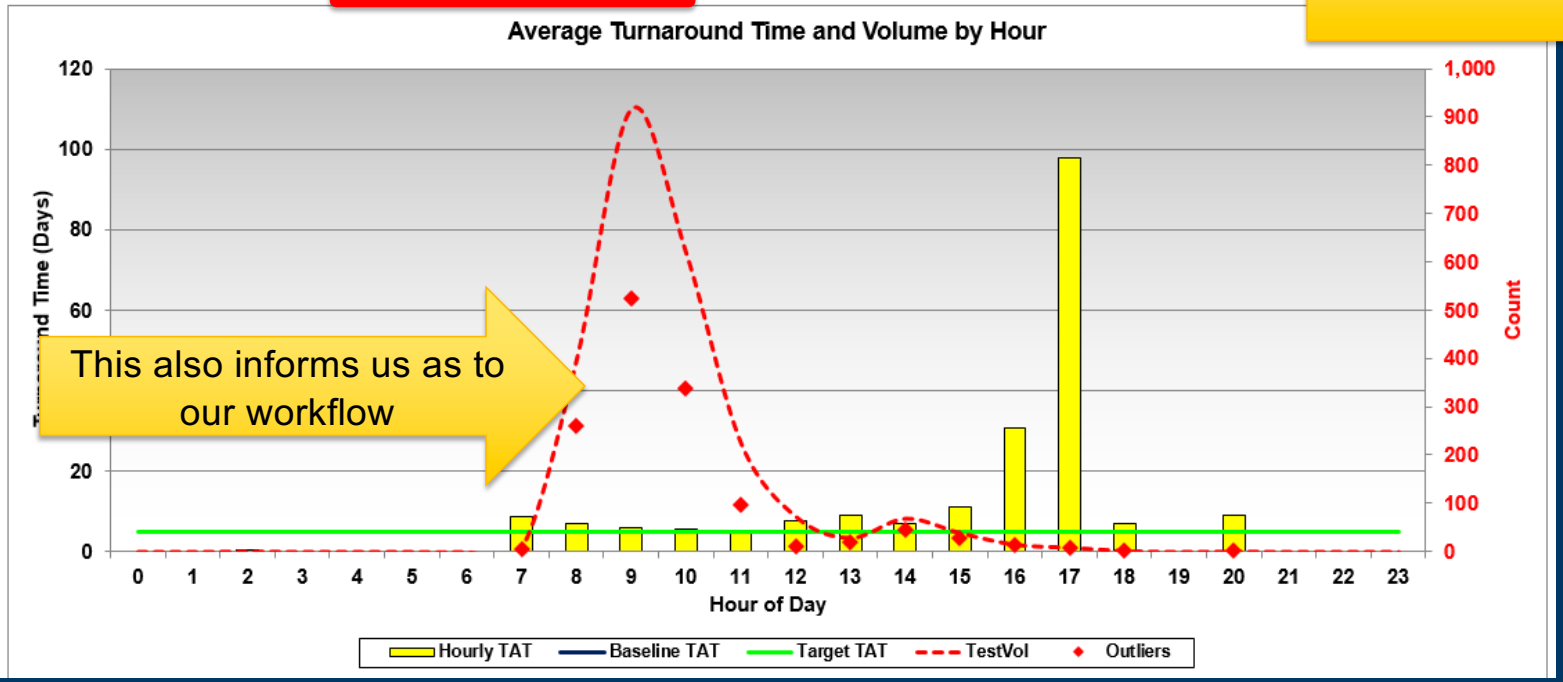
Does a longer transport time, impact time to results?

VCUHS Main Campus

Measurement: Collect to Verify

	Turnaround Time (Days)							
	Average		Median		90% Completion		Outliers (above target)	
		Current vs:		Current vs:		Current vs:	n	% of Total
Target	5.0	132%	5.0	102%	5.0	139%		
Baseline (N/A)								
Mon, Oct 1, 2018 to Mon, Oct 1	6.6		5.1		7.0		1,351	56.2%

VCUHS
Transport time = 102 min

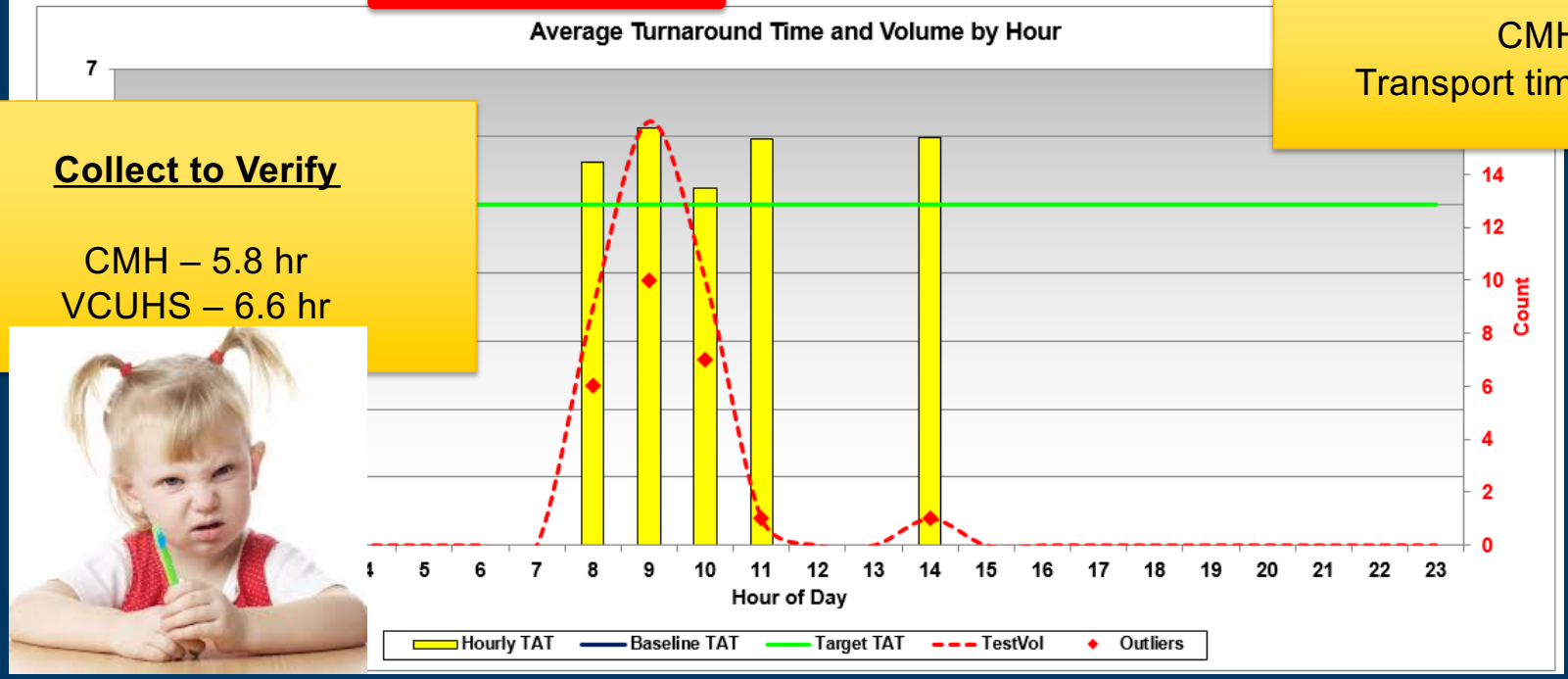


This also informs us as to our workflow

Does delayed transport impact overall TAT?

Measurement: Collect to Verify

Performance Summary	Turnaround Time (Days)						Outliers (above target)	
	Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	n	% of Total
Target	5.0	115%	5.0	112%	5.0	136%		Current vs:
Baseline (N/A)								
Mon, Oct 1, 2018 to Mon, Oct 1	5.8		5.6		6.8		25	67.6%



Collect to Verify

CMH – 5.8 hr
VCUHS – 6.6 hr

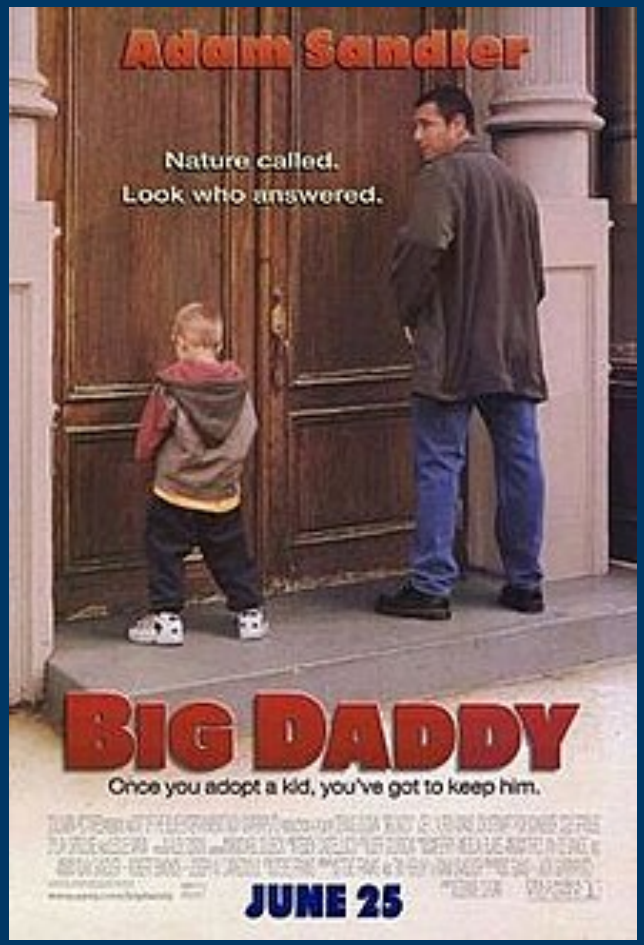
CMH
Transport time = 10 hr

Why isn’t the main campus faster?

Some data limitations:

1. TATs are “all-comers”
2. All positive and negative results counted together.
3. More complex cultures require more work.
    1. Higher positivity rate from VCUHS patients.


I win.


Adam Sandler
Nature called.
Look who answered.
BIG DADDY
Once you adopt a kid, you've got to keep him.
JUNE 25

VCUHealth

Since that didn’t show me what I wanted…let’s look at another culture type….

Urine cultures – complexity should be more uniform between institutions so should make for a good comparator.

Urine Cultures

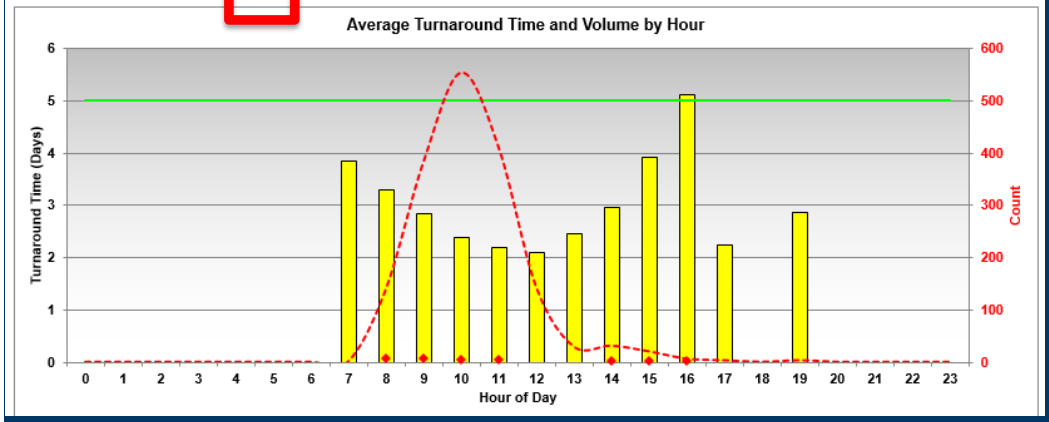
I win?!?!?

Criteria
Test: Urine Culture
Patient Loc: CMH ED

Count: 29,766
Activity Being Counted: Tests
Measurement: Collect to Verify

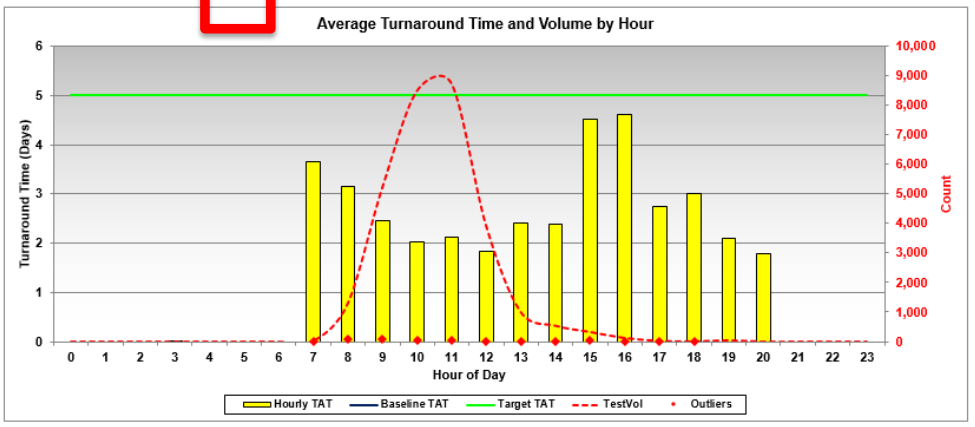
Performance Summary — Turnaround Time (Days)

	Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	Outliers (above target) n	% of Total	Current vs:
Target	5.0	51%	5.0	46%	5.0	75%			
Baseline (N/A)									
Mon, Oct 1, 2018 to Mon,	2.5		2.3		3.7		32	1.9%	



Performance Summary — Turnaround Time (Days)

	Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	Outliers (above target) n	% of Total	Current vs:
Target	5.0	44%	5.0	38%	5.0	62%			
Baseline (N/A)									
Mon, Oct 1, 2018 to Mon,	2.2		1.9		3.1		325	1.1%	



CMH
Collect to verify = 2.5 days

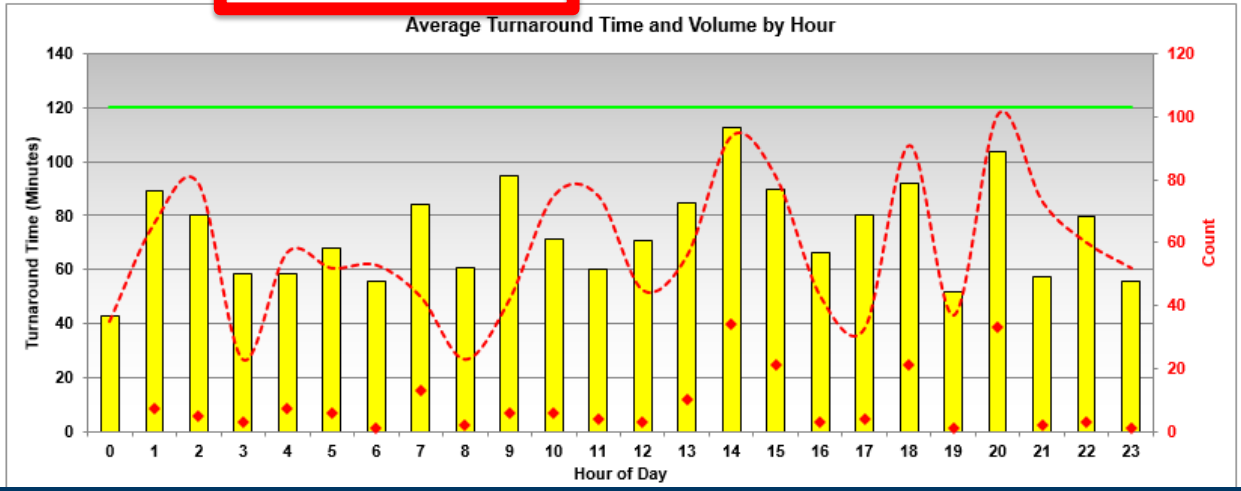
VCUHS
Collect to verify = 2.2 days

How about assessing a more important culture type? Blood cultures

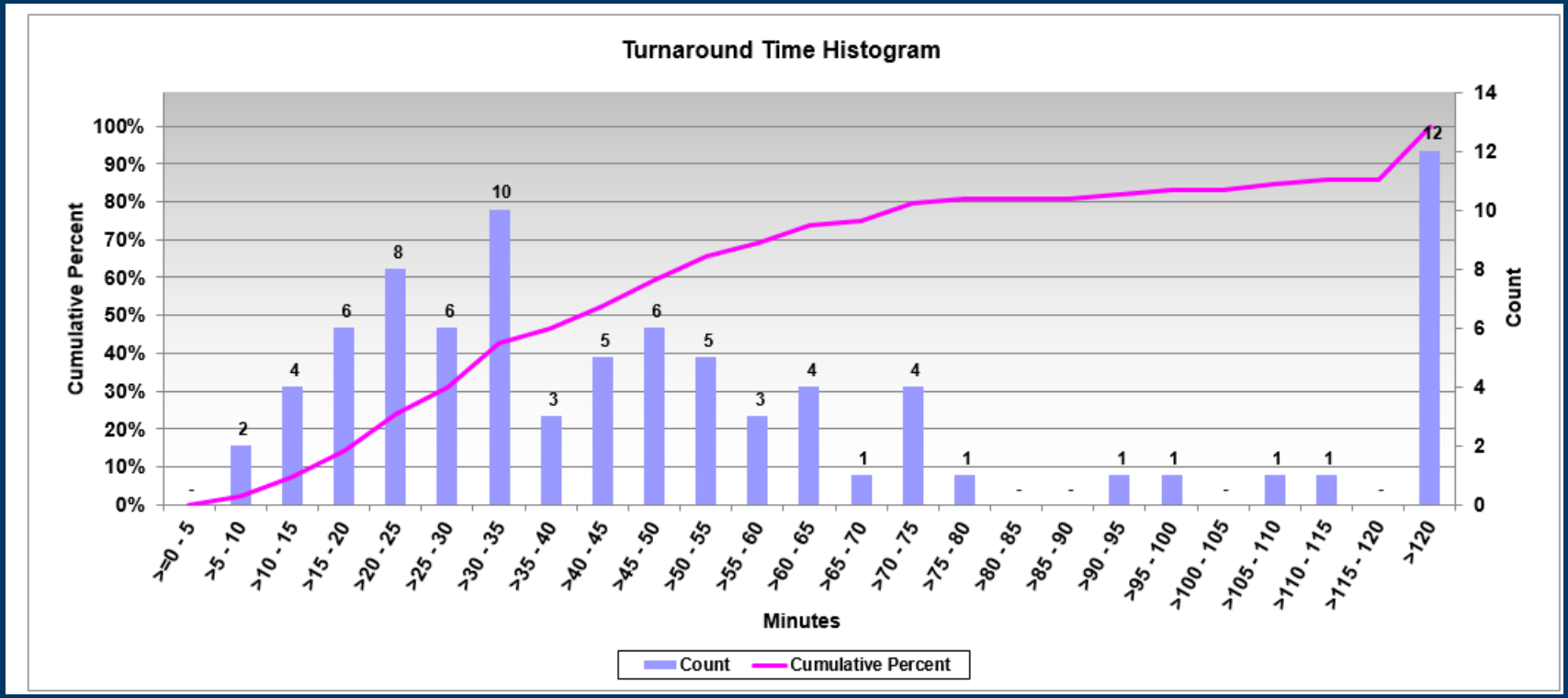
Receive Date	October 2019

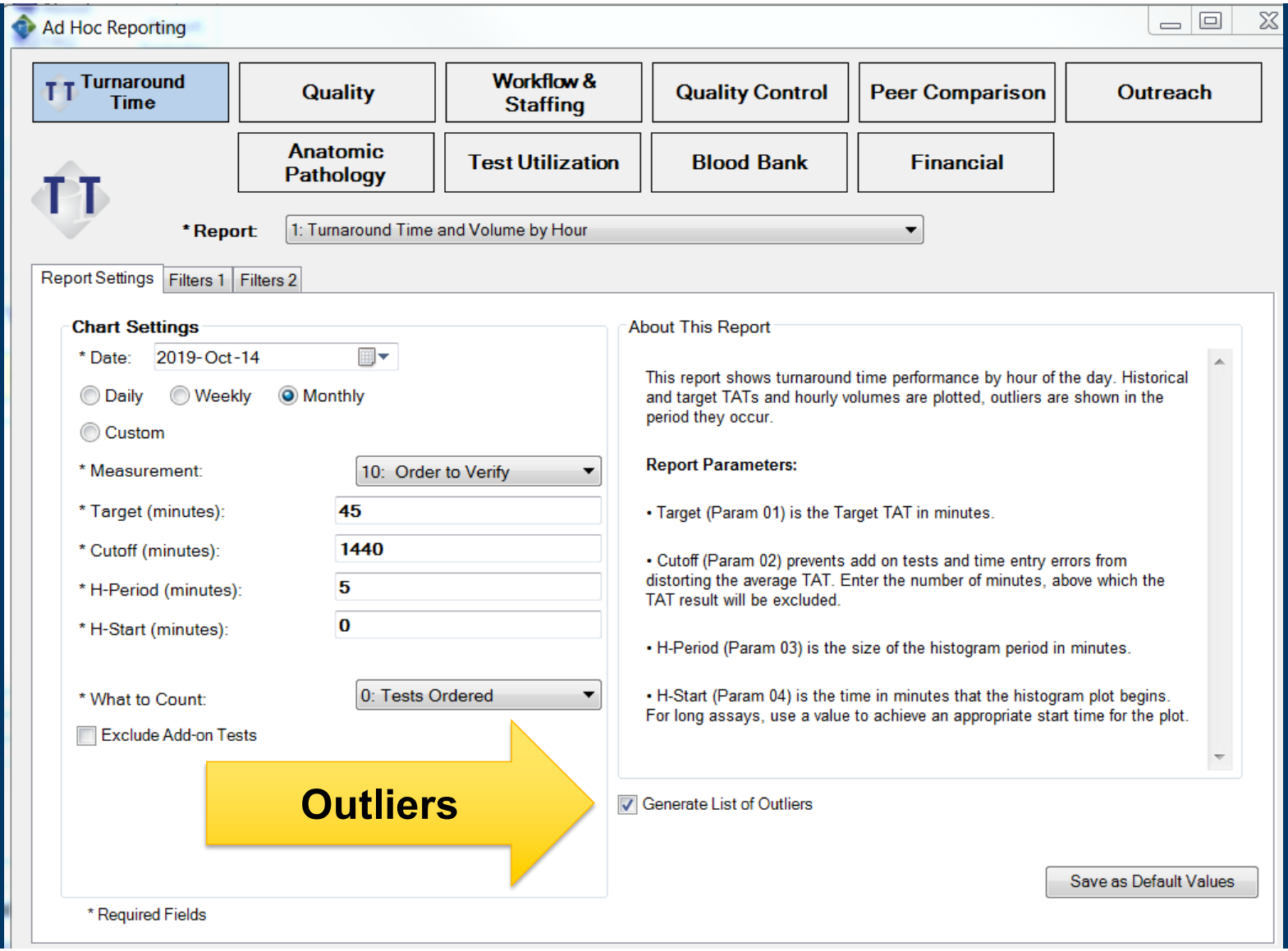
Criteria
Test: Blood Culture
Count: 1,389
Activity Being Counted: Tests
Measurement: Collect to Receive

Performance Summary	Turnaround Time (minutes)							
	Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	Outliers (above target) n	% of Total
Target					120.0	118%		Current vs:
Baseline (N/A)								
October 2019	77.5		60.0		141.0		196	14.1%



Histogram for Blood Culture Transport Time




Ad Hoc Reporting
Turnaround Time
Quality
Workflow & Staffing
Quality Control
Peer Comparison
Outreach
Anatomic Pathology
Test Utilization
Blood Bank
Financial
* Report:
1: Turnaround Time and Volume by Hour
Report Settings
Filters 1
Filters 2
Chart Settings
* Date:
2019-Oct-14
Daily
Weekly
Monthly
Custom
* Measurement:
10: Order to Verify
* Target (minutes):
45
* Cutoff (minutes):
1440
* H-Period (minutes):
5
* H-Start (minutes):
0
* What to Count:
0: Tests Ordered
Exclude Add-on Tests
Outliers
About This Report
This report shows turnaround time performance by hour of the day. Historical and target TATs and hourly volumes are plotted, outliers are shown in the period they occur.
Report Parameters:
• Target (Param 01) is the Target TAT in minutes.
• Cutoff (Param 02) prevents add on tests and time entry errors from distorting the average TAT. Enter the number of minutes, above which the TAT result will be excluded.
• H-Period (Param 03) is the size of the histogram period in minutes.
• H-Start (Param 04) is the time in minutes that the histogram plot begins. For long assays, use a value to achieve an appropriate start time for the plot.
Generate List of Outliers
Save as Default Values
* Required Fields

Outliers

AC	AD		AF		AH	AI	AJ	AK	AL
OrdHospID	LabI	PhysicianID	Dept	PatLoc	Priorit	ContainerID	PatientTyp	AdmitTime	OrderTime
VCUHS	MCV	93844414.00	Micr biology Stat Lab Subsectio	9109 GI	N		OP	10/8/2019 12:42:00 PM	10/8/2019 1:21:47 PM
VCUHS	MCV	12547.00	Micr biology Stat Lab Subsectio	9109 GI	N		OP	9/30/2019 2:43:00 PM	9/30/2019 3:55:14 PM
VCUHS	MCV	313795444.00	Micr biology Stat Lab Subsectio	GI/Med Nutr Cl	N		OP	10/3/2019 12:35:00 PM	10/3/2019 12:24:59 PM
VCUHS	MCV	297493766.00	Micr biology Stat Lab Subsectio	ED-Pediatrics	N		ED OP	10/11/2019 10:50:00 AM	10/11/2019 3:39:59 PM
VCUHS	MCV	180540717.00	Micr biology Stat Lab Subsectio	CtrAdvHlthTeam1	N		OP	9/12/2019 9:28:00 AM	10/3/2019 10:45:46 AM
VCUHS	MCV	144283211.00	Micr biology Stat Lab Subsectio	9W	N		IP	10/7/2019 10:28:00 AM	10/11/2019 2:42:32 PM
VCUHS	MCV	12547.00	Micr biology Stat Lab Subsectio	9109 GI	N		OP	9/30/2019 2:40:00 PM	9/30/2019 2:58:47 PM
VCUHS	MCV	12547.00	Micr biology Stat Lab Subsectio	Endoscopy Suite	N		OP	8/1/2019 10:41:00 AM	10/4/2019 12:04:52 PM
VCUHS	MCV	313544700.00	Micr biology Stat Lab Subsectio	YELO-ED	N		IP	10/4/2019 6:12:00 AM	10/4/2019 6:20:13 AM
VCUHS	MCV	288433460.00	Micr biology Stat Lab Subsectio	Tx Cl-Renal	N		OP	10/7/2019 9:32:00 AM	10/7/2019 10:58:13 AM
VCUHS	MCV	155822685.00	Micr biology Stat Lab Subsectio	OP Test Ctr	N		OP	10/3/2019 9:29:00 AM	9/23/2019 5:08:58 PM
VCUHS	MCV	312358745.00	Micr biology Stat Lab Subsectio	YELO-ED	N		ED OP	10/11/2019 1:36:00 PM	10/11/2019 12:26:25 PM

Other uses for Performance Insight

Workflow Design: Urine Cultures

The highest volume culture in most laboratories.

Question – How to reduce the burden of the urine culture?

Possible Solutions

- Evening/night shift final no growth cultures
- Final No Growths at 18 hours

Consultant recommended.

- Cumitech 2C, Laboratory Diagnosis of Urinary Tract Infections
- ASM Microbiology Clinical Procedure Handbook 4th ed: 3.12 page 13

What organisms are we going to miss by shortening our incubation time from 24 to 18 hours?

But there is no data to support these recommendations.

JOURNAL OF CLINICAL MICROBIOLOGY, June 1992, p. 1600–1601
0095-1137/92/061600-02$02.00/0

Vol. 30, No. 6

Evaluation of Microbiological Processing of Urine Specimens: Comparison of Overnight versus Two-Day Incubation

PATRICK MURRAY,[1,2]* PATRICK TRAYNOR,[2] AND DAVID HOPSON[1]

Washington University School of Medicine[1] and Barnes Hospital Clinical Microbiology Laboratory,[2] Saint Louis, Missouri 63110

- 2,278 urine specimens
- 639 >10,000 CFU/ml

TABLE 1. Detection of organisms in urine cultures after incubation for 24 and 48 h

Organism(s)	No. of isolates[a]	No. detected only at 48 h (%)
Staphylococcus aureus	8	0
Staphylococcus saprophyticus	2	0
Other *Staphylococcus* spp.	23	7 (30.4)
Enterococcus sp.	51	4 (7.8)
Viridans group *Streptococcus* sp.	33	11 (33.3)
Beta-hemolytic *Streptococcus* sp.	17	2 (11.8)
Escherichia coli	203	13 (6.4)
Klebsiella sp.	46	3 (6.5)
Enterobacter sp.	19	0
Citrobacter sp.	14	0
Proteus sp.	26	2 (7.7)
Providencia sp.	2	1 (50)
Morganella sp.	3	0
Serratia sp.	1	0
Hafnia sp.	1	0
Pseudomonas aeruginosa	42	6 (14.3)
Other *Pseudomonas* spp.	2	0
Xanthomonas maltophilia	3	3 (100)
Alcaligenes sp.	5	4 (80)
Acinetobacter sp.	1	0
Moraxella sp.	1	1 (100)
Neisseria gonorrhoeae	1	1 (100)
Gardnerella sp.	16	12 (75)
Corynebacterium sp.	39	22 (56.4)
Lactobacillus sp.	41	32 (78.1)
Candida albicans	31	6 (19.4)
Candida sp.	20	3 (15.0)
Torulopsis glabrata	19	13 (68.4)

[a] Number of isolates present at $\geq 10^4$ CFU/ml after 48 h of incubation.

This doesn't seem right…

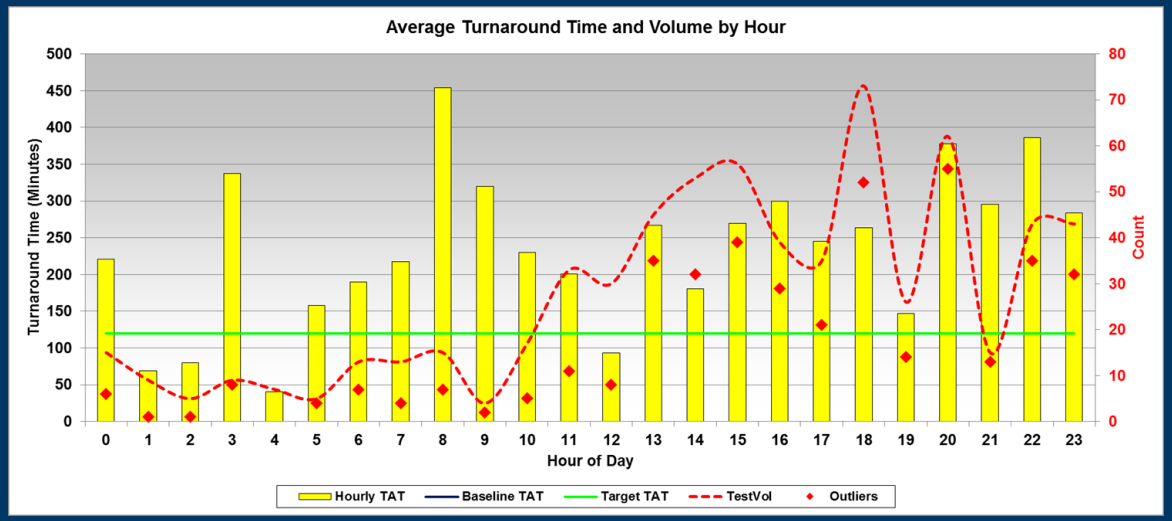
And it isn't….

50 of 62 "missed" pathogens were from specimens rcv'd in the evening

Specimens received in the afternoon were read the next morning and then not again until 48 hrs.

Thus, you can't conclude from these data that a 24 incubation would have missed all of these pathogens.

18 hour vs. 24 hour Incubation of Clean Catch Urine Specimens



Majority of specimens rcv'd between 3 PM and 8 PM

Which means NG can't be finalled until 3-8 PM the following day.

Which means the majority of our specimens are held for 48 hours.

VCU Health

Sept. 6, 2019

Hunter Holmes McGuire VA Urine 18 vs 24 hr incubation analysis

Clean Catch Urines
Excluded spinal cord injury patients
622 Urine Cultures Analyzed
100 positives

	Positive @ 18 hours	Negative @ 18 hrs, Positive @ 24 hrs
E. coli	31	0
E. faecalis	23	0
C. albicans	1	0
C. krusei	1	0
C. tropicalis	1	0
Aerococcus	1	0
Other positives	40	0
Negative	522	N/A

VCU Health

Sept. 6, 2019

VCUHS Urine 18 hr incubation analysis

VCUHS

- 18 hr July 1st, 2019
- Clean Catch Urines

	April – May 2019	July - August 2019
Metric	**24-48 hr**	**18 hr**
Total	7,158	4,121
Median TAT (All)	1.8 days	1.5 days
% complete within 1 day	1.1%	30%
Overall positivity rate	33%	33%
E. coli rate	14%	16%
C. albicans	0.9%	0.5%
C. glabrata	0.02%	0.01%

VCUHealth

Other uses for Performance Insight

Laboratory Utilization

What does laboratory utilization mean?

Controlling Reference Lab Testing

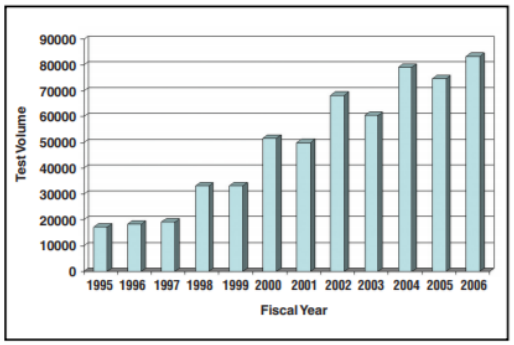


Figure 1_Reference Testing Volume at Massachusetts General Hospital from Fiscal Year 1995 to 2006.

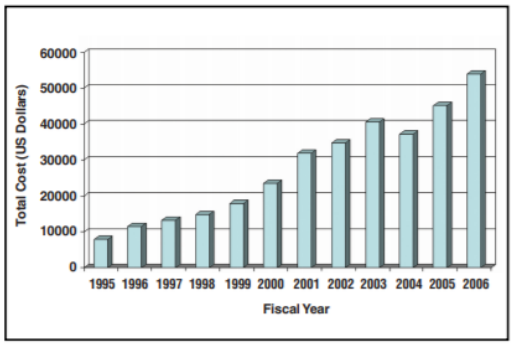
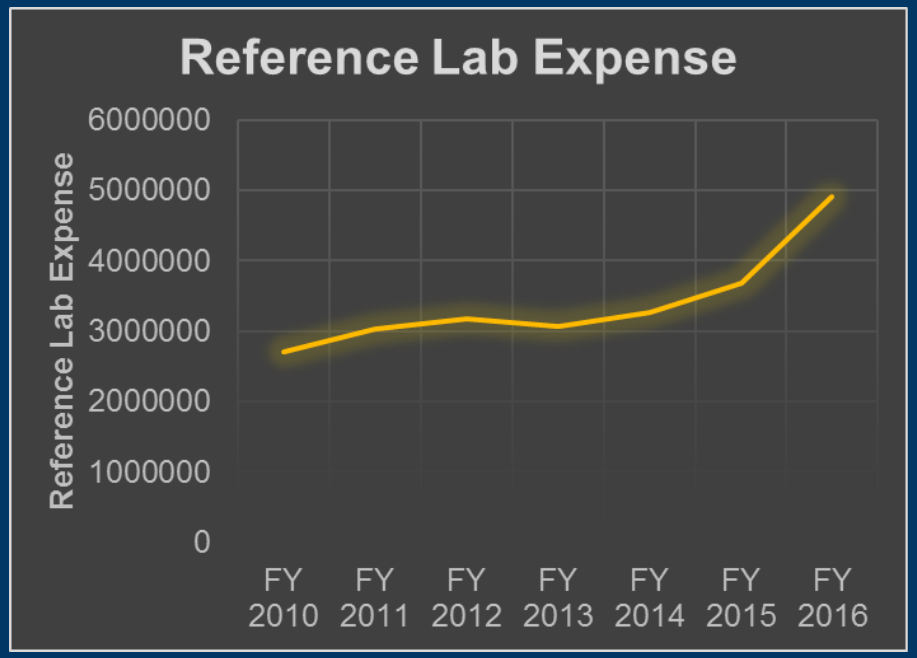
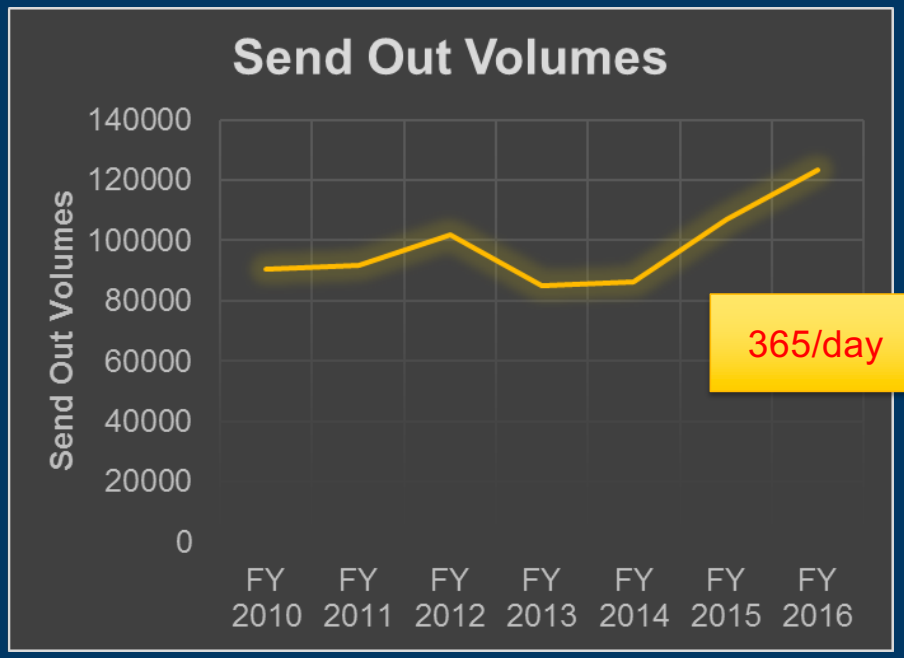


Figure 2_Reference Laboratory Expense at Massachusetts General Hospital from Fiscal Year 1995 to 2006.

Ardisson et al. LabMedicine. 2007. 38(8)

Reference Laboratory Testing at VCUHS





Highest Volume Tests

TestName	YTD_Client_Dollars	YTD_Total_Quantity
T-Spot TB		1301
TESTOSTERONE FREE WI		1280
PLATELIA ASPERGILLUS AG, BAL/		1154
t Transglut IgA		1093
FUNGITELL, SERUM		1076
Testosterone Total		1065
FREE K+L LT CHAINS,Q		959
FRUCTOSAMINE		942
ASMIN		887
		776
		753
		704
First Trimester Scr		620
CALPROTECTIN,		589
Thiopurine Methyltransferase (TPMT), RBC		272
SEROTONIN RELEASE AS		261
INFLIXIMAB (IFX) AND ANTI-IINFLIXIMAB ANTIBODY		169

Do we really need two?

Wrong Test = $900

Right test = $300

Highest Volume Tests

TestName	YTD_Client_Dollars	YTD_Total_Quantity
T-Spot TB		1301
TESTOSTERONE FREE WI		1280
PLATELIA ASPERGILLUS AG, BAL/		1154
t Transglut IgA		1093
FUNGITELL, SERUM		1076
Testosterone Total		1065
FREE K+L LT CHAINS,Q		959
FRUCTOSAMINE		942
CERULOPLASMIN		887
FREE AND TOTAL INSUL		776
ANCA (ANTINEUTROPHIL CYTOP)		753
PROBNP		704
First Trimester Screen with Nuchal Trans		620
CALPROTECTIN, FECAL		589
Thiopurine Methyltransferase (TPMT), RBC		272
SEROTONIN RELEASE AS		261
INFLIXIMAB (IFX) AND ANTI-IINFLIXIMAB ANTIBODY		169

Infectious Diseases Testing

January 2018 – November 2018

IgG - Wrong

IgM - Wrong

Right Test

IgA - Wrong

Wrong test

TestName	YTD_Client_Quantity	YTD_Client_Dollars
ASPERGILLUS AG, BAL/	1154	
FUNGITELL, SERUM	1076	
LYME AB/WESTERN BLOT	647	
H. PYLORI, IGG ABS	533	
TETANUS ANTITOXOID I	469	
DIPHTHERIA ANTITOXOI	415	
CHLAMYDIA TRACHOMATI	384	
HSV 1/2 PCR	318	
VARICELLA-ZOSTER AB,	313	
HAEMOPHILUS INFLUENZ	309	
BLASTOMYCES ANTIGEN	293	
HELICOBACTER PYLORI,	256	
POLIOVIRUS ANTIBODIE	245	
H. PYLORI STOOL AG,	185	
CMV PCR	163	
MYCOPLASMA PNEUMONIA	150	
PARVOVIRUS B19 PCR	128	
PARVOVIRUS B19, HUMA	124	
HELICOBACTER PYLORI,	98	
VZV REAL TIME PCR	60	
EBV EARLY ANTIGEN AB	60	
EPSTEIN-BARR VIRUS P	48	
COXSACKIE A IGG/IGM	48	
JC VIRUS DNA, PCR (C	43	
BARTONELLA DNA PCR	35	
LYME (B. BURGDORFERI	20	
B PERTUSSIS IGM AB	15	
HBV GENOTYPE	12	
HHV 6 IGG ANTIBODIES	12	

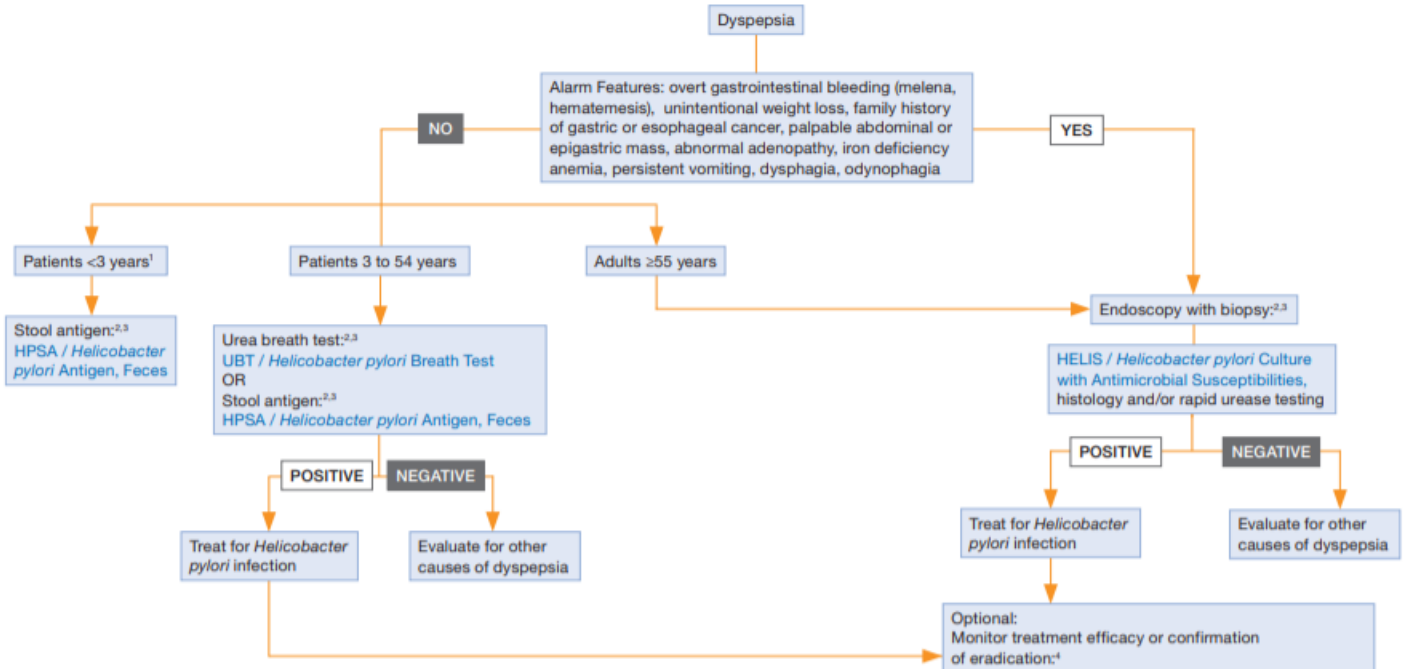
No Serology

2018 Volume
887 serology

185 antigen

MAYO CLINIC LABORATORIES

Helicobacter pylori Diagnostic Algorithm



1. Mayo Clinic Laboratories utilizes the POCone Infrared Spectrophotometer; performance characteristics for this instrument have not been established for persons under age 3. For patients 3 to 17 years, age, weight and height must be included in test request for appropriate result interpretation.
2. Breath test, stool antigen, histology with special staining for *H pylori* organisms, and/or culture are the gold standard tests for diagnosis of *H pylori* infection.
3. According to the 2007 American College of Gastroenterologists guidelines and Talley* et al, serology should be avoided or positive results should be confirmed with a test that identifies an active infection such as the urea breath test or stool antigen test. Serology is no longer performed at Mayo Clinic laboratories as of February 2016.
4. Confirmation of eradication testing should not be ordered until 2 to 4 weeks after cessation of treatment. Proton pump inhibitors and antisecretory drugs should be discontinued for at least 1 week prior to assessment of *H pylori* eradication.
5. Culture is not routinely used for initial diagnosis of *H pylori* infection in the Mayo Clinic practice, but is required for antibiotic susceptibility testing if physicians suspect antibiotic resistance in patients who have previously failed therapy.

*Talley NJ, Ford AC: Functional dyspepsia. N Engl J Med 2015 Nov 5;373(19):1853-1863

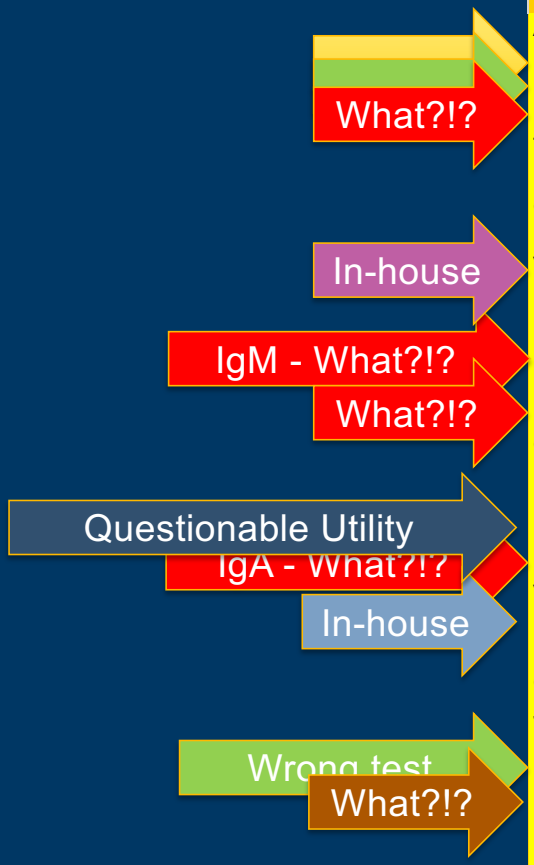
09/2018

Proposal for *H. pylori* Testing

- Eliminate all serology testing from order menu
- Leaving in *H. pylori* Antigen testing
- Bring *H. pylori* Antigen Testing In-house (in progress)

Infectious Diseases Testing

January 2018 – November 2018



TestName	YTD_Client_Quantity	YTD_Client_Dollars
ASPERGILLUS AG, BAL/	1154	$86,550.00
FUNGITELL, SERUM	1076	$118,360.00
LYME AB/WESTERN BLOT	647	$21,334.50
H. PYLORI, IGG ABS	533	$8,528.00
TETANUS ANTITOXOID I	469	$2,814.00
DIPHTHERIA ANTITOXOI	415	$4,980.00
CHLAMYDIA TRACHOMATI	384	$6,144.00
HSV 1/2 PCR	318	$30,528.00
VARICELLA-ZOSTER AB,	313	$2,347.50
HAEMOPHILUS INFLUENZ	309	$21,012.00
BLASTOMYCES ANTIGEN	293	$34,574.00
HELICOBACTER PYLORI,	256	$960.00
POLIOVIRUS ANTIBODIE	245	$4,900.00
H. PYLORI STOOL AG,	185	$8,325.00
CMV PCR	163	$14,670.00
MYCOPLASMA PNEUMONIA	150	$2,700.00
PARVOVIRUS B19 PCR	128	$23,040.00
PARVOVIRUS B19, HUMA	124	$2,232.00
HELICOBACTER PYLORI,	98	$1,960.00
VZV REAL TIME PCR	60	$14,070.00
EBV EARLY ANTIGEN AB	60	$660.00
EPSTEIN-BARR VIRUS P	48	$9,600.00
COXSACKIE A IGG/IGM	48	$8,400.00
JC VIRUS DNA, PCR (C	43	$7,740.00
BARTONELLA DNA PCR	35	$7,087.50
LYME (B. BURGDORFERI	20	$2,820.00
B PERTUSSIS IGM AB	15	$300.00
HBV GENOTYPE	12	$1,500.00
HHV 6 IGG ANTIBODIES	12	$192.00

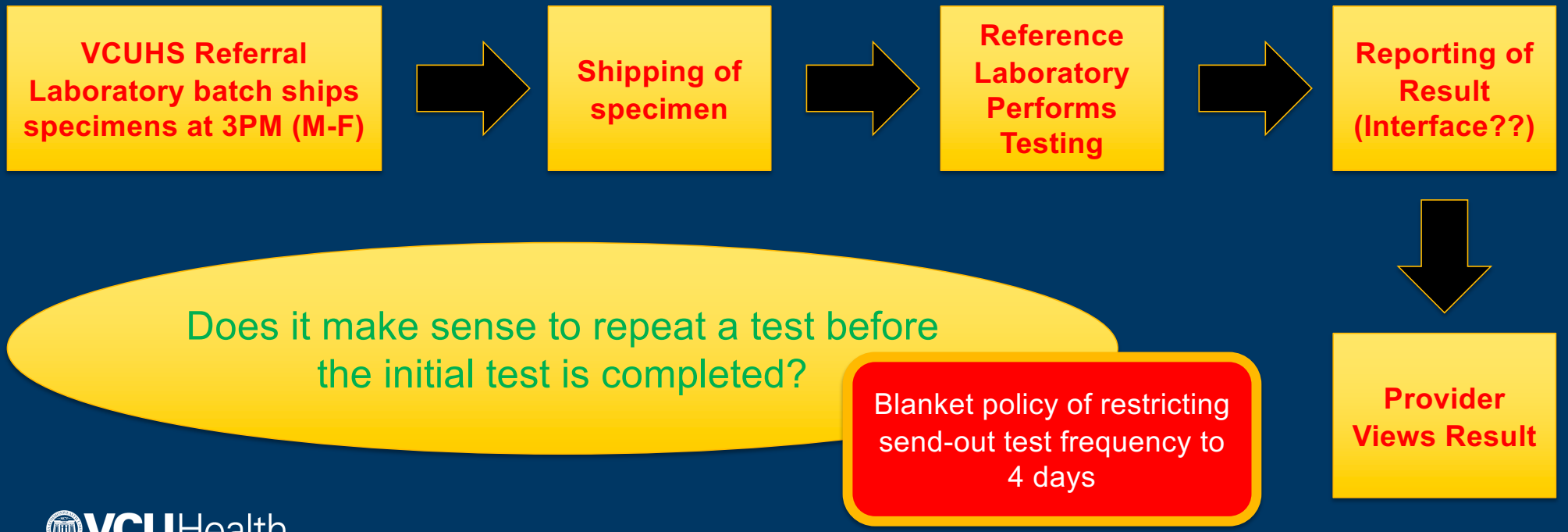
Test Name	Volume
Lyme Testing	20
HHV 6 IgG	12
Pertussis IgM	15
EBV Early Ag	60
Parvovirus Serology	124
Helicobacter IgA	98
Helicobacter Ag	185
Helicobacter IgM	256
VZV IgG	313
Helicobacter IgG	533
	1616

Sept. 6, 2019

Another Strategy to improve Laboratory Utilization: Duplicate Testing

How often should microbiology tests be repeated?

What is the average “effective” turnaround time for a send out test?



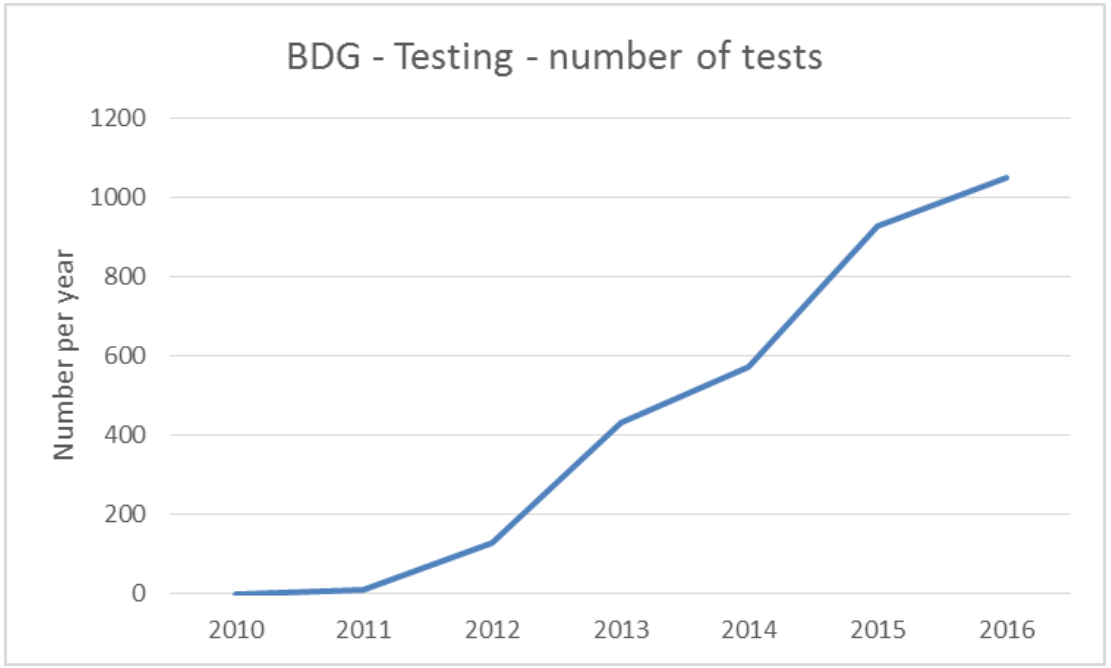
VCUHealth

Infectious Diseases Testing

January 2018 – November 2018

TestName	YTD_Client_Quantity	YTD_Client_Dollars
ASPERGILLUS AG, BAL/	1154	
FUNGITELL, SERUM	1076	
LYME AB/WESTERN BLOT	647	
H. PYLORI, IGG ABS	533	
TETANUS ANTITOXOID I	469	
DIPHTHERIA ANTITOXOI	415	
CHLAMYDIA TRACHOMATI	384	
HSV 1/2 PCR	318	
VARICELLA-ZOSTER AB,	313	
HAEMOPHILUS INFLUENZ	309	
BLASTOMYCES ANTIGEN	293	
HELICOBACTER PYLORI,	256	
POLIOVIRUS ANTIBODIE	245	
H. PYLORI STOOL AG,	185	
CMV PCR	163	
MYCOPLASMA PNEUMONIA	150	
PARVOVIRUS B19 PCR	128	
PARVOVIRUS B19, HUMA	124	
HELICOBACTER PYLORI,	98	
VZV REAL TIME PCR	60	
EBV EARLY ANTIGEN AB	60	
EPSTEIN-BARR VIRUS P	48	
COXSACKIE A IGG/IGM	48	
JC VIRUS DNA, PCR (C	43	
BARTONELLA DNA PCR	35	
LYME (B. BURGDORFERI	20	
B PERTUSSIS IGM AB	15	
HBV GENOTYPE	12	
HHV 6 IGG ANTIBODIES	12	

What is the problem?



N = 1051 in 2016

N = 893 in 2017 to date → projects to 1,200 this year

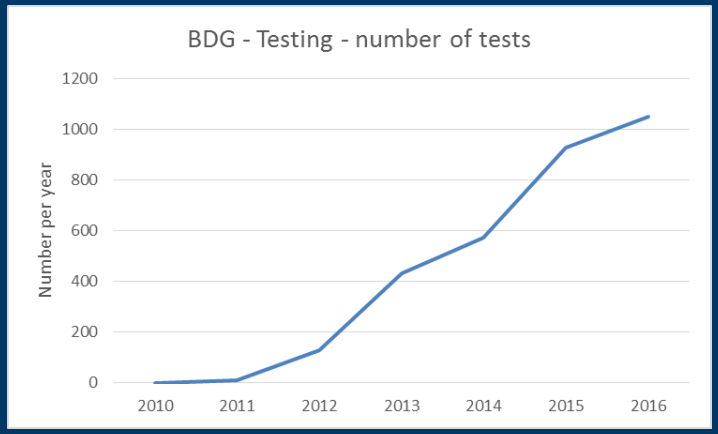
Crusade to eliminate unnecessary duplicate testing...

First up… Fungitell (aka Beta-D-Glucan)

What is it?
A test performed from serum which is used as a marker of invasive fungal infection.

January 2018 – November 2018

TestNum	TestName	YTD_Client_Quantity	YTD_Client_Dollars
284526	FUNGITELL, SERUM	1076	
123255	CALPROTECTIN, FECAL	589	
183805	ASPERGILLUS AG, BAL/	1154	
150018	SERONTONIN RELEASE AS	261	
139350	RNA QUALITATIVE	290	
604086	ALLERGENS (29)	490	
017500	FIRST TRIMESTER SCRE	620	
140002	HEPATOCELLULAR CARCI	540	
503770	INFLIXIMAB (IFX) CON	169	
143000	PROBNP	704	



Sept. 6, 2019

How to get this under control…

Who is ordering?

Location	Number ordered in 2016
BMT Clinic	240
North 10	110
Main 10	61
Peds Heme Onc	38
Peds floor	38
Other	**564**

NO!

NO!

Restrict providers who can order…
but the residents

Assay for (1→3)-β-D-Glucan in Serum

FUNGITELL®

Instructions For Use

ASSOCIATES OF
CAPE COD
INCORPORATED
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CE

PN001268-en Rev2

Revised February 2011

PRECISION

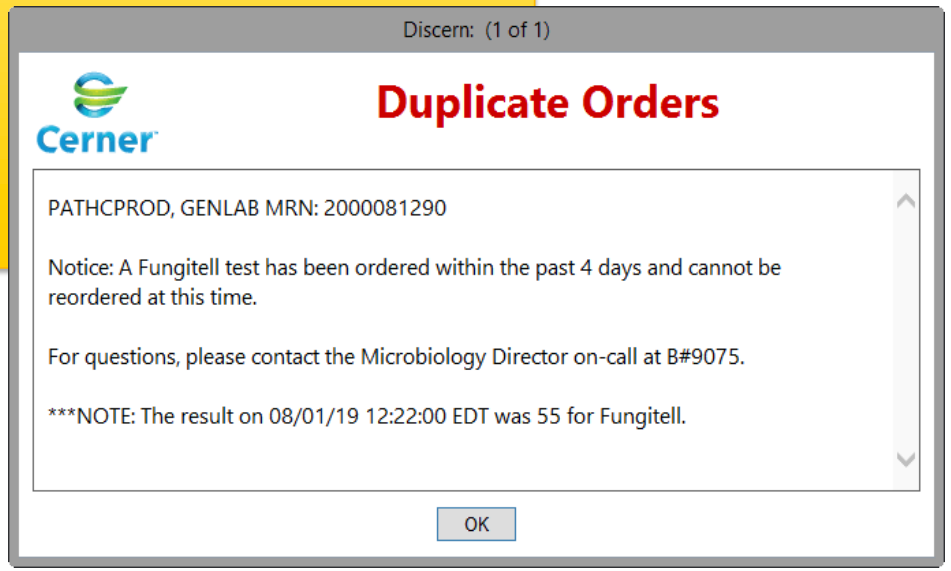
In the Precision Studies, ten (10) different samples were each tested by three testing sites, on three different days. The intra-assay variation ranged from 0.9 to 28.9%. The Inter Assay values ranged from 3.9 to 23.8%. The four (4) negative samples were excluded from both analyses.

Assays with high intra- and inter-assay variation are unlikely to yield clinically meaningful changes with frequent repeat testing

Repeat Fungitell (beta-d-glucan) Since 2011

464 patients with more than one Fungitell (n=1615 total tests in this group)

122 Tests were repeated within 3 days (72 hours)
166 Tests were repeated within 4 days (96 hours)
235 Tests were repeated within 7 days
182 Tests were repeated within 7-14 days



Another example:

Todd:

“Why are we repeating FilmArrays on these patients every 12 hours?”

Me:

“We’re doing what?”

Very popular test…

85% positivity rate from Peds ED

41% positivity rate from Adult ED

Acknowledgments:
Cortney Salmon
Connie Bender

Repeat Testing Following a Negative Result

What is a reasonable time frame for a patient to convalesce (from the initial presentation), get exposed to a pathogen, and develop new symptoms?

Negative

Positive

How much Time???

What is a reasonable time frame for repeat testing for *negative* results?

Between April 2016 and 2017 (N=6,777)

- 537 (1.5 per day and 8% of all tests) are repeated within 7 days
- Primary offender – Inpatient Peds

Harris and Gwaltney. CID. 1996. 23

Incubation periods

Flu (1-4 days) Avg 2 days

RSV (2-8 days) Avg 4-6 days

Rhinovirus

UVA – 1996 – Experimental infection of 6 young adults

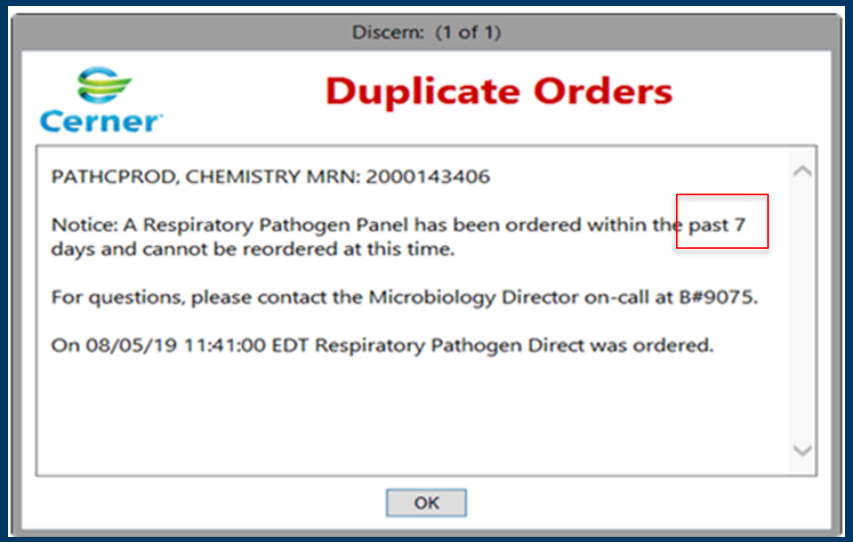
- monitored with nasal washings every 2 hours for 24 hours
  - Symptom onset (sore or scratchy throat) – **10-12 hours**

VCUHS Data: FilmArray Testing

- Retrospectively reviewed Respiratory Pathogen Panel results.
- Specimen type – NP Swab only
- Identified patients who had repeat testing performed within 48 hours and 7 days.
  - Analyzed correlation between repeat testing

Repeated within…	No Change	Neg to Pos	Pos to Neg
48 hours	22	2	0
7 days	227	11	12

AVG Time of conversion = 5.6 days



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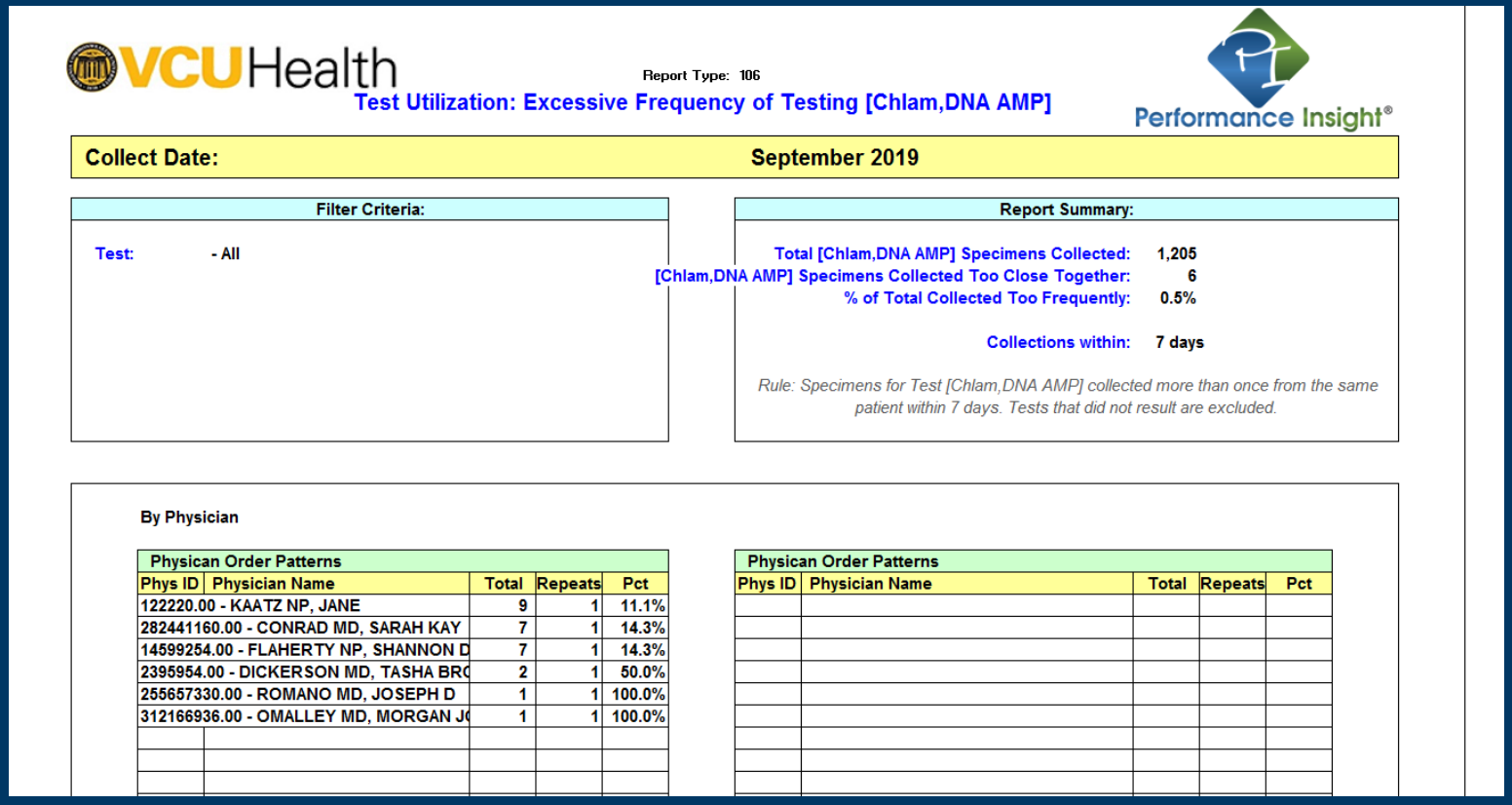
All of these data were collected the hard way.

Ongoing Monitoring of Duplicate Testing



VCU Health

Report Type: 106

Test Utilization: Excessive Frequency of Testing [Chlam,DNA AMP]

Performance Insight®

Collect Date: September 2019

Filter Criteria:

Test: - All

Report Summary:

Total [Chlam,DNA AMP] Specimens Collected:	1,205
[Chlam,DNA AMP] Specimens Collected Too Close Together:	6
% of Total Collected Too Frequently:	0.5%
Collections within:	7 days

Rule: Specimens for Test [Chlam,DNA AMP] collected more than once from the same patient within 7 days. Tests that did not result are excluded.

By Physician

Physican Order Patterns

Phys ID	Physician Name	Total	Repeats	Pct
122220.00	KAATZ NP, JANE	9	1	11.1%
282441160.00	CONRAD MD, SARAH KAY	7	1	14.3%
14599254.00	FLAHERTY NP, SHANNON D	7	1	14.3%
2395954.00	DICKERSON MD, TASHA BRC	2	1	50.0%
255657330.00	ROMANO MD, JOSEPH D	1	1	100.0%
312166936.00	OMALLEY MD, MORGAN JC	1	1	100.0%

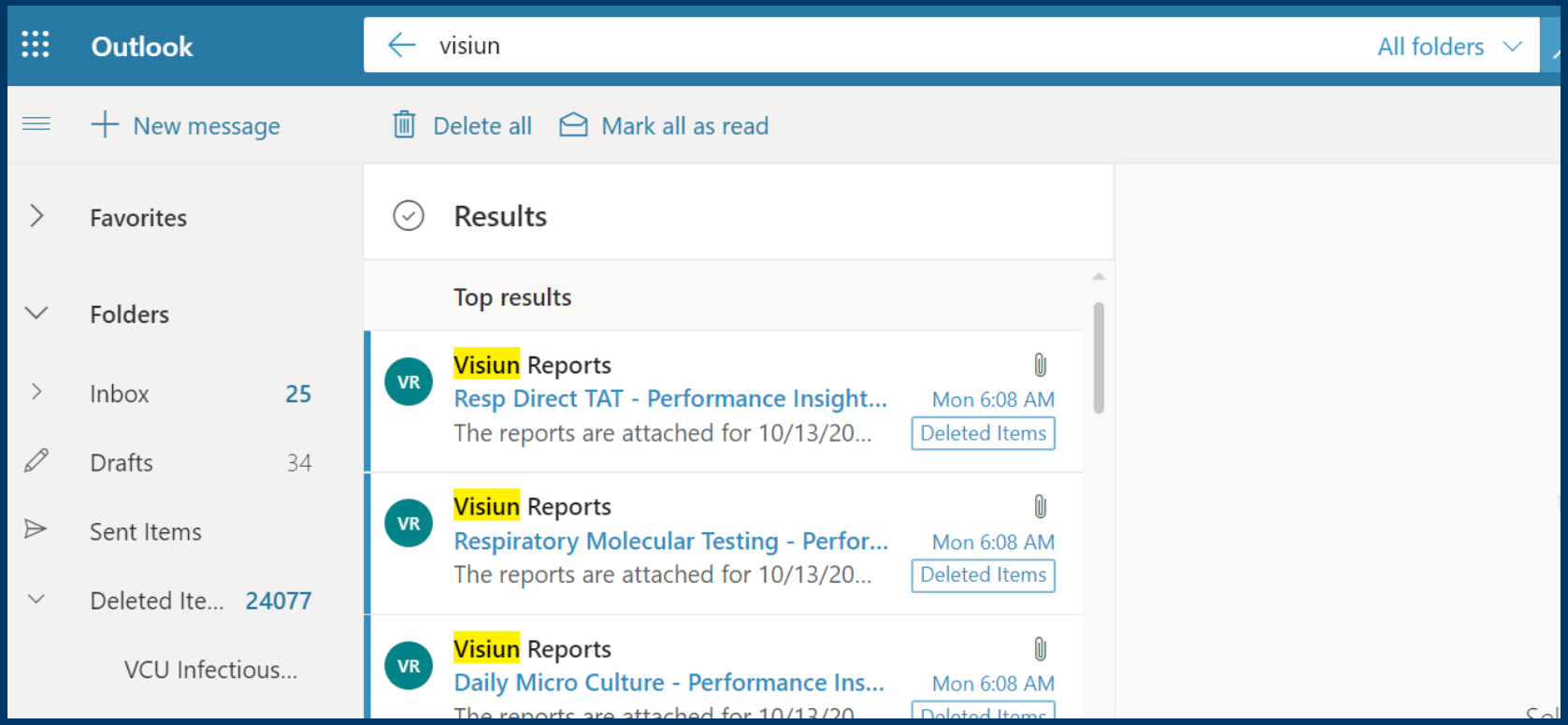
Physican Order Patterns

Phys ID	Physician Name	Total	Repeats	Pct

Repeat Frequency of Microbiology Tests – 1 year of data (2018-19)

Test	Total Volume	Cut off	Percent Repeated
Urine Culture	22,262	48 hrs	1.6%
GC/CT NAAT	11,319	7 days	0.5%
Positive Crypto CSF Ag	170	6 months	3.5%
Respiratory Direct	4,705	7 days	4.0%
Fungitell	983	4 days	6.3%
C. difficile Testing	1,445	7 days	4.5%

On going monitoring…



Report Set Summary

Performance Summary

Performance Insight®

Set #22: Daily Micro Culture - Wednesday, October 9, 2019

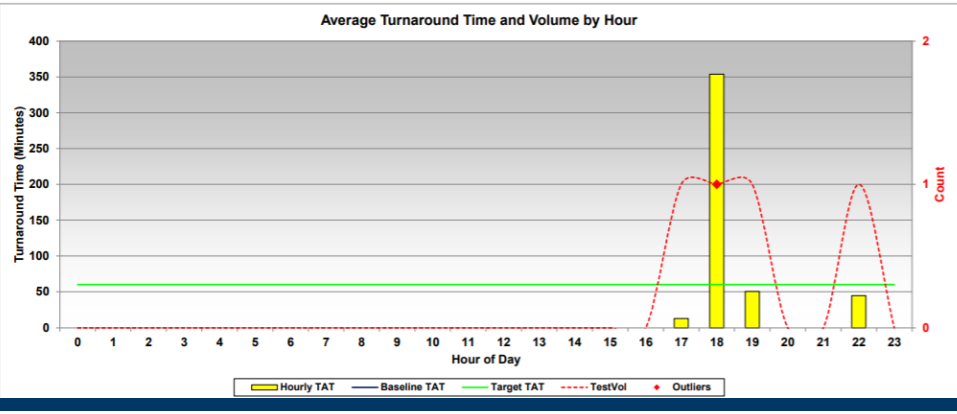
Turnaround Time

#	Pat Type/Loc	Test/Priority	Test Loc/Other	Other Info	Pass	Fail	Target	Actual	Status
1		CSF Culture;Gram		Receive to Verify	3	1	Mean <= 60 min	115.4	Fail

Verify Date Wed, Oct 9, 2019

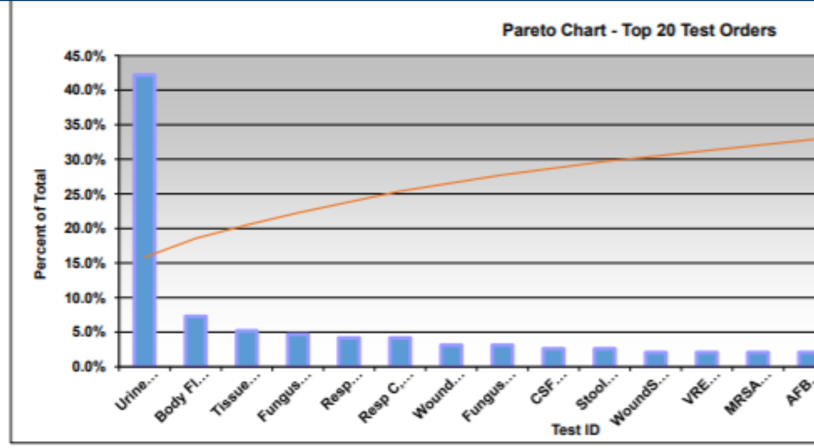
Criteria
Test: CSF Culture
Result Code: Gram
Count: 4
Activity Being Counted: Tests
Measurement: Receive to Verify

Performance Summary	Turnaround Time (minutes) Average	Current vs:	Median	Current vs:	90% Completion	Current vs:	Outliers (above target) n	% of Total	Current vs:
Target	60.0	192%	60.0	79%	60.0	438%			
Baseline (N/A)									
Wed, Oct 9, 2019	115.4		47.4		262.8		1	25.0%	



CSF Gram stain TAT

Daily Culture volumes to predict workload

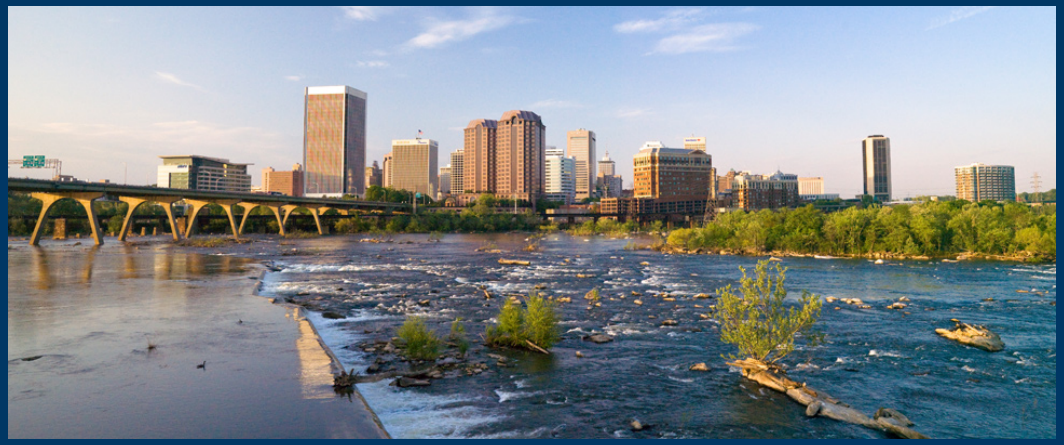


		Period	
Test ID	Test Name	Total	Pct Total
Urine Culture		81	42.2%
Body Fl Cult		14	7.3%
Tissue Culture		10	5.2%
FungusCBld		9	4.7%
Resp Culture		8	4.2%
Resp C, CF		8	4.2%
Wound Deep		6	3.1%
Fungus C, Tiss		6	3.1%
CSF Culture		5	2.6%
Stool Culture		5	2.6%
WoundSuperficial Cult		4	2.1%
VRE Screen		4	2.1%
MRSA Screen		4	2.1%
AFB Cult Body Fluid		4	2.1%
AFB Culture		3	1.6%
AFB Cult, Resp		3	1.6%
Fungus Culture, Body Fl		3	1.6%
GC Culture		2	1.0%
Derm Screen		2	1.0%
Fungus Culture		2	1.0%
Strep A Throat Cult		2	1.0%
Stool C, Yersin		1	0.5%
FungusC CSF		1	0.5%
Fungus Cult Respiratory		1	0.5%
Derm Sc, Fung C		1	0.5%
Fungus C Ur		1	0.5%
Fungus C Genital		1	0.5%
Ear Culture		1	0.5%
			0.0%
			0.0%
			0.0%

Test ID	
Other	
Total	

Thank you for very much for your attention.

Questions?



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