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Project FORESIGHT Annual Report, 2022-2023

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FORESIGHT—Benchmark Annual Report (US$)

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FORESIGHT Benchmark Data 2022-2023

Project FORESIGHT is a business-guided self-evaluation of forensic science laboratories across the globe. The participating laboratories represent local, regional, state, and national agencies. Economics, accounting, finance, and forensic faculty provide assistance, guidance, and analysis. Laboratories participating in Project FORESIGHT have developed standardized definitions for metrics to evaluate work processes, linking financial information to work tasks, and functions. Laboratory managers can then assess resource allocations, efficiencies, and value of services—the mission of Project FORESIGHT is to measure, preserve what works, and change what does not.

The benchmark data for the 2022-2023 performance period includes laboratory submissions for a variety of fiscal year definitions. However, all submissions have December 31, 2022 as part of their fiscal year accounting. The majority of submissions follow a July 1, 2022 through June 30, 2023 convention. Others follow a year that begins as early as January 1, 2022 (ending December 31, 2022) while the other extreme includes laboratories with a fiscal year originating October 1, 2022 and ending September 30, 2023.

Consider the summary statistics for several of the key performance indicators. Because of outliers in several of the investigative areas, the most meaningful comparisons might best be made with respect to median as a representation of "typical" laboratory performance. To lend perspective to the spread of these metrics, each of the quartile metrics are reported along with the specific comparison to the laboratory highlighted in this report.

As of this writing, 211 laboratory or laboratory systems have contributed data to the project for the 2022-2023 period. For most areas of investigation, the submitted data offers a large enough sample to elicit good statistical properties.

For more information on Project FORESIGHT, visit the Project web site at www.be.wvu.edu/forensic/foresight.htm. Questions regarding this report or other matters pertaining to Project FORESIGHT should be directed to the Principal Investigator Paul Speaker (foresightsubmissions@gmail.com).

Characteristics of Submitting Laboratories

Each submission year has seen an increase in the number of participating laboratories. Since the data collection tool, LabRAT, was modified to highlight the minimum data needed (Level I data), there has been an increase in the number of smaller laboratories in FORESIGHT. That is reflected again for the 2022-2023 submissions as the total number of laboratory or laboratory systems submitting data has grown.

Note that any laboratory or laboratory system may voluntarily submit data to the FORESIGHT project. Each submitting laboratory will receive a copy of the annual benchmark data along with the placement of their own data for comparison to the benchmarks. However, the benchmark comparison data only includes the performance from accredited laboratories.

Table 1: Characteristics of Submitting Laboratories

Characteristics of Submitting Laboratories	
Jurisdiction	
National	8
Regional	35
State	62
Metro	61
Regional/Metro*	45
*Regional lab with a city exceeding 100K population	
Total Accredited (ISO/IEC 17025:2017 or ANAB)	208
non-accredited	3
TOTAL SUBMISSIONS	**211**
International/Domestic	
U.S.	187
Non-U.S.	24

Table 1 highlights some of the characteristics of the submitting laboratories. Note that the 207 submissions represent some laboratory systems. There are total of 264 separate facilities represented in these accredited submissions.

COVID-19, Inflation, and the 2022-2023 Submissions

Subsequent years will reveal the full impact of the pandemic, supply chain issues, and resulting inflation on forensic laboratories. Many submitting laboratories indicated the departure from a "normal" year with an increase in case submissions, higher expenses for consumables, and staffing issues from resignations during the pandemic. As we begin a post-pandemic return to normality, we expect to see additional changes in the collection of evidence for submission to crime laboratories. Across reporting laboratories, we observe increased costs in the 2022-2023 FORESIGHT submissions.

There are a few observations to note. As restrictions surrounding COVID-19 were lifted, policing agencies increased evidence submissions to forensic laboratories. The greatest impact appears in evidence screening & processing with the median number of case submissions increasing over 300% from the prior year. Other areas of investigation with large increases in submissions were DNA Casework, Forensic Pathology, and Toxicology (both antemortem and post-mortem).

Since many submitting laboratories mentioned an accelerated impact from inflation for many laboratory supplies from consumables to lab coats, additional cost breakdowns have been added to this year's report. Tables 32-39 highlight the expenses per case and per sample from personnel expenditures, capital expenditures, consumable expenditures, and all other

expenditures. The trend that emerges suggests that many laboratories were able to reduce personnel costs due to employee turnover, but increased productivity. Additional expense cuts came from investment in capital through delayed equipment purchases. These reduced areas for expenses were countered by large increases in the cost of chemicals, reagents, consumables, and gases as well as other supplies.

Future review of the data should reveal the impact of each of these outside stimuli on forensic laboratories.

FORESIGHT Maximus Awards

Started in FY2009 by a cooperative agreement between the John Chambers College of Business and Economics at West Virginia University and the National Institute of Justice, the FORESIGHT program is a business-guided, self-evaluation of forensic science laboratories, which began with local, regional, state, and national agencies in North America. Over the years, the program has expanded to include several laboratories in Europe. Economics, accounting, finance, and forensic faculty from WVU provide assistance, guidance, and analysis. The process involves standardizing definitions for metrics to evaluate work processes, linking financial information to work tasks, and functions. The program has grown over time and its success had led to numerous journal publications, countless laboratory efficiency improvements across the U.S. and a supplementary program with funding by the Laura and John Arnold foundation to examine the interface between Foresight metrics and Laboratory Information Management Systems. Based on the success of the program and the gains seen by forensic laboratories, ASCLD has sought to begin recognizing peak performing laboratories at its Annual Symposium.

> *The FORESIGHT Maximus awards are presented to participant laboratories operating at 90% or better of peak efficiency.*

Maximus Award Winners 2023

- Bexar County Criminal Investigation Laboratory, San Antonio, TX
- Chandler Police Department Forensic Service Section, Chandler, AZ
- City of Greensboro (NC) Police Department, Greensboro, NC
- City of Tulsa Police Department Forensic Laboratory, Tulsa, OK

- Denver Police Department Crime Laboratory, Denver, CO
- Forensic Science Department, Organismo de Investigación Judicial, San Joaquín de Flores, Heredia, Costa Rica
- Indiana State Department of Toxicology, Indianapolis, IN
- Institute of Environmental Science and Research Limited (ESR), Auckland, New Zealand
- Institute of Forensic Sciences of Puerto Rico, San Juan, PR
- Iowa DCI Crime Laboratory, Ankeny, IA
- Marshall University Forensic Science Center, Huntington, WV
- Midwest Regional Forensic Laboratory, Andover, MN
- Montana Forensic Science Division, Missoula, MT
- North Louisiana Criminalistics Laboratory, Shreveport, LA
- Pinellas County Forensic Laboratory, Largo, FL
- Wyoming State Crime Laboratory, Cheyenne, WY

FORESIGHT 20/20

The American Society of Crime Laboratory Directors (ASCLD) was successful in securing a grant from the Laura and John Arnold Foundation (LJAF) to assist laboratories in the extraction of data from their Laboratory Information Management Systems (LIMS), including data for submission to Project FORESIGHT. The executive summary of FORESIGHT 20/20 project follows.

FORESIGHT 20/20 Executive Summary

The proliferation of television shows featuring CSI titles has both glamorized and cursed crime laboratories in America as expectations of laboratory performance have dramatically increased the demand for forensic science services. This increase in demand, coupled with laboratory funding cuts from the Great Recession, created a bottleneck in the justice system as laboratory backlogs rose, slowing down the entire system. The National Institute of Justice (NIJ) recognized this problem and funded a solution via two grants for Project FORESIGHT for the years 2009 through 2015. The Project FORESIGHT team was tasked with studying the forensic science industry and developing business metrics for forensic laboratories that would enable them to gain efficiencies and become more cost effective, thus addressing the bottleneck in the justice system. While Project FORESIGHT has had a pronounced effect on the participating laboratories, fewer than half of U.S. laboratories submit data to the project. The main reason for the lack of participation had been the difficulty in extracting the necessary data on laboratory casework and coupling that information with laboratory expenditures and personnel detail, which come from separate information management systems.

This proposal sought funding to overcome this participation hurdle through the creation of software that provides the interface between the testing and casework information maintained

in a Laboratory Information Management System (LIMS) and the separate financial and personnel systems. This software was be developed by 2nd Logic, LLC under ASCLD's leadership to connect the NIJ's FORESIGHT measurement standards with laboratories nationwide to permit broader forensic science industry perspectives and to enhance the business metrics available to individual laboratory directors for daily decision-making. Organizing software development through the four major LIMS providers offered a permanent software solution to all crime laboratories for access to business metrics and does so at no cost to the individual laboratories. For laboratories participating in FORESIGHT, these business metrics have permitted dramatic increases in efficiency and saved hundreds of millions of dollars. Extending participation fivefold is expected to have similarly magnified gains. Once initiated across the leading LIMS providers, this offered a permanent, broad-based system for monitoring performance of the individual laboratory and details on the performance across all forensic science.

PROJECT DESCRIPTION

The American Society of Crime Laboratory Directors (ASCLD) is a nonprofit professional society of crime laboratory directors and forensic science managers dedicated to providing excellence in forensic science through leadership and innovation. The purpose of the organization is to foster professional interests, assist the development of laboratory management principles and techniques; acquire, preserve and disseminate forensic based information; maintain and improve communications among crime laboratory directors; and to promote, encourage and maintain the highest standards of practice in the field. With this mandate, ASCLD proposed to the Laura and John Arnold Foundation an investment to dramatically increase the efficiency and effectiveness of crime laboratories nationwide through the creation of financial intelligence software.

With ever increasing demands for services and shrinking budgets, a crime laboratory must have a thorough understanding of their operations from a business perspective and a means to compare that performance to the standards of the "forensic science industry." The National Institute of Justice (NIJ) has led efforts to improve laboratory business practices through the creation of Project FORESIGHT. Project FORESIGHT is a performance benchmarking model that enables crime laboratories to perform an internal business assessment and external comparison by standardizing terminology and performance metrics across local, state, and federal laboratories.

The FORESIGHT Project began as a funding award from the National Institute of Justice to the West Virginia University Forensic Science Initiative to develop a system that would enable laboratories to understand and assess the relationship between their casework, personnel, and budgetary expenditures. Forensic laboratory managers use these functions to assess resource allocations, human capital development, drive efficiencies, and evaluate the value of services—the mission is to measure, preserve what works, and change what does not. FORESIGHT is intended to support significant and enduring systematic reforms in accountability and decision-making in public forensic laboratories.

Participation in FORESIGHT is free, voluntary, and open to forensic science laboratories worldwide. FORESIGHT has led to significant improvement at the individual laboratory level and for the forensic industry. Evaluation of efficiency and effectiveness of a crime laboratory was virtually impossible without a common industry language and corresponding performance benchmarks. Individual annual reports to contributing laboratories detail the laboratory's metrics with emphasis on productivity, risk management, analytical process, and economic market forces. These annual evaluations are equivalent to a consultant's report, highlighting performance over time and across the industry. Even though participation is costless, less than 20% of U.S. laboratories enroll in the project. This low participation is not a comment on the value of the project; rather it is a product of the difficulty of data extraction from multiple computer systems. Casework data is extracted from the LIMS, while personnel data and expenditures are extracted from one or more computer systems of the laboratory's parent organization (generally, a policing organization). To bridge the firewalls protecting the data in each system, laboratory management must manually extract data from these multiple systems to report their performance to project FORESIGHT. For many laboratories, the cost in time and resources is deemed too high to participate. NIJ recognizes this burden, and their Forensic Science Technology Working Group Operation Requirements highlight the need for increased IT knowledge and software for management to improve productivity.

FORESIGHT has led to a macro view of the provision of forensic science services. The common measurements have permitted a review of fundamental economic hypotheses and the delivery of crime laboratory services for economic regions. The results have shown that individual laboratories are highly efficient in the provision of services, but rarely cost effective because of the reliance on political jurisdictions, rather than economic markets, for the provision of services.

Although many laboratories have adopted this program to guide their operations, a major obstacle for implementation has been the "hands on" time required by laboratory staff to manually gather and input the required data. This data is composed of both laboratory and financial metrics, each of which is stored in separate locations or in systems that do not communicate. This then requires significant time dedicated to downloading this information and transferring it to the FORESIGHT program. The FORESIGHT program is not integrated with any of the existing vendor LIMS systems. As the LIMS systems have evolved, their capabilities have advanced to allow a more detailed monitoring of evidence samples as they move through the laboratory system. The crime laboratory user can detect problems and/or issues with samples before a report is issued and provides for a greater transparency to the criminal justice system as to the analysis history and quality assurance of that item of evidence.

The development of such freeware then permits simple extraction and submission of FORESIGHT data. That allows 100% participation for all U.S. laboratories. Such a census, rather than the current voluntary sample, will benefit both the new participants as well as those laboratories currently in the program as a more complete picture of the forensic industry emerges. With the combination of casework, expenditures, and personnel data in a single database, the freeware will also permit easier reporting for federal grant purposes. For laboratory leadership, the freeware also permits the construction of a manager's data dashboard with up-to-the-minute productivity metrics.

The American Society of Crime Laboratory Directors requested and received funding to support the development of freeware software, FORESIGHT 20/20, enabling the seamless data collection of core business metrics from Laboratory Information Management Systems (LIMS) commonly employed by laboratories. Once implemented into the major LIMS providers, this legacy program requires no expenditures for individual laboratories beyond the normal updating of their LIMS.

Workforce Calculator

A 2019 National Institute of Justice report estimated that state and local forensic laboratories were understaffed by more than 900 positions.[1] In response to that shortfall, the Forensic Technology Center of Excellence at RTI International (FTCoE) commissioned the creation of a workforce calculator to assist forensic laboratories with an independent, objective determination of staffing needs.[2] The workforce calculator may be accessed from the FTCoE website (https://forensiccoe.org/workforce-calculator-project/) and is free to use. Users input details on the annual caseload for each area of investigation and the calculator provides an immediate response with the corresponding number of operational, administration and support staff to efficiently process that caseload.

The econometric estimates were developed from the performance of FORESIGHT Maximus award winning laboratories. Additional factors in the estimates include the state level violent and property crime rates, populations served, and the type of the jurisdiction covered by the laboratory. Additional output offers the corresponding annual investment in capital expenditures to support the optimal personnel.

Users are encouraged to share their results with Project FORESIGHT to assist in the continual updating of the tool. Greater detail about the project is available via the open-access publication in Forensic Science International: Synergy.[3]

FORESIGHT Digital Evidence

Since the initial efforts to collect data via Project FORESIGHT, receiving responses from forensic laboratories that examine digital evidence has been difficult. A small percentage of forensic laboratories reported areas of investigation for computer analysis or analysis of

[1] U.S. Department of Justice, Office of Justice Programs. (2019). *Report to Congress: Needs Assessment of Forensic Laboratories and Medical Examiner/Coroner Offices*. Washington, DC: National Institute of Justice. https://www.ncjrs.gov/pdffiles1/nij/253626.pdf.

[2] This project was supported by Award No. 2016-MU-BX-K110, awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect those of the Department of Justice.

[3] Speaker, P. J. (2021). An Independent Evaluation of Laboratory Staffing Needs: Launching the Forensic Laboratory Workforce Calculator. *Forensic Science International: Synergy*, 3(1). https://doi.org/10.1016/j.fsisyn.2021.100137.

multimedia audio and video. Additionally, it appeared that the type of digital evidence activity differed widely between state-level laboratories and the analysis performed in metropolitan jurisdictions. Questions emerged regarding changes necessary to increase the number of reporting digital evidence laboratories.

In 2018 the National Institute of Justice created the Forensic Laboratory Needs Technology Working Group (FLN-TWG). "The FLN-TWG explores new ways to increase casework efficiencies and implement forensic technology innovations that will advance system-based strategies and lead to a stronger justice system and safer communities." Among the initial efforts of FLN-TWG was the development of a white paper with suggestions to improve data collection for analysis of digital evidence. The white paper identified additional organizations beyond ASCLD to identify and contact digital evidence laboratories for participation in Project FORESIGHT. FLN-TWG offered some data categorization models to better recognize evolving technologies.

In 2021, the Forensic Technology Center of Excellence (FTCoE) funded a project, FORESIGHT Digital Evidence – Creation & Data Gathering (Award 2016-DN-BX-K110), to improve Project FORESIGHT. The funding led to the creation of the Laboratory Reporting and Analysis Tool for Digital Evidence (LabRAT DE), designed to capture the suggestions from FLN-TWG. LabRAT DE simplifies the reporting of financial data (Figure 1) and updates the data collected on casework (Figure 2).

Figure 1: FORESIGHT DE Expenditures

Expenditure Information:		
Currency of Expenditure data		
Personnel Expenditures (salary, benefits, & overtime)		
Capital Expenditures		
Consumable Expenditures		
Other Expenditures (Overhead, etc.)		
Total Expenditures	$0	Automatically sums the categories above
Do Total Expenditures include a charge for:		
utilities	0	enter 1 for yes; 0 for no
telecommunications	0	enter 1 for yes; 0 for no

Figure 2: FORESIGHT DE Casework & FTE Allocation

Digital Evidence Category:	Mobile	Computer	Video	Mass Storage	Other (drones, watches, Internet of Things, etc.)
Operational FTE					
Administration & Support FTE					
Cases					
items					
items outsourced					
items examined internally					
reports					
Gigabytes examined					
Median (days) turn around time (TAT)					
open cases at end of year					
Year end open cases older than 30 days					
If your laboratory assists outside agencies, please complete the following:					
Cases assisted for outside agencies					
Items examined for outside agencies					
Median TAT for assisted cases (days)					
Personnel Time Allocation	Provide an estimate of the percentage of time spent in each activity for operational FTE.				
Casework					
Technical Review					
Testimony & Testimony Preparation					
Training					
Continuing Education					
Non-Digital Evidence Duties					
Other					

The trial data collection efforts proved to be successful with an additional 49 digital evidence data submissions using the FORESIGHT DE data collection tool in FY2021, rising to 54 digital evidence data submissions from digital-only operations in FY2022.

Relative Volume & Activity Metrics

The use of the forensic crime laboratory differs across jurisdictions. The FBI's National Incident-Based Reporting System (NIBRS) offers some indication of the volume of crime. FORESIGHT offers additional indication of the role of the forensic crime laboratory in the processing of evidence for the population served by the laboratory.

Cases per 100,000 Population Served

A **case** in an investigative area refers to a request from a crime laboratory customer that includes forensic investigation in that investigative area. Note that a customer request may lead to a case in multiple investigative areas.

Table 2: Cases per 100,000 Population Served

Cases per 100,000 population			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	54.00	124.38	179.94
Crime Scene Investigation	1.57	5.61	28.58
Digital evidence	2.70	7.80	22.28
DNA Casework	40.02	69.32	109.39
DNA Database	66.73	160.76	248.43
Document Examination	0.43	1.01	1.31
Drugs - Controlled Substances	160.95	261.70	385.20
Evidence Screening & Processing	39.47	69.77	373.47
Explosives	0.11	0.17	0.35
Fingerprints	19.43	29.49	62.28
Fingerprints Database (including IAFIS)	15.00	33.49	121.83
Fire analysis	1.80	3.01	5.46
Firearms and Ballistics	9.07	19.38	36.83
Firearms Database (including NIBIN)	29.06	71.79	241.97
Forensic Pathology	56.97	57.73	69.56
Gun Shot Residue (GSR)	2.20	3.72	7.18
Marks and Impressions	0.16	0.40	0.66
Serology/Biology	10.99	36.77	59.79
Toxicology ante-mortem (excluding BAC)	41.07	72.05	138.77
Toxicology postmortem (excluding BAC)	53.63	69.95	100.82
Trace Evidence	0.70	1.61	2.57

Items Processed Internally per 100,000 Population Served

An **item** refers to a single object for examination submitted to the laboratory. Note that one item may be investigated and counted in several investigation areas.

Table 3: Items Processed Internally per 100,000 Population Served

Items Examined Internally per 100,000 population			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	72.17	110.89	190.36
Crime Scene Investigation	7.01	47.98	343.75
Digital evidence	3.78	11.31	27.89
DNA Casework	113.19	254.09	562.92
DNA Database	92.89	179.41	284.29
Document Examination	1.26	9.75	10.18
Drugs - Controlled Substances	323.07	554.36	787.35
Evidence Screening & Processing	88.11	199.16	343.21
Explosives			
Fingerprints	52.14	136.57	317.13
Fingerprints Database (including IAFIS)	51.58	189.93	704.82
Fire analysis	5.77	10.15	12.74
Firearms and Ballistics	80.43	111.57	169.60
Firearms Database (including NIBIN)	48.90	285.28	811.18
Forensic Pathology	57.73	58.08	58.88
Gun Shot Residue (GSR)	3.41	6.58	14.90
Marks and Impressions	0.83	1.17	2.42
Serology/Biology	68.00	109.58	177.39
Toxicology ante-mortem (excluding BAC)	42.86	68.46	112.76
Toxicology postmortem (excluding BAC)	84.97	102.13	120.78
Trace Evidence	2.44	3.86	7.22

Samples per 100,000 Population Served

A **sample** refers to an item of evidence or a portion of an item of evidence that generates a reported result.

Table 4: Samples Examined per 100,000 Population Served

Samples Examined per 100,000 population			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	51.81	125.56	215.60
Crime Scene Investigation	6.06	14.48	343.75
Digital evidence	7.36	15.76	96.97
DNA Casework	167.50	390.62	674.26
DNA Database	108.29	230.40	337.56
Document Examination	1.56	2.08	6.27
Drugs - Controlled Substances	286.24	562.08	784.05
Evidence Screening & Processing	45.82	79.78	279.43
Explosives			
Fingerprints	76.70	161.11	451.79
Fingerprints Database (including IAFIS)	51.77	264.32	644.95
Fire analysis	6.96	10.65	18.16
Firearms and Ballistics	94.78	118.37	194.63
Firearms Database (including NIBIN)	48.76	604.61	979.46
Forensic Pathology	57.73	58.08	89.10
Gun Shot Residue (GSR)	4.83	10.38	41.82
Marks and Impressions	0.48	1.13	1.68
Serology/Biology	92.48	135.52	242.27
Toxicology ante-mortem (excluding BAC)	47.22	70.02	86.32
Toxicology postmortem (excluding BAC)	90.99	121.85	156.38
Trace Evidence	2.19	4.60	13.53

Tests per 100,000 Population Served

A **test** refers to an analytical process, including but not limited to visual examination, instrumental analysis, presumptive evaluations, enhancement techniques, extractions, quantifications, microscopic techniques, and comparative examinations. This does not include technical or administrative reviews.

Table 5: Tests Performed per 100,000 Population Served

Tests Performed per 100,000 population			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	100.36	174.38	284.33
Crime Scene Investigation	6.06	14.76	353.16
Digital evidence	4.95	15.29	38.44
DNA Casework	257.82	714.59	1,017.20
DNA Database	108.06	230.40	337.56
Document Examination	2.66	4.27	7.36
Drugs - Controlled Substances	553.60	1,419.27	1,857.40
Evidence Screening & Processing	100.86	294.91	645.21
Explosives			
Fingerprints	94.25	295.12	527.54
Fingerprints Database (including IAFIS)	51.77	187.11	693.70
Fire analysis	9.08	11.13	22.05
Firearms and Ballistics	100.10	144.86	282.19
Firearms Database (including NIBIN)	40.81	380.84	878.87
Forensic Pathology	34.54	57.39	57.73
Gun Shot Residue (GSR)	3.93	19.38	55.59
Marks and Impressions	0.92	1.61	2.32
Serology/Biology	130.49	187.84	293.69
Toxicology ante-mortem (excluding BAC)	87.35	155.52	226.57
Toxicology postmortem (excluding BAC)	144.14	255.63	475.97
Trace Evidence	4.54	9.36	66.99

Reports per 100,000 Population Served

A **report** refers to a formal statement of the results of an investigation, or of any matter on which definite information is required, made by some person or body instructed or required to do so.

Table 6: Reports per 100,000 Population Served

Reports per 100,000 population			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	48.94	76.50	157.41
Crime Scene Investigation	5.97	7.34	61.96
Digital evidence	2.38	8.10	22.05
DNA Casework	51.52	78.68	138.73
DNA Database	12.18	35.91	128.28
Document Examination			
Drugs - Controlled Substances	194.45	271.83	441.72
Evidence Screening & Processing			
Explosives			
Fingerprints	22.18	31.46	58.87
Fingerprints Database (including IAFIS)	13.69	33.49	144.02
Fire analysis	2.07	2.98	5.44
Firearms and Ballistics	14.28	21.73	63.60
Firearms Database (including NIBIN)	27.06	65.99	336.62
Forensic Pathology			
Gun Shot Residue (GSR)	2.02	3.43	6.38
Marks and Impressions	0.18	0.61	1.40
Serology/Biology	12.33	31.37	46.42
Toxicology ante-mortem (excluding BAC)	35.99	59.90	83.67
Toxicology postmortem (excluding BAC)	49.39	65.52	105.62
Trace Evidence	0.75	1.42	2.09

Cost Metrics

Cost per Case

The **cost** includes allocations for capital, wages & salary, benefits, overtime & temporary hires, chemicals, reagents, consumables, gases, travel, quality assurance and accreditation, subcontracting, service of instruments, advertisements, non-instrument repairs and maintenance, equipment leasing, utilities, telecommunications, overhead, and other expenses.

A **case** in an investigative area refers to a request from a crime laboratory customer that includes forensic investigation in that investigative area. Note that a customer request may lead to a case in multiple investigative areas.

Table 7: Cost per Case by Investigative Area

Cost per Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$136	$223	$338
Crime Scene Investigation	$1,652	$3,993	$7,925
Digital evidence	$1,765	$3,373	$5,855
DNA Casework	$1,267	$1,634	$2,395
DNA Database	$55	$104	$167
Document Examination	$3,793	$5,649	$7,874
Drugs - Controlled Substances	$273	$401	$510
Evidence Screening & Processing	$528	$755	$1,211
Explosives	$3,405	$8,826	$16,919
Fingerprints	$801	$1,213	$1,738
Fingerprints Database (including IAFIS)	$209	$713	$908
Fire analysis	$1,537	$2,948	$4,539
Firearms and Ballistics	$1,449	$2,287	$3,429
Firearms Database (including NIBIN)	$82	$192	$415
Forensic Pathology	$1,858	$2,063	$2,683
Gun Shot Residue (GSR)	$1,917	$3,146	$4,498
Marks and Impressions	$4,454	$6,810	$9,644
Serology/Biology	$853	$1,220	$1,900
Toxicology ante-mortem (excluding BAC)	$551	$715	$974
Toxicology postmortem (excluding BAC)	$560	$811	$1,093
Trace Evidence	$4,338	$6,029	$8,675

Real Cost per Case

Project FORESIGHT submissions have increased annually. Although laboratory participation is voluntary, the summary statistics have been relatively consistent across time, particularly for areas of investigation that have large numbers of submissions. For those areas with fewer observations, there has been a fair amount of fluctuation, indicative of the smaller sample and the voluntary nature of the submissions. To illustrate the time series behaviour of the median performance, the following table provides a comparison of the cost/case over time after correcting for inflation. These measures are termed "real cost/case" where real refers to inflation-adjusted measures. We converted prior year's metrics to 2022-2023 prices.

Table 8: Real* Cost per Case across Time

Real Cost per Case over time (2022.12 = 100)				
Area of Investigation	**2019 - 2020**	**2020 - 2021**	**2021 - 2022**	**2022- 2023**
Blood Alcohol	$183	$277	$255	$222
Crime Scene Investigation	$2,339	$4,531	$4,176	$3,993
Digital evidence	$4,472	$4,330	$3,991	$3,253
DNA Casework	$1,676	$1,743	$1,607	$1,641
DNA Database	$75	$91	$84	$100
Document Examination	$6,178	$6,777	$6,246	$5,649
Drugs - Controlled Substances	$434	$473	$436	$399
Evidence Screening & Processing	$1,001	$861	$793	$755
Explosives	$21,219	$21,661	$19,965	$8,826
Fingerprints	$1,117	$1,157	$1,066	$1,193
Fingerprints Database (including IAFIS)		$624	$575	$713
Fire analysis	$2,798	$2,927	$2,698	$2,917
Firearms and Ballistics	$2,288	$2,662	$2,453	$2,196
Firearms Database (including NIBIN)		$256	$236	$204
Forensic Pathology	$2,531	$2,480	$2,286	$2,063
Gun Shot Residue (GSR)	$3,803	$3,883	$3,579	$3,062
Marks and Impressions	$9,456	$10,372	$9,560	$6,814
Serology/Biology	$1,229	$1,305	$1,203	$1,215
Toxicology ante-mortem (excluding BAC)	$970	$952	$877	$727
Toxicology postmortem (excluding BAC)	$1,139	$1,086	$1,001	$811
Trace Evidence	$5,456	$5,784	$5,331	$5,678

Cost per Item

Differences in case detail and differences in case complexity across laboratories (and across time) suggest that other relative cost measures may offer more meaningful comparison. FORESIGHT data collection includes measures for items, samples, and tests in each investigative area.

An **item** refers to a single object for examination submitted to the laboratory. Note that one item may be investigated and counted in several investigation areas. As noted above, the **cost** includes allocations for capital, wages & salary, benefits, overtime & temporary hires, chemicals, reagents, consumables, gases, travel, quality assurance and accreditation, subcontracting, service of instruments, advertisements, non-instrument repairs and maintenance, equipment leasing, utilities, telecommunications, overhead, and other expenses.

Table 9: Cost per Item Processed by Investigative Area

Cost per Item Examined Internally			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$140	$212	$325
Crime Scene Investigation	$330	$685	$1,444
Digital evidence	$1,027	$1,752	$2,856
DNA Casework	$384	$614	$791
DNA Database	$47	$93	$133
Document Examination	$1,236	$1,549	$2,156
Drugs - Controlled Substances	$161	$226	$270
Evidence Screening & Processing	$214	$340	$698
Explosives	$4,132	$4,628	$6,848
Fingerprints	$297	$405	$618
Fingerprints Database (including IAFIS)	$51	$125	$214
Fire analysis	$768	$1,176	$1,962
Firearms and Ballistics	$375	$667	$1,097
Firearms Database (including NIBIN)	$34	$113	$171
Forensic Pathology	$1,954	$2,078	$2,464
Gun Shot Residue (GSR)	$1,195	$1,718	$2,449
Marks and Impressions	$1,827	$2,395	$3,054
Serology/Biology	$224	$355	$569
Toxicology ante-mortem (excluding BAC)	$533	$684	$847
Toxicology postmortem (excluding BAC)	$329	$455	$579
Trace Evidence	$447	$687	$1,074

Cost per Sample

A **sample** refers to an item of evidence or a portion of an item of evidence that generates a reported result.

As noted above, the **cost** includes allocations for capital, wages & salary, benefits, overtime & temporary hires, chemicals, reagents, consumables, gases, travel, quality assurance and accreditation, subcontracting, service of instruments, advertisements, non-instrument repairs and maintenance, equipment leasing, utilities, telecommunications, overhead, and other expenses.

The sample offers a consistently applied metric across laboratories and suggests an average cost measure that is intuitively comparable in cross sectional commentary.

Table 10: Cost per Sample by Investigative Area

Cost per Sample			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$146	$224	$317
Crime Scene Investigation	$190	$450	$687
Digital evidence	$978	$1,603	$1,985
DNA Casework	$253	$385	$516
DNA Database	$46	$65	$119
Document Examination	$930	$1,228	$1,713
Drugs - Controlled Substances	$119	$147	$181
Evidence Screening & Processing	$249	$389	$735
Explosives	$1,659	$1,946	$2,351
Fingerprints	$202	$262	$400
Fingerprints Database (including IAFIS)	$37	$129	$227
Fire analysis	$418	$650	$1,064
Firearms and Ballistics	$318	$451	$732
Firearms Database (including NIBIN)	$52	$113	$161
Forensic Pathology	$1,001	$1,829	$2,340
Gun Shot Residue (GSR)	$643	$911	$1,219
Marks and Impressions	$728	$969	$1,725
Serology/Biology	$64	$115	$172
Toxicology ante-mortem (excluding BAC)	$544	$650	$839
Toxicology postmortem (excluding BAC)	$211	$290	$419
Trace Evidence	$270	$393	$692

Cost per Test

A **test** refers to an analytical process, including but not limited to visual examination, instrumental analysis, presumptive evaluations, enhancement techniques, extractions, quantifications, microscopic techniques, and comparative examinations. This does not include technical or administrative reviews.

As noted above, the **cost** includes allocations for capital, wages & salary, benefits, overtime & temporary hires, chemicals, reagents, consumables, gases, travel, quality assurance and accreditation, subcontracting, service of instruments, advertisements, non-instrument repairs and maintenance, equipment leasing, utilities, telecommunications, overhead, and other expenses.

Table 11: Cost per Test by Investigative Area

Cost per Test

Area of Investigation	25th percentile	Median	75th percentile
Blood Alcohol	$83	$133	$181
Crime Scene Investigation	$199	$458	$687
Digital evidence	$327	$554	$1,404
DNA Casework	$64	$105	$188
DNA Database	$44	$65	$119
Document Examination	$353	$500	$1,265
Drugs - Controlled Substances	$54	$67	$85
Evidence Screening & Processing	$184	$280	$451
Explosives	$383	$482	$752
Fingerprints	$91	$131	$248
Fingerprints Database (including IAFIS)	$76	$101	$227
Fire analysis	$298	$438	$716
Firearms and Ballistics	$248	$391	$589
Firearms Database (including NIBIN)	$68	$113	$181
Forensic Pathology	$1,807	$1,829	$2,340
Gun Shot Residue (GSR)	$445	$618	$946
Marks and Impressions	$525	$715	$1,174
Serology/Biology	$53	$90	$135
Toxicology ante-mortem (excluding BAC)	$94	$131	$206
Toxicology postmortem (excluding BAC)	$86	$115	$180
Trace Evidence	$122	$188	$335

Cost per Report

A **report** refers to a formal statement of the results of an investigation, or of any matter on which definite information is required, made by some person or body instructed or required to do so.

As noted above, the **cost** includes allocations for capital, wages & salary, benefits, overtime & temporary hires, chemicals, reagents, consumables, gases, travel, quality assurance and accreditation, subcontracting, service of instruments, advertisements, non-instrument repairs and maintenance, equipment leasing, utilities, telecommunications, overhead, and other expenses.

Table 12: Cost per Report by Investigative Area

Cost per Report			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$154	$228	$335
Crime Scene Investigation	$1,291	$3,465	$5,442
Digital evidence	$1,720	$3,123	$6,678
DNA Casework	$1,224	$1,723	$2,428
DNA Database	$47	$100	$199
Document Examination	$6,083	$6,860	$8,652
Drugs - Controlled Substances	$301	$427	$511
Evidence Screening & Processing		$882	
Explosives	$11,370	$14,809	$19,194
Fingerprints	$838	$1,066	$1,735
Fingerprints Database (including IAFIS)	$198	$420	$704
Fire analysis	$1,840	$3,142	$5,000
Firearms and Ballistics	$1,439	$2,110	$3,305
Firearms Database (including NIBIN)	$169	$219	$556
Forensic Pathology		$2,136	
Gun Shot Residue (GSR)	$2,323	$3,637	$4,776
Marks and Impressions	$3,997	$6,547	$9,586
Serology/Biology	$894	$1,327	$2,149
Toxicology ante-mortem (excluding BAC)	$604	$781	$1,082
Toxicology postmortem (excluding BAC)	$628	$867	$1,051
Trace Evidence	$3,915	$5,464	$8,519

Metric Interpretation

The various unit cost metrics may be interpreted using the technique highlighted in The Decomposition of Return on Investment for Forensic Laboratories (Speaker, 2009). Consider the Cost/Case metric which may be decomposed into:

$$\frac{Cost}{Case} = \frac{Average\ Compensation\ x\ Testing\ Intensity}{Personnel\ Productivity\ x\ Personnel\ Expense\ Ratio}$$

From the decomposition expression for the Cost/Case, an increase in the numerator components, Average Compensation or Testing (or Sampling) Intensity, will increase the cost per case. Similarly, a decrease in denominator component will increase the cost per case. This may occur from either a drop in productivity, as measured by cases processed per FTE, or from an increase in capital investment for future productivity but financed via a drop in personnel expenses relative to total expenses.

Although the metric breakdown illustrated above offers a decomposition of the Cost/Case metric, a similar procedure may be applied to other cost metrics. Likewise, the Testing Intensity metric may be replaced by a Sampling Intensity metric (e.g., Samples/Case) or similar decomposition which offers the most meaning to the individual laboratory.

Market Metrics

A substantial portion of the cost to the laboratory comes through personal services budget for salary and benefits. (The section below on Analytical Process Metrics highlights the percentage of total costs attributable to personnel expenditures.) Laboratories across the globe and across a particular country face very different labor markets and cost of living conditions. As such, accounting for the salary and benefit pressures in each market is beyond the direct control of the individual laboratory and is subject to the market forces in a laboratory's political jurisdiction.

It may be helpful for a laboratory to replace their specific average compensation with that of the reported sample median to gain insight into how they compare to other laboratories once market forces have been neutralized.

Average Compensation

Note that **compensation** includes all personnel expenditures. This includes wages, salary, and benefits operating staff, support staff, and administrative staff. Centrally assigned compensation is apportioned to each investigative area according to the percentage of full-time equivalent employees assigned to a particular investigative area.

The values reported in this table and other tables with budgetary metrics have been converted to the currency of the reporting laboratory using the exchange rate for December 31 of the measured year as reported at www.xe.com.

Table 13: Average Compensation by Investigative Area

Average Compensation			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$75,985	$93,606	$115,834
Crime Scene Investigation	$92,014	$111,063	$125,074
Digital evidence	$84,145	$110,600	$124,465
DNA Casework	$100,108	$123,417	$140,135
DNA Database	$95,889	$106,544	$123,306
Document Examination	$96,679	$115,167	$137,181
Drugs - Controlled Substances	$95,367	$116,148	$126,796
Evidence Screening & Processing	$79,533	$93,858	$106,420
Explosives	$74,373	$95,132	$119,130
Fingerprints	$99,253	$111,610	$126,432
Fingerprints Database (including IAFIS)	$84,471	$97,608	$120,529
Fire analysis	$94,611	$116,693	$125,801
Firearms and Ballistics	$99,043	$114,670	$130,212
Firearms Database (including NIBIN)	$60,582	$89,053	$117,009
Forensic Pathology	$132,570	$176,438	$309,669
Gun Shot Residue (GSR)	$92,616	$110,951	$126,587
Marks and Impressions	$93,581	$115,264	$150,366
Serology/Biology	$86,572	$104,793	$115,292
Toxicology ante-mortem (excluding BAC)	$96,861	$109,318	$121,746
Toxicology postmortem (excluding BAC)	$90,118	$109,686	$115,225
Trace Evidence	$94,876	$122,056	$163,583

Risk Management Metrics

There are a variety of metrics that may be used in the decomposition of average cost to suggest quality and/or risk. Three of these metrics follow to highlight the level of testing, sampling, and items examined internally per case.

Items per Case

An **item** refers to a single object for examination submitted to the laboratory. Note that one item may be investigated and counted in several investigation areas.

A **case** in an investigative area refers to a request from a crime laboratory customer that includes forensic investigation in that investigative area. Note that a customer request may lead to a case in multiple investigative areas.

Table 14: Items per Case by Investigative Area

Items per Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	1.01	1.06	1.13
Crime Scene Investigation	3.45	4.93	5.40
Digital evidence	1.23	1.89	2.86
DNA Casework	2.90	3.14	3.35
DNA Database	1.00	1.00	1.05
Document Examination	2.77	4.13	4.79
Drugs - Controlled Substances	1.73	1.86	2.03
Evidence Screening & Processing	2.50	2.54	2.76
Explosives	3.15	3.40	3.69
Fingerprints	2.20	2.42	2.76
Fingerprints Database (including IAFIS)	1.62	4.01	5.05
Fire analysis	2.48	2.59	2.80
Firearms and Ballistics	2.74	3.00	3.71
Firearms Database (including NIBIN)	1.07	1.51	3.72
Forensic Pathology		1.00	
Gun Shot Residue (GSR)	1.92	2.03	2.20
Marks and Impressions	2.66	2.92	3.28
Serology/Biology	3.53	3.73	3.98
Toxicology ante-mortem (excluding BAC)	1.07	1.18	1.28
Toxicology postmortem (excluding BAC)	1.43	2.16	2.35
Trace Evidence	5.19	7.82	8.38

Samples per Case

A **sample** refers to an item of evidence or a portion of an item of evidence that generates a reported result.

A **case** in an investigative area refers to a request from a crime laboratory customer that includes forensic investigation in that investigative area. Note that a customer request may lead to a case in multiple investigative areas.

Table 15: Samples per Case by Investigative Area

Samples per Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	1.04	1.10	1.15
Crime Scene Investigation	7.43	8.01	8.66
Digital evidence	2.99	3.91	4.19
DNA Casework	4.51	4.92	5.32
DNA Database	1.00	1.03	1.07
Document Examination	2.96	6.04	6.60
Drugs - Controlled Substances	2.53	2.91	3.13
Evidence Screening & Processing	2.52	2.55	2.74
Explosives	4.98	8.15	9.07
Fingerprints	3.46	3.93	4.27
Fingerprints Database (including IAFIS)	2.14	4.27	5.08
Fire analysis	4.11	5.60	6.12
Firearms and Ballistics	4.49	4.77	5.24
Firearms Database (including NIBIN)	1.07	1.43	3.55
Forensic Pathology		1.00	
Gun Shot Residue (GSR)	3.54	4.00	4.31
Marks and Impressions	5.14	8.52	9.23
Serology/Biology	12.26	16.64	17.74
Toxicology ante-mortem (excluding BAC)	1.13	1.21	1.29
Toxicology postmortem (excluding BAC)	1.80	3.70	4.08
Trace Evidence	12.29	13.53	14.40

Tests per Case

A **test** refers to an analytical process, including but not limited to visual examination, instrumental analysis, presumptive evaluations, enhancement techniques, extractions, quantifications, microscopic techniques, and comparative examinations. This does not include technical or administrative reviews.

A **case** in an investigative area refers to a request from a crime laboratory customer that includes forensic investigation in that investigative area. Note that a customer request may lead to a case in multiple investigative areas.

Table 16: Tests per Case by Investigative Area

Tests per Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	1.70	1.87	2.01
Crime Scene Investigation	7.43	8.01	8.66
Digital evidence	2.70	15.01	17.43
DNA Casework	12.42	20.16	21.93
DNA Database	1.00	1.04	1.10
Document Examination	4.79	16.85	17.24
Drugs - Controlled Substances	5.69	6.68	7.14
Evidence Screening & Processing	2.53	2.62	2.82
Explosives	17.26	34.00	39.08
Fingerprints	7.43	8.51	9.21
Fingerprints Database (including IAFIS)	2.36	4.27	5.08
Fire analysis	7.67	8.91	9.68
Firearms and Ballistics	5.48	5.82	6.53
Firearms Database (including NIBIN)	1.05	1.51	4.64
Forensic Pathology		1.00	
Gun Shot Residue (GSR)	5.46	6.04	6.50
Marks and Impressions	5.64	12.05	13.08
Serology/Biology	17.77	19.47	20.81
Toxicology ante-mortem (excluding BAC)	3.34	7.70	8.14
Toxicology postmortem (excluding BAC)	3.79	9.95	10.70
Trace Evidence	25.41	27.95	29.53

Reports per Case

A **report** refers to a formal statement of the results of an investigation, or of any matter on which definite information is required, made by some person or body instructed or required to do so.

A **case** in an investigative area refers to a request from a crime laboratory customer that includes forensic investigation in that investigative area. Note that a customer request may lead to a case in multiple investigative areas.

Table 17: Reports per Case by Investigative Area

Reports per Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	0.93	1.00	1.03
Crime Scene Investigation	1.00	1.04	1.14
Digital evidence	0.90	1.02	1.09
DNA Casework	0.93	1.01	1.05
DNA Database	0.93	0.98	1.03
Document Examination	0.91	0.96	1.09
Drugs - Controlled Substances	0.95	1.00	1.03
Evidence Screening & Processing	0.56	0.60	1.46
Explosives	0.90	1.00	1.00
Fingerprints	0.94	1.00	1.04
Fingerprints Database (including IAFIS)	0.96	1.00	1.01
Fire analysis	0.95	1.00	1.04
Firearms and Ballistics	0.95	1.00	1.06
Firearms Database (including NIBIN)	0.87	0.99	1.00
Forensic Pathology		1.00	
Gun Shot Residue (GSR)	0.92	0.99	1.02
Marks and Impressions	1.00	1.00	1.15
Serology/Biology	0.90	0.96	1.00
Toxicology ante-mortem (excluding BAC)	0.93	0.99	1.03
Toxicology postmortem (excluding BAC)	0.97	1.00	1.04
Trace Evidence	0.88	0.93	1.00

Samples per Item

A **sample** refers to an item of evidence or a portion of an item of evidence that generates a reported result.

An **item** refers to a single object for examination submitted to the laboratory. Note that one item may be investigated and counted in several investigation areas.

Table 18: Samples per Item examined internally by Investigative Area

Samples per Item Examined Internally			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	1.00	1.00	1.05
Crime Scene Investigation	1.00	1.56	1.68
Digital evidence	1.00	1.28	1.45
DNA Casework	1.39	1.54	1.67
DNA Database	1.00	1.00	1.01
Document Examination	1.00	1.29	1.61
Drugs - Controlled Substances	1.00	1.54	1.65
Evidence Screening & Processing		1.00	
Explosives	2.29	2.39	2.58
Fingerprints	1.00	1.54	1.69
Fingerprints Database (including IAFIS)		1.00	
Fire analysis	1.81	2.19	2.36
Firearms and Ballistics	1.00	1.56	1.73
Firearms Database (including NIBIN)		1.00	
Forensic Pathology		1.00	
Gun Shot Residue (GSR)	1.60	1.91	2.02
Marks and Impressions	1.00	2.51	3.06
Serology/Biology	3.18	4.43	4.84
Toxicology ante-mortem (excluding BAC)	1.00	1.00	1.00
Toxicology postmortem (excluding BAC)	1.00	1.58	1.79
Trace Evidence	1.50	1.65	1.75

Tests per Item

A **test** refers to an analytical process, including but not limited to visual examination, instrumental analysis, presumptive evaluations, enhancement techniques, extractions, quantifications, microscopic techniques, and comparative examinations. This does not include technical or administrative reviews.

An **item** refers to a single object for examination submitted to the laboratory. Note that one item may be investigated and counted in several investigation areas.

Table 19: Tests per Item examined internally by Investigative Area

Tests per Item Examined Internally			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	1.37	1.72	1.89
Crime Scene Investigation	1.02	1.53	1.68
Digital evidence	1.02	5.42	6.13
DNA Casework	5.17	6.53	7.01
DNA Database	1.00	1.00	1.04
Document Examination	1.00	3.38	4.25
Drugs - Controlled Substances	3.11	3.51	3.82
Evidence Screening & Processing		1.00	
Explosives	10.12	10.43	11.00
Fingerprints	1.13	3.59	3.86
Fingerprints Database (including IAFIS)	1.00	1.00	1.20
Fire analysis	3.18	3.42	3.58
Firearms and Ballistics	1.62	1.93	2.05
Firearms Database (including NIBIN)		1.00	
Forensic Pathology		1.00	
Gun Shot Residue (GSR)	2.66	2.95	3.15
Marks and Impressions	1.00	3.20	4.45
Serology/Biology	4.61	5.29	5.63
Toxicology ante-mortem (excluding BAC)	3.26	6.28	6.72
Toxicology postmortem (excluding BAC)	1.72	4.32	4.91
Trace Evidence	3.20	3.39	3.61

Reports per Item

A **report** refers to a formal statement of the results of an investigation, or of any matter on which definite information is required, made by some person or body instructed or required to do so.

An **item** refers to a single object for examination submitted to the laboratory. Note that one item may be investigated and counted in several investigation areas.

Table 20: Reports per Item examined internally by Investigative Area

Reports per Item Examined Internally			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	0.89	0.93	0.99
Crime Scene Investigation	0.19	0.21	0.29
Digital evidence	0.37	0.51	0.75
DNA Casework	0.29	0.32	0.35
DNA Database	0.91	0.97	1.01
Document Examination	0.22	0.23	0.27
Drugs - Controlled Substances	0.49	0.53	0.58
Evidence Screening & Processing	0.17	0.21	0.26
Explosives	0.26	0.28	0.30
Fingerprints	0.38	0.41	0.44
Fingerprints Database (including IAFIS)	0.20	0.22	0.63
Fire analysis	0.35	0.38	0.41
Firearms and Ballistics	0.29	0.34	0.37
Firearms Database (including NIBIN)	0.15	0.20	0.78
Forensic Pathology		0.96	
Gun Shot Residue (GSR)	0.44	0.48	0.54
Marks and Impressions	0.29	0.35	0.38
Serology/Biology	0.24	0.25	0.27
Toxicology ante-mortem (excluding BAC)	0.76	0.82	0.89
Toxicology postmortem (excluding BAC)	0.43	0.46	0.61
Trace Evidence	0.10	0.11	0.13

Tests per Sample

A **test** refers to an analytical process, including but not limited to visual examination, instrumental analysis, presumptive evaluations, enhancement techniques, extractions, quantifications, microscopic techniques, and comparative examinations. This does not include technical or administrative reviews.

A **sample** refers to an item of evidence or a portion of an item of evidence that generates a reported result.

Table 21: Tests per Sample by Investigative Area

Tests per Sample			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	1.40	1.69	1.85
Crime Scene Investigation		1.00	
Digital evidence	1.01	3.99	4.24
DNA Casework	3.63	4.13	4.44
DNA Database		1.00	
Document Examination	1.00	1.16	2.67
Drugs - Controlled Substances	2.09	2.24	2.46
Evidence Screening & Processing		1.00	
Explosives	3.95	4.08	4.55
Fingerprints	1.22	2.19	2.36
Fingerprints Database (including IAFIS)	1.00	1.00	1.19
Fire analysis	1.37	1.54	1.63
Firearms and Ballistics	1.07	1.19	1.26
Firearms Database (including NIBIN)		1.00	
Forensic Pathology		1.00	
Gun Shot Residue (GSR)	1.35	1.50	1.66
Marks and Impressions	1.00	1.37	1.53
Serology/Biology	1.08	1.16	1.26
Toxicology ante-mortem (excluding BAC)	3.48	6.27	6.67
Toxicology postmortem (excluding BAC)	1.29	2.53	2.88
Trace Evidence	1.87	2.07	2.19

Reports per Sample

A **report** refers to a formal statement of the results of an investigation, or of any matter on which definite information is required, made by some person or body instructed or required to do so.

A **sample** refers to an item of evidence or a portion of an item of evidence that generates a reported result.

Table 22: Reports per Sample by Investigative Area

Reports per Sample			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	0.85	0.91	0.96
Crime Scene Investigation	0.13	0.13	0.14
Digital evidence	0.25	0.28	0.34
DNA Casework	0.19	0.20	0.22
DNA Database	0.91	0.97	1.00
Document Examination	0.15	0.16	0.17
Drugs - Controlled Substances	0.31	0.34	0.39
Evidence Screening & Processing		0.31	
Explosives	0.11	0.12	0.17
Fingerprints	0.23	0.25	0.27
Fingerprints Database (including IAFIS)	0.19	0.21	0.44
Fire analysis	0.16	0.18	0.21
Firearms and Ballistics	0.19	0.21	0.22
Firearms Database (including NIBIN)	0.09	0.19	0.63
Forensic Pathology		0.50	
Gun Shot Residue (GSR)	0.22	0.25	0.27
Marks and Impressions	0.11	0.12	0.22
Serology/Biology	0.05	0.06	0.06
Toxicology ante-mortem (excluding BAC)	0.76	0.81	0.88
Toxicology postmortem (excluding BAC)	0.24	0.27	0.46
Trace Evidence	0.06	0.07	0.07

Productivity Metrics

Return to the decomposition measure for the cost/case. The denominator terms have the opposite effect on average cost. That is, as ***labor productivity*** or the ***labor expense ratio*** increases, average costs will fall. This confirms that, as a representative scientist is able to process more cases per year, then the effect will be a decrease in the average cost as fixed expenditures are averaged over a higher volume of processed cases. Similarly, if a greater portion of the budget is devoted to personnel expenditures (as opposed to capital investment) *ceteris paribus*, more cases will be processed for the same expenditure at the opportunity cost of delaying investment in capital equipment for future returns.

The next five tables contain the LabRAT summary statistics for alternative personnel productivity ratio measures.

Cases per FTE

This measure is simply the number of Cases completed for each full-time equivalent (FTE) employee (the work input of a full-time employee working for one full year) retained by the laboratory. It gives an indication of the level of productivity within the average laboratory by investigative area.

Table 23: Cases per FTE by Investigative Area

Cases per FTE			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	341.7	680.2	1062.1
Crime Scene Investigation	14.9	39.8	72.2
Digital evidence	25.1	42.9	82.1
DNA Casework	69.8	95.2	122.4
DNA Database	1023.1	1769.1	3487.3
Document Examination	19.6	23.4	38.4
Drugs - Controlled Substances	302.8	382.1	501.1
Evidence Screening & Processing	93.3	149.8	190.8
Explosives	9.1	12.2	27.8
Fingerprints	91.7	121.9	170.8
Fingerprints Database (including IAFIS)	152.6	307.1	521.6
Fire analysis	27.6	46.6	90.4
Firearms and Ballistics	45.7	62.5	115.0
Firearms Database (including NIBIN)	267.8	658.2	1267.9
Forensic Pathology	60.3	91.1	175.6
Gun Shot Residue (GSR)	29.1	43.7	77.7
Marks and Impressions	13.5	20.4	28.7
Serology/Biology	62.0	104.2	151.0
Toxicology ante-mortem (excluding BAC)	154.9	215.8	300.0
Toxicology postmortem (excluding BAC)	141.1	179.8	219.5
Trace Evidence	20.8	33.2	39.1

Items per FTE

This measure is the number of Items examined internally for each full-time equivalent (FTE) employee (the work input of a full-time employee working for one full year) retained by the laboratory. It gives an indication of the level of productivity within the average laboratory by investigative area.

Table 24: Items examined internally per FTE by Investigative Area

Items Examined Internally per FTE			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	382	648	1,077
Crime Scene Investigation	87	264	358
Digital evidence	54	78	130
DNA Casework	214	306	413
DNA Database	1,547	2,662	3,746
Document Examination	64	88	101
Drugs - Controlled Substances	568	704	936
Evidence Screening & Processing	219	386	503
Explosives	22	30	37
Fingerprints	233	334	476
Fingerprints Database (including IAFIS)	607	1,628	2,382
Fire analysis	65	113	183
Firearms and Ballistics	142	231	433
Firearms Database (including NIBIN)	703	1,438	2,948
Forensic Pathology	150	213	214
Gun Shot Residue (GSR)	57	73	109
Marks and Impressions	37	63	80
Serology/Biology	195	387	559
Toxicology ante-mortem (excluding BAC)	182	230	293
Toxicology postmortem (excluding BAC)	270	321	425
Trace Evidence	225	286	330

Samples per FTE

This measure is the number of samples from Items examined internally for each full-time equivalent (FTE) employee (the work input of a full-time employee working for one full year) retained by the laboratory. It gives an indication of the level of productivity within the average laboratory by investigative area.

Table 25: Samples per FTE by Investigative Area

Samples per FTE			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	364	643	990
Crime Scene Investigation	132	379	627
Digital evidence	83	96	185
DNA Casework	340	459	598
DNA Database	1,669	2,970	3,926
Document Examination	73	130	142
Drugs - Controlled Substances	847	1,016	1,229
Evidence Screening & Processing	200	365	455
Explosives	40	57	78
Fingerprints	328	520	672
Fingerprints Database (including IAFIS)	543	1,751	2,801
Fire analysis	99	190	341
Firearms and Ballistics	223	338	534
Firearms Database (including NIBIN)	709	1,488	2,592
Forensic Pathology	151	215	587
Gun Shot Residue (GSR)	97	134	209
Marks and Impressions	83	156	197
Serology/Biology	578	1,094	2,212
Toxicology ante-mortem (excluding BAC)	182	224	301
Toxicology postmortem (excluding BAC)	359	500	643
Trace Evidence	357	489	538

Tests per FTE

This measure is the number of tests performed on samples for each full-time equivalent (FTE) employee (the work input of a full-time employee working for one full year) retained by the laboratory. It gives an indication of the level of productivity within the average laboratory by investigative area.

Table 26: Tests per FTE by Investigative Area

Tests per FTE			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	579	1,045	1,575
Crime Scene Investigation	132	364	592
Digital evidence	89	330	491
DNA Casework	948	1,713	2,595
DNA Database	1,669	3,161	4,045
Document Examination	80	339	390
Drugs - Controlled Substances	1,839	2,216	2,790
Evidence Screening & Processing	316	418	554
Explosives	146	236	315
Fingerprints	554	1,037	1,465
Fingerprints Database (including IAFIS)	543	1,621	2,543
Fire analysis	178	300	457
Firearms and Ballistics	272	374	670
Firearms Database (including NIBIN)	529	1,488	2,855
Forensic Pathology	90	93	154
Gun Shot Residue (GSR)	154	207	290
Marks and Impressions	126	178	257
Serology/Biology	819	1,331	2,550
Toxicology ante-mortem (excluding BAC)	828	1,099	1,481
Toxicology postmortem (excluding BAC)	733	1,403	1,662
Trace Evidence	842	1,004	1,121

Reports per FTE

This measure is the number of reports filed per full-time equivalent (FTE) employees (the work input of a full-time employee working for one full year) retained by the laboratory. It gives an indication of the level of productivity within the average laboratory by investigative area.

Table 27: Reports per FTE by Investigative Area

Reports per FTE			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	362	627	1,047
Crime Scene Investigation	20	51	79
Digital evidence	25	44	83
DNA Casework	74	92	127
DNA Database	1,133	2,668	3,782
Document Examination	14	21	24
Drugs - Controlled Substances	296	363	496
Evidence Screening & Processing		94	
Explosives	7	9	12
Fingerprints	90	127	161
Fingerprints Database (including IAFIS)	160	358	557
Fire analysis	26	44	82
Firearms and Ballistics	47	65	118
Firearms Database (including NIBIN)	273	418	692
Forensic Pathology		204	
Gun Shot Residue (GSR)	27	35	60
Marks and Impressions	15	20	46
Serology/Biology	55	96	133
Toxicology ante-mortem (excluding BAC)	143	182	261
Toxicology postmortem (excluding BAC)	140	173	248
Trace Evidence	27	32	36

Analytical Process Metrics

The next decomposition measure, **Personnel Expense/Total Expense**, serves as a proxy for the level of analytical technology chosen. This measure has a significant negative correlation with **Capital Expense/Total Expense** and serves as simpler decomposition term for the return on investment.

Below, the cost structure is detailed with a breakdown of expenses in capital, labor, consumables, versus other costs. Investigative areas that are highly automated, such as evidenced by the DNA database processing line, should show a lower Personnel Expense/Total Expense.

Personnel Expense as a proportion of Total Expense

Note that **compensation** includes all personnel expenditures. This includes wages, salary, and benefits operating staff, support staff, and administrative staff. Centrally assigned compensation is apportioned to each investigative area according to the percentage of full-time equivalent employees assigned to a particular investigative area.

Table 28: Personnel Expenditures/Total Expenditures by Investigative Area

Personnel Expenditures/Total Expenditures			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	63.9%	73.4%	81.1%
Crime Scene Investigation	67.2%	77.5%	84.5%
Digital evidence	67.2%	77.2%	90.1%
DNA Casework	63.1%	72.2%	81.6%
DNA Database	50.4%	58.6%	68.5%
Document Examination	66.6%	75.6%	88.5%
Drugs - Controlled Substances	70.1%	79.1%	84.1%
Evidence Screening & Processing	70.9%	80.0%	84.7%
Explosives	60.6%	74.3%	94.4%
Fingerprints	73.6%	82.8%	85.3%
Fingerprints Database (including IAFIS)	78.3%	79.9%	86.5%
Fire analysis	71.6%	82.6%	85.5%
Firearms and Ballistics	68.7%	76.4%	81.7%
Firearms Database (including NIBIN)	65.6%	75.1%	84.7%
Forensic Pathology	77.1%	81.5%	86.5%
Gun Shot Residue (GSR)	73.7%	82.2%	85.7%
Marks and Impressions	78.4%	85.8%	90.9%
Serology/Biology	72.0%	85.9%	89.5%
Toxicology ante-mortem (excluding BAC)	63.3%	70.4%	75.1%
Toxicology postmortem (excluding BAC)	62.5%	74.3%	82.5%
Trace Evidence	72.5%	79.5%	83.3%

Capital Expense as a proportion of Total Expense

Capital expenditures reference those purchases by the laboratory for assets whose use extends across time periods. Since depreciation classifications place laboratory equipment into a five-year depreciation class, the capital expenditures over a five-year period are averaged in the determination of this portion of a laboratory's expenditures.

Table 29: Capital Expenditures/Total Expenditures by Investigative Area

Capital Expenditures/Total Expenditures			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	2.7%	4.8%	9.5%
Crime Scene Investigation	1.8%	5.6%	10.7%
Digital evidence	2.9%	6.6%	15.5%
DNA Casework	2.7%	5.6%	8.4%
DNA Database	3.3%	8.6%	17.8%
Document Examination	0.3%	2.7%	5.5%
Drugs - Controlled Substances	3.0%	4.7%	7.7%
Evidence Screening & Processing	2.4%	4.7%	7.5%
Explosives	1.8%	4.3%	7.5%
Fingerprints	2.8%	4.0%	6.2%
Fingerprints Database (including IAFIS)	1.7%	3.0%	7.1%
Fire analysis	2.7%	3.6%	6.9%
Firearms and Ballistics	3.1%	4.7%	7.4%
Firearms Database (including NIBIN)	1.5%	4.8%	9.8%
Forensic Pathology	2.0%	2.6%	5.8%
Gun Shot Residue (GSR)	2.8%	4.6%	7.5%
Marks and Impressions	1.5%	2.1%	5.3%
Serology/Biology	1.0%	1.8%	4.1%
Toxicology ante-mortem (excluding BAC)	4.6%	8.8%	11.9%
Toxicology postmortem (excluding BAC)	3.4%	5.8%	9.3%
Trace Evidence	4.6%	6.1%	8.1%

Consumables Expense as a proportion of Total Expense

This category includes a variety of variable cost components including chemicals, reagents, consumables, and gases.

Table 30: Consumables Expenditures/Total Expenditures by Investigative Area

Consumable Expenditures/Total Expenditures			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	3.2%	6.0%	10.9%
Crime Scene Investigation	0.3%	1.5%	7.5%
Digital evidence	0.1%	0.9%	3.7%
DNA Casework	4.1%	7.8%	13.3%
DNA Database	2.6%	6.7%	14.0%
Document Examination	0.6%	1.2%	2.9%
Drugs - Controlled Substances	2.8%	4.1%	7.8%
Evidence Screening & Processing	1.2%	3.5%	4.7%
Explosives	1.3%	2.2%	5.0%
Fingerprints	1.1%	1.7%	4.9%
Fingerprints Database (including IAFIS)	0.6%	1.4%	4.4%
Fire analysis	2.3%	3.4%	6.2%
Firearms and Ballistics	1.8%	4.8%	6.9%
Firearms Database (including NIBIN)	0.5%	3.8%	9.5%
Forensic Pathology	3.7%	4.7%	6.7%
Gun Shot Residue (GSR)	1.5%	2.3%	3.4%
Marks and Impressions	1.0%	1.3%	4.2%
Serology/Biology	2.3%	3.1%	5.5%
Toxicology ante-mortem (excluding BAC)	5.8%	8.0%	11.5%
Toxicology postmortem (excluding BAC)	4.4%	6.2%	13.2%
Trace Evidence	2.2%	2.7%	3.6%

Other Expenses as a proportion of Total Expense

This category includes all other cost components not accounted for above in personnel, capital, and consumables expenses.

Table 31: Other Expenses as a Percentage of Total Expenses

Other Expenditures/Total Expenditures			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	5.2%	9.0%	16.2%
Crime Scene Investigation	5.0%	8.1%	15.2%
Digital evidence	2.9%	6.2%	14.7%
DNA Casework	4.8%	8.6%	14.1%
DNA Database	9.6%	17.3%	24.9%
Document Examination	5.3%	13.1%	24.9%
Drugs - Controlled Substances	5.5%	9.0%	14.4%
Evidence Screening & Processing	5.5%	10.6%	19.3%
Explosives	2.6%	14.8%	21.7%
Fingerprints	6.2%	9.5%	12.4%
Fingerprints Database (including IAFIS)	5.0%	9.3%	16.1%
Fire analysis	6.8%	9.2%	12.4%
Firearms and Ballistics	5.9%	12.0%	18.2%
Firearms Database (including NIBIN)	5.0%	7.4%	17.3%
Forensic Pathology	6.9%	9.4%	14.4%
Gun Shot Residue (GSR)	6.5%	8.2%	14.9%
Marks and Impressions	5.0%	6.2%	12.5%
Serology/Biology	5.3%	7.0%	11.5%
Toxicology ante-mortem (excluding BAC)	6.8%	10.6%	14.5%
Toxicology postmortem (excluding BAC)	5.0%	9.6%	14.0%
Trace Evidence	7.5%	9.7%	13.1%

Cost Breakdown

As highlighted above, expenditures are divided into four categories: personnel, capital, consumables, and other expenditures. The next eight tables detail the average size of each category per case and per sample.

Personnel Expenditures per Case

Note that **compensation** includes all personnel expenditures. This includes wages, salary, and benefits operating staff, support staff, and administrative staff. Centrally assigned compensation is apportioned to each investigative area according to the percentage of full-time equivalent employees assigned to a particular investigative area.

Table 32: Personnel Expenditures per Case

Personnel Expenditures/Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$95	$157	$252
Crime Scene Investigation	$1,406	$2,748	$6,101
Digital evidence	$1,186	$2,518	$4,874
DNA Casework	$909	$1,202	$1,711
DNA Database	$32	$57	$95
Document Examination	$2,525	$4,919	$5,248
Drugs - Controlled Substances	$193	$313	$409
Evidence Screening & Processing	$408	$631	$966
Explosives	$2,264	$6,774	$13,985
Fingerprints	$648	$942	$1,277
Fingerprints Database (including IAFIS)	$180	$621	$680
Fire analysis	$1,245	$2,042	$3,874
Firearms and Ballistics	$1,096	$1,813	$2,626
Firearms Database (including NIBIN)	$49	$146	$309
Forensic Pathology	$1,596	$1,810	$2,237
Gun Shot Residue (GSR)	$1,460	$2,471	$3,622
Marks and Impressions	$3,437	$5,629	$7,566
Serology/Biology	$700	$961	$1,697
Toxicology ante-mortem (excluding BAC)	$383	$519	$721
Toxicology postmortem (excluding BAC)	$324	$629	$847
Trace Evidence	$3,046	$4,534	$7,237

Capital Expenditures per Case

Capital expenditures reference those purchases by the laboratory for assets whose use extends across time periods. Since depreciation classifications place laboratory equipment into a five-year depreciation class, the capital expenditures over a five-year period are averaged in the determination of this portion of a laboratory's expenditures.

Table 33: Capital Expenditures per Case

Capital Expenditures/Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$5	$10	$23
Crime Scene Investigation	$45	$221	$810
Digital evidence	$51	$195	$697
DNA Casework	$38	$85	$133
DNA Database	$4	$11	$20
Document Examination	$25	$97	$231
Drugs - Controlled Substances	$12	$18	$30
Evidence Screening & Processing	$7	$34	$65
Explosives	$96	$228	$506
Fingerprints	$23	$45	$86
Fingerprints Database (including IAFIS)	$5	$10	$67
Fire analysis	$54	$121	$202
Firearms and Ballistics	$46	$99	$191
Firearms Database (including NIBIN)	$2	$6	$14
Forensic Pathology	$38	$74	$105
Gun Shot Residue (GSR)	$66	$137	$239
Marks and Impressions	$96	$141	$342
Serology/Biology	$13	$22	$48
Toxicology ante-mortem (excluding BAC)	$26	$59	$104
Toxicology postmortem (excluding BAC)	$22	$44	$68
Trace Evidence	$266	$378	$637

Consumables Expenditures per Case

This category includes a variety of variable cost components including chemicals, reagents, consumables, and gases.

Table 34: Consumables Expenditures per Case

Consumables Expenditures/Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$6	$13	$23
Crime Scene Investigation	$11	$39	$184
Digital evidence	$0	$22	$126
DNA Casework	$66	$132	$267
DNA Database	$3	$8	$25
Document Examination	$36	$87	$129
Drugs - Controlled Substances	$10	$17	$30
Evidence Screening & Processing	$6	$20	$56
Explosives	$93	$353	$575
Fingerprints	$10	$17	$66
Fingerprints Database (including IAFIS)	$4	$7	$16
Fire analysis	$57	$96	$216
Firearms and Ballistics	$32	$95	$192
Firearms Database (including NIBIN)	$1	$2	$20
Forensic Pathology	$78	$129	$163
Gun Shot Residue (GSR)	$33	$65	$134
Marks and Impressions	$70	$84	$170
Serology/Biology	$30	$48	$70
Toxicology ante-mortem (excluding BAC)	$40	$65	$106
Toxicology postmortem (excluding BAC)	$35	$55	$79
Trace Evidence	$123	$193	$378

Other Expenditures per Case

This category includes all other cost components not accounted for above in personnel, capital, and consumables expenses.

Table 35: Other Expenditures per Case

Other Expenditures/Case			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$11	$21	$32
Crime Scene Investigation	$106	$476	$1,022
Digital evidence	$46	$237	$529
DNA Casework	$72	$141	$295
DNA Database	$8	$16	$32
Document Examination	$257	$613	$1,627
Drugs - Controlled Substances	$23	$41	$65
Evidence Screening & Processing	$49	$91	$142
Explosives	$241	$594	$1,241
Fingerprints	$65	$106	$199
Fingerprints Database (including IAFIS)	$14	$54	$113
Fire analysis	$132	$269	$468
Firearms and Ballistics	$104	$263	$498
Firearms Database (including NIBIN)	$10	$17	$43
Forensic Pathology	$141	$219	$261
Gun Shot Residue (GSR)	$133	$283	$456
Marks and Impressions	$335	$421	$689
Serology/Biology	$64	$100	$144
Toxicology ante-mortem (excluding BAC)	$42	$82	$120
Toxicology postmortem (excluding BAC)	$44	$66	$114
Trace Evidence	$449	$739	$1,016

Personnel Expenditures per Sample

Note that **compensation** includes all personnel expenditures. This includes wages, salary, and benefits operating staff, support staff, and administrative staff. Centrally assigned compensation is apportioned to each investigative area according to the percentage of full-time equivalent employees assigned to a particular investigative area.

Table 36: Personnel Expenditures per Sample

Personnel Expenditures/Sample			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$108.61	$160.80	$233.36
Crime Scene Investigation	$115.03	$234.91	$561.75
Digital evidence	$681.25	$1,154.19	$1,354.21
DNA Casework	$200.92	$296.55	$387.94
DNA Database	$25.91	$35.10	$55.01
Document Examination	$0.00	$806.66	$1,018.90
Drugs - Controlled Substances	$95.90	$119.31	$144.23
Evidence Screening & Processing	$190.51	$266.72	$592.28
Explosives	$1,266.59	$1,594.49	$1,805.92
Fingerprints	$151.25	$216.49	$324.60
Fingerprints Database (including IAFIS)	$29.60	$103.51	$179.42
Fire analysis	$322.82	$519.03	$828.10
Firearms and Ballistics	$233.65	$380.05	$546.41
Firearms Database (including NIBIN)	$27.42	$74.87	$122.94
Forensic Pathology	$870.43	$1,609.27	$1,960.57
Gun Shot Residue (GSR)	$543.92	$761.49	$966.13
Marks and Impressions	$385.47	$666.69	$1,026.90
Serology/Biology	$53.95	$99.27	$143.29
Toxicology ante-mortem (excluding BAC)	$362.88	$465.89	$608.20
Toxicology postmortem (excluding BAC)	$141.43	$196.56	$273.09
Trace Evidence	$219.91	$315.61	$488.25

Capital Expenditures per Sample

Capital expenditures reference those purchases by the laboratory for assets whose use extends across time periods. Since depreciation classifications place laboratory equipment into a five-year depreciation class, the capital expenditures over a five-year period are averaged in the determination of this portion of a laboratory's expenditures.

Table 37: Capital Expenditures per Sample

Capital Expenditures/Sample			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$5.39	$9.41	$20.66
Crime Scene Investigation	$1.31	$14.51	$122.11
Digital evidence	$65.25	$163.02	$450.86
DNA Casework	$8.73	$19.57	$32.97
DNA Database	$3.03	$10.29	$17.92
Document Examination	$0.00	$1.03	$14.08
Drugs - Controlled Substances	$4.36	$6.06	$12.43
Evidence Screening & Processing	$11.12	$18.17	$27.49
Explosives	$27.10	$37.19	$73.56
Fingerprints	$5.15	$9.27	$18.88
Fingerprints Database (including IAFIS)	$1.44	$3.95	$17.83
Fire analysis	$11.84	$23.11	$45.84
Firearms and Ballistics	$11.90	$20.52	$35.21
Firearms Database (including NIBIN)	$0.78	$2.97	$7.70
Forensic Pathology	$21.30	$36.95	$113.40
Gun Shot Residue (GSR)	$17.04	$38.63	$57.02
Marks and Impressions	$1.97	$12.35	$37.71
Serology/Biology	$0.79	$1.24	$2.82
Toxicology ante-mortem (excluding BAC)	$23.46	$54.73	$86.96
Toxicology postmortem (excluding BAC)	$8.07	$13.55	$23.05
Trace Evidence	$13.36	$23.90	$47.16

Consumables Expenditures per Sample

This category includes a variety of variable cost components including chemicals, reagents, consumables, and gases.

Table 38: Consumables Expenditures per Sample

Consumables Expenditures/Sample			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$6.42	$12.41	$24.38
Crime Scene Investigation	$0.10	$1.81	$8.42
Digital evidence	$0.72	$15.00	$80.35
DNA Casework	$13.43	$35.46	$64.49
DNA Database	$1.63	$4.25	$10.07
Document Examination	$0.00	$4.34	$15.66
Drugs - Controlled Substances	$4.00	$5.91	$10.30
Evidence Screening & Processing	$6.62	$19.05	$33.98
Explosives	$25.14	$44.03	$81.21
Fingerprints	$2.42	$4.10	$9.60
Fingerprints Database (including IAFIS)	$1.06	$2.10	$14.98
Fire analysis	$11.38	$19.85	$39.94
Firearms and Ballistics	$9.88	$25.61	$40.63
Firearms Database (including NIBIN)	$0.39	$1.05	$9.80
Forensic Pathology	$36.60	$64.07	$91.42
Gun Shot Residue (GSR)	$12.45	$20.87	$33.79
Marks and Impressions	$7.09	$9.92	$21.74
Serology/Biology	$1.97	$2.99	$4.76
Toxicology ante-mortem (excluding BAC)	$36.86	$54.41	$82.33
Toxicology postmortem (excluding BAC)	$10.22	$17.27	$31.71
Trace Evidence	$6.51	$11.74	$23.13

Other Expenditures per Sample

This category includes all other cost components not accounted for above in personnel, capital, and consumables expenses.

Table 39: Other Expenditures per Sample

Other Expenditures/Sample			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$9.15	$18.41	$28.06
Crime Scene Investigation	$2.86	$43.68	$101.43
Digital evidence	$39.45	$79.74	$220.29
DNA Casework	$13.25	$27.02	$45.52
DNA Database	$6.79	$13.05	$24.88
Document Examination	$0.00	$69.50	$290.42
Drugs - Controlled Substances	$8.70	$12.08	$19.71
Evidence Screening & Processing	$24.03	$43.31	$95.91
Explosives	$22.96	$63.35	$228.93
Fingerprints	$15.14	$22.67	$42.55
Fingerprints Database (including IAFIS)	$2.85	$10.13	$35.08
Fire analysis	$36.87	$58.80	$113.89
Firearms and Ballistics	$25.04	$45.97	$86.25
Firearms Database (including NIBIN)	$1.99	$6.51	$8.67
Forensic Pathology	$73.12	$119.04	$174.51
Gun Shot Residue (GSR)	$49.88	$76.53	$135.80
Marks and Impressions	$5.55	$46.01	$81.51
Serology/Biology	$4.36	$6.87	$9.13
Toxicology ante-mortem (excluding BAC)	$44.15	$76.36	$101.78
Toxicology postmortem (excluding BAC)	$14.75	$25.89	$37.06
Trace Evidence	$22.21	$35.35	$66.92

Turn-around Time

Turn-around time is offered in two forms. The first is a measure that begins when the last item of evidence in an investigative area has been submitted to the laboratory. The second measure begins the turn-around time count with the submission of the first piece of evidence in an investigative area. Because most laboratories only record one or the other of these measures, there is some seeming inconsistency which is attributed to the limited sample. The metric has been slightly altered from previous years to correspond to recommendations from Project FORESIGHT participants. The change in the metric reflects the time from each request for analysis to issuance of a report. As such, a case in one investigative area may have multiple turn-around times that correspond to separate requests.

Turn-around Time (Days from last submission of evidence to Report submission)

Table 40: Turnaround Time from Last Item Received by Investigative Area

Turnaround Time from Last Item Received			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	13	20	26
Crime Scene Investigation	7	13	14
Digital evidence	2	9	28
DNA Casework	28	53	101
DNA Database	1	21	47
Document Examination	17	32	42
Drugs - Controlled Substances	45	69	90
Evidence Screening & Processing			
Explosives			
Fingerprints	9	44	78
Fingerprints Database (including IAFIS)	0	1	2
Fire analysis	20	21	56
Firearms and Ballistics	10	30	134
Firearms Database (including NIBIN)	1	3	11
Forensic Pathology	13	26	38
Gun Shot Residue (GSR)	29	48	114
Marks and Impressions	20	44	64
Serology/Biology	9	43	69
Toxicology ante-mortem (excluding BAC)	26	33	50
Toxicology postmortem (excluding BAC)	29	31	36
Trace Evidence	32	60	78

Turn-around Time (Days from first submission of evidence to Report submission)

Table 41: Turnaround Time from First Item Received by Investigative Area

Turnaround Time from First Item Received			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	22	29	40
Crime Scene Investigation	26	43	54
Digital evidence	26	63	152
DNA Casework	100	135	161
DNA Database	47	59	72
Document Examination	44	56	65
Drugs - Controlled Substances	50	71	92
Evidence Screening & Processing	33	46	52
Explosives	103	135	159
Fingerprints	53	72	90
Fingerprints Database (including IAFIS)	6	12	22
Fire analysis	33	93	128
Firearms and Ballistics	58	80	102
Firearms Database (including NIBIN)	3	9	31
Forensic Pathology		74	
Gun Shot Residue (GSR)	74	90	114
Marks and Impressions	84	106	165
Serology/Biology	55	67	85
Toxicology ante-mortem (excluding BAC)	47	70	82
Toxicology postmortem (excluding BAC)	45	70	83
Trace Evidence	165	206	246

Backlog

Another area of concern involves the increased demand for laboratory services and the level of backlog. For data collection purposes, the definition of backlog has been defined as open cases at the end of the fiscal year that have been open for more than thirty days. As a relative comparative measure, the ratio of open cases to total cases for the year is presented in the following table.

Cases Open over 30 Days/Annual Caseload

Table 42: Backlog Cases as a Percent of Total Cases by Investigative Area

Backlog Cases as a Percent of Total Cases by Investigative Area			
Area of Investigation	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	1.37%	1.64%	2.99%
Crime Scene Investigation	5.10%	6.08%	20.42%
Digital evidence	6.63%	11.54%	22.22%
DNA Casework	8.82%	10.14%	30.59%
DNA Database	9.41%	11.34%	12.30%
Document Examination	6.45%	10.57%	18.18%
Drugs - Controlled Substances	5.39%	8.02%	9.63%
Evidence Screening & Processing	3.41%	4.70%	7.82%
Explosives	35.85%	39.00%	41.11%
Fingerprints	7.78%	9.33%	11.02%
Fingerprints Database (including IAFIS)		1.96%	
Fire analysis	13.96%	16.33%	22.65%
Firearms and Ballistics	10.09%	11.51%	17.63%
Firearms Database (including NIBIN)		1.92%	
Forensic Pathology	7.18%	7.69%	10.42%
Gun Shot Residue (GSR)	12.46%	17.78%	57.14%
Marks and Impressions	20.00%	24.14%	54.05%
Serology/Biology	7.69%	8.39%	9.73%
Toxicology ante-mortem (excluding BAC)	7.84%	9.31%	10.72%
Toxicology postmortem (excluding BAC)	3.34%	8.41%	10.20%
Trace Evidence	15.96%	20.14%	49.94%

Digital Evidence LabRAT outcomes

The Forensic Laboratory Needs Technology Working Group (FLN-TWG) provided recommendations for data collection for Digital Evidence analysis. The next two tables highlight some of the details that emerged from that special data collection.

Table 43: Digital Evidence Level I Metrics

Digital Evidence Level I Metrics			
Measure	**25th percentile**	**Median**	**75th percentile**
Cases			
Total	79	185	455
Mobile	200	468	677
Computer	22	40	92
Video	28	52	110
Mass Storage	2	6	19
Internet of Things	9	20	38
Reports			
Total	83	191	511
Mobile	162	342	737
Computer	17	43	98
Video	25	43	116
Mass Storage	2	4	13
Internet of Things	6	10	40
FTE			
Total	2.61	3.87	7.85
Mobile	0.63	1.02	1.35
Computer	1.00	1.59	3.00
Video	1.02	1.99	3.07
Mass Storage	0.25	0.52	1.36
Internet of Things	0.78	1.00	1.30

Table 44: Digital Evidence Level II Metrics

Digital Evidence Level II Metrics			
Measure	**25th percentile**	**Median**	**75th percentile**
Turnaround Time			
Total	26	63	152
Mobile	4	7	13
Computer	35	48	104
Video	31	47	122
Mass Storage	10	23	37
Internet of Things	31	37	65
Gigabytes Examined			
Total	43,381	52,476	118,592
Mobile	13,256	19,326	34,672
Computer	22,576	27,685	52,500
Video	6,807	9,900	15,739
Mass Storage	500	1,560	1,863
Internet of Things	46	59	163
Personnel Time Allocation			
Casework	59.5%	65.0%	71.9%
Technical Review	0.0%	2.0%	4.9%
Testimony & Testimony Preparation	4.6%	5.0%	7.3%
Training	1.5%	4.1%	5.0%
Continuing Education	5.0%	9.8%	10.1%
Non-Digital Evidence Duties	3.1%	6.1%	14.9%
Other	0.0%	0.2%	4.1%
Outside Agencies Assisted	7	12	45

Time Trends

The 2019 National Institute of Justice report noted some worrisome trends as forensic laboratory resources were stressed from increased demands for services outpacing any increase in resources to the laboratories.[4] The report estimated that state and local forensic laboratories were understaffed by more than 900 positions and those shortfalls resulted in growing backlogs as turnaround times increased. Part of the additional strain on resources could be attributed to the attention placed on unsubmitted sexual assault kits (SAKs) and the drive to test the 200,000 to 400,000 outstanding SAKs that had yet to be submitted for laboratory analysis. Another key influence on the increased demand for resources was the growing opioid crisis. The COVID-19 pandemic introduced additional stress on forensic laboratories.

Using the Project FORESIGHT benchmark data from fiscal years 2014-2022, we note some of the trends influenced by these systemic stressors.[5] The tables illustrate the growth in various metrics over this period. Both the arithmetic mean and the geometric mean are provided. The arithmetic mean provides an average of the year-to-year growth, while the geometric average offers a long-term growth trend. The latter highlights the influence of COVID-19 on forensic laboratories.

[4] U.S. Department of Justice, Office of Justice Programs. (2019). *Report to Congress: Needs Assessment of Forensic Laboratories and Medical Examiner/Coroner Offices*. Washington, DC: National Institute of Justice. https://www.ncjrs.gov/pdffiles1/nij/253626.pdf.

[5] Speaker, P. J. (2023) Project FORESIGHT Annual Report, 2021-2022. https://researchrepository.wvu.edu/faculty_publications/3284/
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Speaker, P. J. (2015). Project FORESIGHT Benchmark Data 2013-2014. https://researchrepository.wvu.edu/faculty_publications/1142/

Table 45: Average Annual Growth in Case Submissions per 100,000 population, 2014-2023

Growth in Case Submissions per 100K population (2014-2023)		
Area of Investigation	**Arithmetic Average**	**Geometric Average**
Blood Alcohol	12.88%	0.18%
Crime Scene Investigation	42.34%	-18.90%
Digital evidence	186.14%	30.65%
DNA Casework	10.28%	4.86%
DNA Database	25.78%	-3.29%
Document Examination	29.55%	-2.35%
Drugs - Controlled Substances	3.66%	0.01%
Evidence Screening & Processing	18.18%	2.93%
Explosives	20.57%	-8.54%
Fingerprints	12.64%	-3.28%
Fingerprints Database (including IAFIS)	28.52%	-22.53%
Fire analysis	-3.53%	-3.99%
Firearms and Ballistics	4.54%	-0.83%
Firearms Database (including NIBIN)	19.62%	16.49%
Forensic Pathology	36.23%	7.30%
Gun Shot Residue (GSR)	18.82%	-2.19%
Marks and Impressions	4.77%	-7.76%
Serology/Biology	20.93%	3.03%
Toxicology ante-mortem (excluding BAC)	6.68%	5.26%
Toxicology postmortem (excluding BAC)	13.08%	10.49%
Trace Evidence	6.03%	0.76%

Table 46: Average Annual Growth in TAT, 2014-2023

Growth in Case Turnaround Time (2014-2023)		
Area of Investigation	**Arithmetic Average**	**Geometric Average**
Blood Alcohol	36.02%	13.74%
Crime Scene Investigation	9.91%	-5.12%
Digital evidence	127.11%	15.72%
DNA Casework	12.01%	7.25%
DNA Database	22.50%	-16.74%
Document Examination	97.49%	-9.57%
Drugs - Controlled Substances	22.15%	8.59%
Evidence Screening & Processing	28.47%	-0.59%
Explosives	59.83%	1.10%
Fingerprints	24.91%	4.09%
Fingerprints Database (including IAFIS)	39.96%	-5.81%
Fire analysis	4.73%	0.58%
Firearms and Ballistics	26.30%	5.92%
Firearms Database (including NIBIN)	-27.75%	-26.84%
Forensic Pathology	16.02%	12.12%
Gun Shot Residue (GSR)	21.79%	-1.97%
Marks and Impressions	41.56%	-2.62%
Serology/Biology	16.69%	-5.49%
Toxicology ante-mortem (excluding BAC)	13.71%	2.58%
Toxicology postmortem (excluding BAC)	2.66%	1.24%
Trace Evidence	16.99%	0.28%

Table 47: Average Annual Growth in FTE (2014-2023)

Growth in FTE (2014-2023)		
Area of Investigation	**Arithmetic Average**	**Geometric Average**
Blood Alcohol	8.61%	0.10%
Crime Scene Investigation	3.97%	-2.53%
Digital evidence	36.89%	18.94%
DNA Casework	14.28%	0.47%
DNA Database	27.86%	3.31%
Document Examination	0.66%	-9.59%
Drugs - Controlled Substances	14.25%	3.03%
Evidence Screening & Processing	19.82%	1.72%
Explosives	21.81%	5.06%
Fingerprints	2.04%	-1.60%
Fingerprints Database (including IAFIS)	-10.90%	-10.44%
Fire analysis	7.85%	2.77%
Firearms and Ballistics	13.62%	4.64%
Firearms Database (including NIBIN)	11.29%	7.19%
Forensic Pathology	30.80%	11.85%
Gun Shot Residue (GSR)	28.94%	7.68%
Marks and Impressions	96.64%	1.99%
Serology/Biology	2.69%	0.06%
Toxicology ante-mortem (excluding BAC)	1.96%	-1.40%
Toxicology postmortem (excluding BAC)	28.59%	-4.84%
Trace Evidence	37.94%	-0.81%

Efficiency and Cost Effectiveness of Forensic Science Services—FORESIGHT 2022-2023 Benchmark Data

The summary statistics offer a one-dimensional view of performance. In this section, that view is expanded through consideration of cost effectiveness and efficiency. Economic theory indicates that any industry, including forensic science laboratories, will have average costs (Cost/Case) that decline as caseload is increased until reaching a point of perfect economies of scale. Thereafter, diseconomies of scale will be realized and average costs will rise as caseload increases. This behavior is exemplified via U-shaped average cost curves.

For each investigative area, the industry average total cost curve has been estimated by a series of non-linear regressions. When a laboratory performs on or near the curve, it is an indication of efficiency for the corresponding caseload. For an efficient performance that is near the bottom of the U-shaped curve, the laboratory exhibits cost effective performance as it approaches perfect economies of scale.

Each of the average cost curves is illustrated with a corresponding table of values for the cost/case for various caseloads. Also note that productivity in the form of Cases/FTE versus the corresponding caseload exhibits an inverted curve as compared to the average cost. Research to-date suggests that the level of productivity for any caseload is the most critical component in the DuPont breakdown to explain efficiency in the laboratory. That is, a laboratory which exemplifies high productivity for their caseload is likely to be operating near peak efficient average cost for that level of casework.

In addition to this cross–sectional comparison, it is recommended that participants track their average cost and productivity for all past FORESIGHT submissions in real terms. The term "real" indicates that costs have been adjusted for inflation and converted to the most recent year's price index.

Blood Alcohol Analysis

Figure 3: Efficient Frontier for Blood Alcohol Analysis—Average Total Cost v. Cases Processed

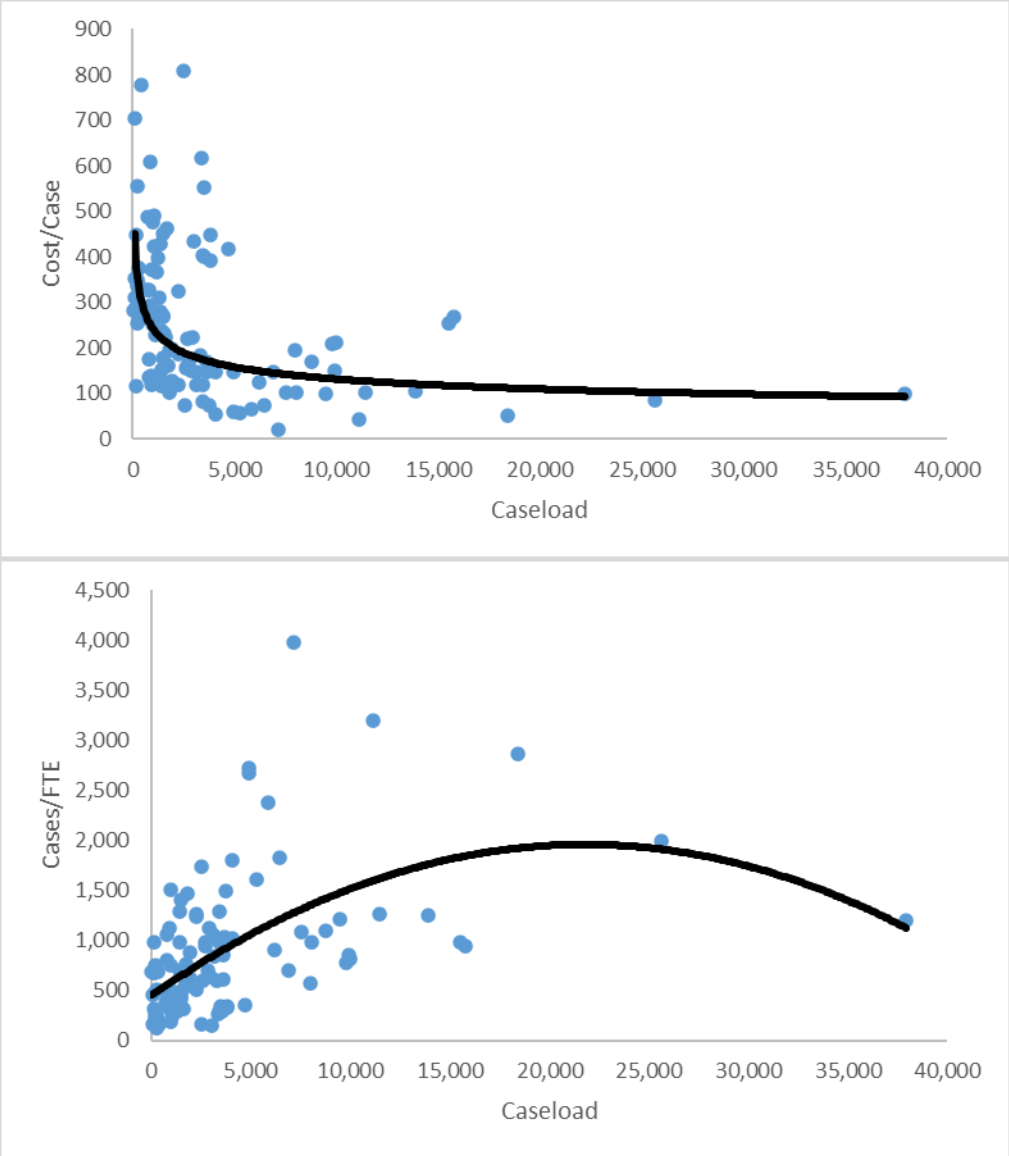


Figure 4: Efficient Frontier for Blood Alcohol Analysis—Cases/FTE v. Cases Processed

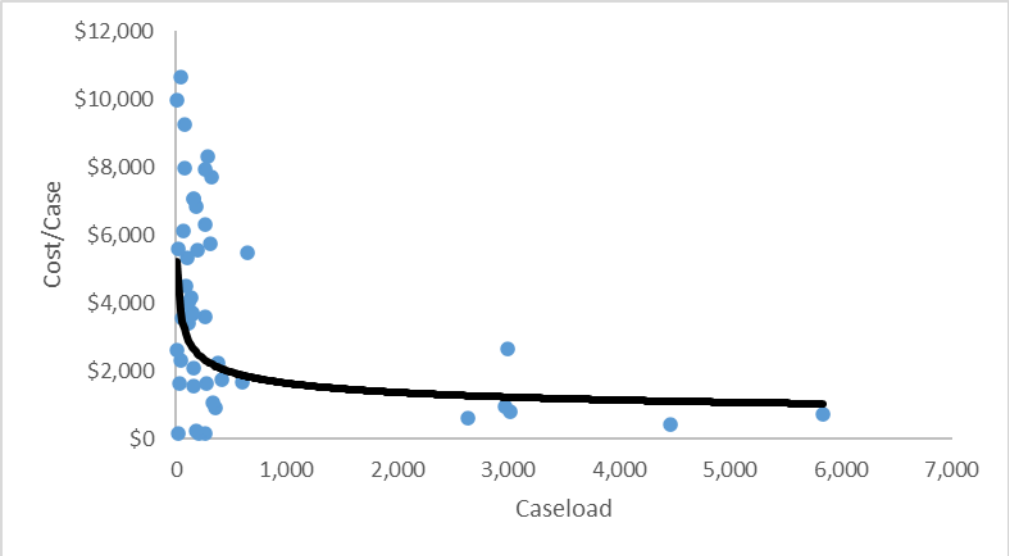
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 48: Efficient Frontier for Blood & Breath Alcohol Analysis—Efficient Cost/Case & Cases/FTE for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
100	$443	262	5,000	$158	866
200	$369	324	5,500	$154	891
300	$332	367	6,000	$151	915
400	$308	400	6,500	$148	938
500	$290	428	7,000	$145	959
600	$277	453	8,000	$140	999
700	$266	475	9,000	$136	1,036
800	$256	495	10,000	$132	1,070
900	$249	513	11,000	$129	1,102
1,000	$242	529	12,000	$126	1,131
1,250	$228	567	13,000	$123	1,159
1,500	$217	599	14,000	$121	1,186
1,750	$209	628	15,000	$119	1,211
2,000	$202	654	16,000	$117	1,235
2,250	$195	678	17,000	$115	1,258
2,500	$190	701	18,000	$113	1,280
2,750	$185	721	19,000	$112	1,302
3,000	$181	741	20,000	$110	1,322
3,250	$177	759	22,500	$107	1,371
3,500	$174	776	25,000	$104	1,416
3,750	$171	793	30,000	$99	1,497
4,000	$168	809	35,000	$95	1,397
4,500	$163	838	40,000	$92	896

Crime Scene Investigation

Figure 5: Efficient Frontier for Crime Scene Investigation—Average Total Cost v. Cases Processed



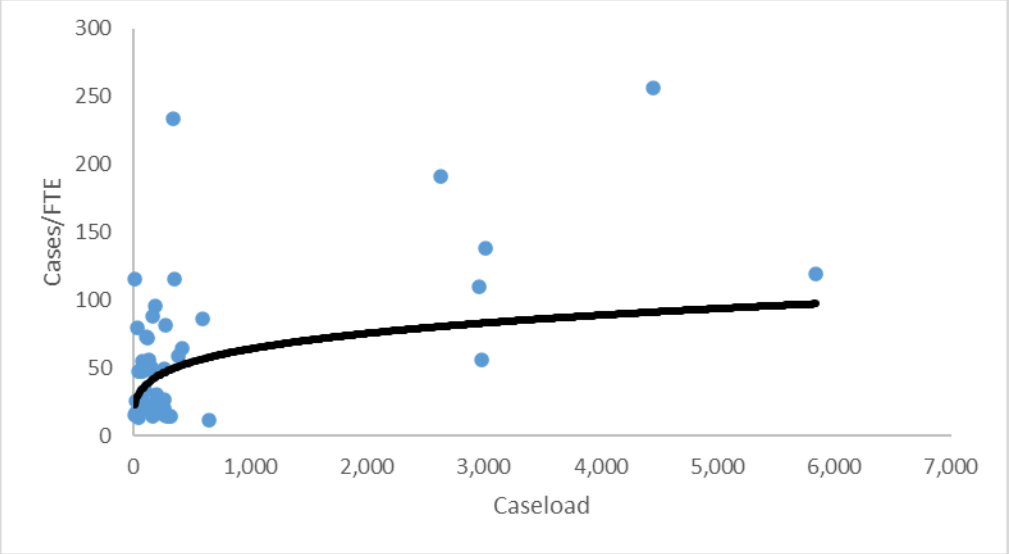


Figure 6: Efficient Frontier Crime Scene Investigation—Cases/FTE v. Caseload

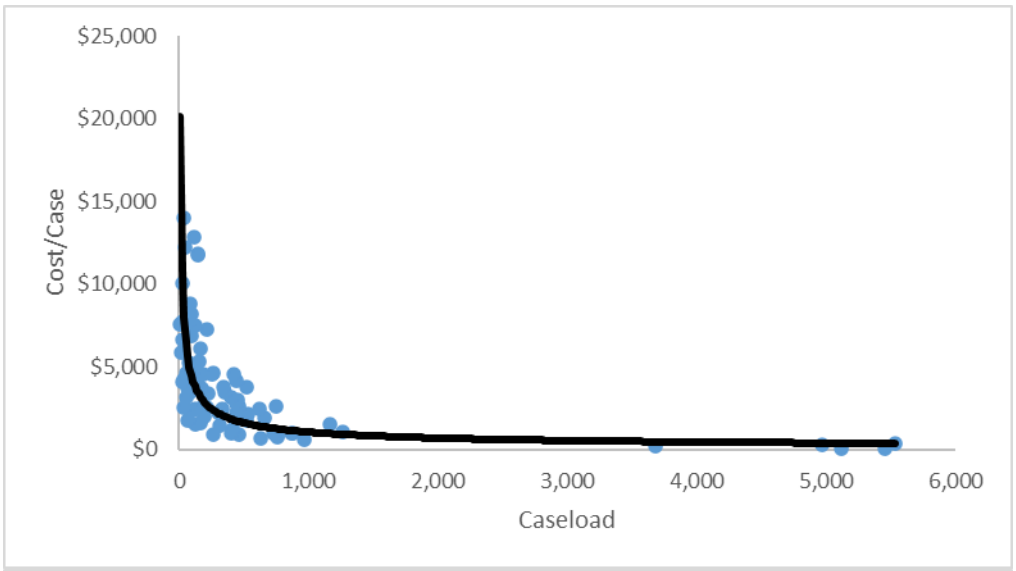
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 49: Efficient Frontier for Crime Scene Investigation—Efficient Cost/Case & Cases/FTE for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
10	$7,900	16	400	$2,195	49
15	$6,863	18	425	$2,149	50
25	$5,747	21	450	$2,107	51
35	$5,114	23	500	$2,032	52
45	$4,687	25	600	$1,907	55
55	$4,371	27	700	$1,808	58
65	$4,125	28	800	$1,726	60
75	$3,925	29	900	$1,657	62
85	$3,758	31	1,000	$1,597	64
95	$3,616	32	1,250	$1,478	69
105	$3,492	33	1,500	$1,387	73
115	$3,384	33	1,750	$1,315	76
125	$3,287	34	2,000	$1,256	80
150	$3,086	36	2,250	$1,205	82
175	$2,925	38	2,500	$1,162	85
200	$2,792	40	2,750	$1,124	88
225	$2,681	41	3,000	$1,091	90
250	$2,584	42	3,500	$1,034	94
275	$2,500	44	4,000	$987	98
300	$2,426	45	4,500	$948	102
325	$2,359	46	5,000	$913	105
350	$2,299	47	5,500	$884	157
375	$2,245	48	6,000	$857	150

Digital Evidence Analysis

Figure 7: Efficient Frontier for Digital Evidence Analysis—Average Total Cost v. Cases Processed



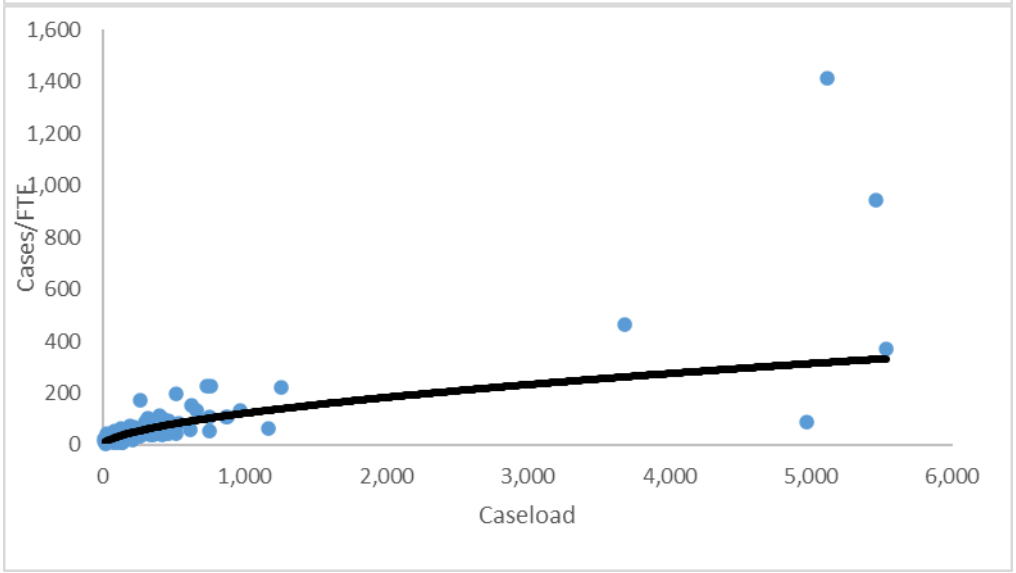


Figure 8: Efficient Frontier Digital Evidence Analysis—Cases/FTE v. Caseload

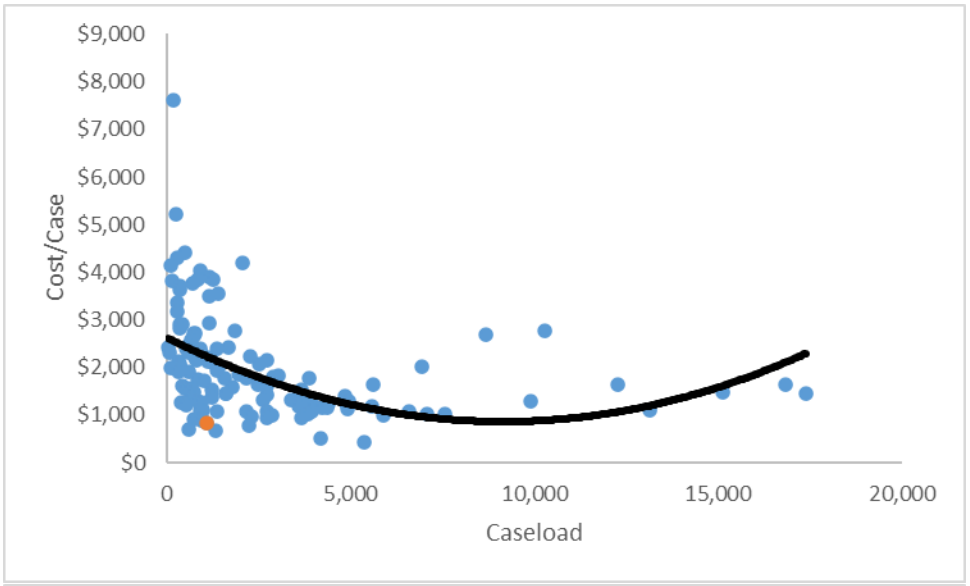
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 50: Efficient Frontier for Digital Evidence Analysis—Efficient Cost/Case & Cases/FTE for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
15	$15,134	10	450	$1,726	76
25	$10,923	14	500	$1,614	81
35	$8,812	17	550	$1,519	85
45	$7,506	20	600	$1,437	90
55	$6,603	22	650	$1,365	94
65	$5,936	25	700	$1,302	98
75	$5,417	27	800	$1,196	106
85	$5,001	29	900	$1,109	114
95	$4,659	31	1,000	$1,037	121
105	$4,370	33	1,250	$899	138
115	$4,124	34	1,500	$800	154
125	$3,910	36	1,750	$725	168
150	$3,481	40	2,000	$666	182
175	$3,154	44	2,250	$618	195
200	$2,897	47	2,500	$578	207
225	$2,687	51	2,750	$544	219
250	$2,512	54	3,000	$514	230
275	$2,364	57	3,500	$466	252
300	$2,236	60	4,000	$428	272
325	$2,125	63	4,500	$397	292
350	$2,027	66	5,000	$371	310
375	$1,939	68	5,500	$349	328
400	$1,861	71	6,000	$330	345

DNA Casework Analysis

Figure 9: Efficient Frontier for DNA Casework Analysis—Average Total Cost v. Cases Processed



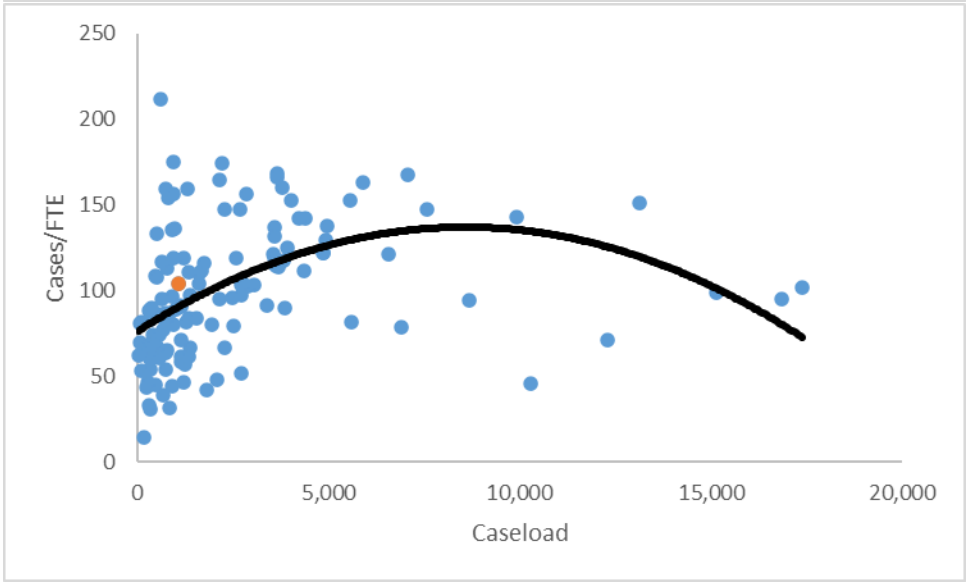


Figure 10: Efficient Frontier DNA Casework Analysis—Cases/FTE v. Caseload

Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 51: Efficient Frontier for DNA Casework Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
40	$3,905	47	2,000	$1,979	101
80	$3,346	53	2,250	$1,904	104
125	$3,029	58	2,500	$1,831	106
150	$2,908	60	2,750	$1,761	109
175	$2,810	61	3,000	$1,693	111
200	$2,727	63	3,500	$1,565	116
250	$2,575	66	4,000	$1,447	120
300	$2,556	68	4,500	$1,339	124
350	$2,537	70	5,000	$1,241	127
400	$2,519	72	5,500	$1,152	130
450	$2,500	74	6,000	$1,074	133
500	$2,482	75	6,500	$1,006	135
600	$2,446	78	7,000	$947	137
700	$2,410	80	7,500	$899	139
800	$2,374	82	8,000	$860	140
900	$2,339	84	9,000	$813	142
1,000	$2,304	85	10,000	$805	142
1,100	$2,270	87	11,000	$837	141
1,200	$2,236	88	12,000	$909	138
1,300	$2,203	90	13,000	$1,021	134
1,400	$2,169	94	14,000	$1,172	129
1,500	$2,137	96	15,000	$1,363	122
1,750	$2,057	98	16,000	$1,594	114

DNA Database

Figure 11: Efficient Frontier for DNA Database—Average Total Cost v. Cases Processed

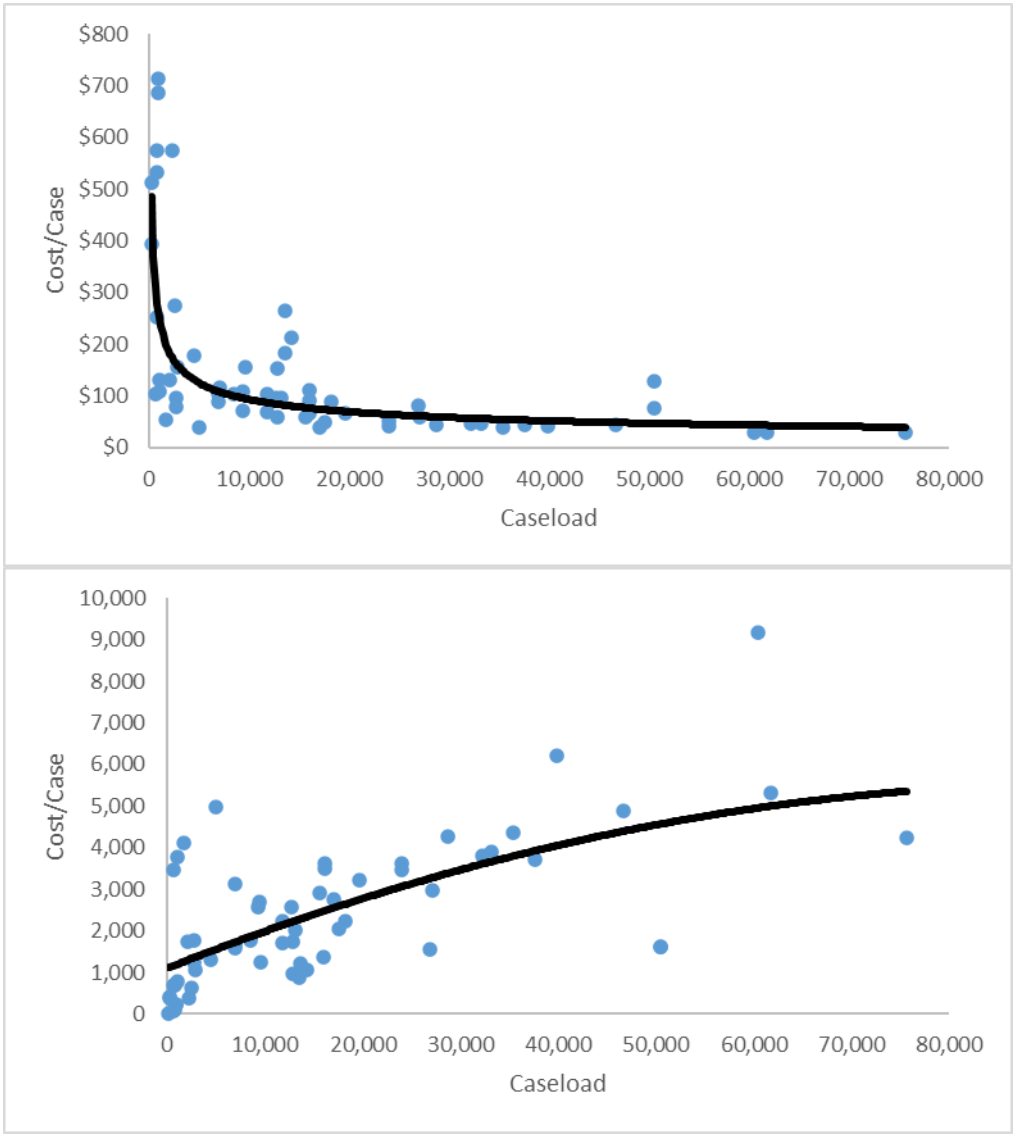


Figure 12: Efficient Frontier DNA Database—Cases/FTE v. Caseload

Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 52: Efficient Frontier for DNA Database—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
500	$372	390	16,000	$76	2,409
600	$343	429	18,000	$72	2,563
700	$319	465	20,000	$69	2,709
800	$300	499	22,000	$66	2,848
900	$285	531	24,000	$63	2,981
1,000	$271	561	26,000	$61	3,109
1,250	$245	631	28,000	$59	3,233
1,500	$225	694	30,000	$57	3,352
1,750	$210	753	32,000	$56	3,468
2,000	$198	807	34,000	$54	3,580
2,500	$178	908	36,000	$53	3,690
3,000	$164	999	38,000	$51	3,796
3,500	$153	1,084	40,000	$50	3,900
4,000	$144	1,162	42,000	$49	4,001
4,500	$136	1,237	44,000	$48	4,100
5,000	$130	1,307	46,000	$47	4,197
6,000	$119	1,439	48,000	$46	4,292
7,000	$111	1,560	50,000	$45	4,385
8,000	$105	1,673	52,000	$44	4,476
9,000	$99	1,780	54,000	$44	4,566
10,000	$95	1,882	56,000	$43	4,654
12,000	$87	2,071	58,000	$42	4,741
14,000	$81	2,246	60,000	$42	4,826

Document Examination

Figure 13: Efficient Frontier for Document Examination—Average Total Cost v. Cases Processed

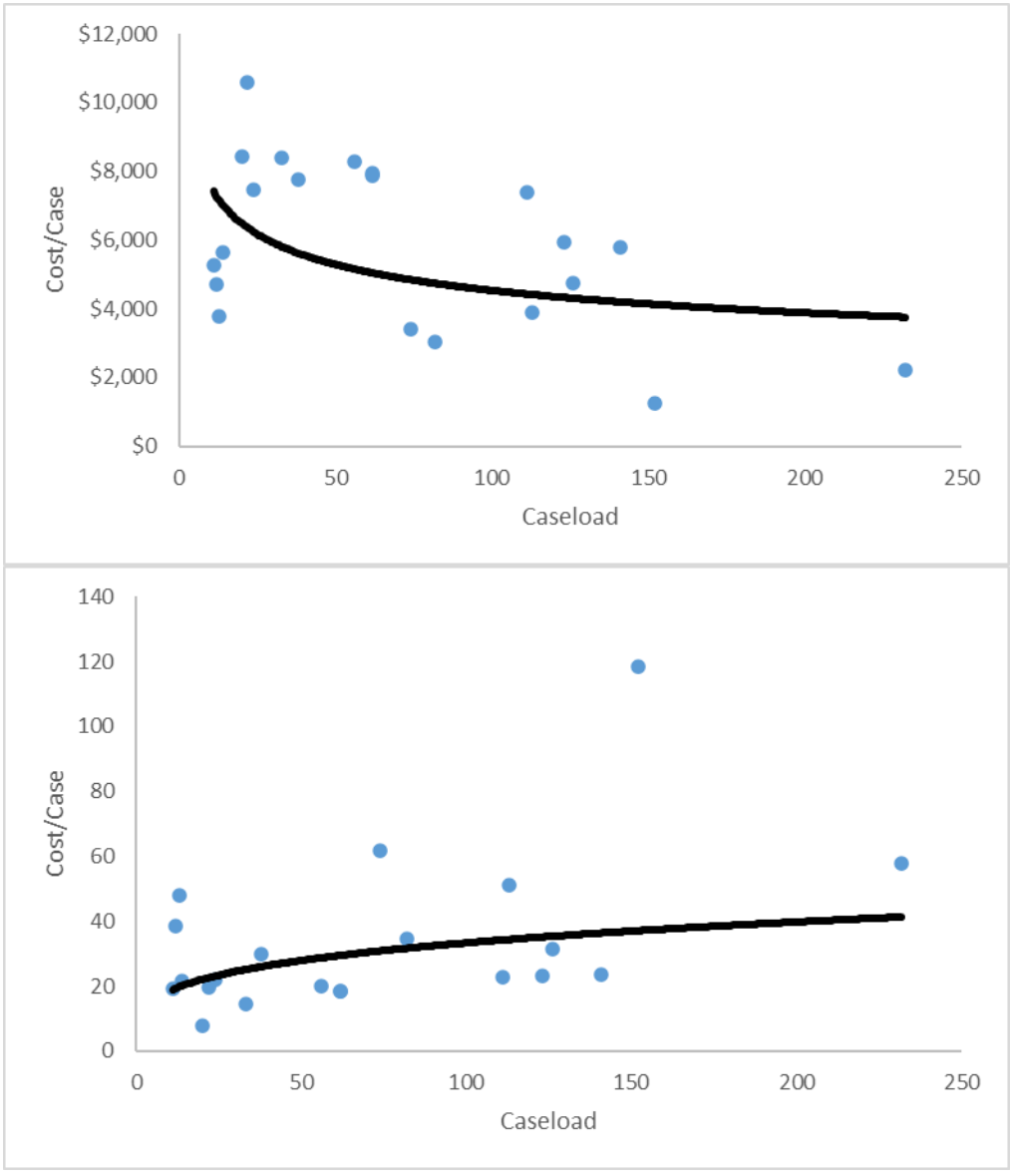


Figure 14: Efficient Frontier Document Examination—Cases/FTE v. Caseload

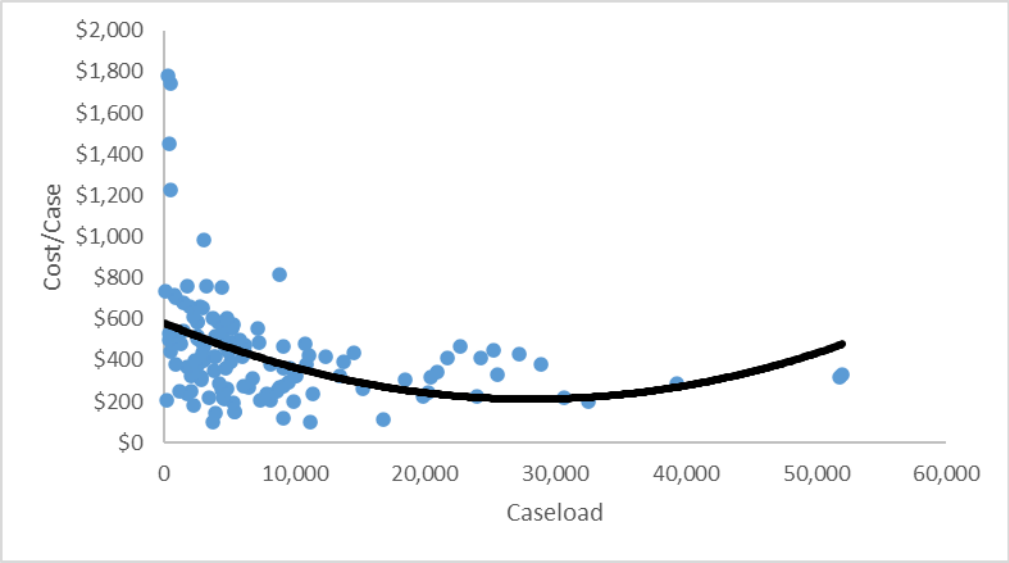
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 53: Efficient Frontier for Document Examination—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
2	$10,843	12	44	$5,441	27
3	$9,905	14	46	$5,387	27
4	$9,289	15	48	$5,336	28
5	$8,838	15	50	$5,288	28
6	$8,486	16	55	$5,176	29
8	$7,958	17	60	$5,077	29
10	$7,572	18	65	$4,987	30
12	$7,270	19	70	$4,905	30
14	$7,024	20	80	$4,761	31
16	$6,818	21	90	$4,638	32
18	$6,641	21	100	$4,530	33
20	$6,487	22	110	$4,435	34
22	$6,351	23	120	$4,350	35
24	$6,228	23	130	$4,273	36
26	$6,118	24	140	$4,203	36
28	$6,018	24	150	$4,138	37
30	$5,926	24	160	$4,079	38
32	$5,841	25	170	$4,024	38
34	$5,763	25	180	$3,973	39
36	$5,690	26	190	$3,926	39
38	$5,622	26	200	$3,881	40
40	$5,558	26	220	$3,799	41
42	$5,497	27	240	$3,726	42

Drugs—Controlled Substances Analysis

Figure 15: Efficient Frontier for Drugs-Controlled Substances Analysis—Average Total Cost v. Cases Processed



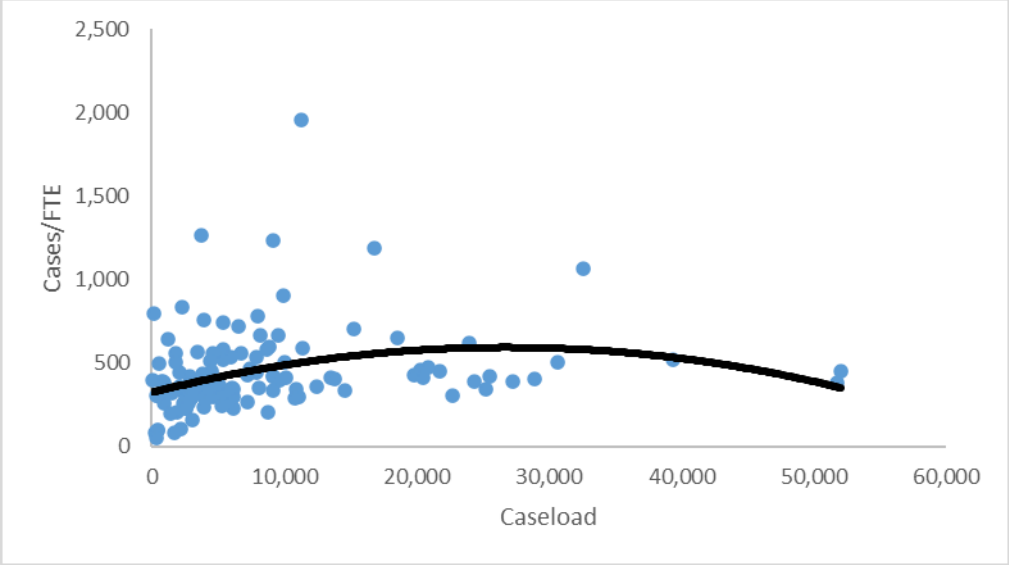


Figure 16: Efficient Frontier Drugs-Controlled Substances Analysis—Cases/FTE v. Caseload

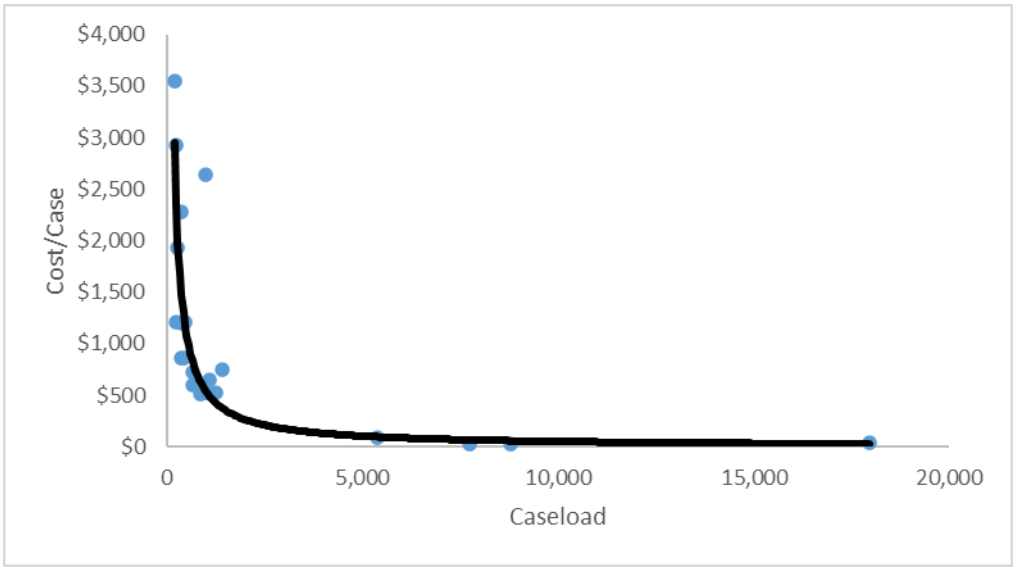
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 54: Efficient Frontier for Drugs-Controlled Substances Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
50	$1,038	158	10,000	$366	435
100	$893	181	11,000	$345	443
150	$817	195	12,000	$325	451
200	$768	206	13,000	$307	458
250	$731	215	14,000	$290	464
500	$629	246	16,000	$259	476
750	$616	265	18,000	$233	487
1,000	$608	280	20,000	$212	497
1,250	$600	293	22,000	$196	506
1,500	$592	303	24,000	$184	514
1,750	$584	312	26,000	$178	522
2,000	$576	320	28,000	$176	530
2,250	$568	327	30,000	$179	537
2,500	$561	334	32,000	$187	544
3,000	$546	346	34,000	$200	550
3,500	$531	356	36,000	$218	556
4,000	$516	365	38,000	$241	545
4,500	$502	374	40,000	$268	526
5,000	$488	381	42,000	$300	505
6,000	$461	395	44,000	$337	480
7,000	$436	407	46,000	$379	453
8,000	$411	417	48,000	$426	422
9,000	$388	427	50,000	$478	388

Evidence Screening & Processing

Figure 17: Efficient Frontier for Evidence Screening & Processing—Average Total Cost v. Cases Processed



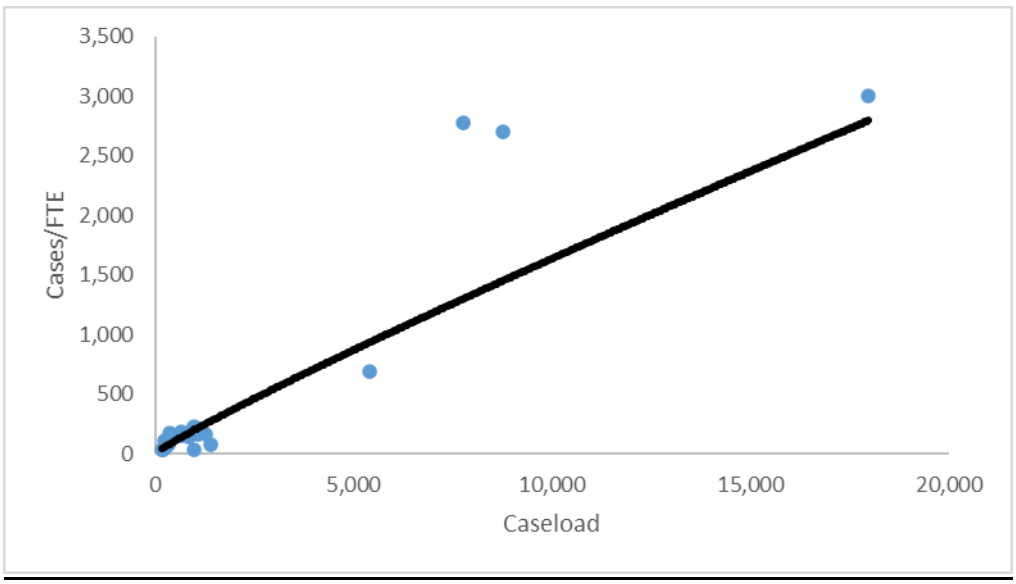


Figure 18: Efficient Frontier for Evidence Screening & Processing — Cases/FTE v. Caseload

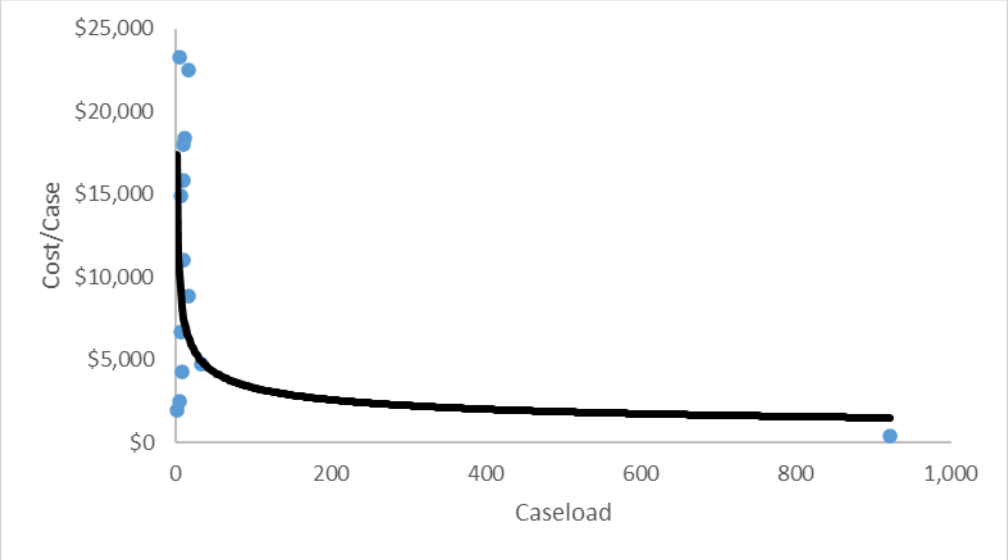
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 55: Efficient Frontier for Evidence Screening & Processing—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
175	$3,152	41	800	$671	163
200	$2,752	46	850	$631	173
225	$2,441	51	900	$596	182
250	$2,193	56	950	$564	191
275	$1,990	62	1,000	$535	200
300	$1,822	67	1,500	$354	290
325	$1,679	72	2,000	$264	377
350	$1,557	77	2,500	$211	462
375	$1,452	82	3,000	$175	546
400	$1,359	87	3,500	$150	628
425	$1,278	92	4,000	$131	710
450	$1,206	97	4,500	$116	790
475	$1,141	101	5,000	$104	870
500	$1,083	106	6,000	$86	1,027
525	$1,031	111	7,000	$74	1,183
550	$983	116	8,000	$64	1,336
575	$940	121	9,000	$57	1,488
600	$900	126	10,000	$51	1,638
625	$863	130	11,000	$47	1,787
650	$829	135	12,000	$43	1,934
675	$798	140	14,000	$36	2,227
700	$769	145	16,000	$32	2,515
750	$717	154	18,000	$28	2,801

Explosives Analysis

Figure 19: Efficient Frontier for Explosives Analysis—Average Total Cost v. Cases Processed



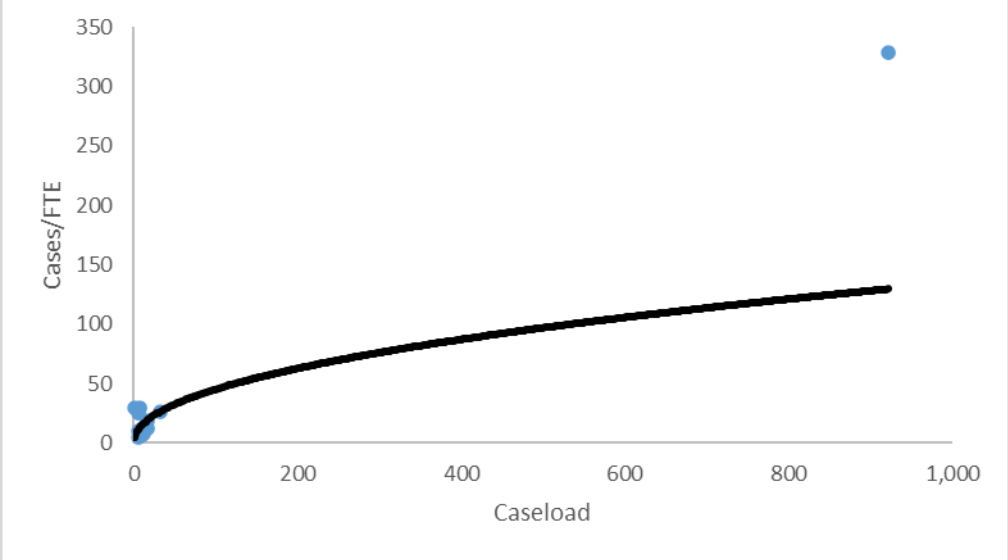


Figure 20 : Efficient Frontier for Explosives Analysis—Cases/FTE v. Caseload

Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

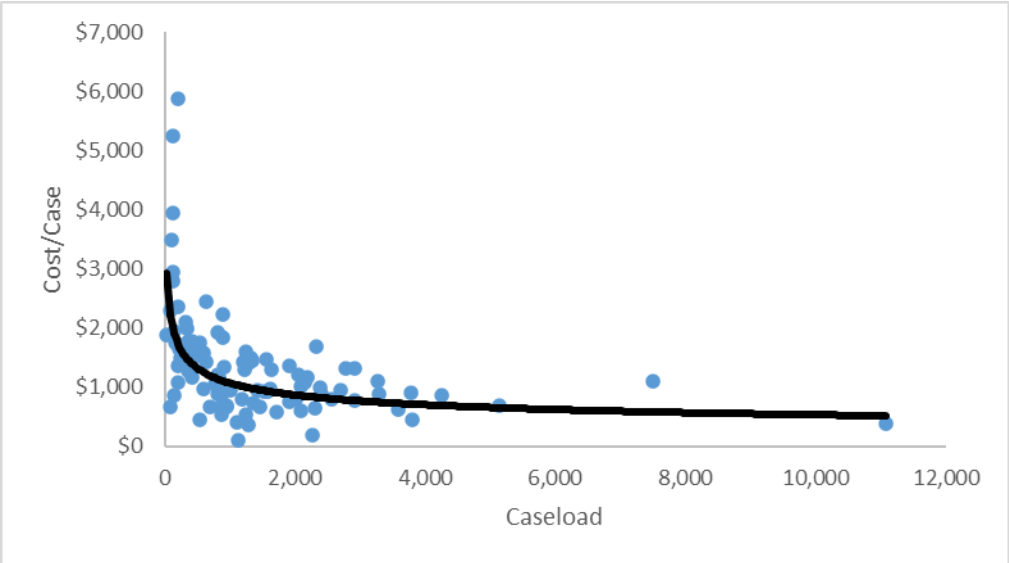
The sample size was too small to enable a relevant estimation of the efficient frontiers.

Table 56: Efficient Frontier for Explosives Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
1	$17,346	5	24	$5,530	23
2	$13,518	7	25	$5,450	23
3	$11,684	9	30	$5,104	25
4	$10,535	10	35	$4,828	27
5	$9,723	11	40	$4,602	29
6	$9,106	12	45	$4,411	31
7	$8,614	13	50	$4,247	32
8	$8,210	14	60	$3,977	35
9	$7,870	14	70	$3,763	38
10	$7,577	15	80	$3,586	41
11	$7,322	16	90	$3,438	43
12	$7,096	16	100	$3,310	45
13	$6,895	17	125	$3,055	50
14	$6,713	18	150	$2,861	55
15	$6,549	18	175	$2,706	59
16	$6,399	19	275	$2,300	73
17	$6,261	19	375	$2,057	84
18	$6,133	20	475	$1,890	94
19	$6,015	20	575	$1,764	103
20	$5,905	21	675	$1,665	112
21	$5,802	21	775	$1,585	119
22	$5,706	22	875	$1,517	126
23	$5,616	22	975	$1,459	133

Fingerprint ID

Figure 21: Efficient Frontier for Fingerprint Identification—Average Total Cost v. Cases Processed



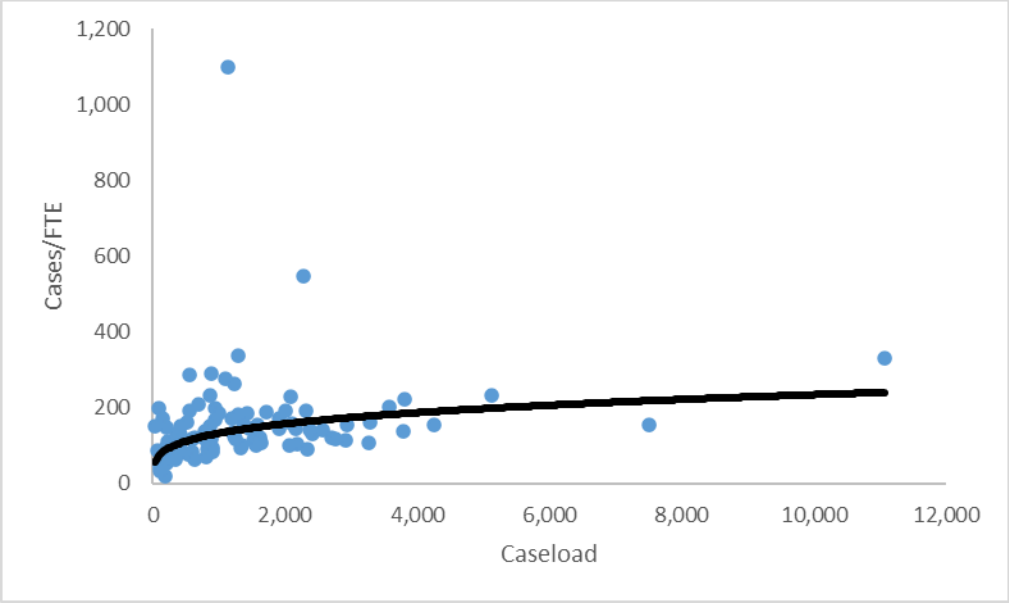


Figure 22: Efficient Frontier for Fingerprint Identification—Cases/FTE v. Caseload

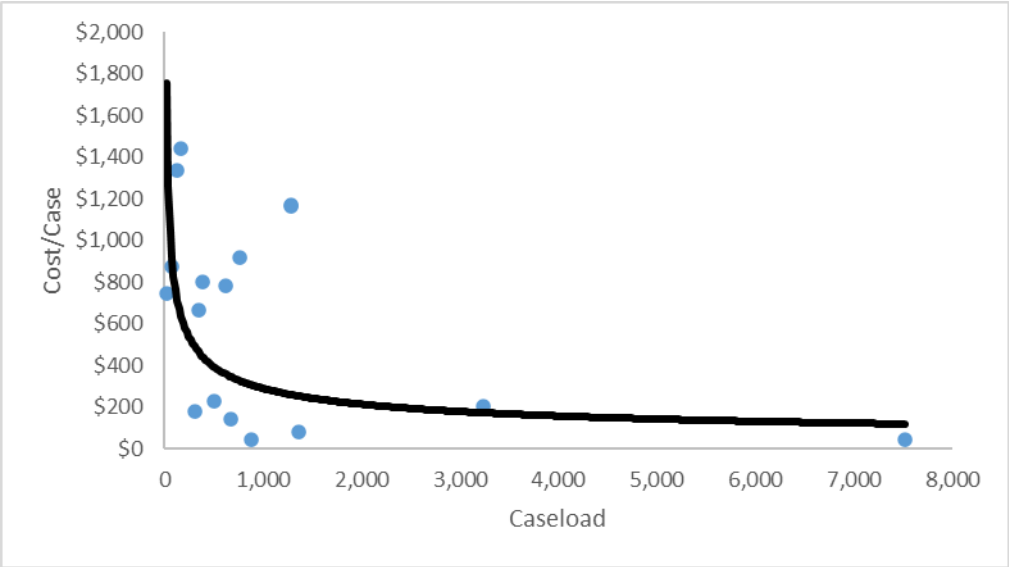
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 57: Efficient Frontier for Fingerprint Identification—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
30	$3,101	56	1,400	$970	144
40	$2,842	60	1,500	$949	147
50	$2,657	64	1,750	$906	153
75	$2,350	70	2,000	$870	158
100	$2,154	75	2,250	$840	162
125	$2,014	80	2,500	$814	167
150	$1,905	83	2,750	$790	171
175	$1,819	87	3,000	$770	174
200	$1,747	89	3,250	$751	178
250	$1,633	94	3,500	$735	181
300	$1,545	99	3,750	$720	184
350	$1,475	103	4,000	$706	187
400	$1,416	106	4,250	$693	190
450	$1,367	109	4,500	$681	193
500	$1,324	112	4,750	$670	195
600	$1,253	117	5,000	$660	198
700	$1,196	122	5,250	$650	200
800	$1,148	126	5,500	$641	202
900	$1,108	130	5,750	$632	205
1,000	$1,073	133	6,000	$624	207
1,100	$1,043	136	6,500	$609	211
1,200	$1,016	139	7,000	$596	215
1,300	$991	142	7,500	$583	219

Fingerprint Database

Figure 23: Efficient Frontier for Fingerprint Database—Average Total Cost v. Cases Processed



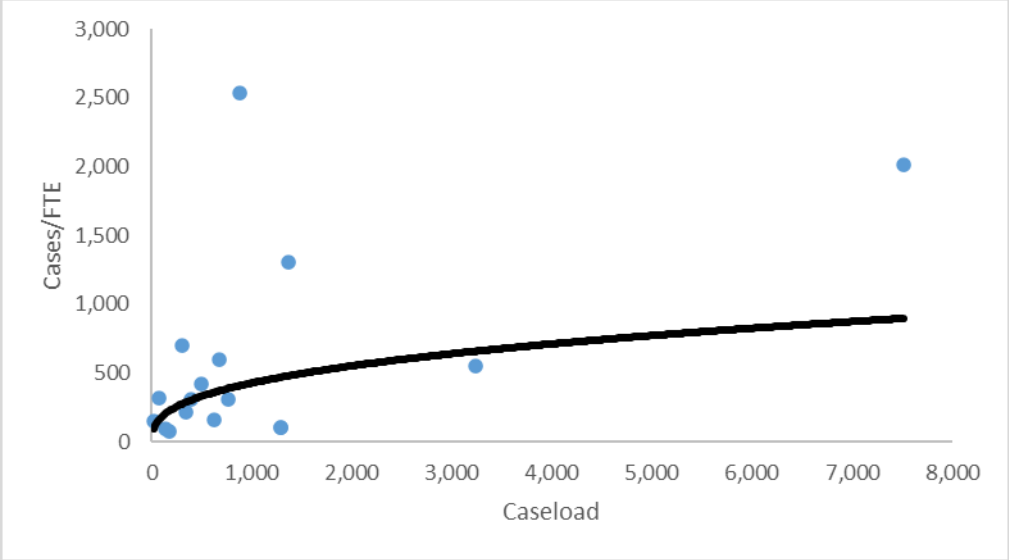


Figure 24: Efficient Frontier for Fingerprint Database—Cases/FTE v. Caseload

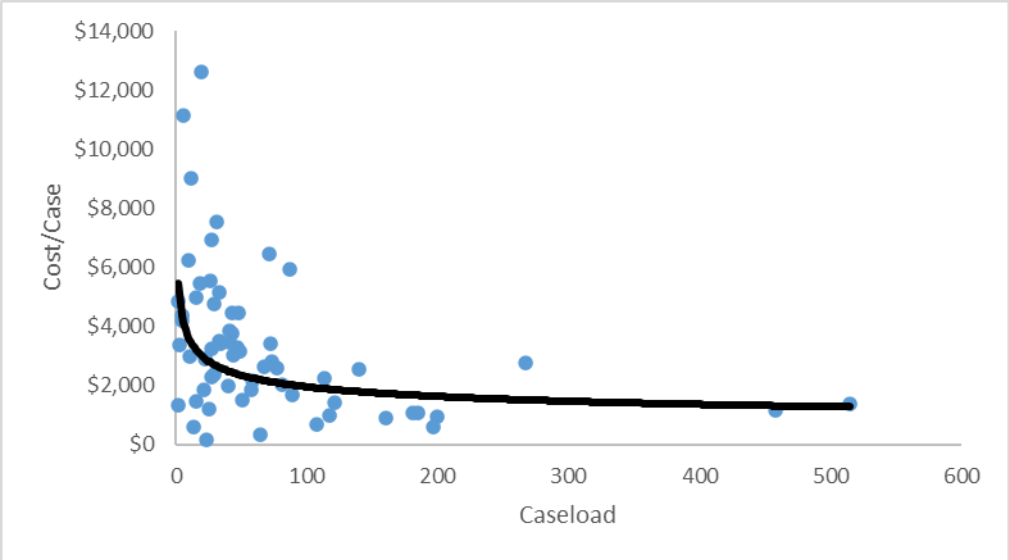
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 58: Efficient Frontier for Fingerprint Identification Database—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
15	$1,852	92	1,400	$250	485
30	$1,364	118	1,500	$242	497
50	$1,088	143	1,750	$226	526
75	$910	166	2,000	$213	552
100	$801	184	2,250	$203	577
125	$726	200	2,500	$193	599
150	$670	214	2,750	$185	621
175	$626	226	3,000	$178	641
200	$590	237	3,250	$172	660
250	$535	258	3,500	$167	678
300	$493	276	3,750	$162	695
350	$461	292	4,000	$157	712
400	$434	306	4,250	$153	728
450	$412	320	4,500	$149	743
500	$394	332	4,750	$146	758
600	$363	355	5,000	$142	773
700	$339	376	5,250	$139	787
800	$320	395	5,500	$137	800
900	$304	412	5,750	$134	813
1,000	$290	428	6,000	$131	826
1,100	$278	444	6,500	$127	851
1,200	$267	458	7,000	$123	874
1,300	$258	472	7,500	$119	896

Fire Analysis

Figure 25: Efficient Frontier for Fire Analysis--Average Total Cost v. Cases Processed



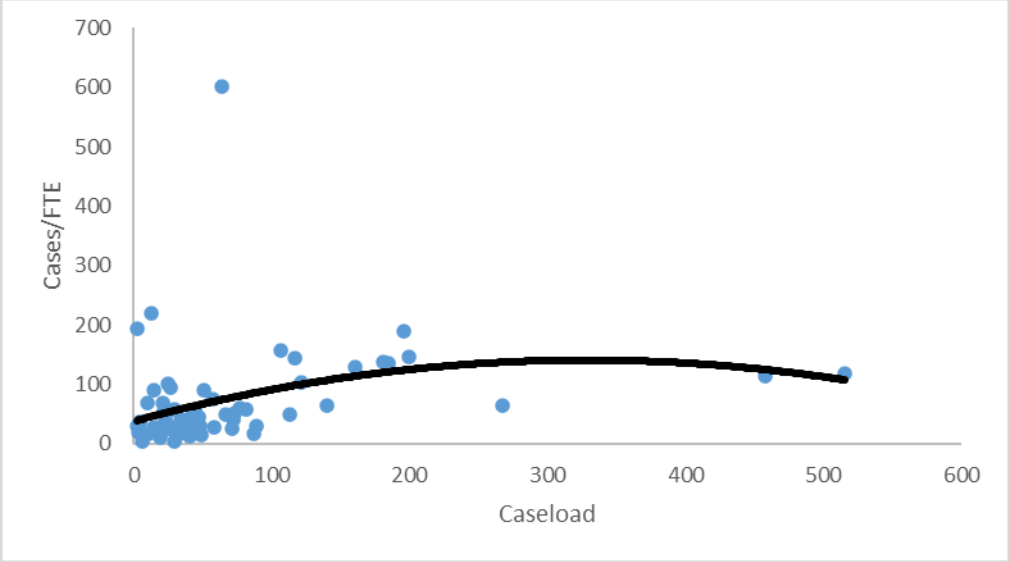


Figure 26: Efficient Frontier for Fire Analysis—Cases/FTE v. Caseload

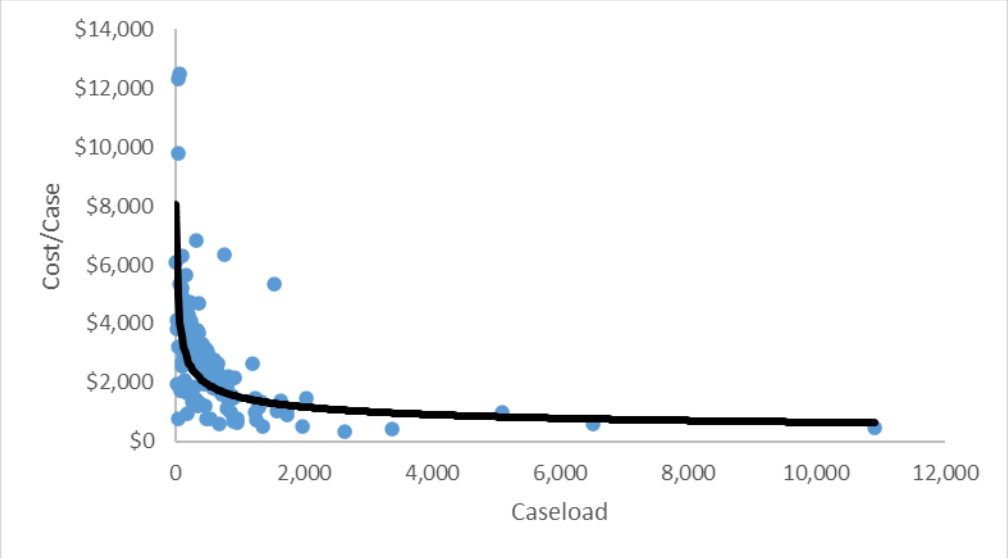
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 59: Efficient Frontier for Fire Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
1	$6,530	15	38	$2,518	45
2	$5,446	18	40	$2,485	46
3	$4,897	21	45	$2,409	47
4	$4,542	23	50	$2,344	49
5	$4,284	24	55	$2,286	50
6	$4,084	26	60	$2,235	51
7	$3,922	27	70	$2,146	54
8	$3,788	28	80	$2,072	56
9	$3,673	29	90	$2,009	58
10	$3,573	30	100	$1,955	60
12	$3,406	32	110	$1,907	62
14	$3,271	33	120	$1,864	63
16	$3,159	35	130	$1,825	65
18	$3,063	36	140	$1,790	67
20	$2,980	37	150	$1,758	68
22	$2,906	38	200	$1,630	74
24	$2,841	39	250	$1,538	79
26	$2,782	40	300	$1,466	84
28	$2,728	41	350	$1,408	88
30	$2,679	42	400	$1,360	91
32	$2,634	43	450	$1,318	95
34	$2,593	43	500	$1,282	98
36	$2,554	44	550	$1,251	101

Firearms & Ballistics Analysis

Figure 27: Efficient Frontier for Firearms & Ballistics Analysis—Average Total Cost v. Cases Processed



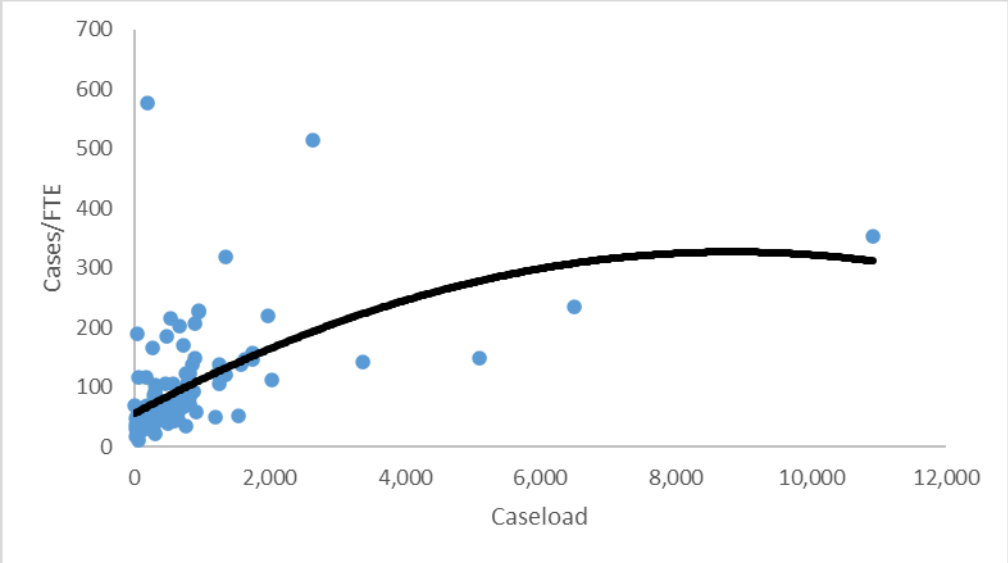


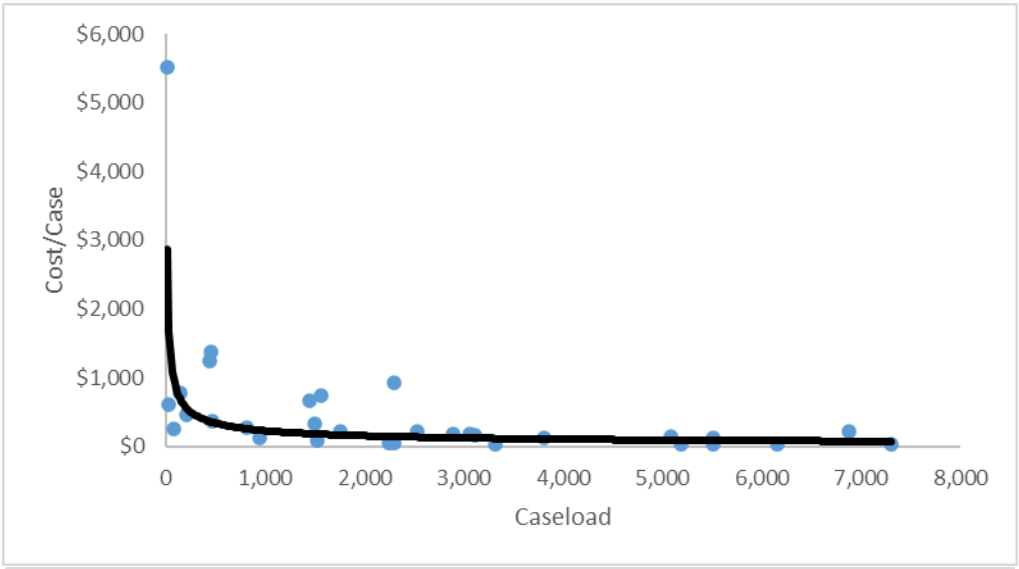
Figure 28: Efficient Frontier for Firearms & Ballistics Analysis—Cases/FTE v. Caseload

Table 60: Efficient Frontier for Firearms & Ballistics Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
25	$5,767	28	1,100	$1,459	118
50	$4,484	36	1,200	$1,414	124
75	$3,870	41	1,300	$1,373	129
100	$3,486	45	1,400	$1,337	134
125	$3,214	49	1,500	$1,304	139
150	$3,008	52	1,750	$1,233	152
175	$2,845	55	2,000	$1,174	164
200	$2,710	58	2,250	$1,125	176
225	$2,597	68	2,500	$1,083	187
250	$2,499	70	2,750	$1,046	198
300	$2,339	73	3,000	$1,014	208
350	$2,212	76	3,250	$984	218
400	$2,107	79	3,500	$958	228
450	$2,019	82	4,000	$913	245
500	$1,943	85	4,500	$875	261
550	$1,877	88	5,000	$842	275
600	$1,818	90	5,500	$813	288
650	$1,766	93	6,000	$788	299
700	$1,719	96	7,000	$745	315
750	$1,677	99	8,000	$710	324
800	$1,638	102	9,000	$680	327
900	$1,569	107	10,000	$655	322
1,000	$1,510	113	11,000	$632	310

Firearms Database

Figure 29: Efficient Frontier for Firearms Database—Average Total Cost v. Cases Processed



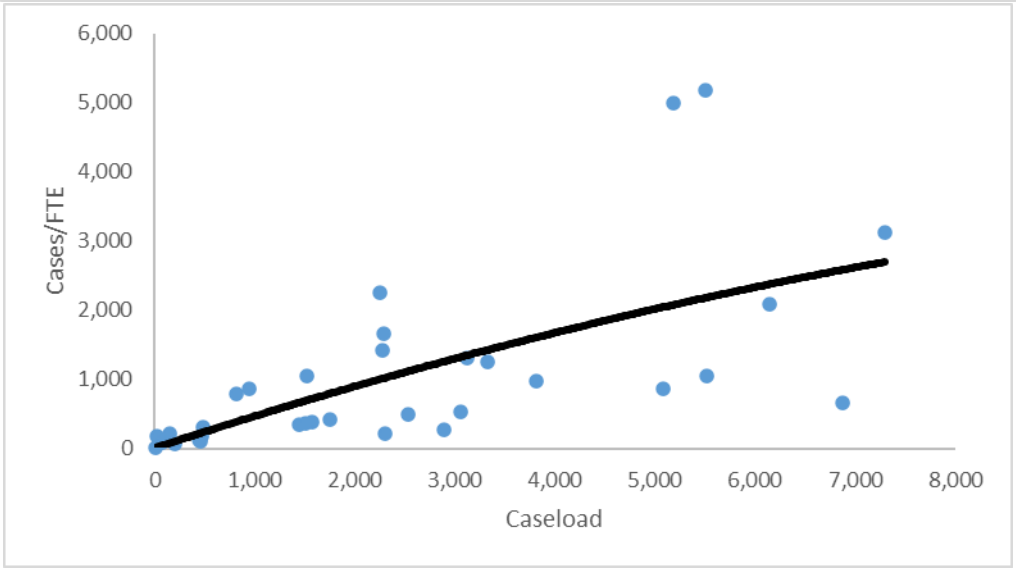


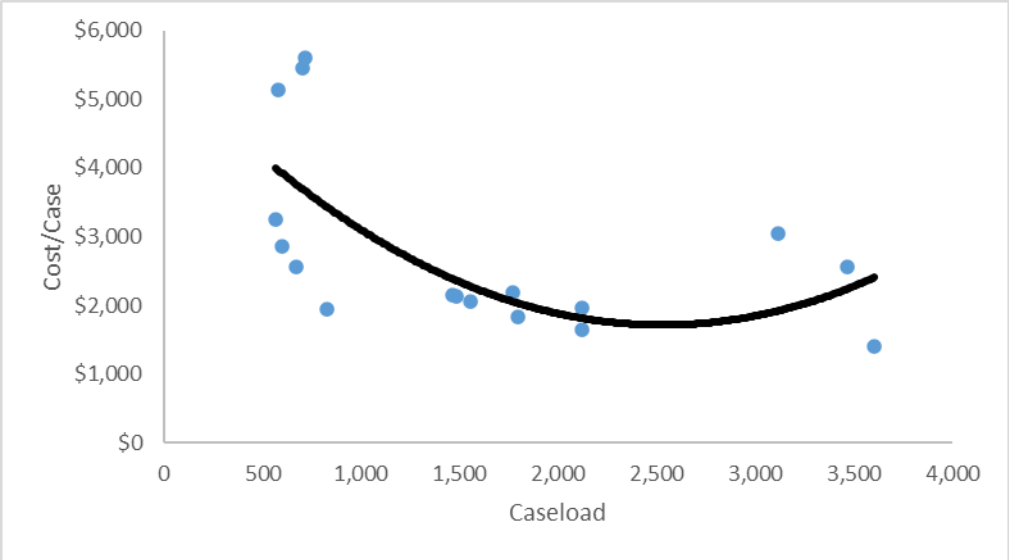
Figure 30: Efficient Frontier for Firearms Database—Cases/FTE v. Caseload

Table 61: Efficient Frontier for Firearms Database—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
10	$3,181	26	1,500	$180	689
20	$2,137	40	1,750	$164	795
30	$1,694	52	2,000	$152	900
40	$1,436	62	2,250	$142	1,003
50	$1,264	71	2,500	$134	1,105
100	$849	110	2,750	$127	1,204
150	$673	141	3,000	$121	1,302
200	$571	169	3,250	$115	1,397
250	$502	195	3,500	$110	1,491
300	$452	218	3,750	$106	1,584
350	$414	240	4,000	$102	1,674
400	$383	261	4,250	$99	1,763
450	$358	281	4,500	$96	1,849
500	$337	300	4,750	$93	1,934
600	$304	337	5,000	$90	2,017
700	$278	371	5,250	$88	2,099
800	$258	403	5,500	$85	2,178
900	$241	434	5,750	$83	2,256
1,000	$227	470	6,000	$81	2,332
1,100	$215	515	6,250	$79	2,406
1,200	$204	559	6,500	$77	2,479
1,300	$195	602	7,000	$74	2,618
1,400	$187	646	7,500	$71	2,750

Forensic Pathology

Figure 31: Efficient Frontier for Forensic Pathology—Average Total Cost v. Cases Processed



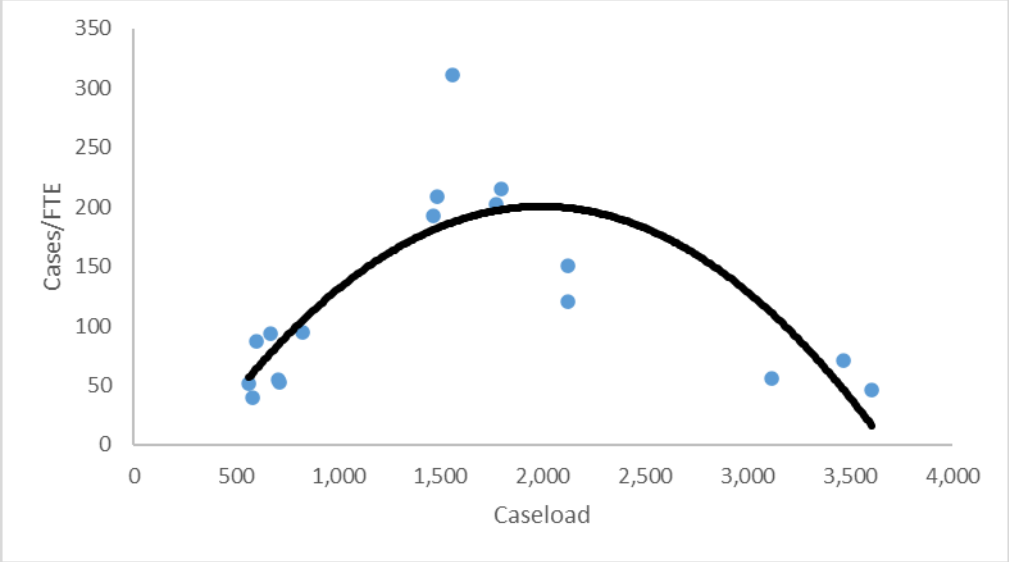


Figure 32: Efficient Frontier for Forensic Pathology—Cases/FTE v. Caseload

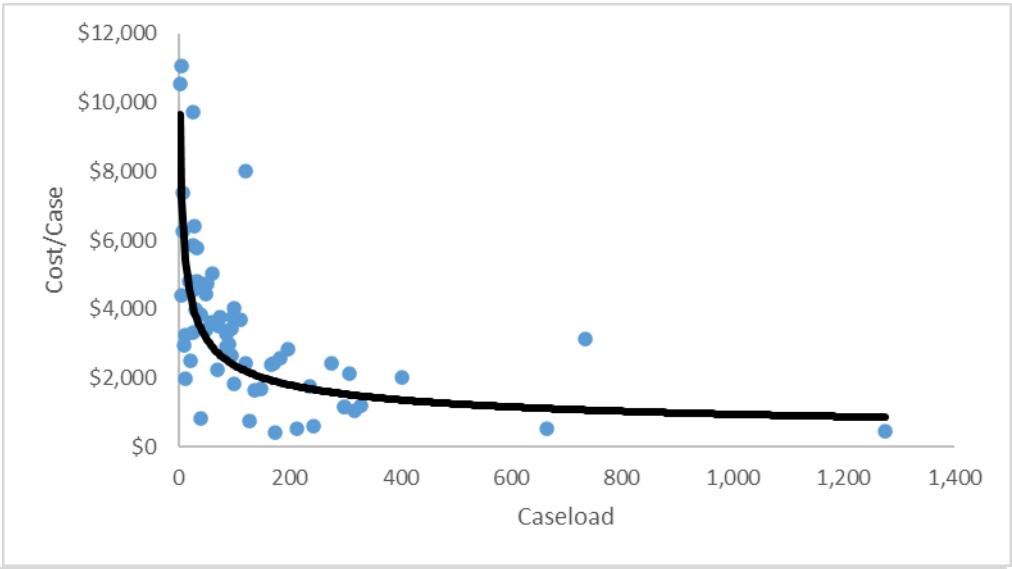
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 62: Efficient Frontier for Forensic Pathology—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
500	$4,158	44	1,650	$2,172	192
550	$4,039	54	1,700	$2,121	194
600	$3,923	64	1,750	$2,073	196
650	$3,810	74	1,800	$2,029	198
700	$3,700	83	1,850	$1,987	199
750	$3,592	92	1,900	$1,948	200
800	$3,488	100	2,000	$1,880	200
850	$3,387	109	2,100	$1,823	200
900	$3,289	116	2,200	$1,778	197
950	$3,194	124	2,300	$1,745	194
1,000	$3,101	131	2,400	$1,724	189
1,050	$3,012	138	2,500	$1,715	182
1,100	$2,926	144	2,600	$1,717	174
1,150	$2,842	150	2,700	$1,732	165
1,200	$2,762	156	2,800	$1,758	154
1,250	$2,684	162	2,900	$1,797	142
1,300	$2,610	167	3,000	$1,847	129
1,350	$2,538	171	3,100	$1,909	114
1,400	$2,470	176	3,200	$1,983	97
1,450	$2,404	180	3,300	$2,069	80
1,500	$2,342	183	3,400	$2,167	60
1,550	$2,282	187	3,500	$2,276	40
1,600	$2,226	190	3,600	$2,398	18

Gunshot Residue Analysis

Figure 33: Efficient Frontier for Gunshot Residue Analysis--Average Total Cost v. Cases Processed



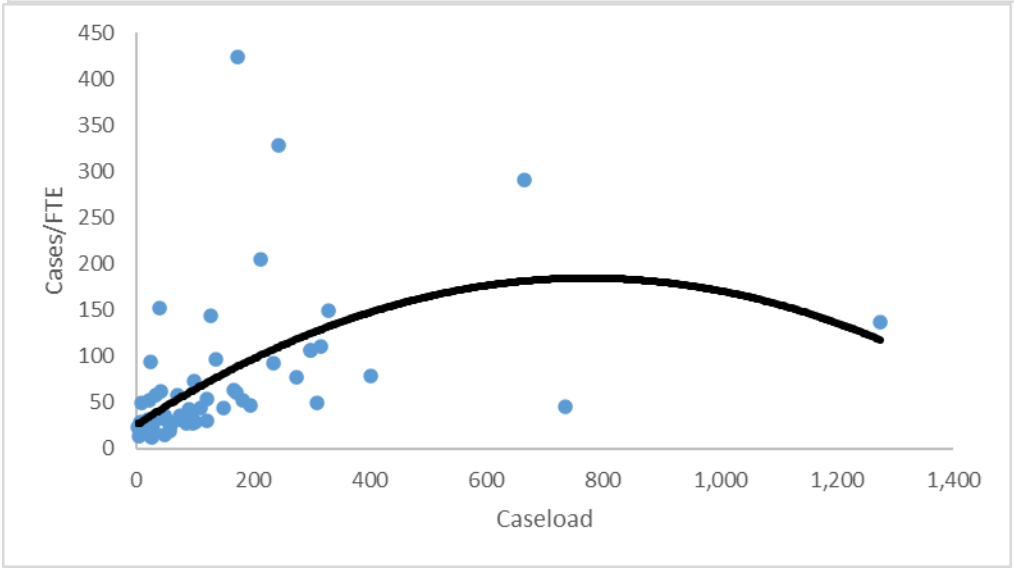


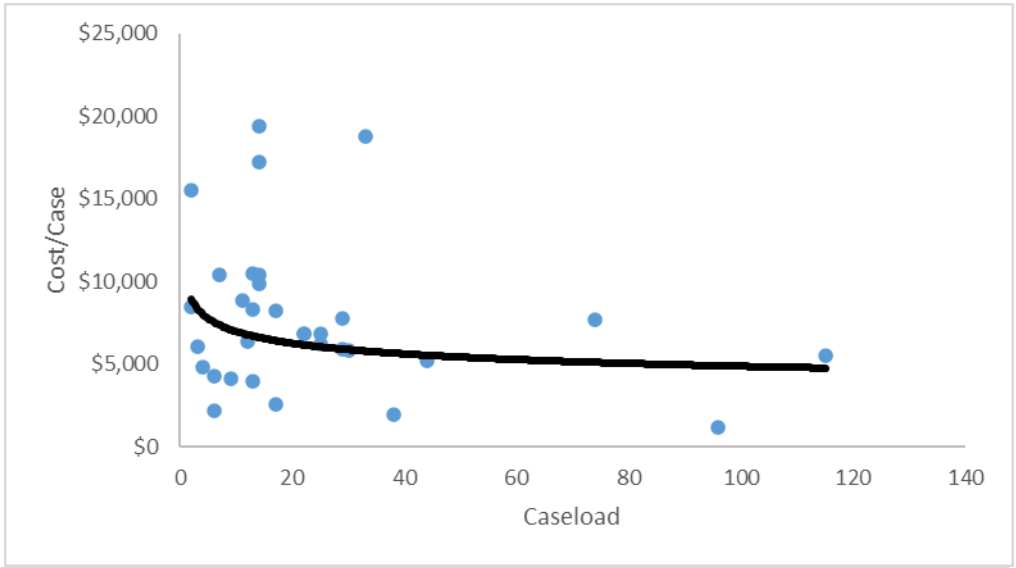
Figure 34: Efficient Frontier for Gunshot Residue Analysis—Cases/FTE v. Caseload

Table 63: Efficient Frontier for Gunshot Residue Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
2	$11,355	12	60	$2,919	49
4	$8,609	16	65	$2,827	51
6	$7,322	18	70	$2,744	53
8	$6,527	21	80	$2,602	57
10	$5,970	22	90	$2,482	60
12	$5,551	24	100	$2,380	64
14	$5,219	26	125	$2,177	73
16	$4,948	27	150	$2,024	81
18	$4,721	28	175	$1,903	89
20	$4,526	29	200	$1,804	97
22	$4,357	30	250	$1,650	112
24	$4,208	31	300	$1,535	125
26	$4,076	32	400	$1,368	147
28	$3,957	33	500	$1,251	165
30	$3,850	34	600	$1,163	176
32	$3,752	35	700	$1,094	183
34	$3,662	36	800	$1,037	184
36	$3,579	37	900	$989	180
38	$3,503	38	1,000	$949	171
40	$3,432	38	1,100	$913	156
45	$3,274	40	1,200	$882	136
50	$3,139	45	1,300	$854	111
55	$3,022	47	1,400	$829	80

Marks & Impressions Analysis

Figure 35: Efficient Frontier for Marks & Impressions Analysis--Average Total Cost v. Cases Processed



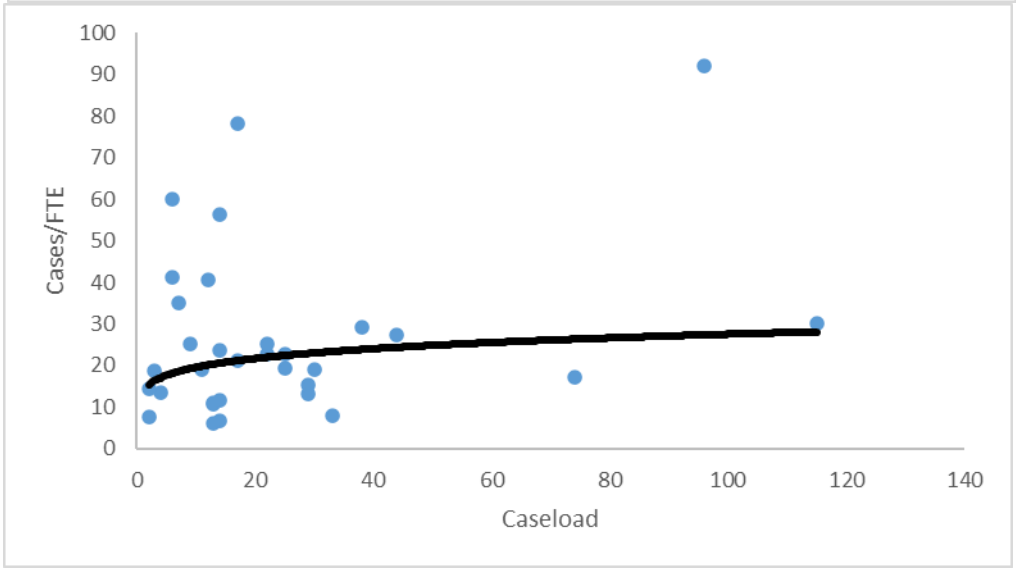


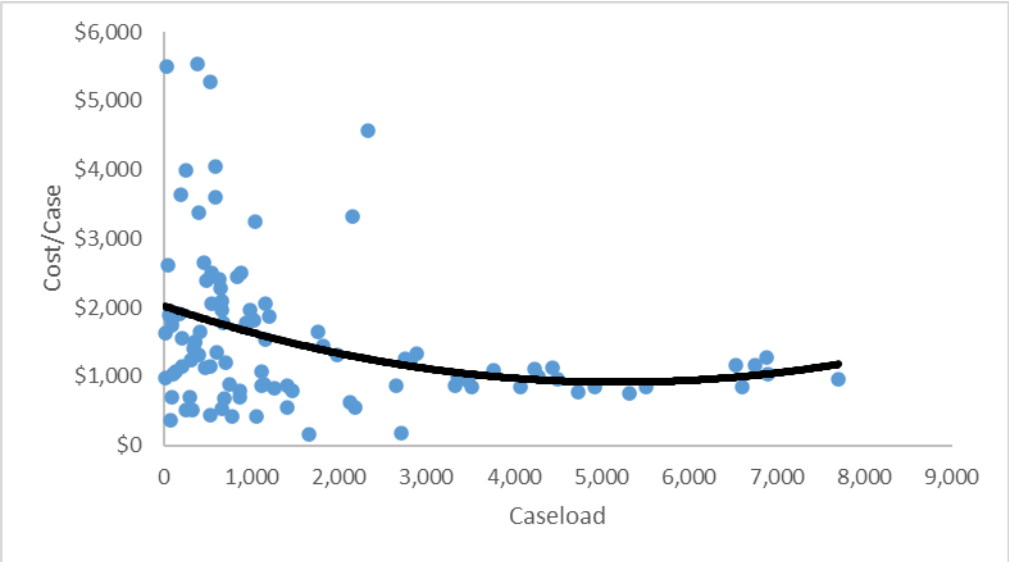
Figure 36: Efficient Frontier for Marks & Impressions Analysis—Cases/FTE v. Caseload

Table 64: Efficient Frontier for Marks & Impressions Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
2	$8,961	15	48	$5,461	27
4	$8,044	17	50	$5,427	27
6	$7,551	18	52	$5,394	28
8	$7,220	19	54	$5,362	28
10	$6,973	20	56	$5,332	29
12	$6,778	20	58	$5,303	29
14	$6,617	21	60	$5,275	30
16	$6,481	21	62	$5,248	30
18	$6,363	21	64	$5,222	31
20	$6,260	22	66	$5,197	31
22	$6,167	22	68	$5,173	32
24	$6,084	22	70	$5,150	33
26	$6,009	23	75	$5,095	35
28	$5,940	23	80	$5,044	36
30	$5,876	23	85	$4,996	39
32	$5,818	23	90	$4,952	41
34	$5,763	23	95	$4,910	43
36	$5,712	24	100	$4,871	46
38	$5,664	24	105	$4,834	49
40	$5,619	24	110	$4,800	52
42	$5,576	24	115	$4,766	55
44	$5,536	26	120	$4,735	58
46	$5,498	26	125	$4,705	62

Serology/Biology Analysis

Figure 37: Efficient Frontier for Serology/Biology Analysis—Average Total Cost v. Caseload



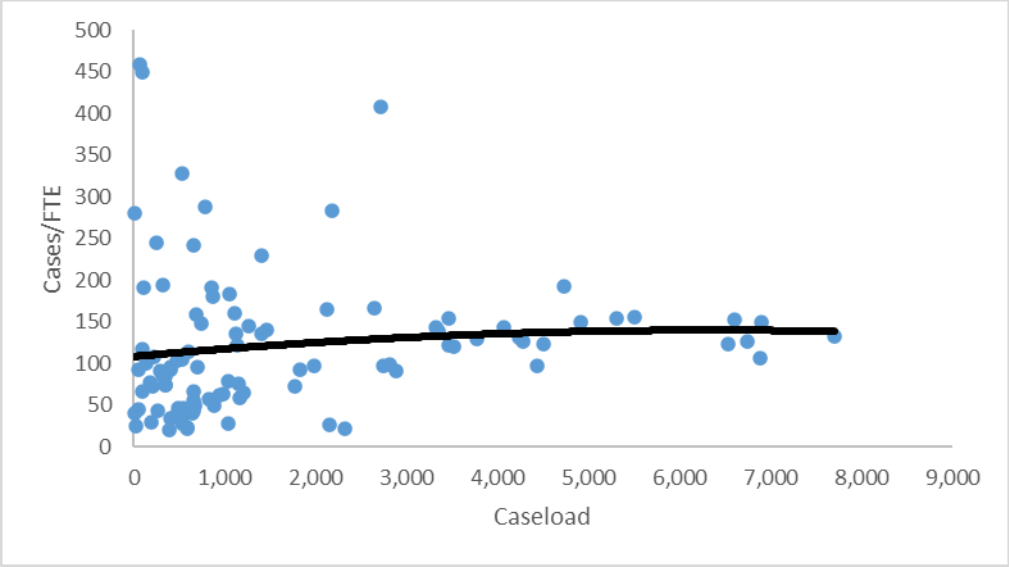


Figure 38: Efficient Frontier for Serology/Biology Analysis—Cases/FTE v. Caseload

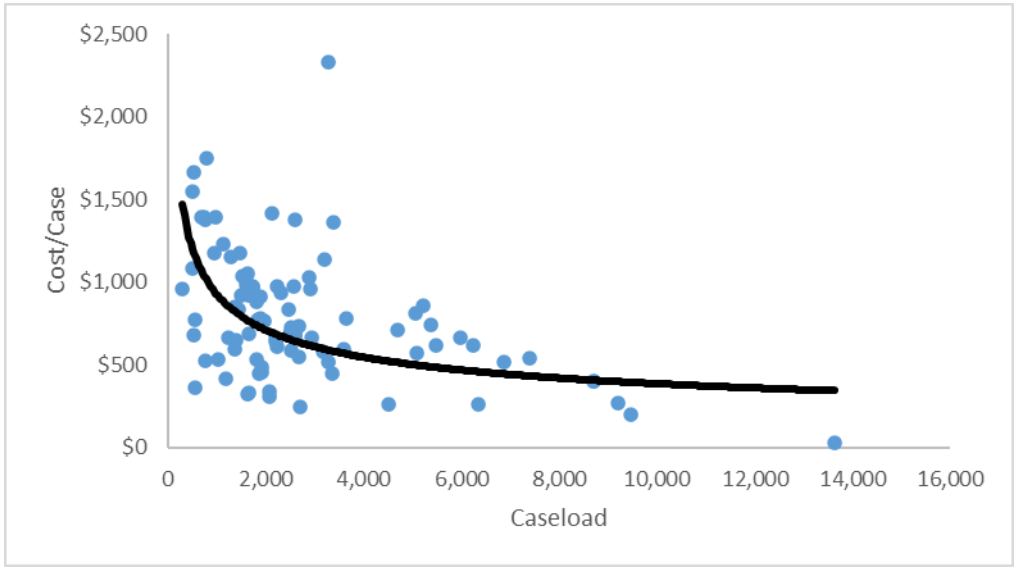
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 65: Efficient Frontier for Serology/Biology Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
15	$2,018	64	700	$1,745	96
30	$2,011	68	750	$1,727	97
45	$2,005	72	800	$1,709	98
60	$1,999	74	900	$1,673	99
75	$1,992	76	1,000	$1,638	100
90	$1,986	77	1,100	$1,604	101
105	$1,980	78	1,200	$1,571	102
120	$1,973	80	1,300	$1,539	103
140	$1,965	81	1,400	$1,507	104
160	$1,957	82	1,500	$1,476	104
180	$1,949	83	1,750	$1,403	106
200	$1,940	84	2,000	$1,335	108
225	$1,930	85	2,250	$1,272	109
250	$1,920	86	2,500	$1,214	110
275	$1,910	87	3,000	$1,113	113
300	$1,900	88	3,500	$1,033	114
350	$1,880	89	4,000	$974	116
400	$1,860	91	5,000	$917	119
450	$1,840	92	6,000	$942	121
500	$1,821	93	7,000	$1,050	123
550	$1,802	94	8,000	$1,240	125
600	$1,783	95	9,000	$1,512	127
650	$1,764	95	10,000	$1,866	128

Toxicology Analysis ante-mortem Analysis

Figure 39: Efficient Frontier for Toxicology Analysis (antemortem)—Average Total Cost v. Caseload



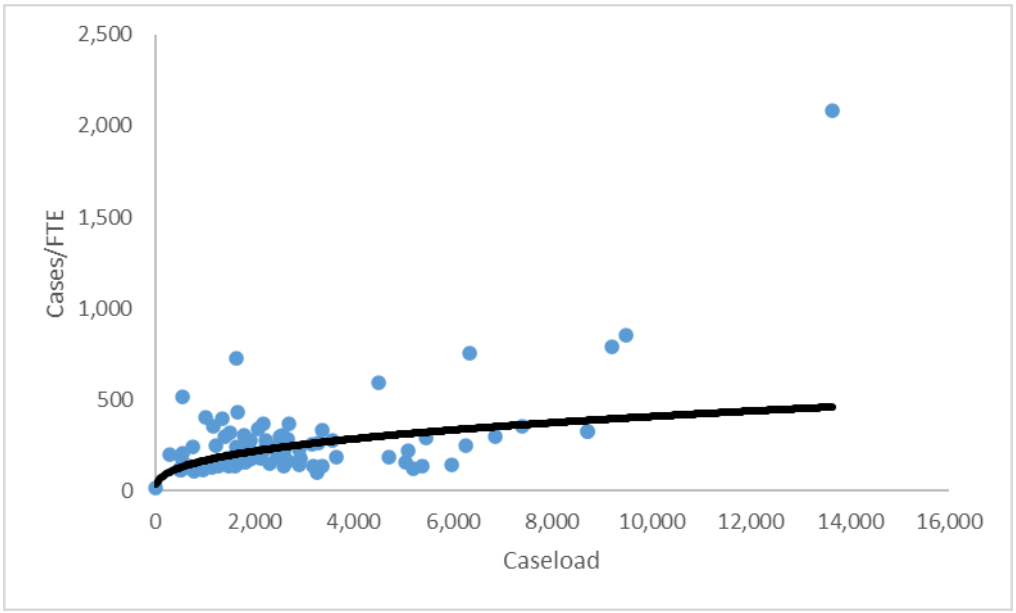


Figure 40: Efficient Frontier for Toxicology Analysis (antemortem)—Cases/FTE v. Caseload

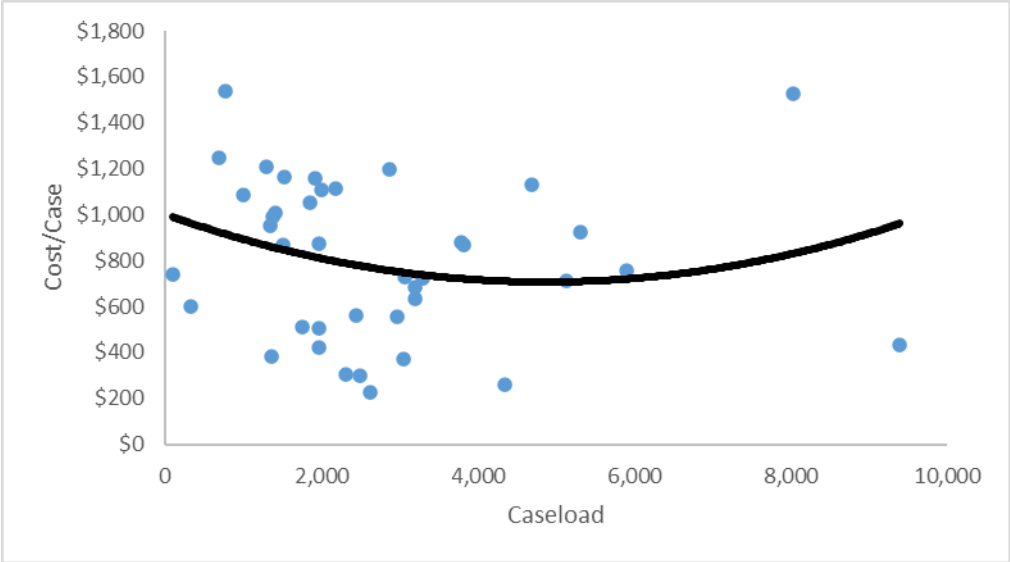
Foresight Project 2022-2023, West Virginia University, Morgantown, WV, USA

Table 66: Efficient Frontier for Toxicology ante-mortem—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
15	$4,536	52	700	$1,058	162
30	$3,488	64	750	$1,030	166
45	$2,992	72	800	$1,005	169
60	$2,683	79	900	$962	175
75	$2,465	84	1,000	$924	180
90	$2,301	89	1,100	$925	185
105	$2,170	93	1,200	$916	190
120	$2,063	97	1,300	$908	195
140	$1,946	101	1,400	$900	199
160	$1,850	105	1,500	$892	203
180	$1,769	109	1,750	$872	213
200	$1,700	112	2,000	$852	221
225	$1,626	116	2,250	$832	229
250	$1,562	120	2,500	$812	236
275	$1,507	123	3,000	$773	249
300	$1,458	127	3,500	$734	261
350	$1,375	132	4,000	$696	271
400	$1,307	138	5,000	$621	289
450	$1,250	143	6,000	$549	305
500	$1,201	147	8,000	$411	332
550	$1,159	151	10,000	$282	355
600	$1,121	155	12,000	$161	374
650	$1,088	159	14,000	$49	392

Toxicology Analysis post-mortem Analysis

Figure 41: Efficient Frontier for Toxicology Analysis (postmortem)—Average Total Cost v. Caseload



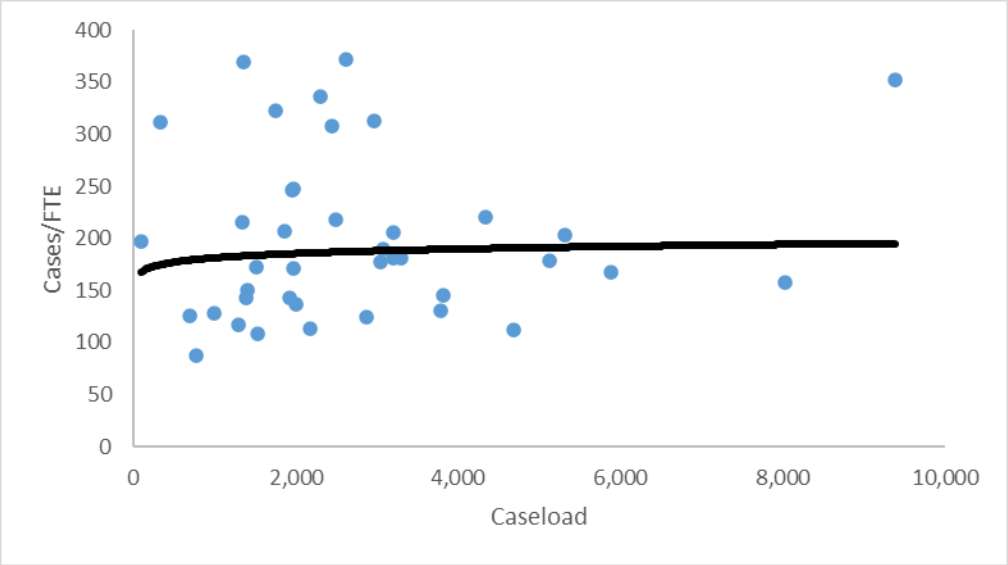


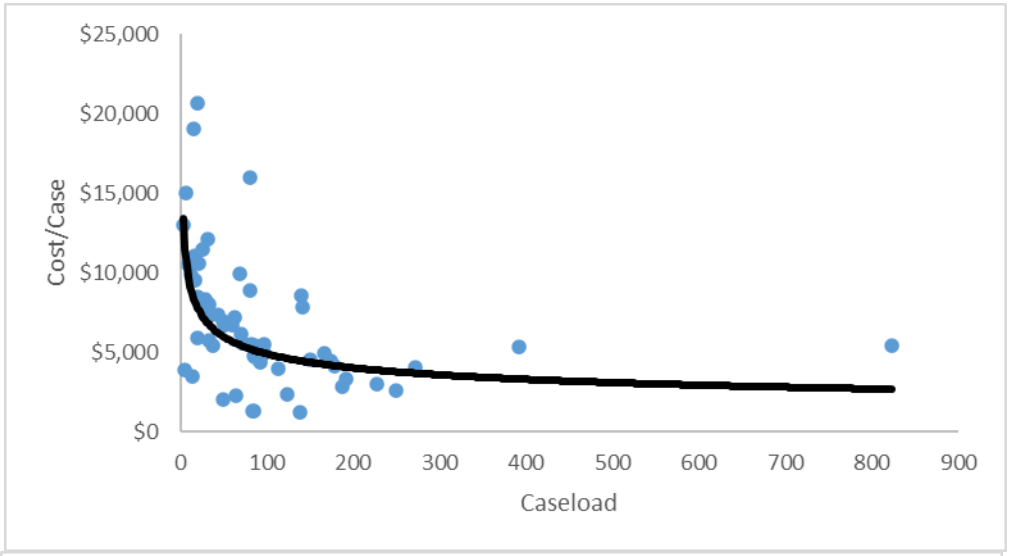
Figure 42: Efficient Frontier for Toxicology Analysis (postmortem)—Cases/FTE v. Caseload

Table 67: Efficient Frontier for Toxicology post-mortem—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
15	$1,130	158	700	$922	179
30	$1,062	162	750	$917	180
45	$1,025	164	800	$912	180
60	$999	165	900	$902	181
75	$992	167	1,000	$892	181
90	$990	168	1,100	$883	182
105	$988	168	1,200	$874	182
120	$987	169	1,300	$865	183
140	$984	170	1,400	$856	183
160	$982	171	1,500	$847	184
180	$980	171	1,750	$827	185
200	$977	172	2,000	$809	185
225	$974	173	2,250	$792	186
250	$971	173	2,500	$776	187
275	$969	174	3,000	$750	188
300	$966	174	3,500	$730	189
350	$960	175	4,000	$716	190
400	$955	176	5,000	$707	191
450	$949	177	6,000	$722	192
500	$944	177	7,000	$763	193
550	$938	178	8,000	$828	194
600	$933	178	9,000	$918	195
650	$928	179	10,000	$1,033	196

Trace Evidence Analysis

Figure 43: Efficient Frontier for Trace Evidence Analysis—Average Total Cost v. Caseload



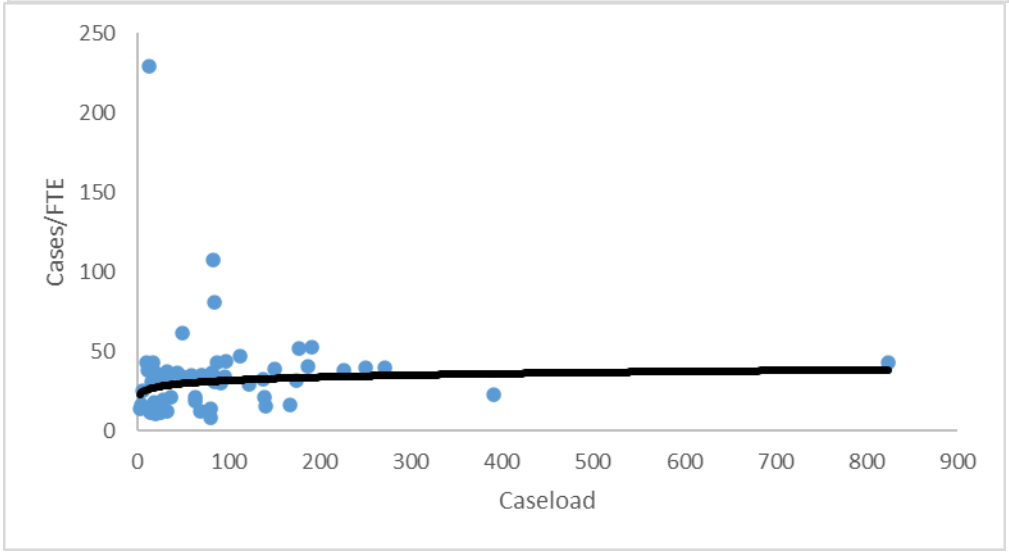


Figure 44: Efficient Frontier for Trace Evidence Analysis—Cases/FTE v. Caseload

Table 68: Efficient Frontier for Trace Evidence Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
5	$11,555	24	140	$4,462	33
10	$9,480	26	150	$4,375	33
15	$8,443	27	160	$4,295	33
20	$7,778	27	170	$4,221	33
25	$7,297	28	180	$4,153	33
30	$6,927	28	190	$4,089	33
35	$6,629	29	200	$4,030	34
40	$6,381	29	225	$3,897	34
45	$6,170	29	250	$3,781	34
50	$5,987	30	275	$3,680	35
55	$5,826	30	300	$3,589	35
60	$5,683	30	325	$3,508	35
65	$5,555	30	350	$3,435	35
70	$5,438	31	375	$3,368	36
75	$5,332	31	400	$3,306	36
80	$5,235	31	425	$3,249	36
85	$5,145	31	450	$3,197	36
90	$5,062	31	500	$3,102	37
95	$4,984	31	550	$3,019	37
100	$4,912	32	600	$2,945	37
110	$4,780	32	650	$2,878	37
120	$4,663	32	700	$2,818	38
130	$4,557	32	800	$2,712	38

FORESIGHT Glossary

Lab RAT	Glossary of Definitions
backlog	Open cases that are older than 30 days after submission to the laboratory.
capital expense	Purchases of equipment, instruments, etc. with a lifetime longer than three years and a cost above $1,000.
case - institute case	A request from a crime lab "customer" that includes forensic investigations in one or more investigative areas related to an event, crime, or investigation.
case - area case	A request for examination in one forensic investigation area. An area case is a subset of an institute case and is equivalent to the term "request."
Case – as reported in the LabRat form	Cases reported in LabRat are "area cases"
casework	All laboratory activities involved in examination of cases.
casework time	Total for operational personnel in an investigation area (in hours) subtracted by the hours of R&D and, E&T and support and service given to external partners.
full-time equivalent (FTE)	The work input of a full-time employee working for one full year.
investigation area	Area limited by item type and methods as they are listed in the "definitions of investigative areas" tab.
item	A single object for examination submitted to the laboratory. Note: one item may be investigated and counted in several investigation areas.
non-reporting manager	An individual whose primary responsibilities are in managing and administering a laboratory or a unit thereof and who is not taking part in casework.
operational personnel	Personnel in operational units providing casework, research and development (R & D), education and training (E & T) and external support services. Non-reporting unit heads are included.
personnel expense	Sum of direct salaries, social expenses (employer contribution to FICA, Medicare, Workers Comp, and Unemployment Comp), retirement (employer contribution only towards pensions, 401K plans, etc.), personnel development and training (internal or external delivery, including travel), and occupational health service expenses (employer contribution only).
report	A formal statement of the results of an investigation, or of any matter on which definite information is required, made by some person or body instructed or required to do so.

request	A request for examination in one forensic investigation area. A request is a subset of an institute case and is equivalent to the term "area case."
sample	An item of evidence or a portion of an item of evidence that generates a reportable result.
support personnel	Forensic laboratory staff providing various internal support services. Management and administration personnel not belonging to the operational units are included.
test	An analytical process, including but not limited to visual examination, instrumental analysis, presumptive evaluations, enhancement techniques, extractions, quantifications, microscopic techniques, and comparative examinations. This does not include technical or administrative reviews.
Turn-around time	The number of days from a request for examination in an investigative area until issuance of a report. (Note that an area case may have multiple requests and each new request has a separate turn-around time.)
workload	Total time spent on all work related to job, including overtime.

Definitions: Investigative Areas

Lab RAT	Definitions of Investigation Areas
Blood Alcohol	The analysis of blood or breath samples to detect the presence of and quantify the amount of alcohol.
Computer Analysis	The analysis of computers, computerized consumer goods, and associated hardware for data retrieval and sourcing.
Crime Scene Investigation	The collection, analysis, and processing of locations for evidence relating to a criminal incident.
Digital evidence	The analysis of multimedia audio, video, and still image materials, such as surveillance recordings and video enhancement. Includes computer analysis as defined above.
DNA Casework	Analysis of biological evidence for DNA in criminal cases.
DNA Database	Analysis and entry of DNA samples from individuals for database purposes.
Document Examination	The analysis of legal, counterfeit, and questioned documents, including handwriting analysis.
Drugs - Controlled Substances	The analysis of solid dosage licit and illicit drugs, including pre-cursor materials.
Evidence Screening & Processing	The detection, collection, and processing of physical evidence in the laboratory for potential additional analysis.
Explosives	The analysis of energetic materials in pre- and post-blast incidents.
Fingerprint Identification	The development and analysis of friction ridge patterns.
Fingerprint Database	Accessing the fingerprint database (including IAFIS)
Fire analysis	The analysis of materials from suspicious fires to include ignitable liquid residue analysis.
Firearms and Ballistics	The analysis of firearms and ammunition, to include distance determinations, shooting reconstructions, NIBIN, and toolmarks.
Firearms Database	Accessing the firearms database (including NIBIN)

Forensic Pathology	Forensic pathology is a branch of medicine that deals with the determination of the cause and manner of death in cases in which death occurred under suspicious or unknown circumstances.
Gun Shot Residue (GSR)	The analysis of primer residues from discharged firearms (not distance determinations).
Hairs & Fibers	The analysis of human and animal hairs (non-DNA) and textile fibers as trace evidence.
Marks and Impressions	The analysis of physical patterns received and retained through the interaction of objects of various hardness, including shoeprints and tire tracks.
Paint & Glass	The analysis of paints—generically, coatings—and glass as trace evidence.
Serology/Biology	The detection, collection, and non-DNA analysis of biological fluids.
Toxicology, ante-mortem	The chemical analysis of body fluids and tissues to determine if a drug or poison is present in a living individual, excluding blood alcohol analysis (BAC).
Toxicology, post-mortem	The chemical analysis of body fluids and tissues to determine if a drug or poison is present in a deceased individual, excluding blood alcohol analysis (BAC).
Trace Evidence	The analysis of materials that, because of their size or texture, transfer from one location to another and persist there for some period of time. Microscopy, either directly or as an adjunct to another instrument, is involved. Includes Hairs & Fibers and Paint & Glass as defined above.
Other Specialties	Other forensic science applications not covered by the other categories.

Project FORESIGHT Publications

Houck, M. M., & Speaker, P. J. (2024). *Forensic Science Laboratory Benchmarking: The FORESIGHT Manual*. CRC Press.

Speaker, P. J. (2024). Intelligence and the Value of Forensic Science. *Forensic Sciences*, 4(2). https://doi.org/10.3390/forensicsci4020001

Speaker, P. J. (2023). *Project FORESIGHT Annual Report, 2021-2022*. https://researchrepository.wvu.edu/faculty_publications/3284/

McAndrew, W. P., Speaker, P. J., & Houck, M. M. (2023). Forensic Science Management, 2019-2022. *Forensic Science International: Synergy, 6(1)*. https://doi.org/10.1016/j.fsisyn.2022.100301

Ropero Miller, J. D., Mullen, L. D., Speaker, P. J., (2022). The Sentinel Role of Forensic Toxicology Laboratories to Identify and Act upon Emerging Drug Threats by Addressing Toxicology and Economic Demands. *Forensic Science International: Synergy*. https://doi.org/10.1016/j.fsisyn.2022.100292

Speaker, P. J., (October 2022). Advancements in Understanding the Cost-Effectiveness of Testing Sexual Assault Kits in *Sexual Assault Kits and Reforming the Response to Rape*, Rachel Lovell and Jennifer Langhinrichsen-Rohling, editors.

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Forensic Science International: Synergy

An international journal dedicated to the forensic sciences and its cross-disciplinary effects on the administration of justice.

Editor-in-Chief: M. Houck

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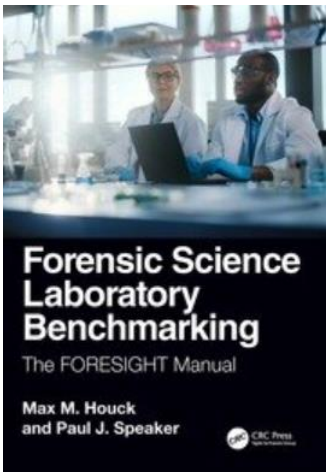
Forensic science is central to modern criminal justice systems. It supports investigations, demonstrates associations between people, places, and things involved in criminal activity, and exonerates the innocent. Forensic services are sciences integral to a just society governed through rule of law, it is unarguably a public good and should be accessible to anyone. Transparency is key to good science, rational governance, and equitable justice.



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