

# Turn Around Time for Lower Respiratory Gram Stain and Culture across Hospital Shifts

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## Abstract

It was suspected that there was an increase in turnaround time (TAT) at the Providence Sacred Heart Medical Center (PSHMC) Clinical Microbiology Lab. In an analysis of the TAT for lower respiratory tract infections (LRTI) among three different shifts (first, second, and third shifts), we see a significant increase in TAT for preliminary reports if they arrive after 20:00. The delay after 20:00 may be the result of interpreting agar plates on first shift only. As a result, preliminary reports will be delayed up to 16 hours. Even though there is no difference in amount of samples between first and second shifts, the TAT appears to significantly different.

## Introduction

Restrepo and colleagues call the long-term prognosis of patients with community-acquired pneumonia “unacceptably high” of mortality rates, inpatient care costs, and poor 5-year prognosis<sup>2,4</sup>. Therefore the time it takes to diagnose pneumonia can be clinically significant. Research has shown that very early targeted antibiotic therapy to ventilator-acquired pneumonia can decrease the mortality rate, which is currently about 37% for ICU patients<sup>1,4,5</sup>. The PSHMC Clinical Microbiology Lab currently utilizes a culturing method for all LRTI. The aim of this study was to calculate the average TAT for cultures of LRTI across three different shifts in order to resolve TAT discrepancies.

## Methods

This study was conducted using data from PSHMC in Spokane, Washington.

**Data collection:** Data pertaining to LRTI from the months of February, June, and October 2019 was collected using the laboratory information system (LIS) Cerner. The data from the three months were compiled into one data bank for the year of 2019.

**Data included:** The data used pertaining to this study included: time of arrival to the microbiology lab and time of completion for the following tasks: Gram stain, preliminary, and final reports. Duplicate entries for an accession number were excluded. Amended reports were also excluded.

**Analysis:** We analyzed data via Microsoft Excel and stratified by shift the Time of Arrival in the lab compared to completion of Gram stain, preliminary and final reports. The first shift was from 07:00 to 15:00, the second was 15:00 to 23:00, and the third was 23:00 to 07:00. We compared overall averages of reports and plotted TAT vs time of arrival, with each shift distinguished by a different color.

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## Results

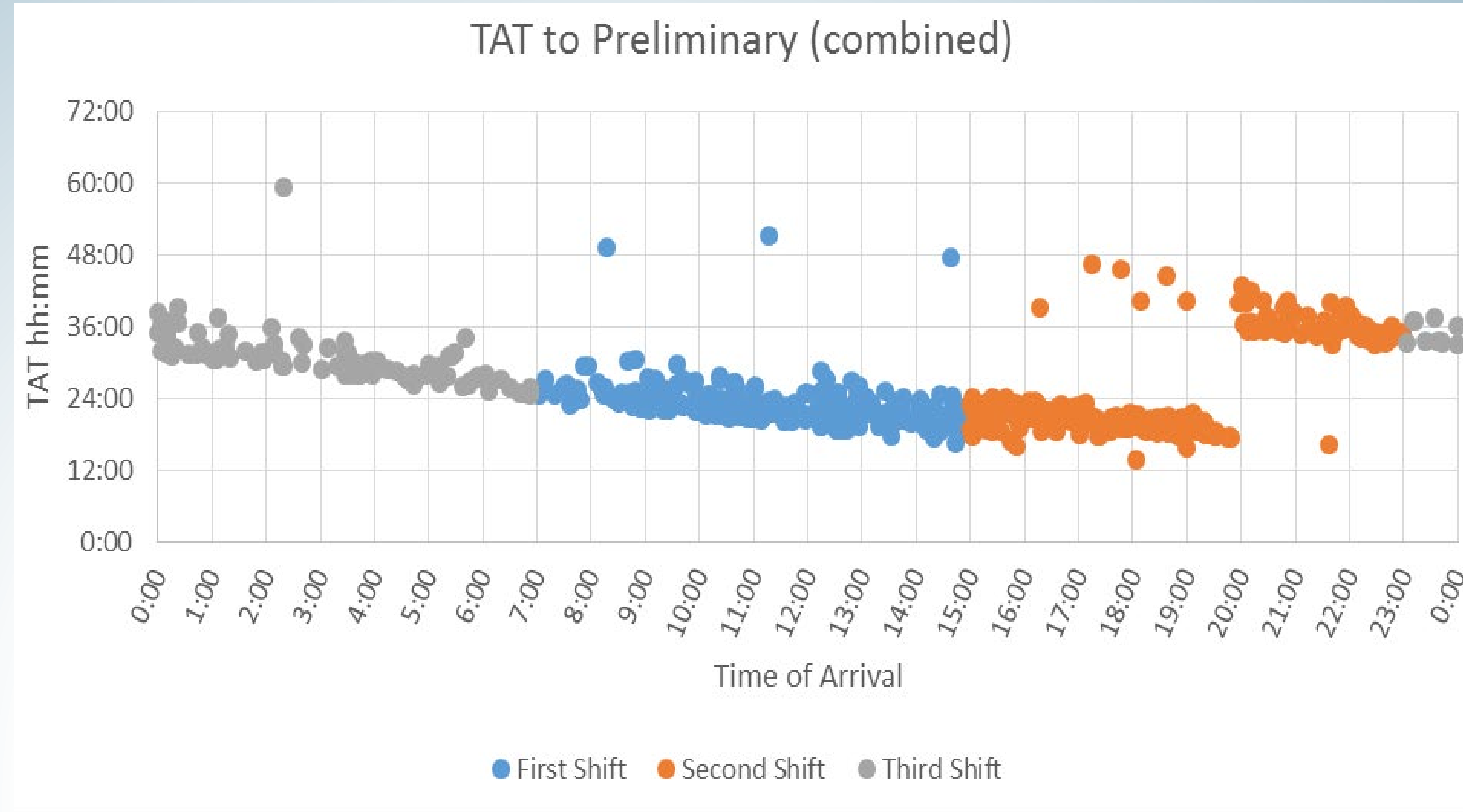


Figure 3. The TAT of the preliminary report versus time of arrival. A pattern has emerged which is discussed in the results section.

Interpreting agar plates occurs on first shift, at approximately 07:00, 10:00, 13:00, and 14:00. If a specimen has not met the 18 hour incubation time by 14:00, it will be read at 07:00 the next morning. The agar plate will be left in the incubator for an additional 16 hours, which explains the increase in TAT on Figure 3 if samples arrive after 20:00. As described in Figure 1, there is no difference in total amount of samples received between first and second shifts (254, 276 respectively). The TAT to Preliminary Report was the most significant pattern found that correlated to the parameters of this study.

## Discussion

An increase in TAT of the preliminary report in Figure 3 illustrates an opportunity for improvement. TAT may decrease if interpreting agar plates is introduced to second or third shifts. Research has shown that up to 20% of deaths from hospital-acquired pneumonia can be attributed to inappropriate, empirical antibiotic therapy; while early targeted therapy has been shown to decrease the mortality rate. Therefore the lowest TAT for preliminary and final reports are critical to patient outcomes.

By interpreting agar plates on second or thirds shift, we expect to see the following results:

- Decrease in TAT for preliminary and final reports for specimens arriving after 20:00
- Initiation of targeted antibiotic therapy, up to 16 hours sooner
- Possible improved patient outcomes, including decreasing the mortality rate and inpatient hospitalization costs
- Reduced risk of secondary complications (ex: C. difficile infection following antibiotic therapy)

A second suggestion is using a PCR based method. Further investigation is needed to see if the higher upfront cost of PCR would lower costs in other departments, like inpatient care and pharmacy. Reasons to consider PCR include:

- Identification of an organism within about 45 minutes
- A PCR and Gram stain report would likely have similar TAT
- Gram stain report is still being investigated on its clinical usefulness<sup>5,6,7</sup>

## Acknowledgements

We give special thanks to Michael Majors, MLS(ASCP) SM, and Richard Davis, PhD, D(ABMM), MLS(ASCP) who so graciously routed our questions and helped us with every step of this project. Laurianne Mullinax, MS, MLS(ASCP) helped immensely with editing our poster. A colleague in the security department, Arkadiy Kuropatko, nicknamed “The Excel Guru” helped us with computing data in Microsoft Excel.

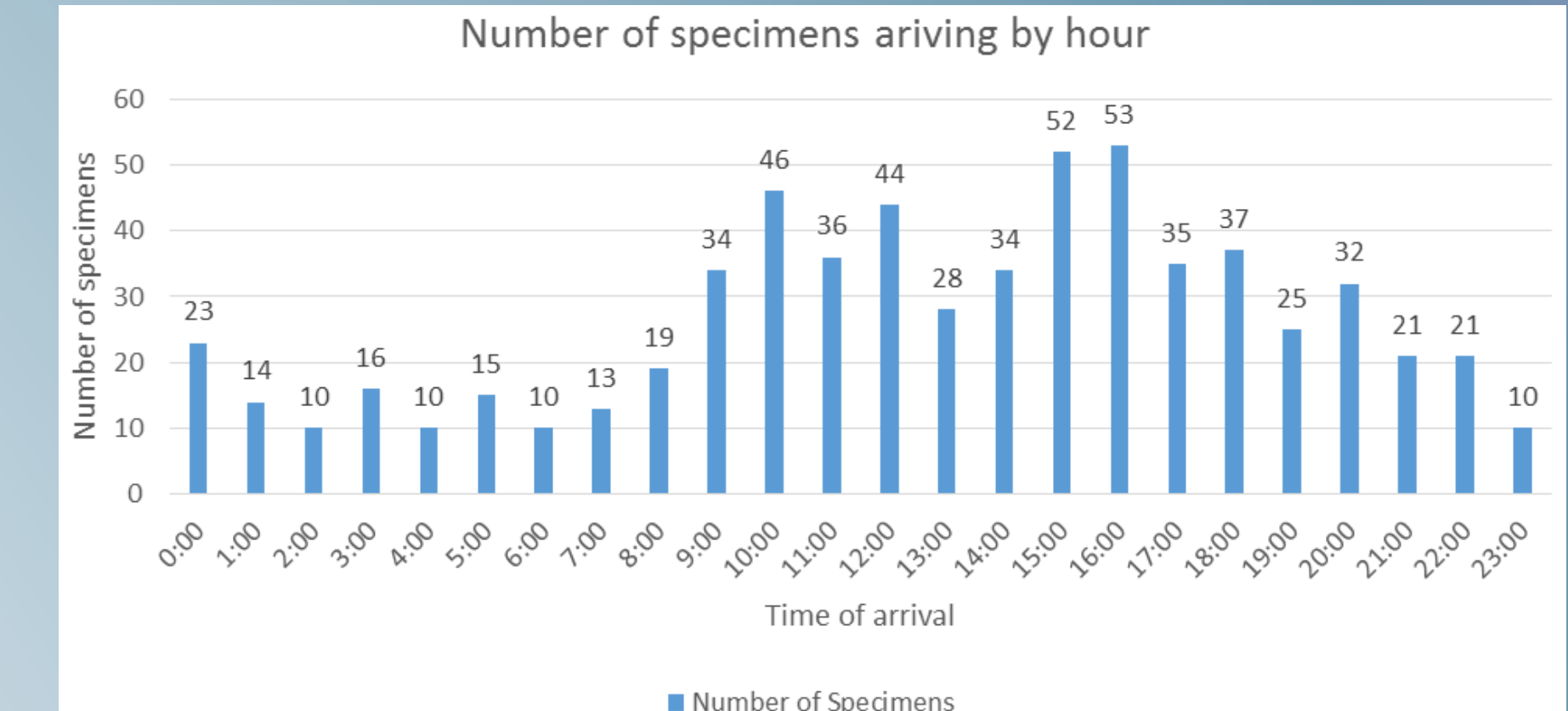


Figure 1. Samples arriving to the microbiology lab by hour. First and second shifts receive a similar amount of LRTI specimens (254, 276 respectively). Third shift received the lowest amount.

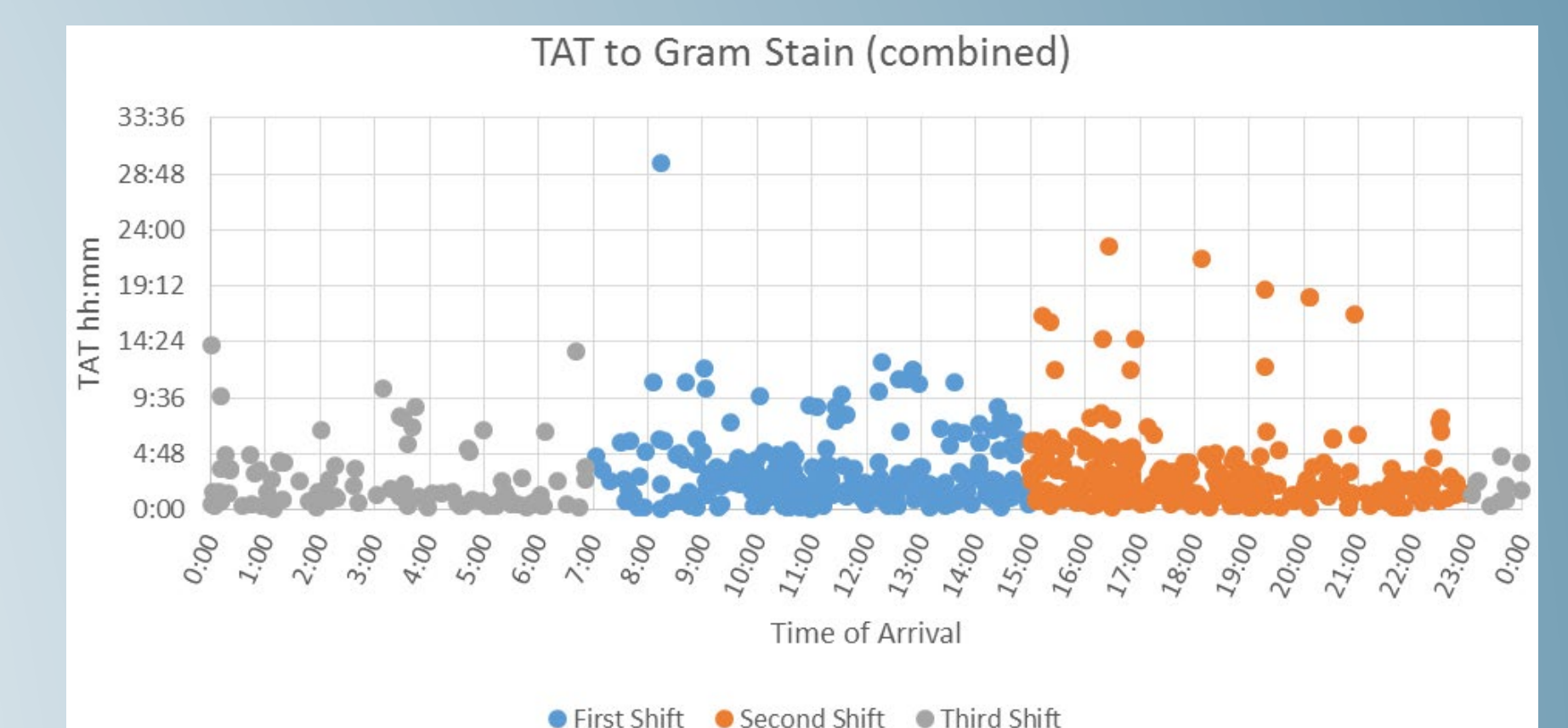


Figure 2. TAT for Gram stain reports vs. time of arrival. No obvious patterns arose. Variation is suggested to be caused by day-to-day issues within the department.

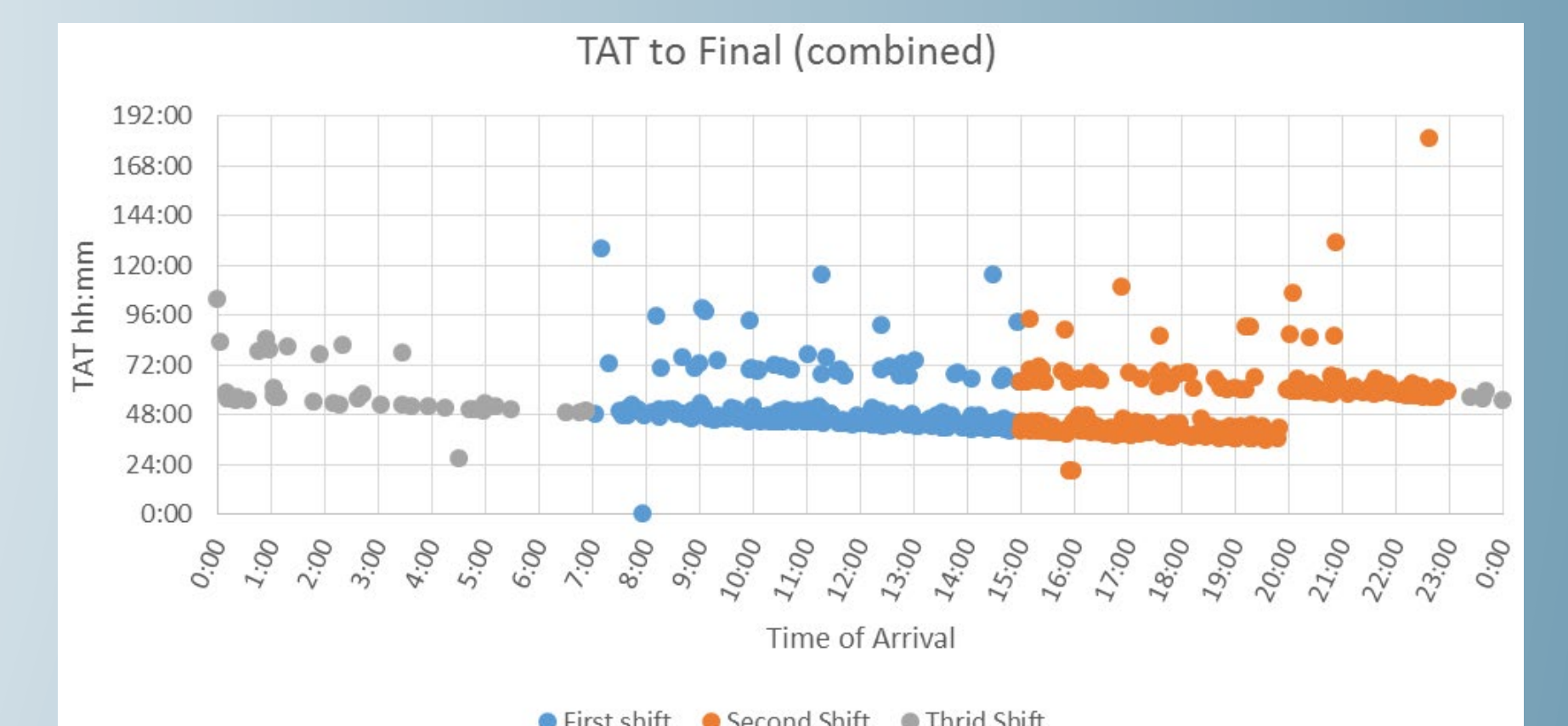
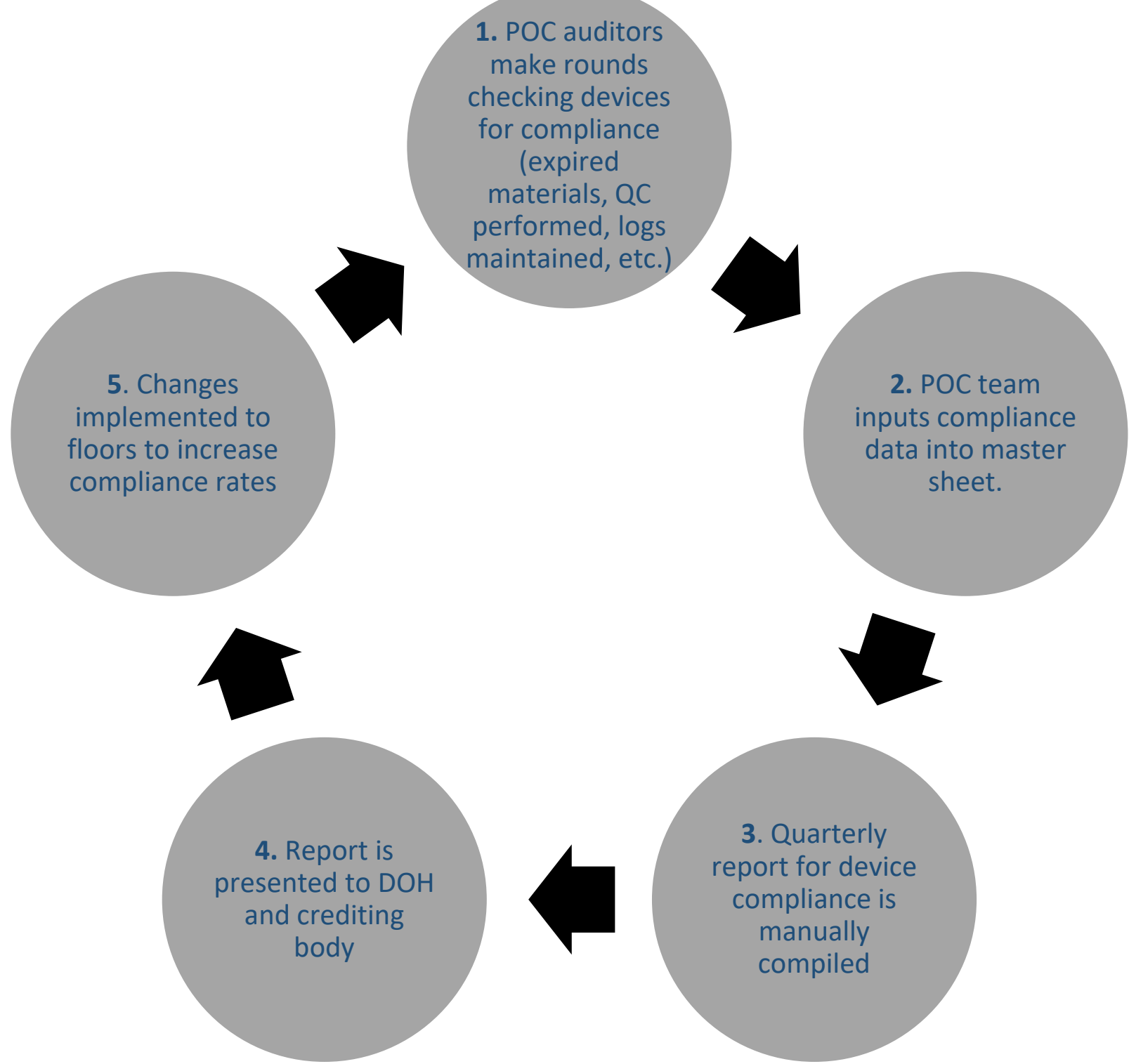


Figure 4. TAT of the final report vs. time of arrival. The pattern is thought to be caused by species-specific variations. (ex: fastidious organism with extra culturing requirements). More investigation is needed to examine this relationship.



## Background

Studies show that the communication of quality control metrics and the communication between units improve compliance as a whole, impacting patient care as well as employee morale.<sup>1</sup> Effective communication is possible by providing relevant, clear concise information in a timely manner.<sup>2</sup> By improving notification visibility, data transparency, and real-time round updates for nursing staff, there was an improvement in meeting efficiency from 28% to 61%.<sup>2</sup> Compliance approaches using hospital informatics and implementation of dashboard interfaces have been shown to result in improved compliance.<sup>3,4</sup> Below is an outline of the current flow of information between the Point of Care (POC) team, the nursing units, and accrediting bodies.



## Approach

The PSHMC Point of Care Team ensures POC devices meet hospital standards for compliance is required for maintaining certification. Rapid communication of compliance information to the nursing staff prevents inefficient implementation of compliance updates, and may compromise patient care and put the hospital at risk for falling out of compliance with the Department of Health (DOH) and Joint Commission.

**Objective:**  
Create a “dashboard,” a user interface with automatically generated updating tables to easily enter and visualize compliance data to compare units’ compliance metrics.

**Goal:**  
To improve POC device maintenance and compliance rates and improve communication of compliance rates between the nursing staff and POC Team. Planned features include color coded representation of compliance percentages organized by floor, real-time updates, and no required manual data compiling.

**Methods:**  
To monitor implementation of the dashboard, a survey was provided to the POCT team of user satisfaction of the dashboard and were asked how much time they estimate they saved through the automated data compiling process.

**Outcome:**  
Survey responses indicate that the creation of the dashboard was effective in aiding the display of compliance rates and decreased the time to prepare compliance rates to regulatory agencies.

## Results

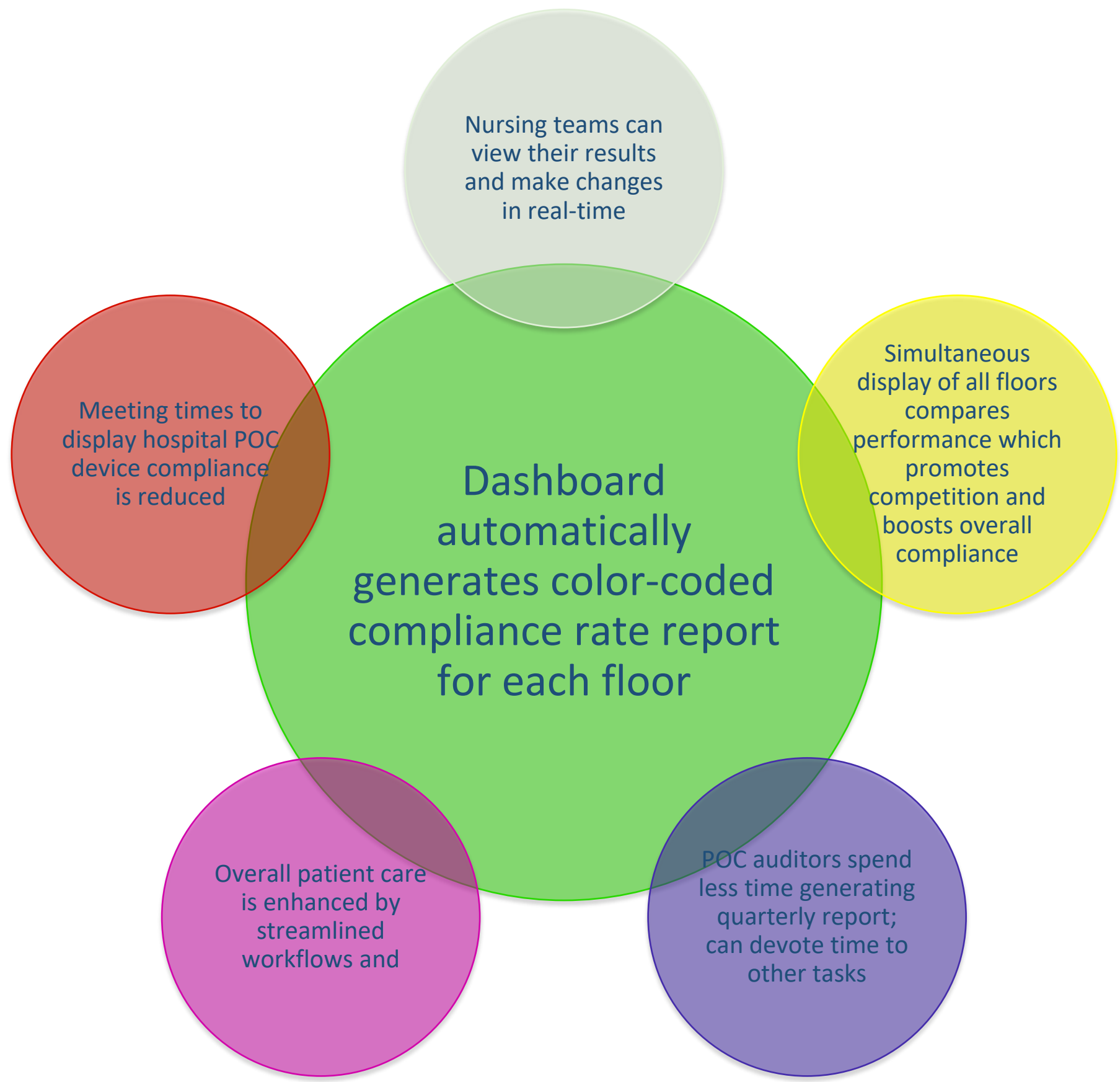


Figure 1: New flow of information following creation of dashboard

Quarter	Unit	Glucose QC Dating	Meter Cleanliness	Dock Cleanliness	Hemaprompt (Within Expiration Date)	Pregnancy (Within Expiration Date)	Clinitek Auto QC Dated	Clinitek Strips	Clinitek Log QC	Clinitek Log Maintenance	Urine QC Dated	Urine Dipsticks Dated	Urine QC Log	iStat total	All Devices % Compliance/Unit
1	1	100%	100%	100%		100%									100%
2	1	100%	100%	100%		100%									100%
3	1	100%	100%	100%		100%									100%
4	1	100%	100%	100%		100%									100%

Quarter	Unit	Glucose QC Dating	Meter Cleanliness	Dock Cleanliness	Hemaprompt (Within Expiration Date)	Pregnancy (Within Expiration Date)	Clinitek Auto QC Dated	Clinitek Strips	Clinitek Log QC	Clinitek Log Maintenance	Urine QC Dated	Urine Dipsticks Dated	Urine QC Log	iStat total	All Devices % Compliance/Unit
1	1	100%	92%	100%	5%										74%
1	2	100%	100%	100%	0%										75%
1	3	100%	100%	100%	0%		100%		100%	100%					88%
1	4	100%	100%	100%			100%	100%	97%	100%					100%
1	5	90%	100%	100%	0%		100%	100%	100%	100%					86%
1	6	100%	100%	100%	100%										100%
1	7	100%	100%	100%	100%										100%
1	8	78%	100%	100%											90%

Figure 2. Dashboard allows color-coded representation of whether a given unit is within acceptable limits for compliance. Modular features allow for filtering of units, quarters, devices. A search function allows caregivers to rapidly access data regarding their unit’s performance.

### Figure 3: POCT Satisfaction Survey Results

Time saving (estimated)	1-2 hours/quarter per auditor
Likelihood of increased job satisfaction	66% “increased” 33% “somewhat increased”

## Discussion and Future Directions

The creation of the dashboard will improve POCT communication with nursing leadership regarding POCT devices compliance rate in each of the nursing units. The dashboard will provide a way for nurses from each unit to compare their compliance rate with compliance rates from other units and display compliance rates in PSHMC’s performance improvement program.

Being one of the larger hospitals in the Providence Healthcare Network, Sacred Heart will pilot the implementation of this dashboard and could provide downsized versions of it to accommodate smaller, rural facilities with their own POCT devices. Overall, we anticipate that the visual representation and ability to compare performance between units will result in substantial increases in compliance rates and improve feedback loops between nurses and the POCT team.

Future projects may include measuring the increase in compliance rates with POCT devices from each of the nurse’s units following the implementation of the dashboard.

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# Evaluating Manual Blood Differential Ordering

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## Abstract

Everyday hundreds of complete blood counts are ordered at Providence Sacred Heart Medical Center (PSHMC), many of which include manual differentials. Manual differentials, while a very useful tool, are more labor intensive and expensive. Research has suggested that automated analyzers can perform differential counts with greater precision and more accurate detection than those performed by manual examination, so many labs are looking to increase the use of automated analyzers for differentials. The PSHMC hematology division recently implemented a new automated analyzer (Sysmex) and it was suggested that physicians might have increased orders of manual differentials in response to a validated but new instrument. We sought to examine manual differential ordering behaviors at our institution to determine the rate of manual differential ordering, whether our institution's criteria would've resulted in a subsequent manual differential, and whether clinicians' ordering behavior changed in response to the new analyzer. CBC orders from May 1<sup>st</sup>, 2018 through December 31<sup>st</sup>, 2019 were examined. From this data we concluded that 7% of differentials ordered were manual counts. The hospital services most likely to order these are the outpatient lab and NICU, ordering 40% of all manual differentials. Only 20% of outpatient manual orders while 71% of NICU orders had flags indicating a manual count would have been suggested by an analyzer. Looking at order patterns pre and post Sysmex implementation, we saw no increase in manual orders to suggest a negative response towards the new analyzer.

# Introduction

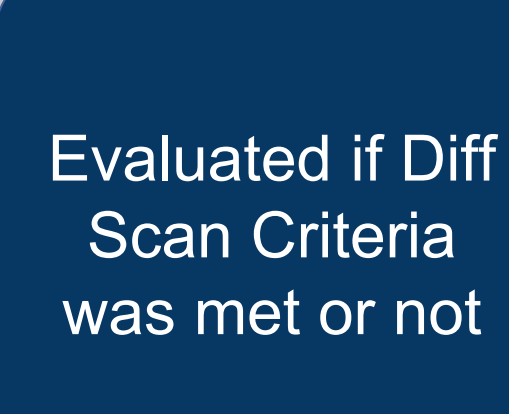
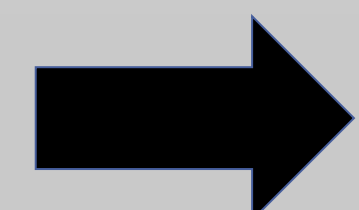
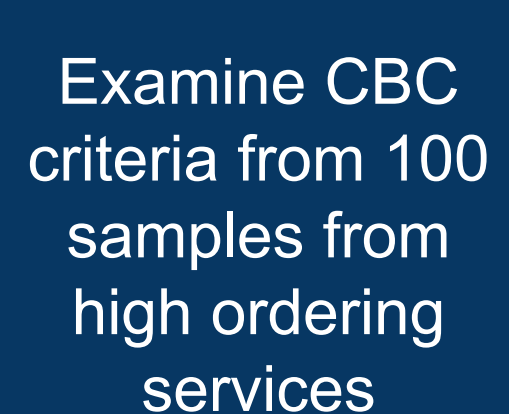
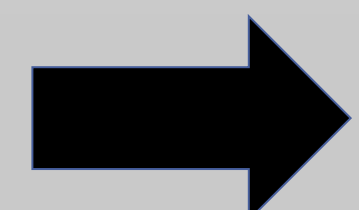
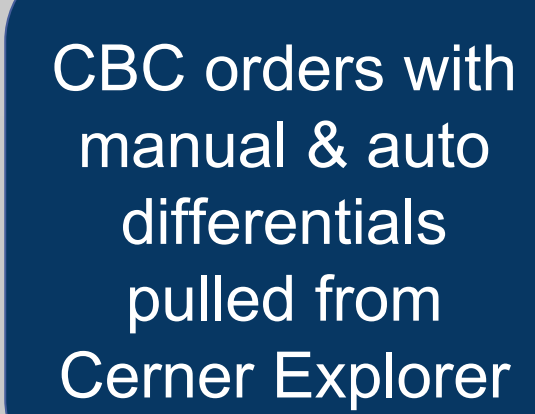
A complete blood count (CBC) determines the relative number and type of blood cells, as well as hemoglobin and hematocrit levels in a patient's blood. A differential (diff) determines the percentage of each type of white blood cell present. Differentials can be performed by an instrument (automated), or by a trained technologist (manual) which are more labor intensive and expensive.

<b>Providence Sacred Heart Medical Center and Children's Hospital Sysmex Diff Scan Criteria</b>		
<b>WBC</b>	< 2.50	> 30.00
<b>RBC</b>		> 7.0
<b>Hgb</b>	< 7.0	
<b>MCV</b>	< 71.1	> 110 .0
<b>MCHC</b>		> 37.5
<b>RDW</b>		> 22.0
<b>PLT</b>	< 100	> 999
<b>NRBC</b>		> 1.0%
<b>NEUT ABS</b>	< 1.00	> 20.00
<b>LYMPH ABS</b>		> 5.00
<b>MONO ABS</b>		> 1.50
<b>EOS ABS</b>		> 2.00
<b>BASO ABS</b>		> 0.50
<b>IG</b>		> 5% or 0.05 #
<b>RETIC</b>		> 30.0% or 0.9999 #

Table 1. Hold differential criteria for Sysmex analyzer. If any of the criteria is met, sample will be flagged for review by technologist.

**AIMS:** Examine rates of ordering manual differentials, how often “reflex to manual differential” criteria was met, and whether clinicians’ ordering changed in response to the new analyzer.

## Methodology & Materials



## Results

CBC	109,230
CBC Auto Diff	164,650
CBC Manual Diff	20,788
<b>Total</b>	<b>294,668</b>

**Table 2. Total number of CBCs ordered at Sacred Heart hospital (5/1/18 - 12/31/19).** The ranking of most to least ordered tests was a CBC w/ auto diff, a CBC, and lastly a CBC w/ manual diff.

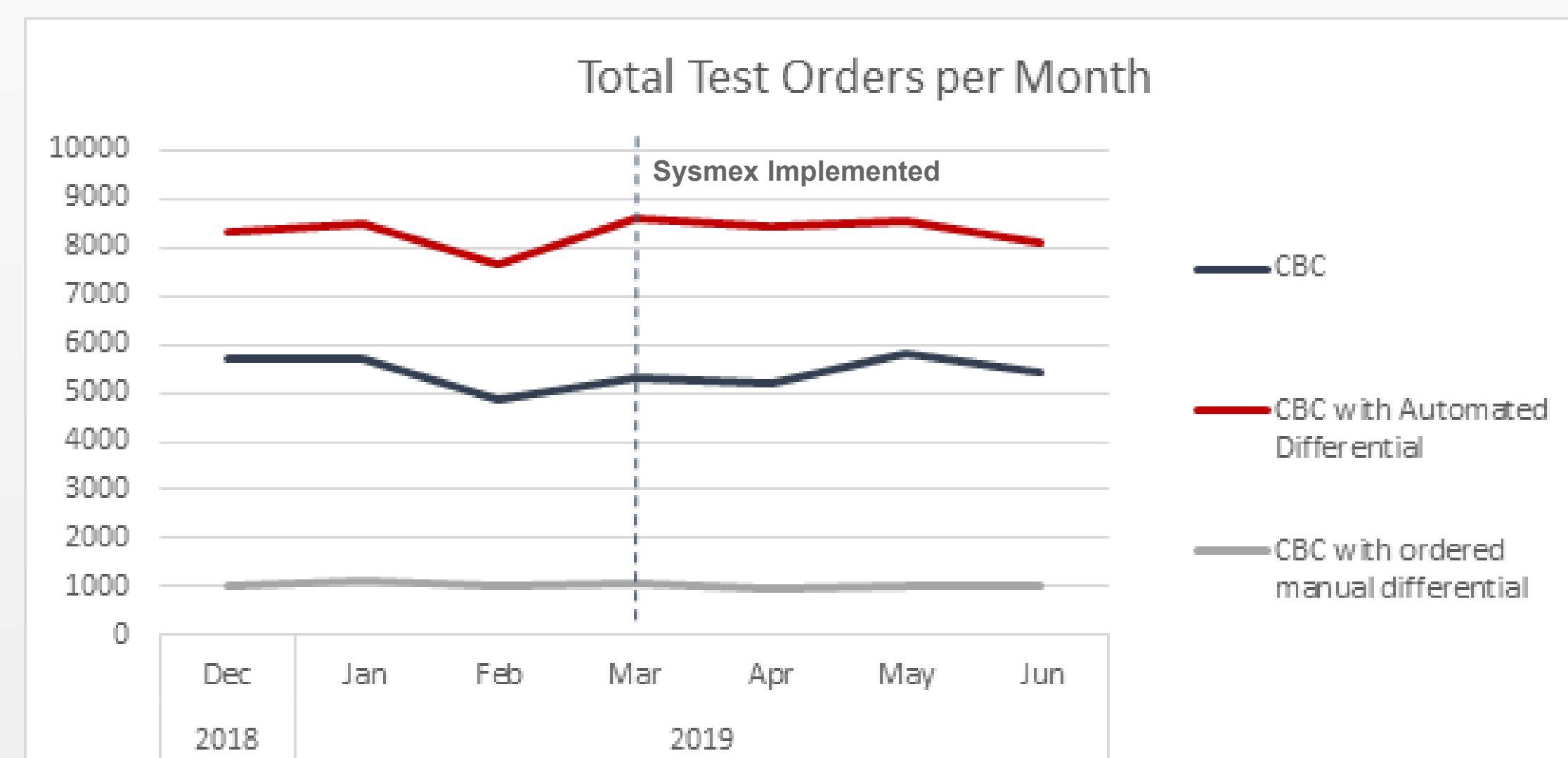


Figure 1. No significant increase in total number of manual diffs ordered was seen after implementation of the Sysmex XN analyzer on 3/19/19, despite hypothesis that it might.

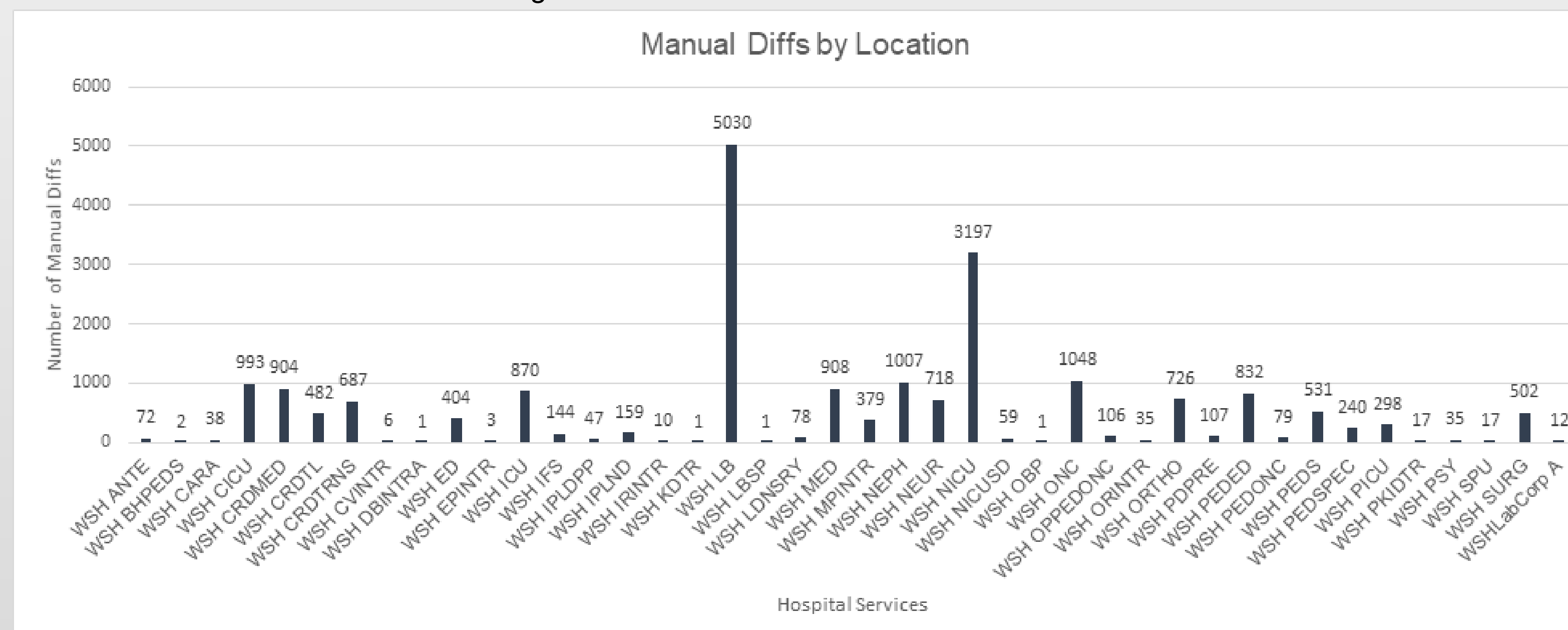


Figure 2. Breakdown of the number of manual differentials ordered by location in Sacred Heart Hospital. **The outpatient lab and NICU areas showed highest order volumes, making up 40% of all manual differentials.**

Distribution of Outpatient Orders	
CBC	4,900
CBC w/ Auto Diff	20,515
<b>CBC w/ Manual Diff</b>	<b>5,030</b>

Table 3. Total number of CBCs ordered in the outpatient unit (5/1/18 - 12/31/19). The ranking of most to least ordered tests was a CBC w/ auto diff, a CBC w/ manual diff, and lastly a CBC.

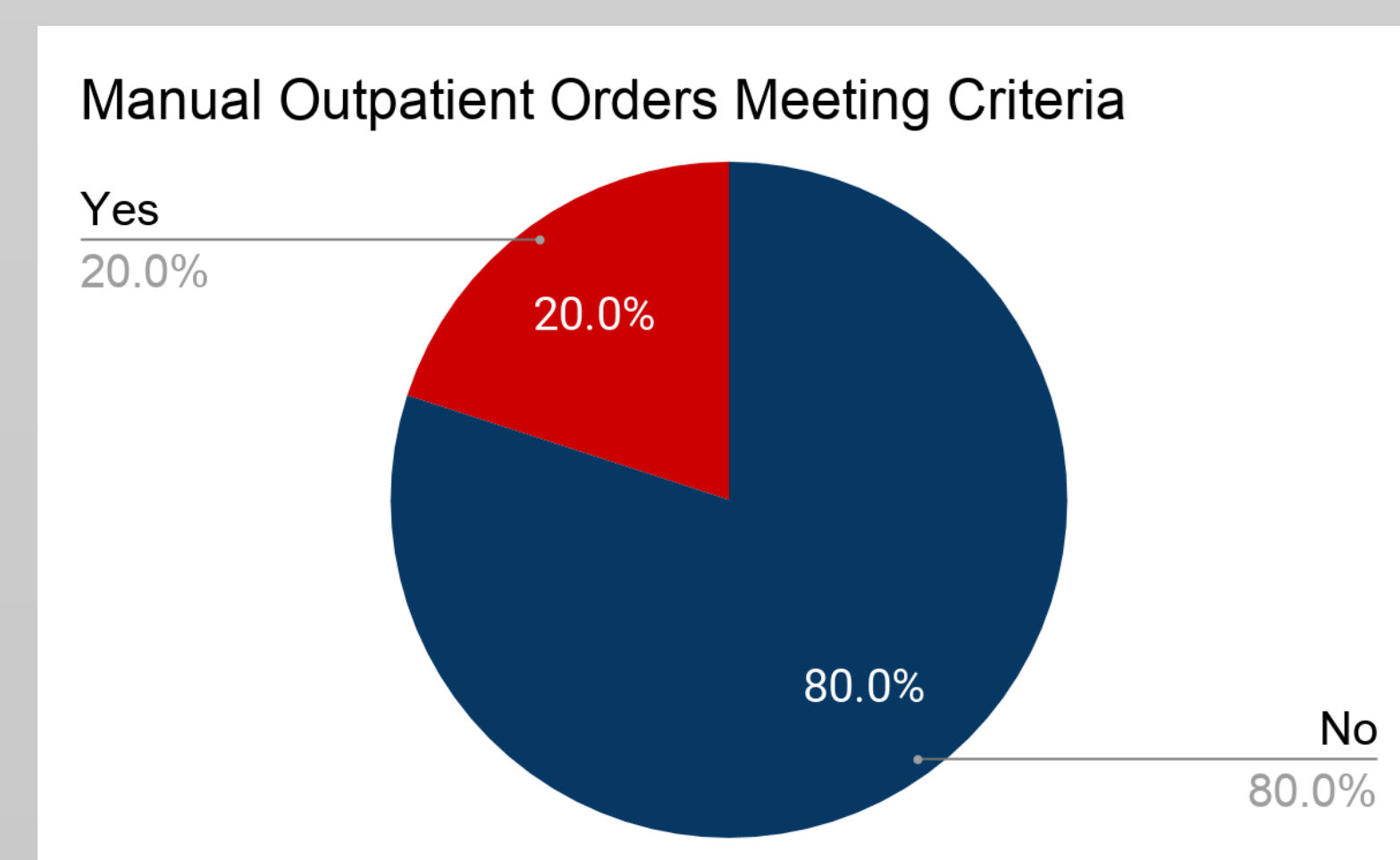


Figure 3. 100 manual differentials' results from the outpatient unit were examined to see if the analyzer would have flagged it for review by a technologist. **20% met the criteria listed in table 1.**

Distribution of NICU Orders	
CBC	22
CBC w/ Auto Diff	1,408
<b>CBC w/ Manual Diff</b>	<b>3,197</b>

Table 4. Total number of CBCs ordered in the NICU unit (5/1/18 - 12/31/19). The ranking of most to least ordered tests was a CBC w/ manual diff, a CBC w/ auto diff, and lastly a CBC.

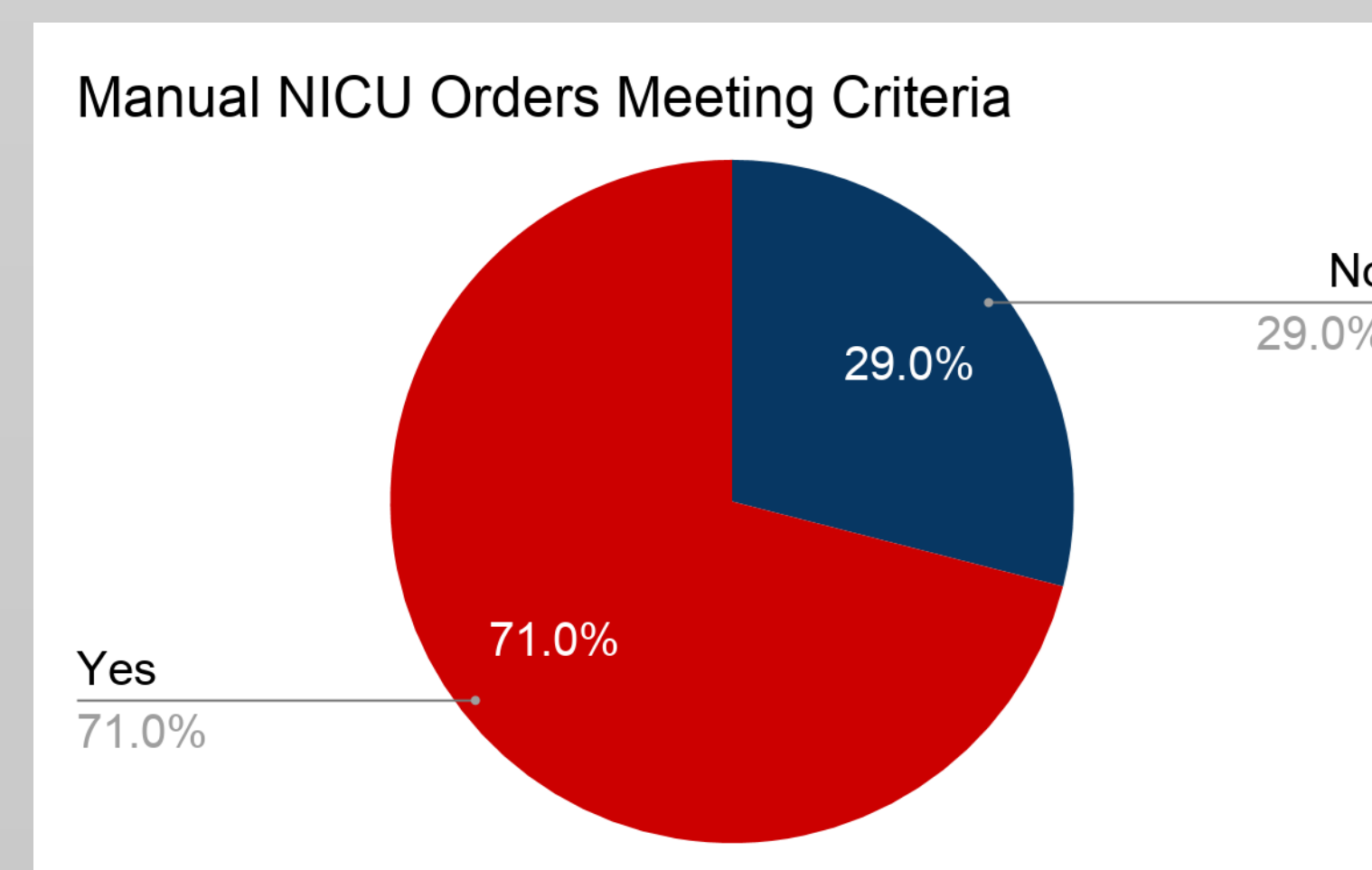


Figure 4. 100 manual differentials' results from the NICU unit were examined to see if the analyzer would have flagged it for review by a technologist. **71% met the criteria listed in table 1.**

## Conclusion

- Our research found that **of the 294,668 CBCs ordered 5/1/18 - 12/31/19, 20,788 (~7%) were ordered as manual differentials (Table 2).**
- It was suggested that an increase in the ordering of manual differentials might have occurred after the implementation of the Sysmex XN analyzer on March 19th, 2019. In comparing the months before and after the Sysmex was validated, **there was no increase in the number of manual differentials ordered due to new CBC instrumentation (Figure 1).**
- We found that 40% of all manual differentials ordered were from two departments, outpatient and NICU (Figure 2).
- Outpatient had the most manual differentials ordered, which only made up ~17% of the total number of CBCs ordered in the department (Table 3).
- Only 20% of the outpatient samples would have been flagged by the Sysmex XN as meeting the manual differential criteria (Figure 3).
- In the NICU, 70% of all CBCs ordered were manual differentials (Table 4). Upon further inspection, we found that **it's current PSHMC protocol to perform a manual differential on all NICU patients**, regardless of what type of differential is ordered by the physician. This explained why the distribution of tests was reversed between the two units.
- Within the NICU department, 71% of orders met criteria (Figure 4).
- **This data suggests that the number of manual differentials ordered in the outpatient setting might not be necessary since many are not meeting manual differential scan criteria. However, the high number of NICU orders that did meet the criteria suggests that PSHMC has good reason for performing manual differentials on all NICU patients.**

## Future Directions

Future directions might include speaking with doctors who are ordering manual differentials from outpatients. In doing so we could not only gain insight into the physician's criteria for manual differential ordering but could potentially lead to further conversations that may influence physicians to reduce the number of manuals ordered and save technologist's time. Another possibility would be to explore if there's a generational difference among physicians who order manual differentials; is the bulk of orders coming from an older or younger population and are there any decreases or upticks in orders when physicians retire or enter the field from residency.

## Acknowledgements

We would like to thank our mentor, Julieanna Thomas in the hematology department, for all of her guidance and mentorship throughout this project. We would also like to thank Dr. Davis in the microbiology department for his continuing support.

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# Development of a Point of Care Dashboard

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## Introduction and Objective:

Collecting laboratory compliance data is cumbersome and time intensive. This results in 1) wasted employee hours and 2) slow or out of date reporting of compliance data. More rapid compliance awareness will ultimately result in a more efficient lab and a better standard of care for our patients. The objective of this project is to reduce the amount of time required for data collection and reporting by creating a centralized dashboard.

## Solution:

Reduce the amount of time required for data collection and reporting by creating a centralized dashboard.

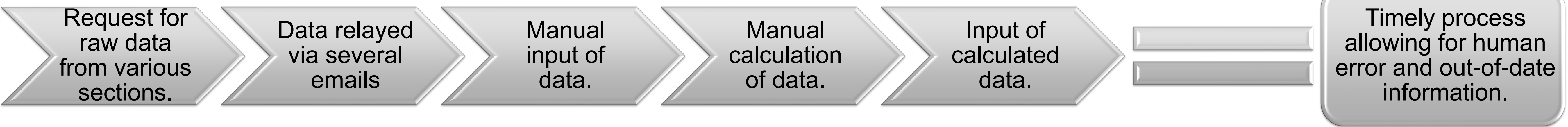
## Approach:

- Create a streamlined dashboard featuring:
  - Direct data entry by departments of the clinical laboratory (instead of compliance officers)
  - Compliance information that is calculated and updated immediately, reducing human error.
  - Color coded indicators to allow for easy identification of compliant or non-compliant items and quarterly trends.

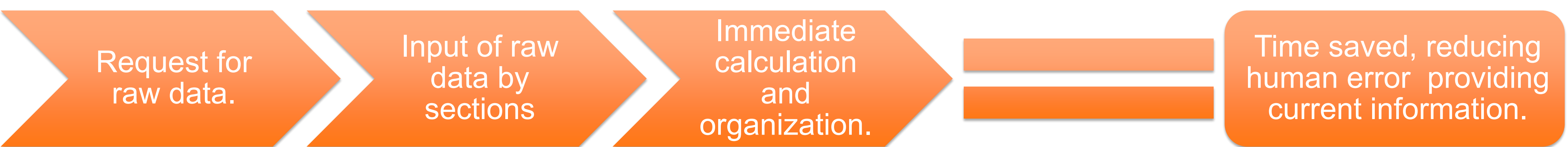
Trending		Goal	Trending		Goal	Q1	Q4	Q3
0.00 Hospital specimens	0	0	0.07	0.09	0.1	0.07	0.09	0.1
Specimens called to caregiver	95%	95%	99.7%	99.3%	99.7%	99.7%	99.3%	99.7%
Specimens Look for trends	3	3	1.7	1.9	2.3	1.7	1.9	2.3
Corrected Reports/10,000	3%	3%	3.6%	3.0%	2.9%	3.6%	3.0%	2.9%
Specimens in ED (nurse collect specimens)	3%	3%	1.3%	1.5%	1.3%	1.3%	1.5%	1.3%
Specimens phlebotomist drawn specimens	95%	95%	99.2%	98.8%	98.6%	99.2%	98.8%	98.6%
Specimens Survey Clinical SHMC (ytd)	0.22	0.22	0.43	0.44	0.48	0.43	0.44	0.48
Specimens (L) - Hospital specimens PER 1000	2.4%	2.4%	2.0%	1.60%	1.1%	2.0%	1.60%	1.1%
Specimens DOH - unsatisfactory specimens	8.7%	8.7%	8.7%	8.1%	7.3%	8.7%	8.1%	7.3%
Specimens - forms with demographic errors	88.3%	88.3%	87.0%	93.7%	96.2%	87.0%	93.7%	96.2%
Specimens On Time Transit (< 72 hours)	3	3	0.01	0.07	0.1	0.01	0.07	0.1
Specimens failures -- Lost Specimens per 10,000	15.0%	15.0%	16.5%	17.1%	17.1%	15.0%	16.5%	17.1%
Specimens unscheduled P1 and P2 <b>excluding ED</b>	look for trends	look for trends	15.0%	16.5%	17.1%	15.0%	16.5%	17.1%
Specimen Transport Time (HF to SH)								

Quarter 3	Quarter 4	Department	January	February
0	0	Total Transactions		
		Specimen labeling errors Hospital (unlabeled and mislabeled - all)		
		Total Lab Cases: from Staci Bays' report (x 2.8 specs/lab case)		
		Month 1	Month 2	
		Source	Lab error	Non-lab error
0	0	QA / Quantros		
		Specimen ID errors Hospital (wrong patient) Note: Subset of Mislabeled Specimens		
		Month 1	Month 2	
		Source	Lab error	Non-lab error
0	0	QA / Quantros		
		Cases		
		Wrong Site for Tissue Biopsies		
		Month 1	Month 2	
		Lab error	Non-lab error	
0	0			
		Critical Values Audit		
		Month 1	Month 2	
0	0	Audited	# Compliant	
0	0			
0	0	Total		
		Corrected Reports		
		Source	Month 1	Month 2
0	0	Corrected report forms		
0	0	Cytopathology (Patty's report)		
0	0	Histopathology (LIS CoPath report)		
0	0	Total		

## Original Workflow:



## Updated Workflow:

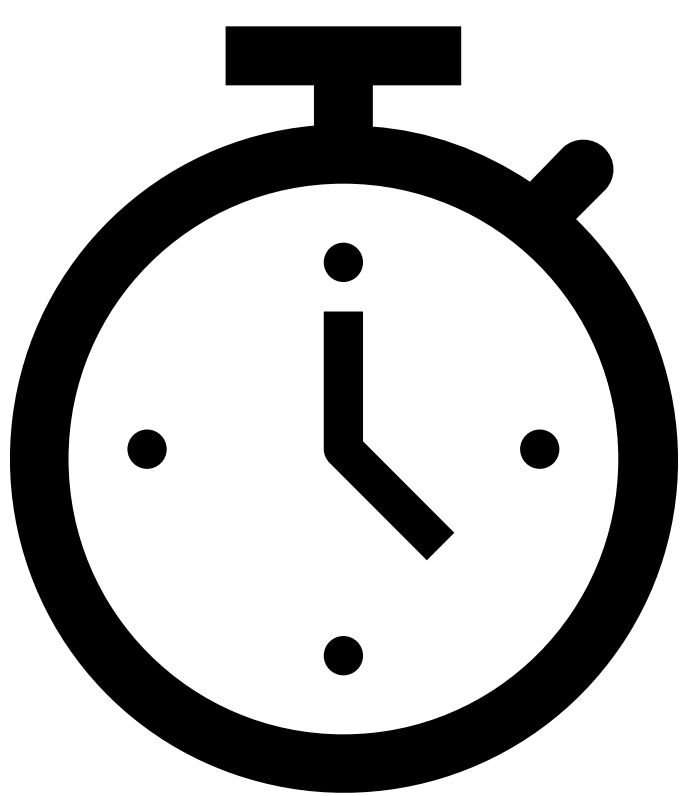


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## What are we tracking?

- Turn around time of specimen processing including STAT as well as routine lab tests.
- Patient satisfaction with specimen collection experience.
- Overall lab proficiency with certifying agency (CAP)
- Reporting of critical lab results to provider
- Specimen contamination, errors, and more...



Time required for workflow reduced from approximately two weeks to less than a day.

## Conclusion and Discussion:

An often-repeated sentiment is that about 70% of medical decisions are influenced by lab results. Though there is no way to quantitate the utilization of lab results alone in terms of diagnosis and treatment, the importance of lab findings are a critical part of patient outcome.<sup>2</sup>

There is a strong correlation between effective dashboards that provide immediate access to information and improved patient outcomes.<sup>1</sup> When utilized correctly dashboards can be used as a tool to provide busy managers and workers with a visual overview of workplace performance. A dashboard can be used as a visual tool that displays the most relevant information important to a specific area, allowing for swift corrective action as well as reducing the amount of time relaying information in meetings and memos.<sup>4</sup> In addition to time saved, an effective dashboard can also prevent error. Evidence supports a connection between information overload and medical errors, dashboards can relay pertinent information in a concise and easy to understand visual manner, reducing cognitive load and resulting in fewer errors.<sup>3</sup>

Creating an effective dashboard will result in better tracking of lab compliance, as well as providing improved ease of use and reducing time to compile and convert raw data from several weeks to nearly instantaneous. Our goal is to ensure that the quality of lab results, through compliance awareness, are kept in line with the core values of Providence and our commitment to compassionate, safe and reliable practices of care for all.

## Acknowledgements:

A special thank you to Tawny Arensmeyer, Laurianne Mullinax and Dr. Richard Davis for their support and guidance.



# The Case for Implementation of Sputum Rejection Criteria

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## Introduction

Expectorated sputum is the most common specimen collected when a lower respiratory tract infection is suspected.<sup>1</sup> However, sputum specimens are difficult to collect and as a result, secretions primarily from the mouth and throat are collected instead. Poor quality specimens are indicated by the presence of many squamous epithelial cells (SECs) and few infiltrating neutrophils (PMNs) as observed in a preliminary Gram stain.<sup>2</sup>

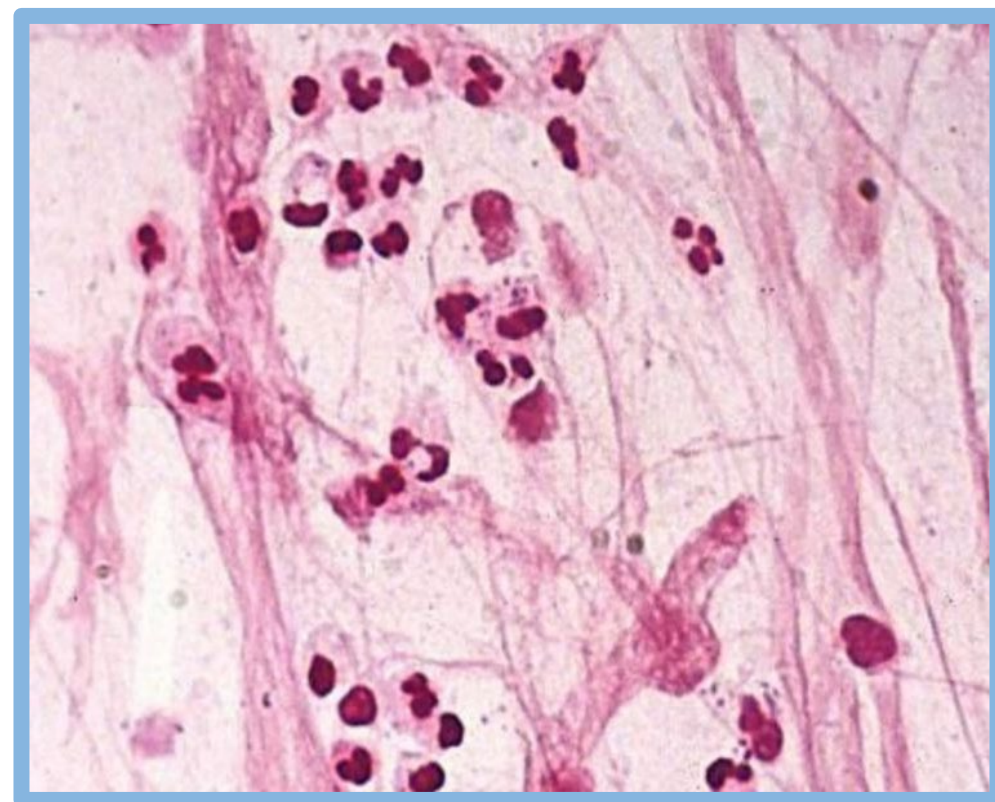


Figure 1 : Polymorphonuclear leukocytes (PMNs) on sputum sample Gram stain.<sup>5</sup>

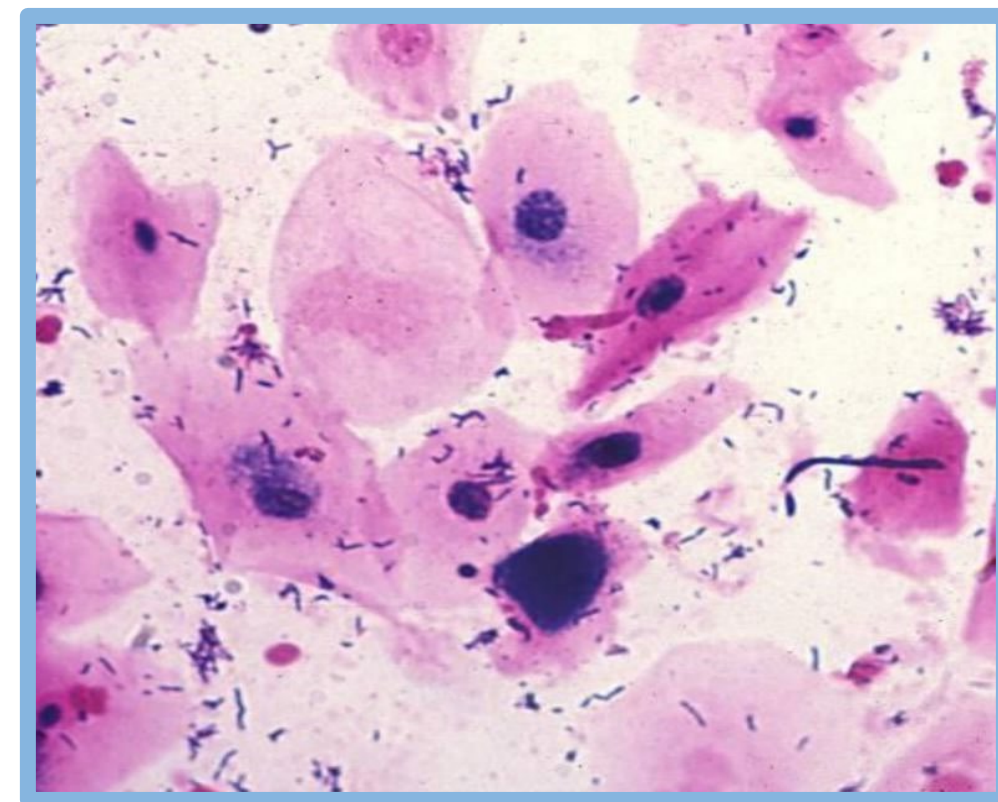


Figure 2 : Squamous epithelial cells on Gram stain.<sup>5</sup>

Many microbiology laboratories have rejection criteria based on these indicators. A scoring system (Q score) is used to assess specimen quality and to determine how much culture workup should be done. A Q0 rating is the lowest quality and would be rejected for culture because it likely contains contaminating oral flora. Currently, this criteria is not used at Providence Sacred Heart Medical Center (PSHMC) and all specimens are processed, however they frequently do not result in identification of relevant pathogens. Low-quality specimens are instead reported with a comment recommending that the clinician recollect the specimen. We investigated how the implementation of an automatic sputum rejection criteria would benefit PSHMC by examining the rate of submission and extent of workup done on low-quality specimens. It is believed that automatic quality rejection criteria would result in better quality lab diagnostics provided to clinicians, circumvention of improper diagnosis and treatment, and savings by better allocating efforts from technologists.<sup>3</sup>

## Methodology

Technologist-reported Gram stain observations were collected for the number of PMNs and SECs seen per low power field (lpf). Positive values assigned to PMNs and negative values assigned to SECs were then added, resulting in an overall Q score of either 0, 1, 2, or 3 (see table 1).

We evaluated two potential rejection criteria for low quality specimens

- #1: any specimen that was an overall Q0
- #2: only specimens with >25 SECs

Factors evaluated:

- Percentage of low-quality specimens for each month under both criteria
- Work-up performed other than standard Gram stain and initial culture
- Whether any organism was identified and tested for susceptibility
- If specimens were recollected based on the suggestion of the laboratory
- Which of the locations and medical services submitted the most samples

PMNs	SECs(-)				
	0	-1	-2	-3	
	0	3	0	0	0
	1	3	0	0	0
	2	3	1	0	0
	3	3	2	1	0

0 = no cells  
1 = 1 - 9 cells/lpf  
2 = 10 - 24 cells/lpf  
3 = > 24 cells/lpf

Figure 3 : Q score chart used to guide rejection of sputum samples.<sup>4</sup>

## Sputum Laboratory Timeline



Figure 4 : Timeline of typical sputum laboratory workup

## Results

When evaluating overall Q0 specimens, they were 30%, 23% and 20% of total sputum specimens for the months of February, June, and October, respectively. The less stringent second criteria only considers specimens with <25 SECs to account for immunocompromised patients who don't have high numbers of PMNs. This second criteria resulted in 23%, 19%, and 14% of total specimens considered rejectable for the same three months. Of the Q0 specimens, 66.4% had additional work done beyond Gram stain and initial culture, 28.9% had an organism identified, 6.3% were tested for susceptibility, and only 9.4% were recollected. The location with the most low-quality specimens submitted was the WSH Pulmonology department.

### % of Specimens with > 25 SECs

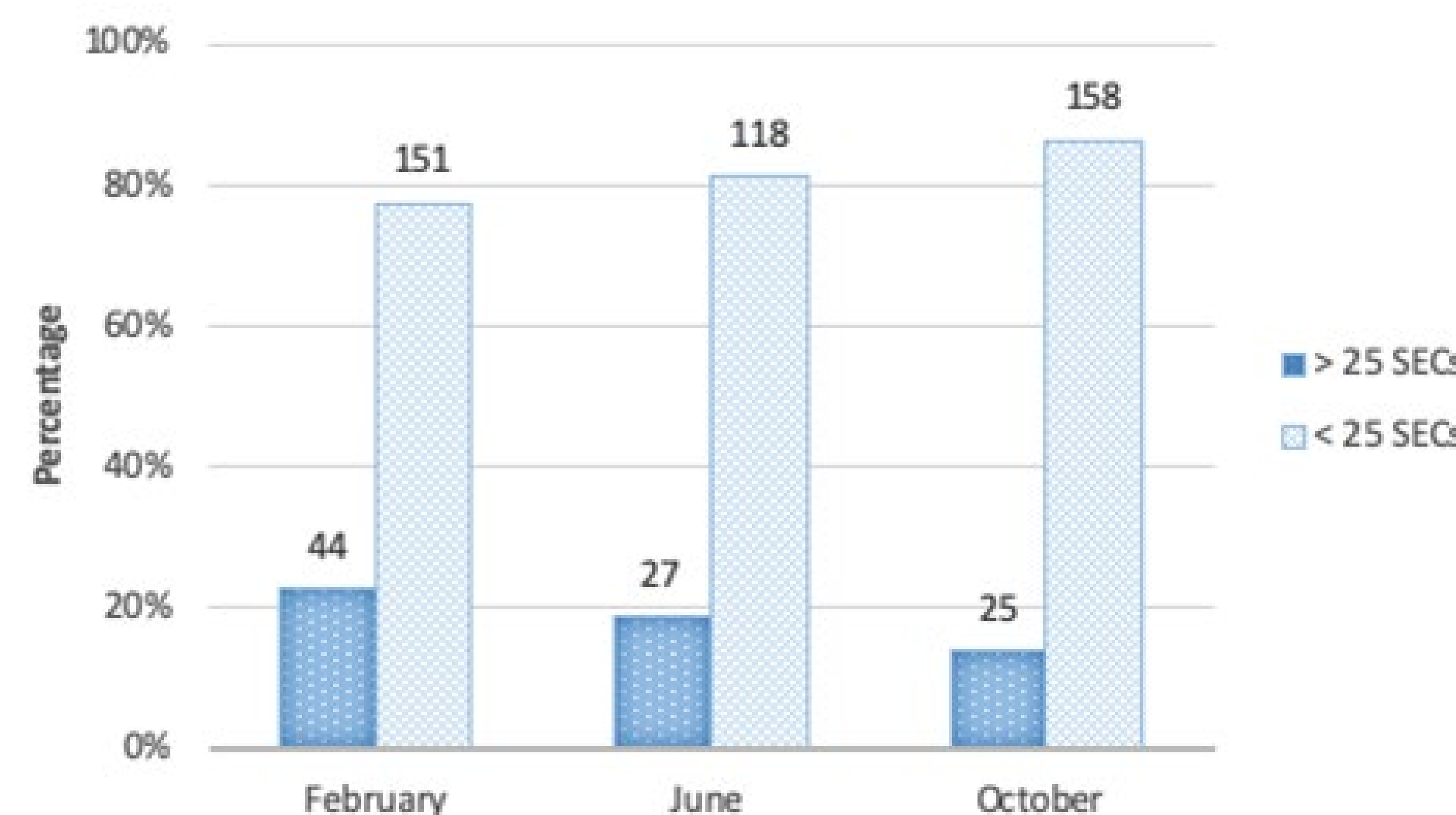


Figure 5 : Graphed percentage of specimens with >25 SEC/lpf

### % of Q0 Specimens

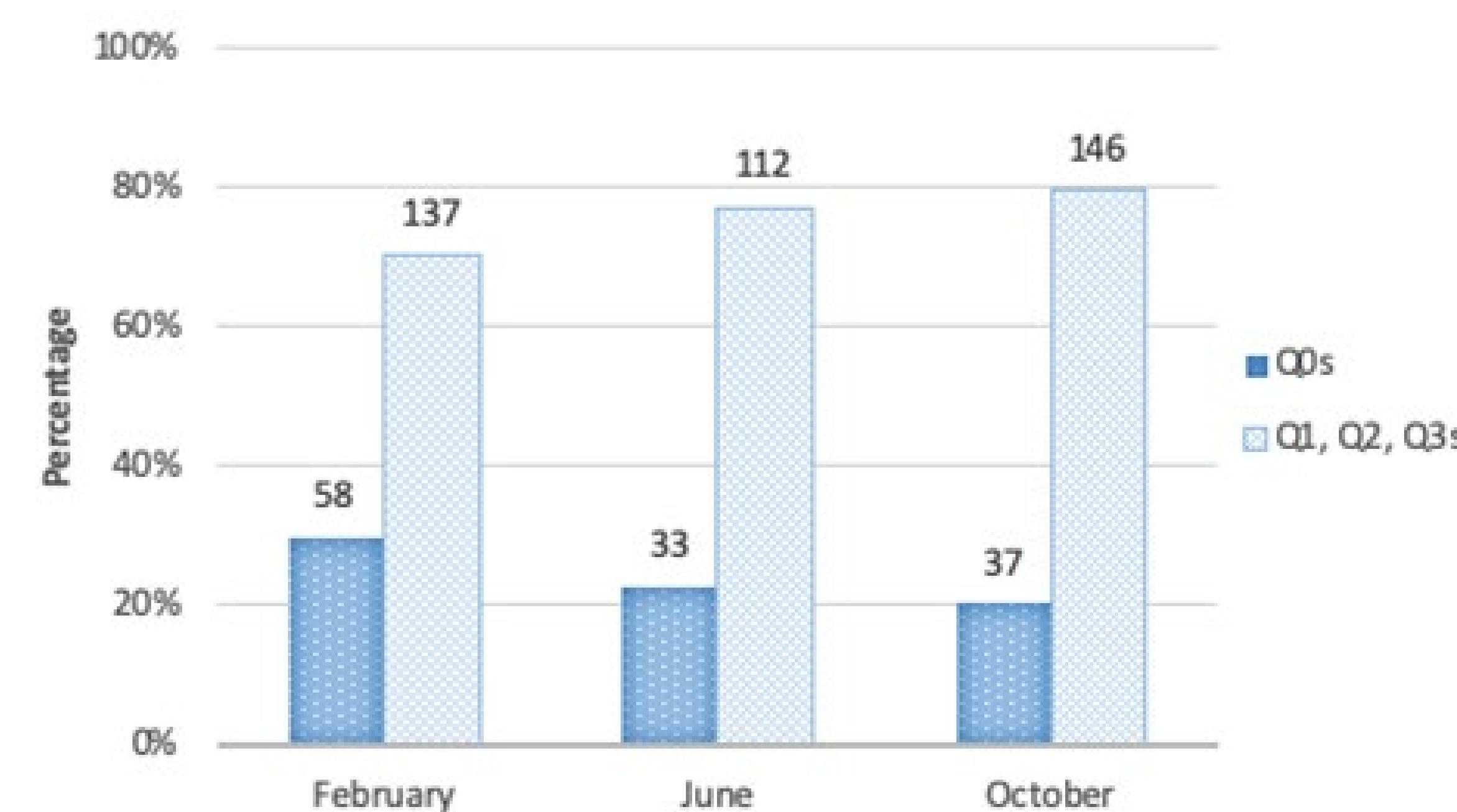


Figure 6 : Graphed percentage of specimens that had an overall Q0 score

## Results

Work-up beyond Gram stain	66.4%
Organism identified	28.9%
Tested for susceptibility	6.3%
Recollected	9.4%

Figure 7 : Percentage of low-quality samples with lab action performed beyond Gram stain.

WSH Pulmonology	18.0%
WHF Medical Oncology	10.2%
WHF Advanced Care	7.0%
WSH Cardiac Medicine	7.0%
WSH Cardiac Transplant	6.3%

Figure 8 : The percentage of low-quality specimens provided by each location at Sacred Heart (WSH) or Holy Family (WHF).

## Conclusion

This study found that 24% of the sputum samples submitted to the microbiology laboratory at PSHMC were low enough quality specimens to warrant rejection. With an estimated 70% of downstream medical decisions based on laboratory results and pathology, it's imperative that good laboratory stewardship and best practices are implemented.<sup>6</sup> This is especially true in the microbiology laboratory. Routine sputum specimens are one of the most common patient samples submitted for culture. Unfortunately, these specimens have a high propensity to be contaminated with normal oropharyngeal flora and contamination would not provide an accurate clinical picture of the patient's lower respiratory tract.<sup>7</sup>

One of the ways to detect contamination is the observation of squamous epithelial cells present in the initial Gram stain of the specimen. Diagnostic information obtained from analysis of these low-quality specimens can be potentially misleading and result in unnecessary antimicrobial therapy or even prolonged hospital stays.<sup>8</sup>

As responsible stewards of the clinical laboratory, it is the recommendation of these authors that a sputum rejection criteria is implemented. These higher standards would require samples to have less than 25 squamous epithelial cells per low power field or otherwise be rejected for culture, and further testing with a recollect recommended to produce a sample of higher quality. By not performing these work-ups on suboptimal sputum specimens, both valuable materials and technologist time can be reallocated to specimens that are more diagnostically applicable.<sup>9</sup>

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# Appropriateness of Clinician Pre-Transfusion Laboratory Testing Orders for Blood Products at a Level One Trauma Center

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## Introduction & Approach

The supply of blood products in a hospital or blood bank is dependent on donors within the community. Product management is critical in maintaining a working supply of blood products. Blood products are precious and lifesaving medical interventions, and transfusions are inherently risky for the patient and can lead to potentially life-threatening reactions. The Joint Commission has named blood transfusions as one of the most overused therapeutic approaches.<sup>3</sup> Pre-transfusion testing and complying with hospital guidelines helps evaluate the necessity of transfusion. This in turn helps maintain blood supply and protect the health of patients.

**Objective:** In order to determine the rate of appropriate pre-transfusion testing being performed at the trauma center, we evaluated pre-transfusion testing orders for patients receiving blood products for Q1, Q2, and Q3 of 2019. We analyzed data by blood product given, administering department, ordering provider, the type of testing performed if testing was performed at all, and the test values. This information could then be used to improve patient care and safety at the hospital.

## Methodology

Our data were collected from Epic HIS. Our dataset included all transfusion events occurring in Q1, Q2, and Q3 of 2019.

**Analysis:** Data were organized based on product given: packed Red Blood Cells (PRBCs), Plasma, Platelets, and Cryoprecipitate. We examined overall testing trends as well as those from individual departments.

**Appropriate Pre-transfusion Testing:** We determined the percentage of products receiving appropriate primary and alternative pre-transfusion testing.

- **“Primary” Testing:** Hemoglobin (Hgb) for PRBCs, platelet count for Platelets, INR for Plasma, and fibrinogen for Cryoprecipitate.
- **“Alternative” Testing:** Hematocrit (Hct) for PRBCs, Pt/PTT for Plasma, and PT/PTT or INR for Cryoprecipitate.

## Conclusions & Discussion

- Per 1000 patient days, Red Blood Cells were transfused more frequently than Plasma and Platelets.
- Cryoprecipitates were transfused the least often.
- Frequencies of transfusion events seemed to increase from the first quarter to the third quarter in 2019.
- The majority of blood products had appropriate pre-transfusion testing.
- The blood product most often transfused without appropriate testing was Plasma.
- Plasma transfusions have the most events with values outside of transfusion indication, when analyzed by test ranges for appropriate pre-transfusion testing.
- The data did not reveal that any specialty in particular was prescribing and administering blood product transfusions without appropriate testing.

**Future Directions:** Use analysis spreadsheets to examine ongoing blood product testing. We can also use these results to address blood product supply management at PSHMC and educate PSHMC staff on standard protocol for pre-transfusion testing.

## Results

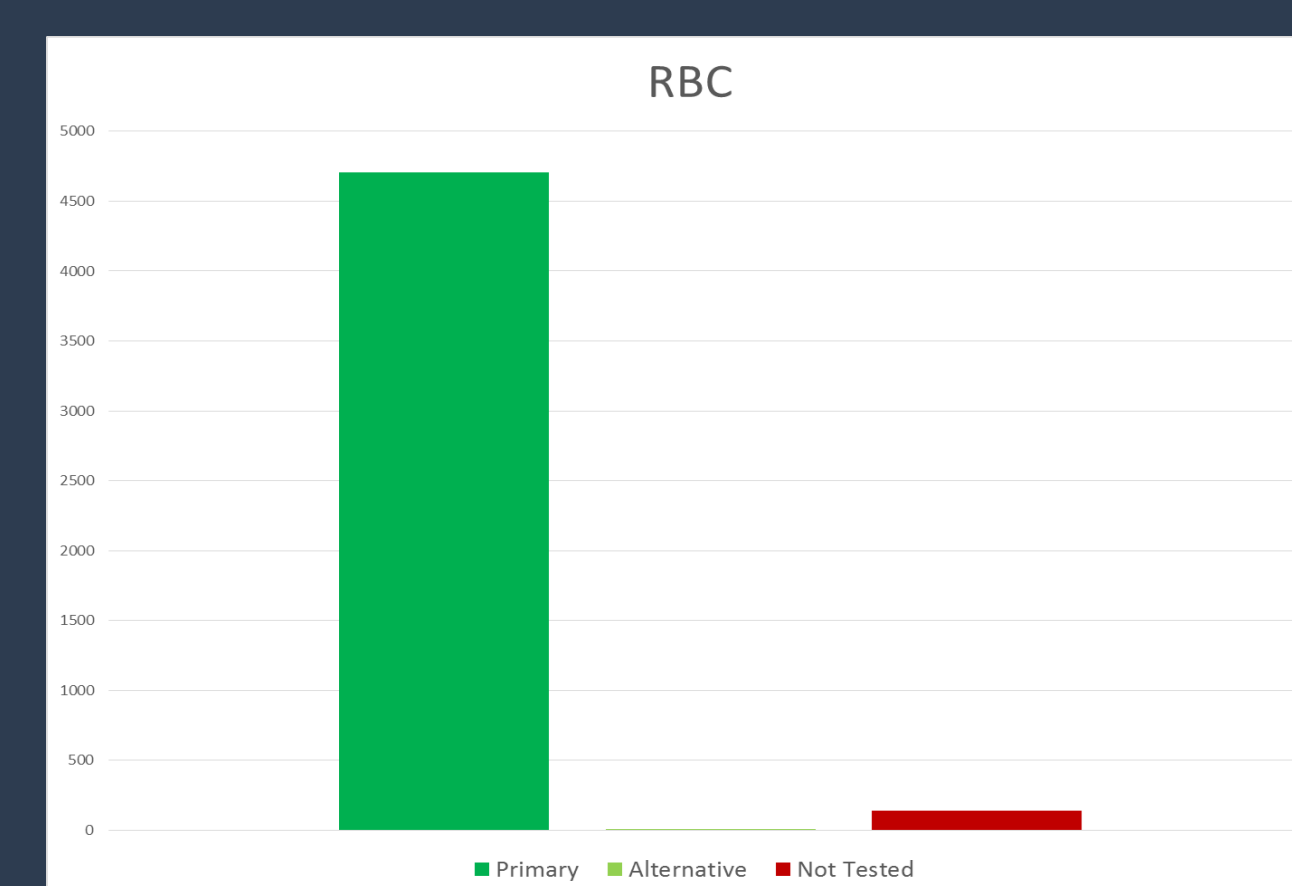


Fig. 1A Number of Primary, Alternate and Not Tested done on RBCs done Q1-Q3 2019

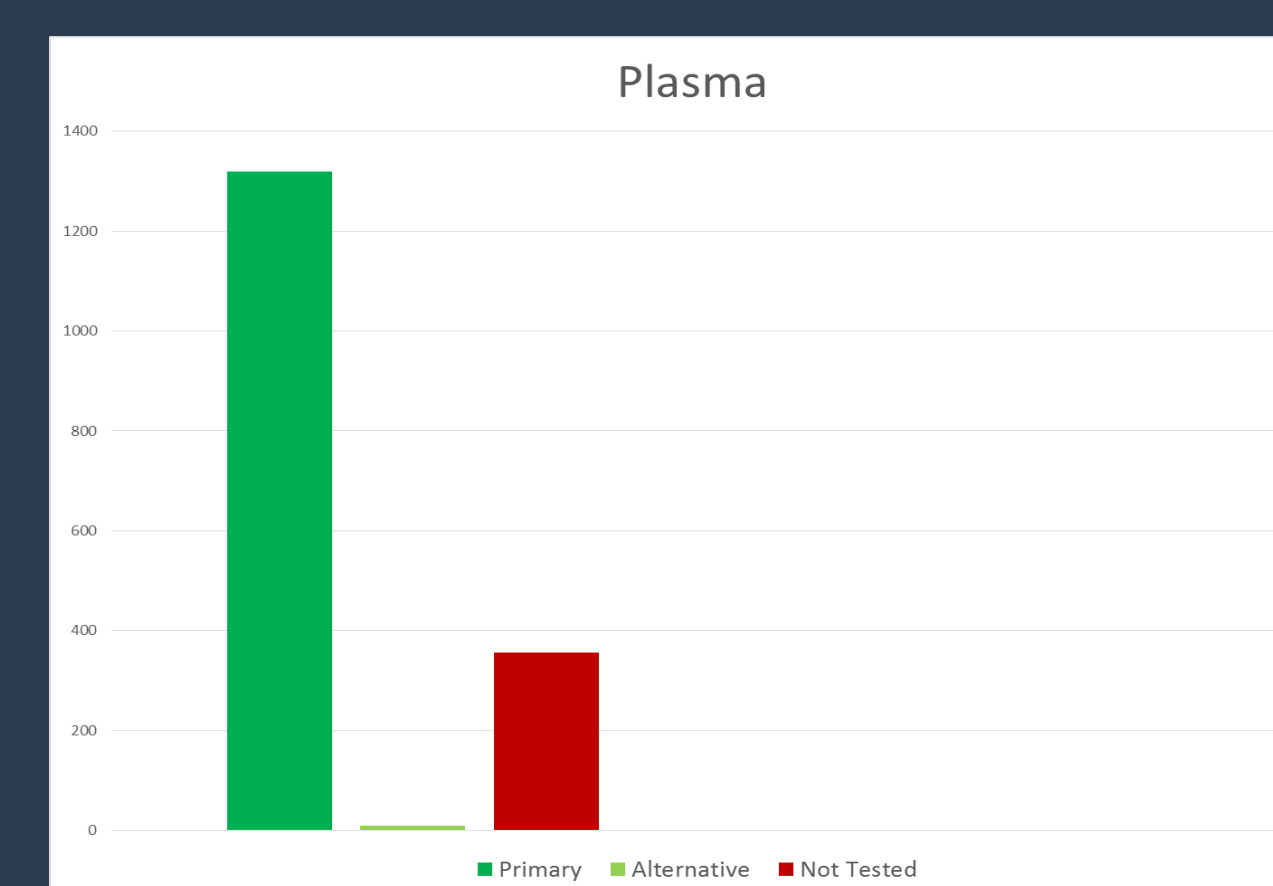


Fig. 1B Number of Primary, Alternate and Not Tested done on Plasma done Q1-Q3 2019

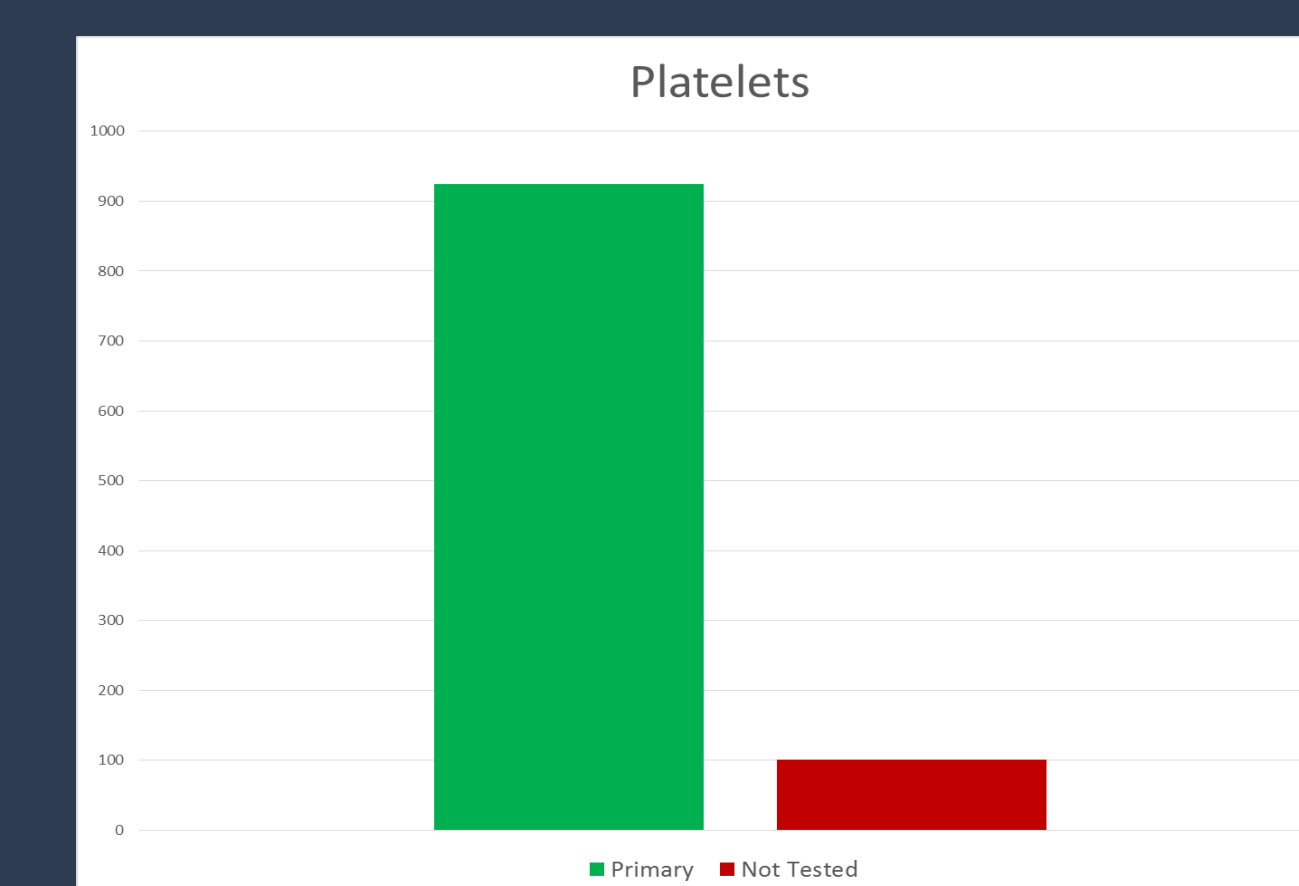


Fig. 1C Number of Primary and Not Tested done on Platelets done Q1-Q3 2019

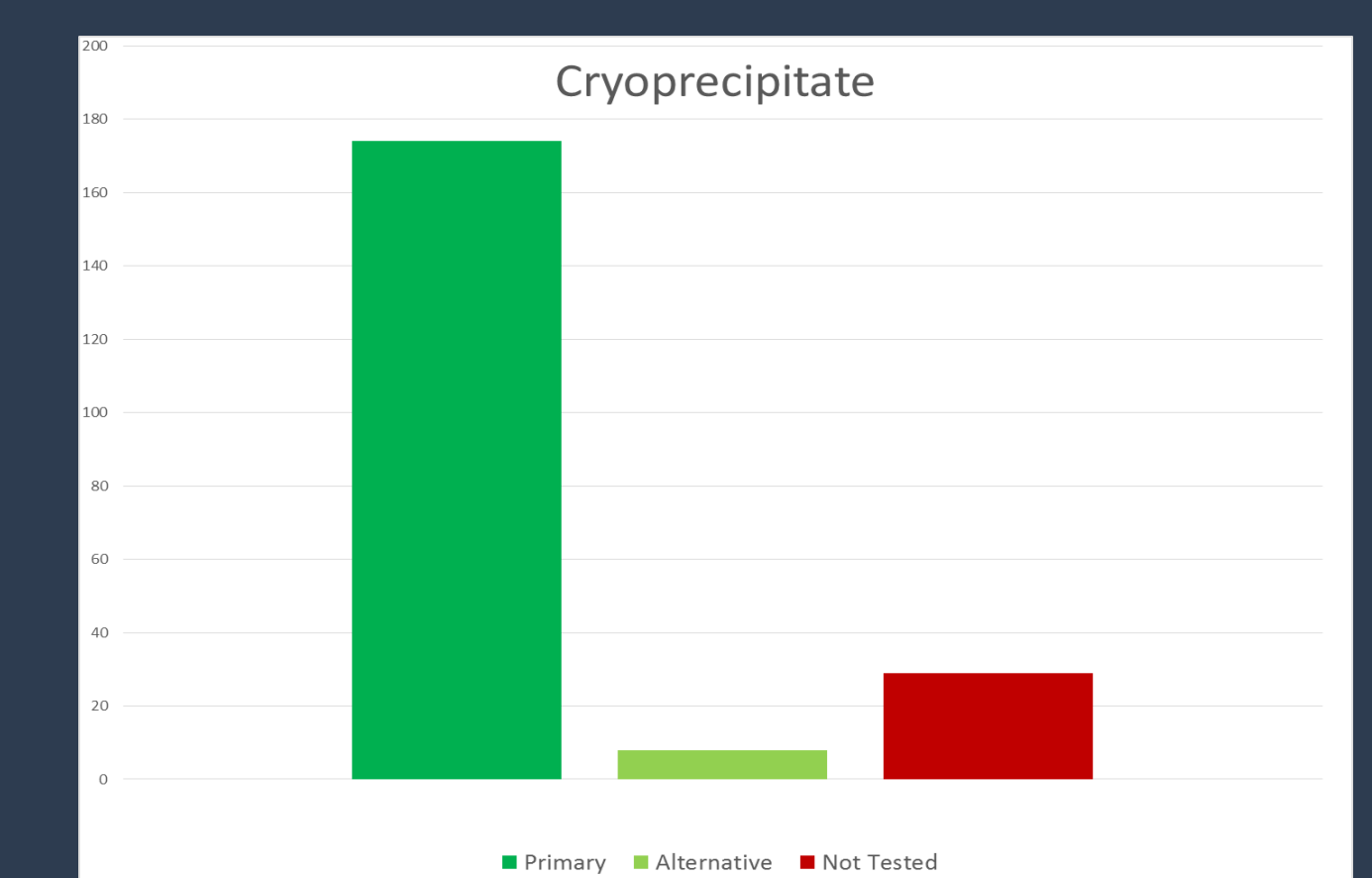


Fig. 1D Number of Primary, Alternate and Not Tested done on Cryoprecipitate done Q1-Q3 2019

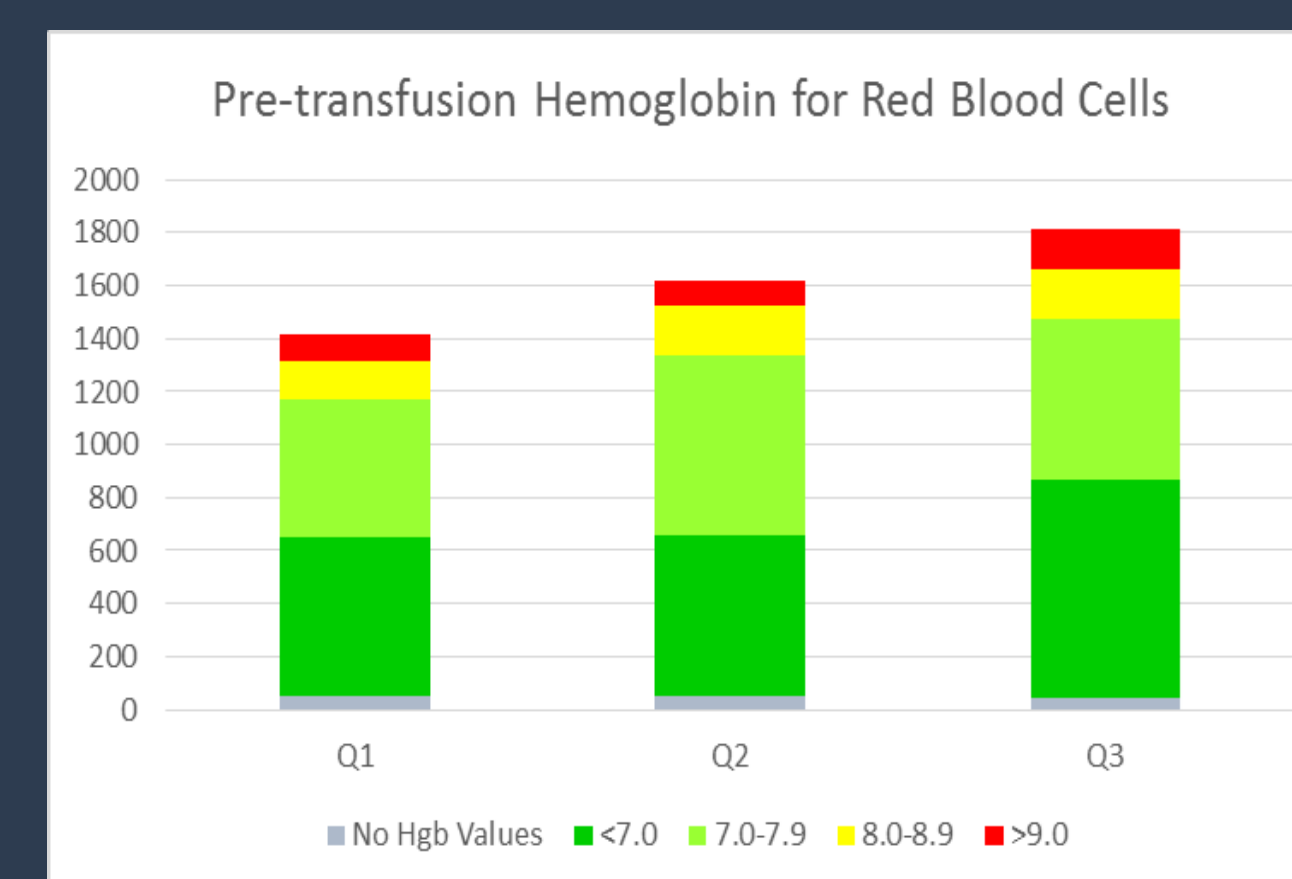


Fig. 2A Testing ranges for Hemoglobin Q1-Q3 2019

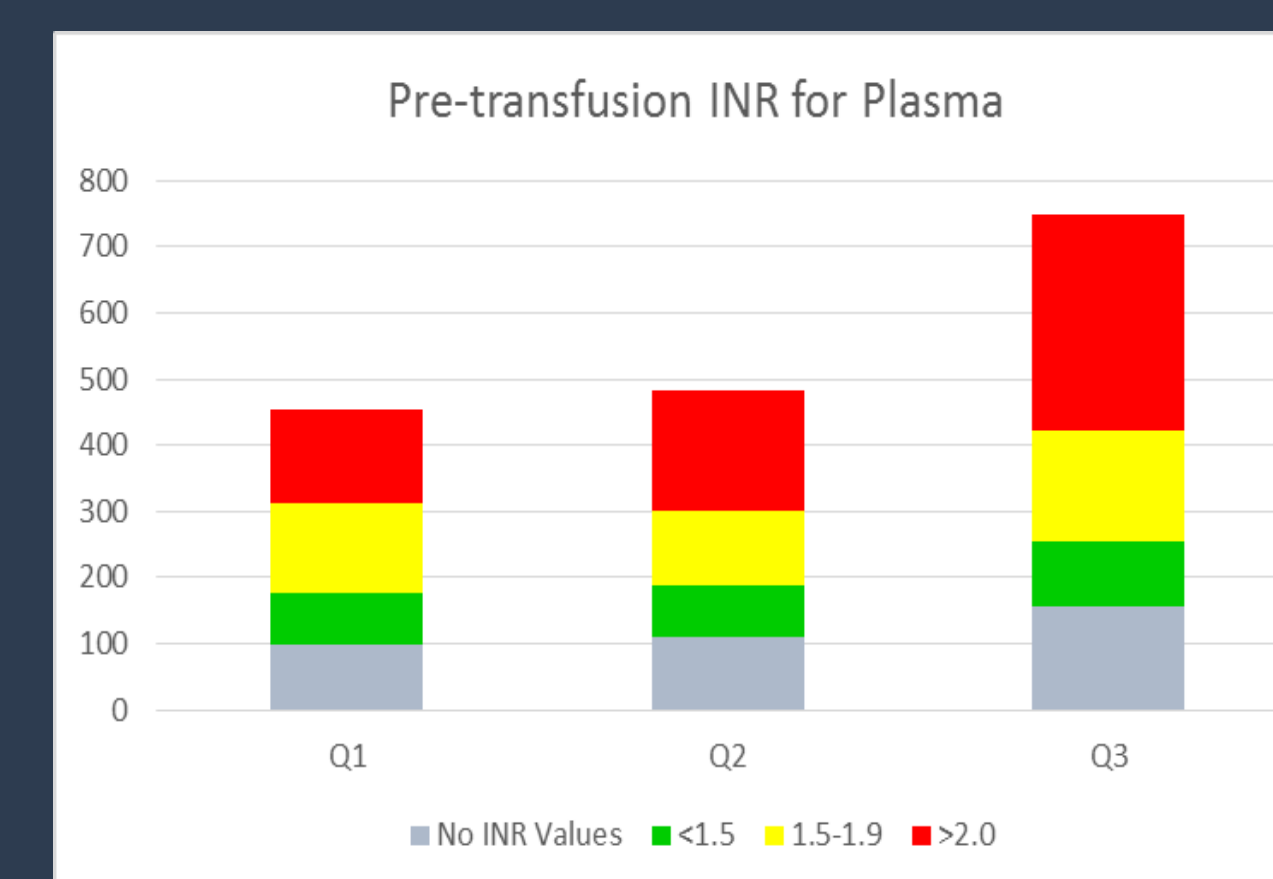


Fig. 2B Testing ranges for INR Q1-Q3 2019

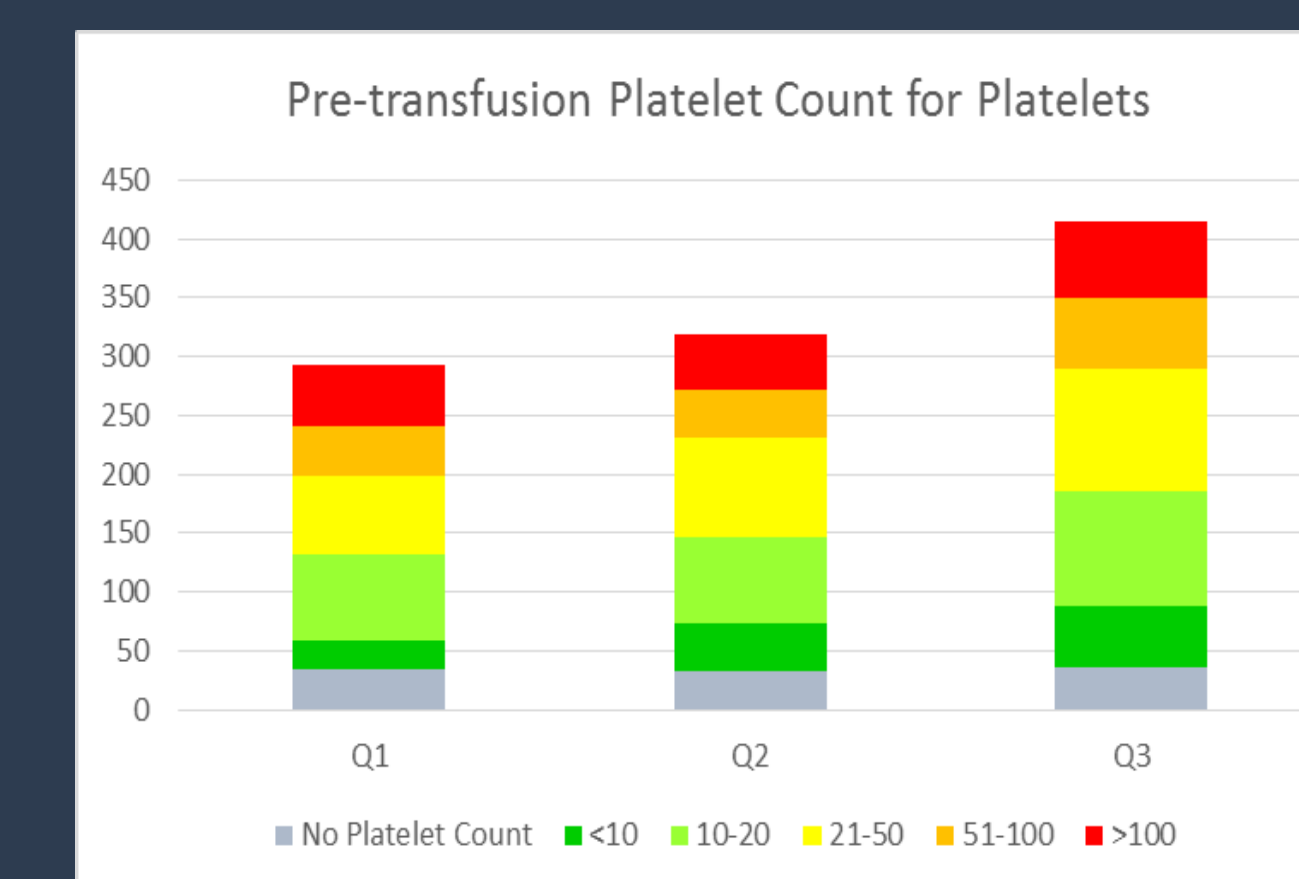


Fig. 2C Testing ranges for Platelet Count Q1-Q3 2019

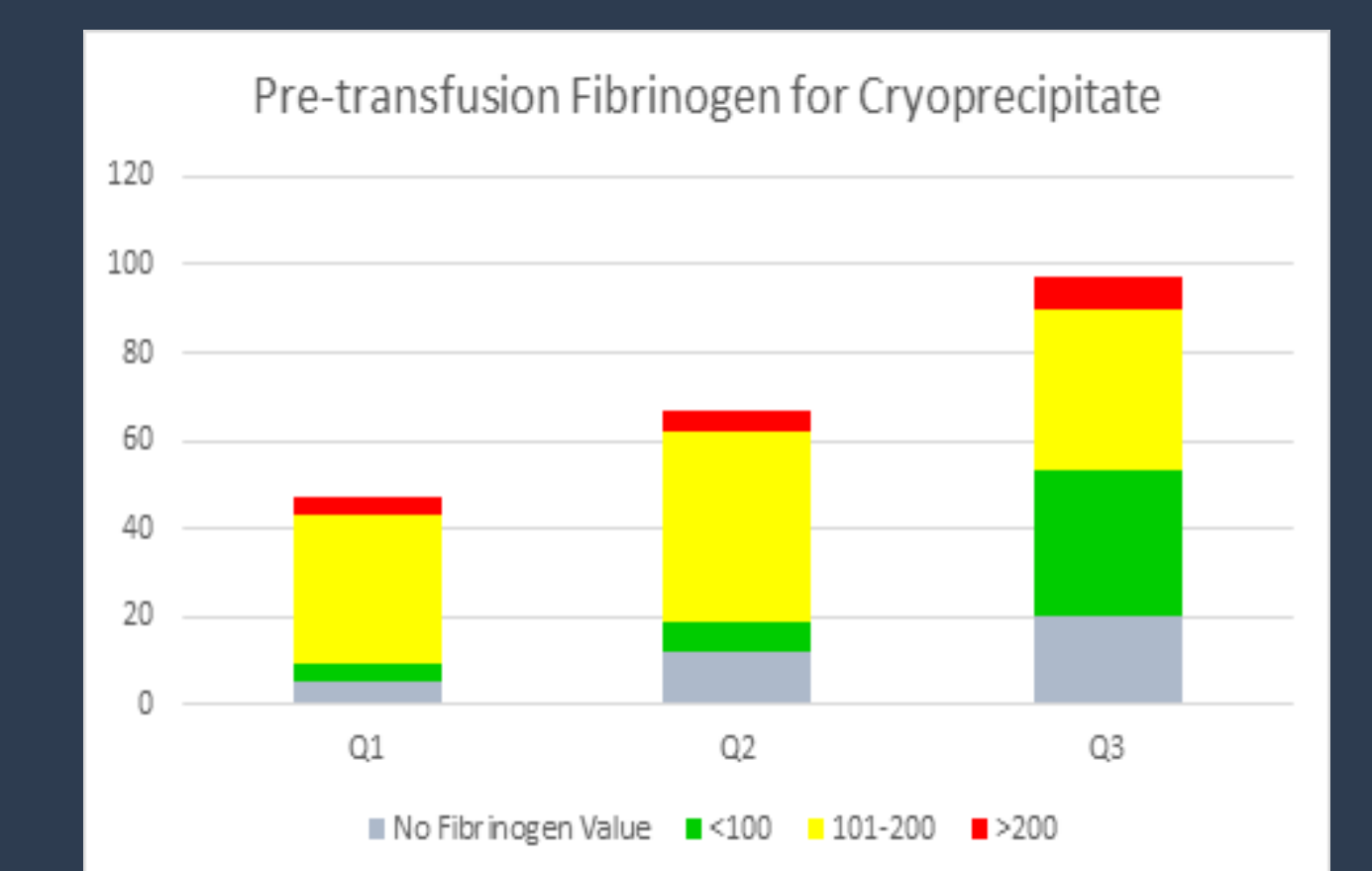


Fig. 2D Testing ranges for Cryoprecipitate Q1-Q3 2019

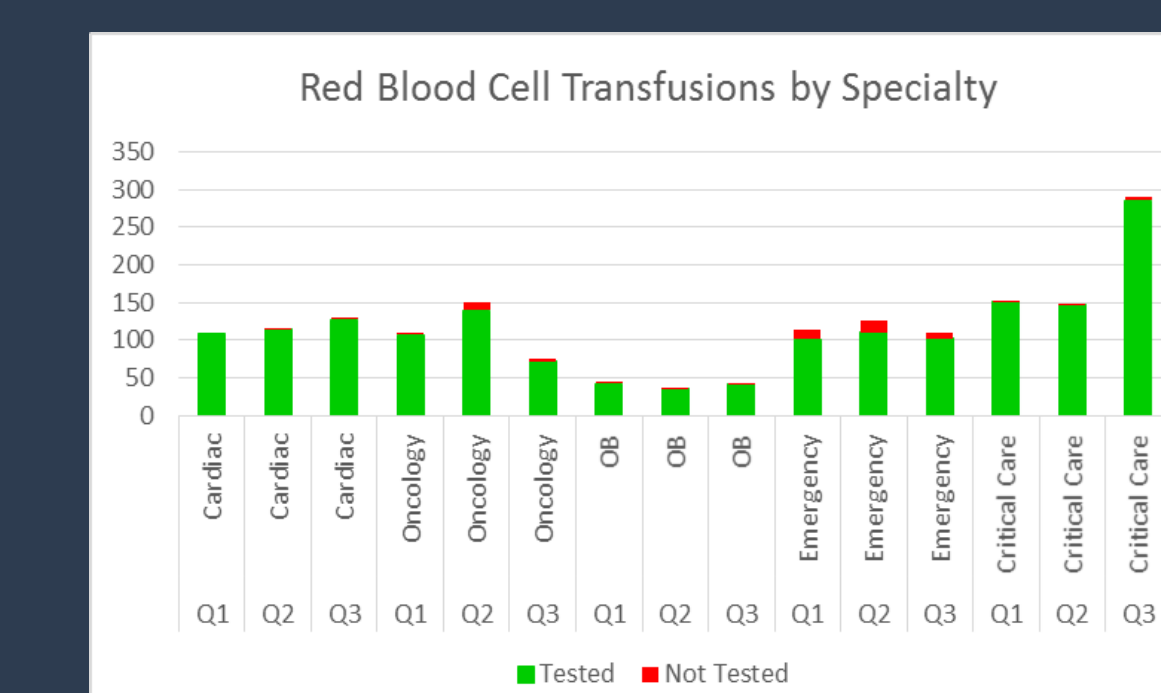


Fig. 3A Number of instances where Testing was done for RBCs by specialty Q1-Q3 2019

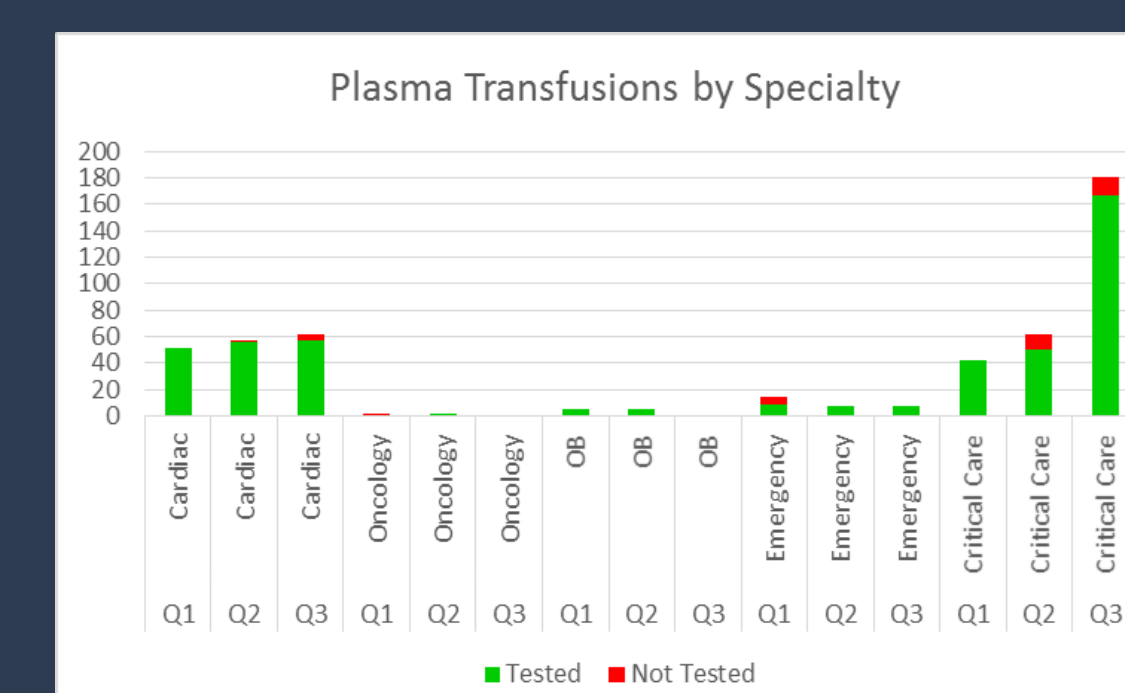


Fig. 3B Number of instances where testing was done for Plasma by specialty Q1-Q3 2019

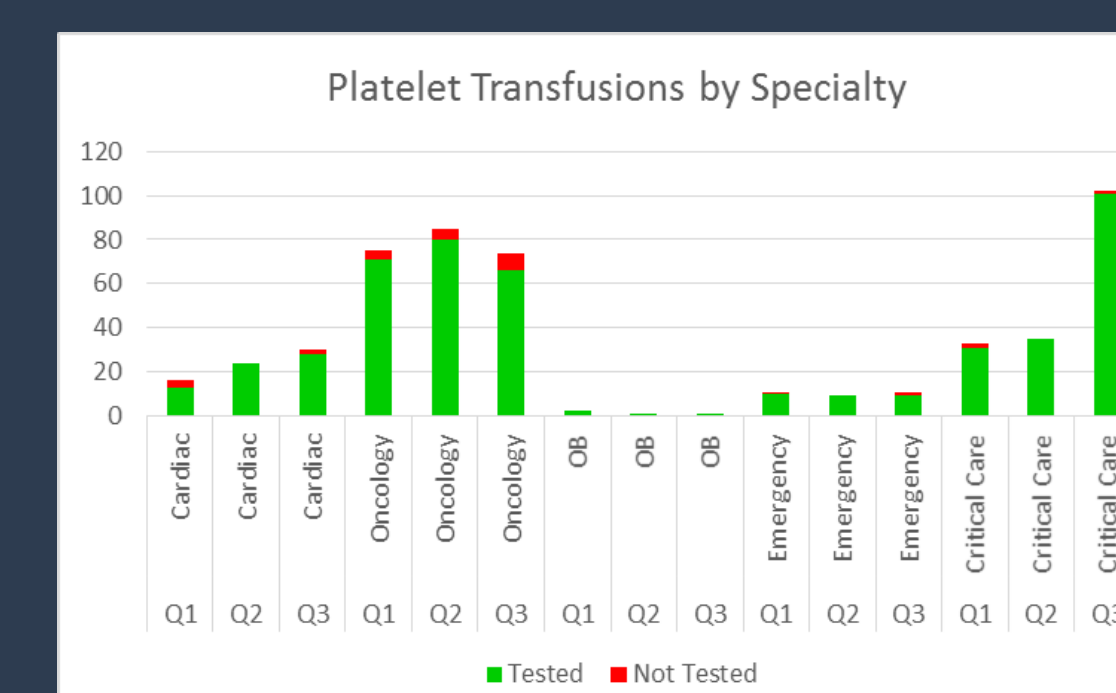


Fig. 3C Number of instances where testing was done for Platelets by specialty Q1-Q3 2019

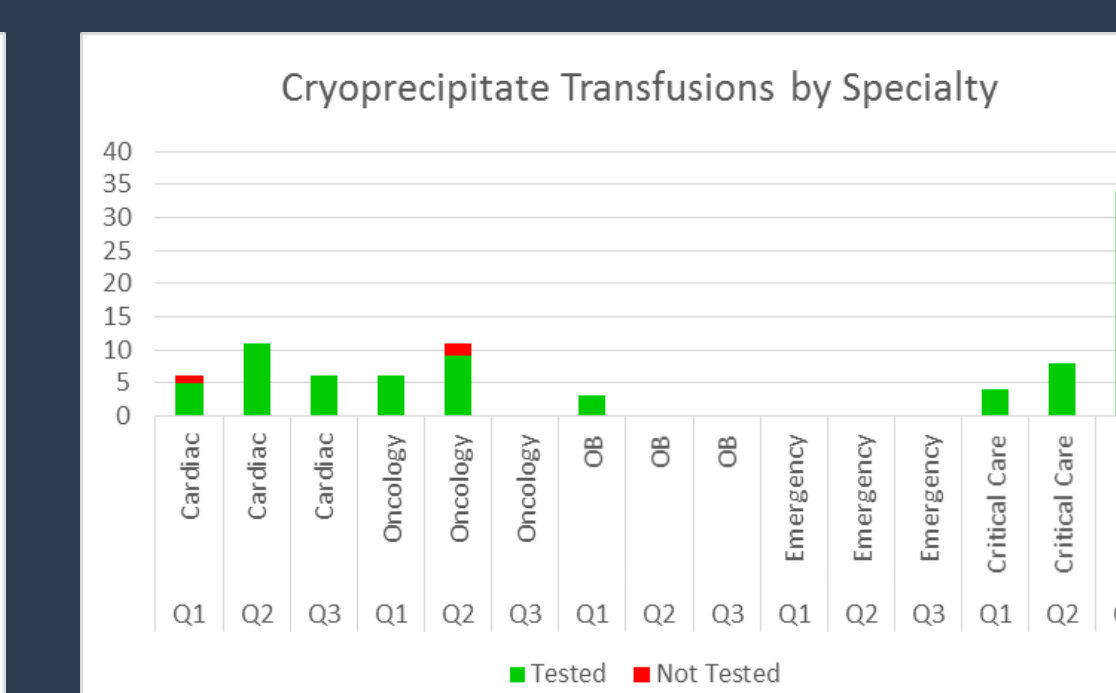


Fig. 3D Number of instances where testing was done for Cryoprecipitate by specialty Q1-Q3 2019

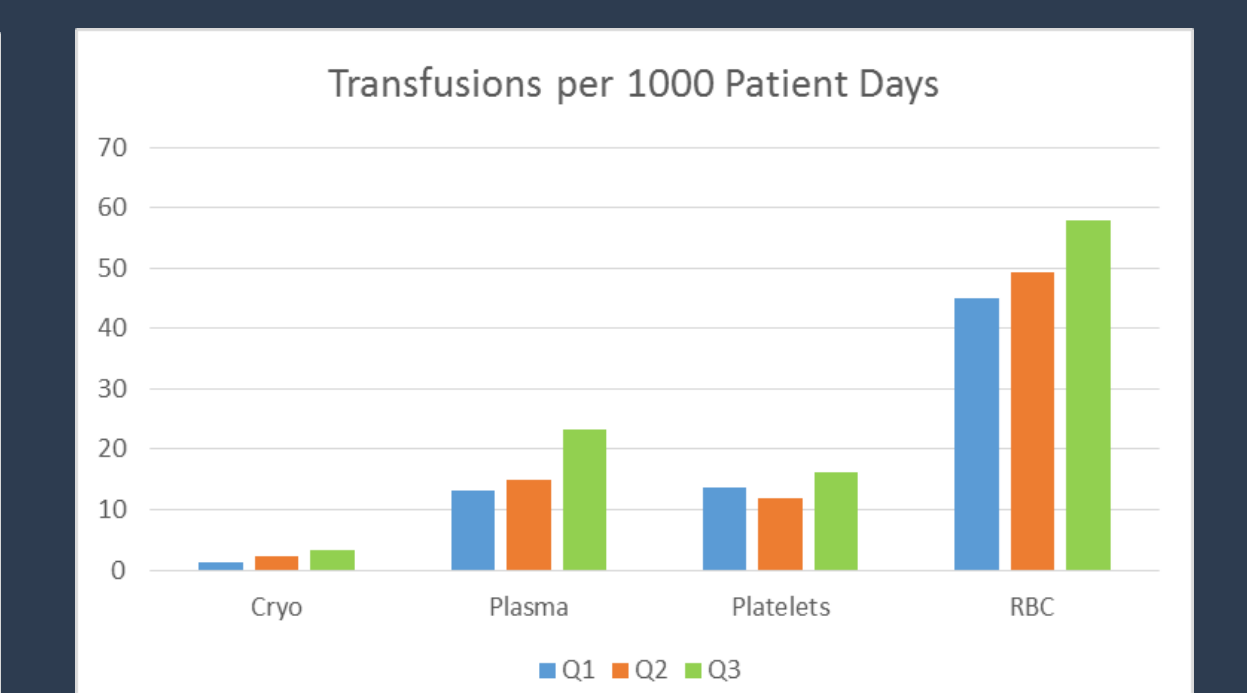


Fig. 4 Transfusions per 1000 Patient Days

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