

Use of a data analytic platform for the determination and tracking of blood culture contamination at an academic health care system

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ABSTRACT

Background: Monitoring of blood culture contamination may be prone to errors when identified manually. This study evaluated the trend and accuracy of blood culture contamination rates obtained from the CLARION™ Blood Culture Stewardship dashboard, a bioMérieux data analytic platform, versus manual monitoring at an academic healthcare system.

Methods: Tampa General Hospital, an academic healthcare system serving West Central Florida, implemented the CLARION™ Blood Culture Stewardship dashboard in May 2021 as a data analytic platform to track, trend, and monitor key performance indicators within the laboratory. Using an interrupted times series design, the monthly percentages of blood cultures contaminated during the post-implementation period (May 2021 - August 2023; when blood culture contamination rates were determined by the CLARION™ Blood Culture Stewardship dashboard) were compared to a pre-implementation period (January 2015 – April 2021; when blood culture contamination rates were determined manually by a medical laboratory staff).

Results: A total of 301,544 blood culture sets occurred during the study period. During the pre-implementation period, contamination rates ranged from 1.48% to 3.65%, while 3.01% to 4.33% were contaminated during the post-implementation period. In segmented regression analysis, electronic monitoring of contamination rates in the post-implementation period was associated with an absolute 1.56% (95% confidence interval [CI]: 1.20% to 1.95%) and relative 72.0% (95% CI: 55.1% to 90.0%) increase in contamination compared with projected estimates from the pre-implementation period. This increase is represented in the Figure by the difference between the solid regression line segments coinciding with the CLARION™ Blood Culture Stewardship dashboard implementation.

Conclusion: Electronic monitoring of blood culture contamination rates through a data analytic platform may identify contaminants that are missed when rates are calculated manually. Accurate surveillance is necessary for infection control and antimicrobial stewardship programs to implement interventions to decrease contamination rates, unnecessary antibiotic exposure, and healthcare costs.

BACKGROUND

- ❖ Blood culture contamination is associated with the use of unnecessary antibiotic exposure, increased length of hospital stay, and additional expense
- ❖ Microbiology laboratories typically track blood culture contamination rates, which can be used to inform practices targeted at reducing contamination rates
- ❖ Identifying, tracking, and reporting blood culture contamination rates can be time-consuming and prone to errors when determined manually
- ❖ A feature of the CLARION™ Blood Culture Stewardship dashboard (BC Dashboard) is the performance of an automated determination of blood culture contamination, which may result in improvements in the accuracy, workflow efficiency, and level of detail available to the user

OBJECTIVE

- ❖ To compare the trend and accuracy of blood culture contamination rates obtained from the BC Dashboard versus manual determinations
- ❖ To describe how implementation of the BC Dashboard impacted the workflow and efficiency of blood culture contamination determination and reporting
- ❖ To describe how the depth of knowledge and insight on blood culture contamination provided by the BC Dashboard can be used for quality improvement

METHODOLOGY

- ❖ Single center retrospective, pre-/post-implementation observational study performed at Tampa General Hospital Laboratory, an academic healthcare system that serves over 4 million people and administers close to 20,000 tests each month
- ❖ In May 2021, the CLARION™ Blood Culture Dashboard was implemented as a data analytic platform to track, trend, and monitor key performance indicators within the laboratory
- ❖ During the pre-implementation phase (January 2015 – April 2021), blood culture contamination rates were determined manually by a medical laboratory scientist (MLS)
- ❖ During the post-implementation phase (May 2021 - August 2023), blood culture contamination rates were determined by the CLARION™ Blood Culture Dashboard
- ❖ The definition of blood culture contamination remained consistent during both implementation phases
- ❖ A comparison of the monthly blood culture contamination rates between pre-implementation and post-implementation was performed to evaluate accuracy and trends
- ❖ A segmented linear regression model was used to compare the postimplementation phase to the pre-implementation phase
- ❖ An assessment of the impact the BC Dashboard had on workflow efficiency was performed

RESULTS

- ❖ A total of 301,544 blood culture sets occurred during the study period
- ❖ Pre-implementation contamination rates ranged from 1.48% to 3.65%
- ❖ Post-implementation contamination rates ranged from 3.01% to 4.33%
- ❖ In segmented regression analysis (Figure 1), the post-implementation period was associated with:
 - an absolute 1.56% (95% CI: 1.20% to 1.95%) increase in contamination
 - a relative 72.0% (95% CI: 55.1% to 90.0%) increase in contamination
- ❖ During the electronic monitoring of blood culture contamination using the BC Dashboard (May 2021 to August 2023), rates of blood culture contamination varied when stratifying by age group, day of the week, and whether the BC was collected by a nurse or a phlebotomist (Figure 2)
- ❖ Compared to the manual process for determination of blood culture contamination rates, the BC Dashboard reduced the number of daily and monthly workflow steps and time required by the MLS (Table)

Figure 1. Segmented regression analysis of blood culture contamination during pre- and post-implementation phases

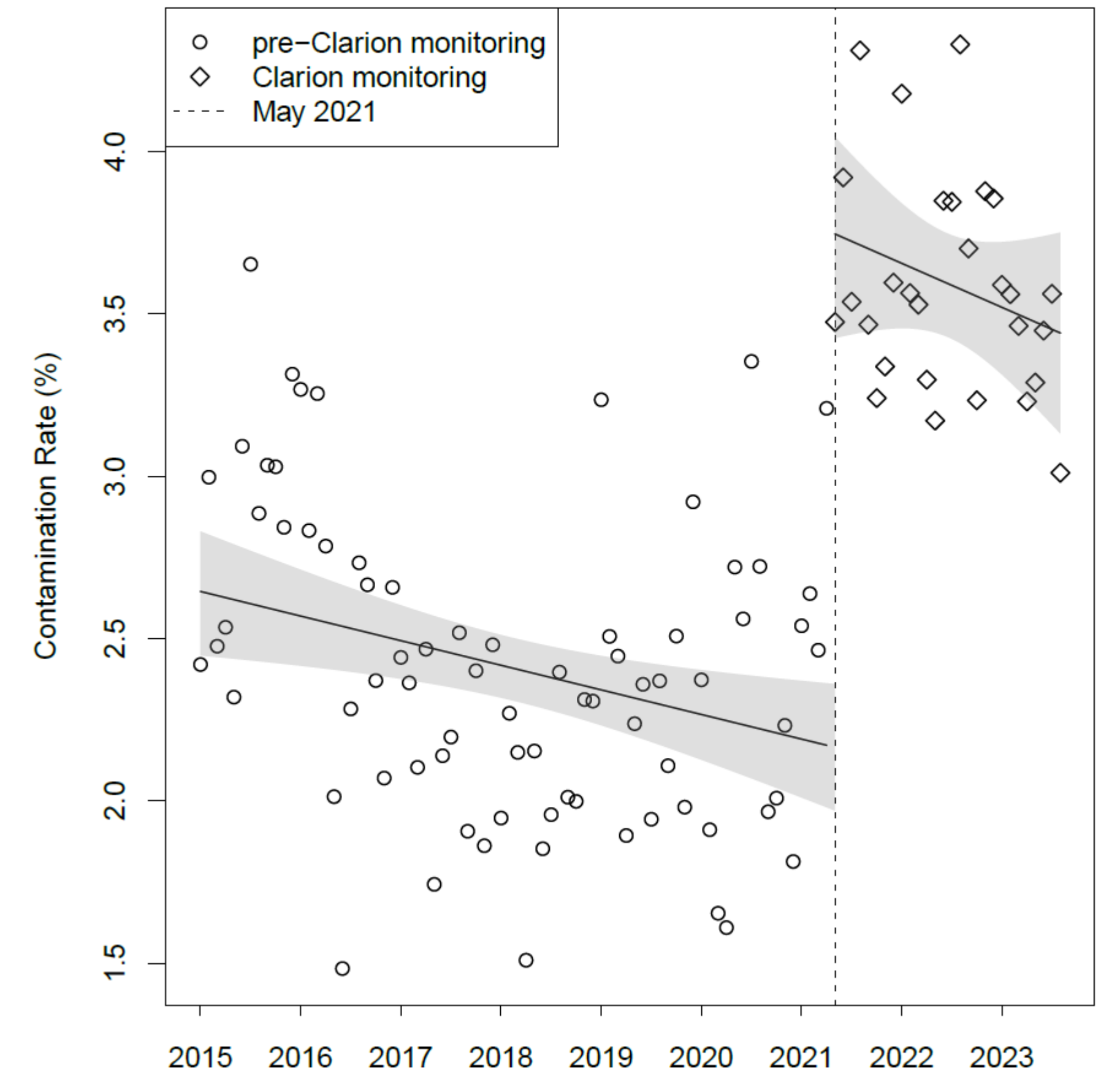


Figure 2A. Frequency and Contamination % by Age Group

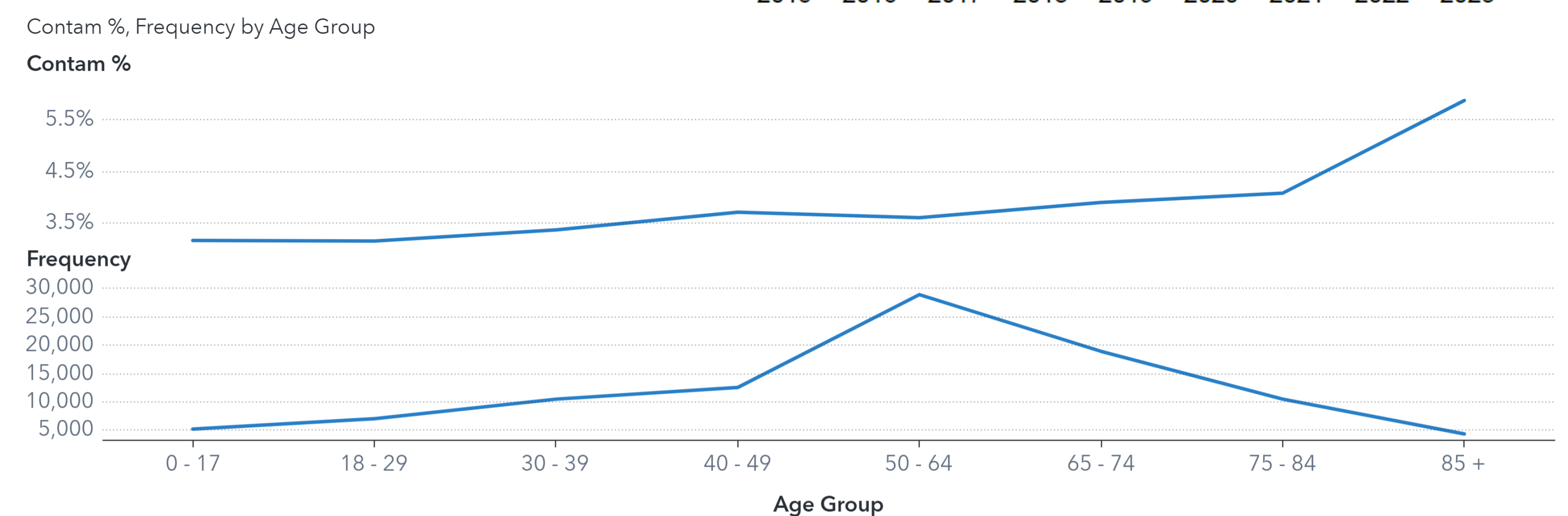


Figure 2B. Contamination % by Collector Class

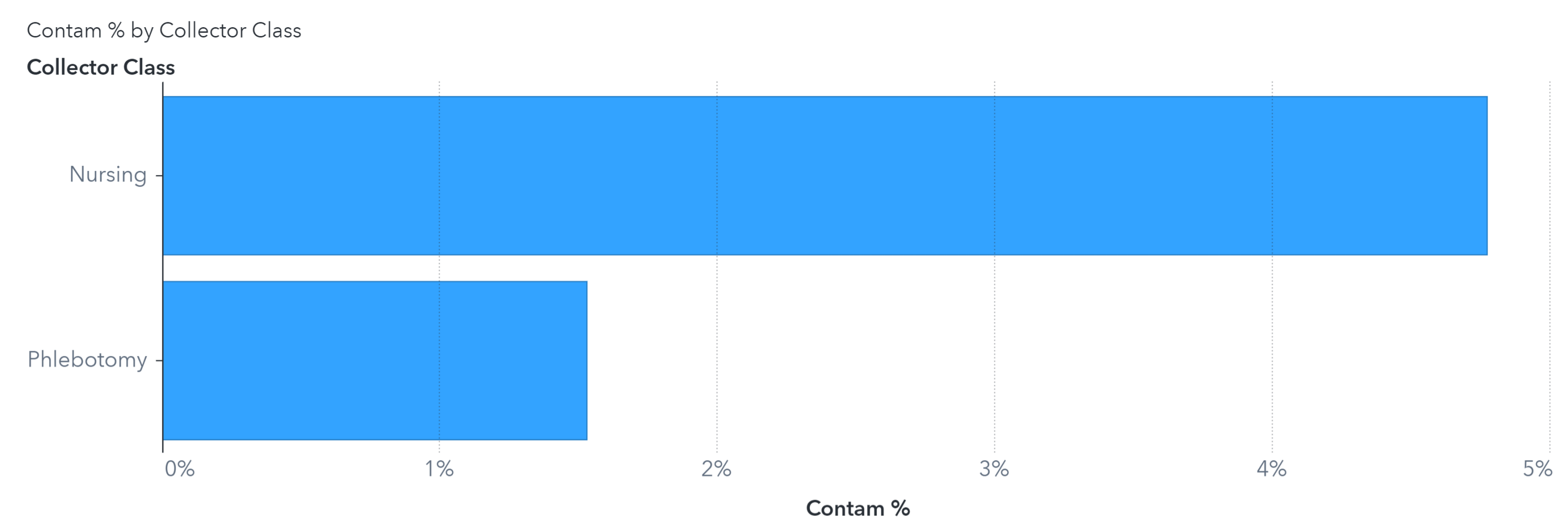


Figure 2C. Frequency and Contamination % by Day of Week

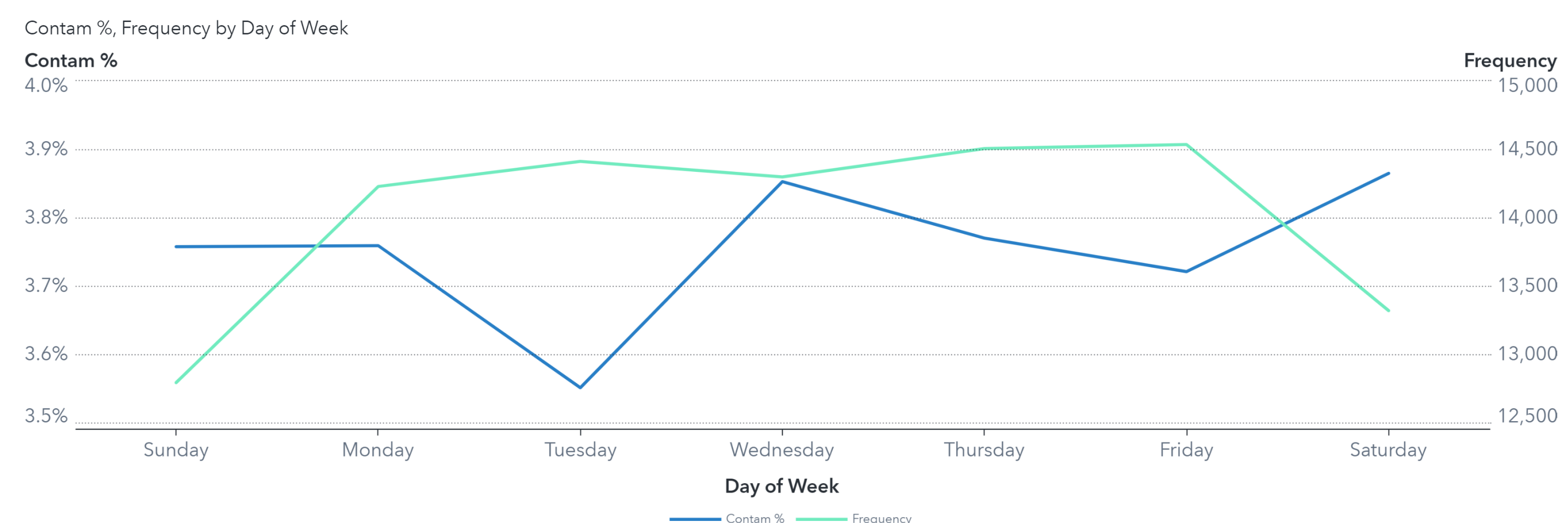


Table. Workflow variables for blood culture contamination calculations pre- and post-implementation of a data analytic platform

Manual process for determination of blood culture contamination workflow			Blood Culture dashboard workflow		
Step	Description	Frequency (time required)	Step	Description	Frequency (time required)
1	MLS working the blood culture bench reviews all the positive cultures and flags contaminants	Daily (15 minutes)	1	Log into data analytics platform and download an Excel spreadsheet of the detailed data for the month	Monthly (2 hours)
2	Patient label placed on a 3-ring binder designating the blood culture to be contaminated, along with the date and the organism isolated		2	Separate contaminated blood cultures based on collector type	
3	3 rd shift MLS manually counts work cards to obtain the total number of collected blood cultures		3	Add info to main table to calculate contamination rate	
4	Designated MLS reviews the binder to determine whether the cultures tracked were true contaminants or not	Weekly (1 hour)	4	Submit email with all information	
5	Designated MLS reviews LIS to obtain the location and collector information, then collates all data to determine blood culture contamination rates	Monthly (2 days)			
MLS time spent per month		27.5 hours	MLS time spent per month		2 hours

CONCLUSIONS

- ❖ The data analytic platform helped to streamline the process for determination of blood culture contamination at a large academic healthcare system by automating daily and monthly case finding and reporting activities
- ❖ Identification of blood culture contamination through an electronic system may save valuable MLS time that could be used for expert-level tasks
- ❖ Electronic monitoring of blood culture contamination rates through a data analytic platform may identify contaminants that are missed when rates are calculated manually
- ❖ Accurate surveillance is necessary for infection control and antimicrobial stewardship programs to implement interventions to decrease contamination rates, unnecessary antibiotic exposure, and healthcare costs