Project FORESIGHT Annual Report, 2020-2021

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FORESIGHT—North Louisiana Criminalistics Laboratory Annual Report (US$)

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FORESIGHT Benchmark Data 2020-2021

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 2020-2021 performance period includes laboratory submissions for a variety of fiscal year definitions. However, all submissions have December 31, 2020 as part of their fiscal year accounting. The majority of submissions follow a July 1, 2020 through June 30, 2021 convention. Others follow a year that begins as early as January 1, 2020 (ending December 31, 2020) while the other extreme includes laboratories with a fiscal year originating October 1, 2020 and ending September 30, 2021.

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, 196 laboratory or laboratory systems have contributed data to the project for the 2020-2021 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 2020-2021 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	6
Regional	37
State	48
Metro	64
Regional/Metro*	41
*Regional lab with a city exceeding 100K population	
Total Accredited (ISO/IEC 17025:2017 or ANAB)	192
non-accredited	4
TOTAL SUBMISSIONS	**196**
International/Domestic	
U.S.	177
Non-U.S.	19

Table 1 highlights some of the characteristics of the submitting laboratories. Note that the 196 submissions represent some laboratory systems. There are total of 233 separate facilities represented in these accredited submissions.

COVID-19 and 2020-2021 Submissions

Subsequent years will reveal the impact of the pandemic on forensic laboratories. Submitting laboratories reported for a fiscal year that overlapped with the pandemic. Many indicated the departure from a “normal” year with limitations on laboratory time and the necessity of remote work. As we begin to receive crime data during the pandemic, we expect to see additional departures on the collection of evidence for submission to crime laboratories. For all reporting laboratories, we anticipate similar disruptions will be revealed in the 2021-2022 FORESIGHT submissions.

There are a few observations to note. Case submissions fell in several investigative categories during this reporting year. Most notably, the median number of cases per 100,000 population (highlighted in Table 2) were drops in blood alcohol analysis, crime

scene investigation, digital evidence analysis, and marks & impressions. With the drop in case submissions, there was a subsequent increase in the average cost in most of these same areas as diseconomies of scale resulted from the decline in demand for these services. These reversed some time trends that laboratories experienced for the prior seven years.

Future review of the data should reveal the impact of COVID-19 on forensic laboratories.

FORESIGHT Maximus Awards

The American Society of Crime Laboratory Directors (ASCLD) announced fifteen forensic laboratories in 2021 and thirteen forensic laboratories in 2022 as recipients of the FORESIGHT Maximus Award, a distinction recognizing the top performing forensic laboratories in the world based on FORESIGHT business metrics. The 2021 FORESIGHT Maximus Award winners were announced at the August 2021 ASCLD Symposium and the 2022 FORESIGHT Maximus Award winners were announced at the April 2022 ASCLD Symposium.

Started in 2007 by a cooperative agreement between the West Virginia University College of Business and Economics 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 2022

- Arkansas State Crime Laboratory, Little Rock, AR
- Bexar County Criminal Investigation Laboratory, San Antonio, TX
- Chandler Police Department Forensic Service Section, Chandler, AZ
- Charlotte Mecklenburg Police Department Crime Lab, Charlotte, NC
- City of Tulsa Police Department Forensic Laboratory, Tulsa, OK
- DuPage County Forensic Science Center, Wheaton, IL
- Forensic Science Department, Organismo de Investigación Judicial, San Joaquín, Flores, Heredia, Costa Rica
- Indiana State Department of Toxicology, Indianapolis, IN
- Midwest Regional Forensic Laboratory, Andover, MN
- Montana Forensic Science Division, Missoula, MT
- North Louisiana Criminalists Laboratory, Shreveport, LA
- Pinellas County Forensic Lab, Largo, FL
- St. Louis County Police Crime Laboratory, Clayton, MO

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, has created a bottleneck in the justice system as laboratory backlogs have risen, 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, less than 20% of U.S. laboratories submit data to the project. The main reason for the lack of participation has 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 seeks 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 will be developed 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 offers 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 offers 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 value of the project; rather 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 is requesting 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 are available via the open-access publication in Forensic Science International: Synergy.[3]

[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.

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 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.

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	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	26.65	40.45	68.00	173.26
Crime Scene Investigation	NA	1.30	5.56	13.17
Digital evidence	NA	1.39	5.82	37.80
DNA Casework	58.66	51.82	87.82	146.31
DNA Database	24.72	24.72	137.05	272.46
Document Examination	NA	0.55	1.45	1.78
Drugs - Controlled Substances	1,097.36	156.36	235.12	368.66
Evidence Screening & Processing	NA	41.54	79.71	577.16
Explosives	NA	0.14	0.23	0.43
Fingerprints	1.26	24.66	31.67	81.90
Fingerprints Database (including IAFIS)	NA	8.71	40.36	112.20
Fire analysis	4.02	2.29	3.18	4.80
Firearms and Ballistics	29.41	14.82	24.13	45.61
Firearms Database (including NIBIN)	449.50	34.07	61.03	289.00
Forensic Pathology	NA	50.07	57.57	61.00
Gun Shot Residue (GSR)	NA	2.24	4.37	8.63
Marks and Impressions	0.25	0.15	0.25	0.52
Serology/Biology	59.83	22.82	39.92	69.33
Toxicology ante mortem (excluding BAC)	31.01	42.92	65.33	116.01
Toxicology post mortem (excluding BAC)	4.19	48.05	67.53	131.80
Trace Evidence	0.25	0.73	1.51	2.33

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 Processed Internally per 100,000 population				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	47.87	84.52	159.15
Crime Scene Investigation	NA	29.09	254.19	418.20
Digital evidence	NA	2.31	12.31	96.02
DNA Casework	NA	149.02	258.80	588.25
DNA Database	NA	81.73	115.45	229.67
Document Examination	NA	4.33	9.30	10.12
Drugs - Controlled Substances	NA	377.96	542.64	803.33
Evidence Screening & Processing	NA	60.85	111.34	115.37
Explosives	NA	0.29	0.80	0.91
Fingerprints	NA	61.46	170.68	397.69
Fingerprints Database (including IAFIS)	NA	28.01	76.00	452.55
Fire analysis	NA	5.93	8.87	13.48
Firearms and Ballistics	NA	99.33	126.91	195.56
Firearms Database (including NIBIN)	NA	58.58	309.90	1,233.44
Forensic Pathology	NA	50.84	51.64	52.44
Gun Shot Residue (GSR)	NA	4.36	8.81	20.61
Marks and Impressions	NA	0.92	1.90	2.74
Serology/Biology	NA	78.67	144.17	247.88
Toxicology ante mortem (excluding BAC)	NA	42.63	59.90	87.24
Toxicology post mortem (excluding BAC)	NA	82.33	101.39	205.93
Trace Evidence	NA	2.72	6.74	9.54

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	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	45.41	123.33	162.22
Crime Scene Investigation	NA	2,086.31	4,076.55	6,066.79
Digital evidence	NA			
DNA Casework	NA	247.99	457.72	724.22
DNA Database	NA	79.18	270.55	306.75
Document Examination	NA	2.28	5.74	9.38
Drugs - Controlled Substances	NA	438.42	539.33	694.43
Evidence Screening & Processing	NA	74.34	111.34	115.97
Explosives	NA	0.89	1.76	2.93
Fingerprints	NA	107.77	178.77	457.07
Fingerprints Database (including IAFIS)	NA	91.88	184.64	917.69
Fire analysis	NA	7.88	12.28	24.53
Firearms and Ballistics	NA	119.58	130.78	148.46
Firearms Database (including NIBIN)	NA	441.57	1,121.22	1,407.86
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	11.48	41.13	46.86
Marks and Impressions	NA	1.01	1.56	2.10
Serology/Biology	NA	112.51	186.25	273.98
Toxicology ante mortem (excluding BAC)	NA	59.90	80.65	112.99
Toxicology post mortem (excluding BAC)	NA	119.77	181.13	421.80
Trace Evidence	NA	1.00	14.76	16.55

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	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	96.29	145.32	213.29
Crime Scene Investigation	NA	400.58	406.49	412.40
Digital evidence	NA	32.78	46.44	66.37
DNA Casework	NA	685.54	828.44	2,791.23
DNA Database	NA	213.74	283.24	785.96
Document Examination	NA	5.88	6.86	7.85
Drugs - Controlled Substances	NA	878.45	1,513.48	1,924.23
Evidence Screening & Processing	NA	327.85	493.18	586.94
Explosives	NA	3.08	3.84	7.13
Fingerprints	NA	224.99	468.07	900.84
Fingerprints Database (including IAFIS)	NA	59.73	363.66	517.99
Fire analysis	NA	7.88	14.12	23.33
Firearms and Ballistics	NA	120.50	154.58	206.39
Firearms Database (including NIBIN)	NA	242.73	275.80	810.72
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	14.91	42.99	61.02
Marks and Impressions	NA	1.80	2.77	6.38
Serology/Biology	NA	196.39	395.38	459.24
Toxicology ante mortem (excluding BAC)	NA	107.84	180.26	236.90
Toxicology post mortem (excluding BAC)	NA	174.72	381.56	715.43
Trace Evidence	NA	9.02	27.23	100.75

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	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	20.87	39.45	50.61	108.27
Crime Scene Investigation	NA	2.74	7.20	70.00
Digital evidence	NA	1.38	5.75	46.05
DNA Casework	28.99	43.40	82.75	132.45
DNA Database	24.72	23.20	29.72	60.46
Document Examination	NA	1.15	1.20	1.49
Drugs - Controlled Substances	1,005.60	165.00	224.89	351.63
Evidence Screening & Processing	NA	32.48	34.93	37.37
Explosives	NA	0.12	0.25	0.25
Fingerprints	1.26	20.54	31.77	83.14
Fingerprints Database (including IAFIS)	NA	8.75	43.55	126.30
Fire analysis	3.52	2.21	2.80	4.90
Firearms and Ballistics	23.30	15.81	19.65	47.55
Firearms Database (including NIBIN)	NA	22.23	45.36	301.60
Forensic Pathology	NA	46.76	49.62	52.48
Gun Shot Residue (GSR)	NA	2.63	4.29	8.93
Marks and Impressions	NA	0.19	0.30	0.52
Serology/Biology	1.17	19.03	32.95	49.09
Toxicology ante mortem (excluding BAC)	30.08	32.12	54.21	68.89
Toxicology post mortem (excluding BAC)	2.18	48.70	68.29	78.43
Trace Evidence	0.25	0.51	1.48	2.33

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$575	$148	$236	$352
Crime Scene Investigation	NA	$1,194	$3,867	$6,899
Digital evidence	NA	$1,961	$3,695	$6,836
DNA Casework	$980	$1,076	$1,488	$2,349
DNA Database	$781	$46	$78	$147
Document Examination	NA	$4,805	$5,783	$10,168
Drugs - Controlled Substances	$122	$285	$404	$493
Evidence Screening & Processing	NA	$564	$734	$1,045
Explosives	NA	$13,012	$18,486	$24,046
Fingerprints	$16,111	$666	$987	$1,397
Fingerprints Database (including IAFIS)	NA	$226	$532	$1,014
Fire analysis	$1,069	$1,372	$2,498	$3,727
Firearms and Ballistics	$1,733	$1,308	$2,272	$3,341
Firearms Database (including NIBIN)	$19	$70	$219	$398
Forensic Pathology	NA	$1,856	$2,116	$2,606
Gun Shot Residue (GSR)	NA	$2,214	$3,314	$4,460
Marks and Impressions	$9,113	$5,434	$8,852	$11,640
Serology/Biology	$960	$830	$1,114	$1,995
Toxicology ante mortem (excluding BAC)	$812	$578	$812	$1,010
Toxicology post mortem (excluding BAC)	$2,354	$699	$927	$1,152
Trace Evidence	$17,102	$3,244	$4,936	$7,301

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 2020-2021 prices.

Table 8: Real* Cost per Case across Time

Real Cost per Case over time (2020.12 = 100)					
Area of Investigation	**2016 - 2017**	**2017 - 2018**	**2018 - 2019**	**2019 - 2020**	**2020 - 2021**
Blood Alcohol	$190	$148	$154	$157	$236
Crime Scene Investigation	$4,074	$1,648	$2,428	$1,996	$3,867
Digital evidence	$12,856	$4,519	$4,387	$3,817	$3,695
DNA Casework	$2,023	$1,317	$1,401	$1,431	$1,488
DNA Database	$110	$60	$57	$64	$78
Document Examination	$7,520	$4,869	$4,139	$5,272	$5,783
Drugs - Controlled Substances	$528	$364	$326	$370	$404
Evidence Screening & Processing	$2,010	$667	$786	$855	$734
Explosives	$17,240	$18,346	$17,199	$18,109	$18,486
Fingerprints	$949	$826	$831	$953	$987
Fingerprints Database (including IAFIS)				$799	$532
Fire analysis	$2,916	$2,214	$2,462	$2,388	$2,498
Firearms and Ballistics	$2,018	$1,891	$1,729	$1,952	$2,272
Firearms Database (including NIBIN)	$0	$0	$0	$201	$219
Forensic Pathology	$4,900	$1,804	$2,592	$2,160	$2,116
Gun Shot Residue (GSR)	$3,794	$3,223	$2,941	$3,245	$3,314
Marks and Impressions	$8,356	$7,047	$6,327	$8,070	$8,852
Serology/Biology	$2,100	$958	$966	$1,049	$1,114
Toxicology ante mortem (excluding BAC)	$790	$894	$739	$828	$812
Toxicology post mortem (excluding BAC)	$969	$909	$936	$972	$927
Trace Evidence	$5,186	$4,628	$6,460	$4,657	$4,936

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	$139	$228	$309
Crime Scene Investigation	NA	$314	$648	$1,348
Digital evidence	NA	$905	$1,572	$2,885
DNA Casework	NA	$370	$491	$744
DNA Database	NA	$41	$62	$103
Document Examination	NA	$1,141	$1,414	$1,972
Drugs - Controlled Substances	NA	$161	$224	$274
Evidence Screening & Processing	NA	$244	$320	$436
Explosives	NA	$3,779	$4,668	$6,204
Fingerprints	NA	$249	$375	$507
Fingerprints Database (including IAFIS)	NA	$60	$174	$272
Fire analysis	NA	$590	$1,008	$1,550
Firearms and Ballistics	NA	$403	$676	$1,095
Firearms Database (including NIBIN)	NA	$29	$60	$118
Forensic Pathology	NA	$1,885	$1,913	$1,940
Gun Shot Residue (GSR)	NA	$1,133	$1,597	$2,167
Marks and Impressions	NA	$2,092	$2,937	$3,955
Serology/Biology	NA	$236	$354	$650
Toxicology ante mortem (excluding BAC)	NA	$550	$691	$878
Toxicology post mortem (excluding BAC)	NA	$346	$450	$604
Trace Evidence	NA	$444	$638	$943

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	$142	$222	$290
Crime Scene Investigation	NA	$181	$425	$682
Digital evidence	NA	$824	$1,615	$2,212
DNA Casework	NA	$240	$342	$495
DNA Database	NA	$41	$58	$101
Document Examination	NA	$774	$900	$1,365
Drugs - Controlled Substances	NA	$108	$140	$168
Evidence Screening & Processing	NA	$246	$342	$452
Explosives	NA	$1,388	$1,806	$2,291
Fingerprints	NA	$172	$231	$344
Fingerprints Database (including IAFIS)	NA	$59	$202	$231
Fire analysis	NA	$326	$469	$752
Firearms and Ballistics	NA	$307	$537	$691
Firearms Database (including NIBIN)	NA	$51	$74	$92
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	$607	$828	$1,064
Marks and Impressions	NA	$699	$946	$1,429
Serology/Biology	NA	$58	$100	$163
Toxicology ante mortem (excluding BAC)	NA	$544	$751	$942
Toxicology post mortem (excluding BAC)	NA	$205	$274	$357
Trace Evidence	NA	$253	$370	$476

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	$74	$122	$166
Crime Scene Investigation	NA	$11	$11	$242
Digital evidence	NA	$225	$408	$789
DNA Casework	NA	$56	$81	$121
DNA Database	NA	$40	$58	$95
Document Examination	NA	$272	$337	$609
Drugs - Controlled Substances	NA	$51	$60	$73
Evidence Screening & Processing	NA	$39	$109	$181
Explosives	NA	$357	$425	$569
Fingerprints	NA	$70	$102	$161
Fingerprints Database (including IAFIS)	NA	$102	$129	$132
Fire analysis	NA	$195	$304	$494
Firearms and Ballistics	NA	$234	$430	$568
Firearms Database (including NIBIN)	NA	$42	$58	$76
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	$410	$552	$712
Marks and Impressions	NA	$483	$650	$891
Serology/Biology	NA	$48	$78	$118
Toxicology ante mortem (excluding BAC)	NA	$90	$115	$160
Toxicology post mortem (excluding BAC)	NA	$82	$100	$137
Trace Evidence	NA	$123	$183	$258

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$734	$152	$225	$318
Crime Scene Investigation	NA	$1,007	$3,110	$5,319
Digital evidence	NA	$1,778	$3,977	$7,317
DNA Casework	$1,982	$1,108	$1,645	$2,324
DNA Database	$781	$42	$63	$117
Document Examination	NA	$4,716	$5,808	$9,017
Drugs - Controlled Substances	$133	$295	$415	$497
Evidence Screening & Processing	NA	$1,582	$2,286	$2,991
Explosives	NA	$13,659	$17,910	$25,103
Fingerprints	$16,111	$711	$966	$1,402
Fingerprints Database (including IAFIS)	NA	$224	$290	$1,132
Fire analysis	$1,222	$1,541	$2,621	$3,786
Firearms and Ballistics	$2,189	$1,330	$2,151	$3,266
Firearms Database (including NIBIN)	NA	$214	$337	$419
Forensic Pathology	NA	$1,949	$2,005	$2,061
Gun Shot Residue (GSR)	NA	$2,502	$3,599	$4,550
Marks and Impressions	NA	$5,906	$8,285	$10,783
Serology/Biology	$48,981	$921	$1,294	$2,372
Toxicology ante mortem (excluding BAC)	$837	$643	$858	$1,167
Toxicology post mortem (excluding BAC)	$4,527	$755	$985	$1,202
Trace Evidence	$17,102	$4,011	$5,784	$8,255

Metric Interpretation

The various unit cost metrics may be interpreted using the technique highlighted in The Decomposition of Return on Investment for Forensic Laboratories, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 2, 2009, Paul J. Speaker, pages 96-102. 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.

Note that 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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	$57,350	$72,749	$87,613	$104,584
Crime Scene Investigation	NA	$92,231	$108,587	$121,522
Digital evidence	NA	$81,654	$100,789	$114,714
DNA Casework	$86,847	$103,121	$122,285	$134,638
DNA Database	$88,104	$89,002	$95,933	$113,568
Document Examination	NA	$103,323	$110,969	$123,795
Drugs - Controlled Substances	$88,460	$96,781	$108,628	$120,551
Evidence Screening & Processing	NA	$79,351	$88,291	$97,137
Explosives	NA	$98,420	$109,086	$119,213
Fingerprints	$112,626	$91,642	$102,127	$115,581
Fingerprints Database (including IAFIS)	NA	$83,383	$103,415	$118,624
Fire analysis	$104,891	$98,171	$107,893	$117,763
Firearms and Ballistics	$96,389	$101,356	$108,502	$119,184
Firearms Database (including NIBIN)	$72,411	$71,069	$87,851	$132,292
Forensic Pathology	NA	$184,968	$191,810	$347,792
Gun Shot Residue (GSR)	NA	$92,259	$101,518	$111,635
Marks and Impressions	$115,766	$98,394	$112,746	$131,802
Serology/Biology	$86,847	$88,470	$98,189	$108,935
Toxicology ante mortem (excluding BAC)	$68,650	$93,160	$100,056	$110,329
Toxicology post mortem (excluding BAC)	$91,248	$92,356	$102,503	$111,111
Trace Evidence	$104,891	$96,824	$118,720	$165,156

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	1.01	1.05	1.09
Crime Scene Investigation	NA	4.35	4.83	5.08
Digital evidence	NA	1.75	2.59	2.95
DNA Casework	NA	2.86	3.04	3.27
DNA Database	NA	0.97	1.00	1.03
Document Examination	NA	3.93	4.16	4.53
Drugs - Controlled Substances	NA	1.70	1.80	1.95
Evidence Screening & Processing	NA	2.42	2.45	2.57
Explosives	NA	3.69	3.82	4.14
Fingerprints	NA	2.15	2.33	2.49
Fingerprints Database (including IAFIS)	NA	1.80	3.22	4.17
Fire analysis	NA	2.47	2.56	2.75
Firearms and Ballistics	NA	2.72	2.89	3.08
Firearms Database (including NIBIN)	NA	1.04	1.46	3.37
Forensic Pathology	NA	0.94	0.96	0.98
Gun Shot Residue (GSR)	NA	2.00	2.13	2.21
Marks and Impressions	NA	2.69	2.83	3.00
Serology/Biology	NA	3.55	3.71	3.86
Toxicology ante mortem (excluding BAC)	NA	1.12	1.20	1.27
Toxicology post mortem (excluding BAC)	NA	2.08	2.21	2.34
Trace Evidence	NA	7.48	7.85	8.42

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	1.04	1.09	1.13
Crime Scene Investigation	NA	7.66	8.09	8.31
Digital evidence	NA	3.95	4.06	4.24
DNA Casework	NA	4.67	4.97	5.20
DNA Database	NA	0.98	1.02	1.04
Document Examination	NA	6.25	6.50	6.99
Drugs - Controlled Substances	NA	2.73	3.02	3.13
Evidence Screening & Processing	NA	2.33	2.44	2.52
Explosives	NA	10.08	10.44	11.00
Fingerprints	NA	3.62	3.80	4.01
Fingerprints Database (including IAFIS)	NA	4.50	4.57	5.12
Fire analysis	NA	5.54	5.83	6.26
Firearms and Ballistics	NA	4.60	4.79	4.95
Firearms Database (including NIBIN)	NA	1.78	3.40	3.82
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	3.98	4.16	4.35
Marks and Impressions	NA	8.78	9.05	9.59
Serology/Biology	NA	16.41	17.20	18.01
Toxicology ante mortem (excluding BAC)	NA	1.07	1.12	1.18
Toxicology post mortem (excluding BAC)	NA	3.70	3.99	4.14
Trace Evidence	NA	13.32	13.72	14.44

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	1.80	1.90	2.00
Crime Scene Investigation	NA	11.00	13.39	13.50
Digital evidence	NA	16.05	17.01	18.00
DNA Casework	NA	20.10	21.09	22.01
DNA Database	NA	0.98	1.02	1.05
Document Examination	NA	15.52	17.37	18.24
Drugs - Controlled Substances	NA	6.36	6.69	7.09
Evidence Screening & Processing	NA	8.68	11.68	13.62
Explosives	NA	41.05	43.24	47.45
Fingerprints	NA	8.34	8.75	9.15
Fingerprints Database (including IAFIS)	NA	2.06	2.37	2.92
Fire analysis	NA	8.81	9.31	9.63
Firearms and Ballistics	NA	5.53	5.89	6.20
Firearms Database (including NIBIN)	NA	1.95	3.09	4.13
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	6.05	6.46	6.72
Marks and Impressions	NA	12.75	13.16	13.83
Serology/Biology	NA	19.14	20.00	20.73
Toxicology ante mortem (excluding BAC)	NA	7.61	8.11	8.51
Toxicology post mortem (excluding BAC)	NA	9.98	10.66	11.04
Trace Evidence	NA	16.96	22.19	29.47

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	0.78	0.96	0.99	1.02
Crime Scene Investigation	NA	1.00	1.04	1.08
Digital evidence	NA	0.94	1.01	1.13
DNA Casework	0.49	0.97	1.01	1.05
DNA Database	1.00	0.98	1.01	1.03
Document Examination	NA	0.97	1.00	1.06
Drugs - Controlled Substances	0.92	0.95	0.99	1.02
Evidence Screening & Processing	NA	0.39	0.45	0.51
Explosives	NA	0.98	1.00	1.09
Fingerprints	1.00	0.93	0.98	1.01
Fingerprints Database (including IAFIS)	NA	0.96	1.00	1.02
Fire analysis	0.88	0.94	1.00	1.01
Firearms and Ballistics	0.79	0.95	1.00	1.04
Firearms Database (including NIBIN)	NA	0.18	0.80	1.01
Forensic Pathology	NA	0.90	0.92	0.94
Gun Shot Residue (GSR)	NA	0.93	0.99	1.03
Marks and Impressions	NA	0.93	1.00	1.00
Serology/Biology	0.02	0.93	0.97	1.00
Toxicology ante mortem (excluding BAC)	0.97	0.95	1.00	1.04
Toxicology post mortem (excluding BAC)	0.52	0.95	1.00	1.03
Trace Evidence	1.00	0.85	0.89	0.93

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	1.00	1.02	1.07
Crime Scene Investigation	NA	1.59	1.68	1.77
Digital evidence	NA	1.34	1.44	1.51
DNA Casework	NA	1.51	1.61	1.74
DNA Database	NA	0.97	1.01	1.06
Document Examination	NA	1.47	1.57	1.69
Drugs - Controlled Substances	NA	1.52	1.65	1.76
Evidence Screening & Processing	NA	0.95	0.98	1.03
Explosives	NA	2.56	2.67	2.78
Fingerprints	NA	1.56	1.66	1.76
Fingerprints Database (including IAFIS)	NA	1.00	1.00	1.00
Fire analysis	NA	2.14	2.28	2.36
Firearms and Ballistics	NA	1.52	1.66	1.76
Firearms Database (including NIBIN)	NA	1.00	1.00	1.07
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	1.85	1.96	2.05
Marks and Impressions	NA	3.02	3.17	3.33
Serology/Biology	NA	4.44	4.65	4.83
Toxicology ante mortem (excluding BAC)	NA	0.89	0.94	0.99
Toxicology post mortem (excluding BAC)	NA	1.62	1.76	1.89
Trace Evidence	NA	1.63	1.72	1.83

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	1.68	1.81	1.92
Crime Scene Investigation	NA	0.98	1.01	1.02
Digital evidence	NA	5.66	6.02	6.45
DNA Casework	NA	6.47	6.90	7.38
DNA Database	NA	0.98	1.02	1.06
Document Examination	NA	4.00	4.20	4.37
Drugs - Controlled Substances	NA	3.43	3.71	4.01
Evidence Screening & Processing	NA	5.38	10.69	15.68
Explosives	NA	10.73	11.31	11.89
Fingerprints	NA	3.56	3.83	4.03
Fingerprints Database (including IAFIS)	NA	0.46	1.91	2.21
Fire analysis	NA	3.40	3.60	3.72
Firearms and Ballistics	NA	1.89	2.04	2.17
Firearms Database (including NIBIN)	NA	0.67	1.00	2.98
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	2.88	3.03	3.22
Marks and Impressions	NA	4.33	4.53	4.84
Serology/Biology	NA	5.24	5.42	5.56
Toxicology ante mortem (excluding BAC)	NA	6.04	6.70	6.97
Toxicology post mortem (excluding BAC)	NA	4.48	4.75	5.00
Trace Evidence	NA	3.32	3.51	3.73

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	0.89	0.95	1.00
Crime Scene Investigation	NA	0.20	0.21	0.23
Digital evidence	NA	0.35	0.40	0.60
DNA Casework	NA	0.31	0.33	0.35
DNA Database	NA	0.95	1.00	1.05
Document Examination	NA	0.23	0.25	0.26
Drugs - Controlled Substances	NA	0.50	0.54	0.58
Evidence Screening & Processing	NA	0.29	0.30	0.32
Explosives	NA	0.25	0.26	0.27
Fingerprints	NA	0.39	0.42	0.44
Fingerprints Database (including IAFIS)	NA	0.24	0.27	0.42
Fire analysis	NA	0.35	0.38	0.40
Firearms and Ballistics	NA	0.32	0.35	0.37
Firearms Database (including NIBIN)	NA	0.09	0.18	0.28
Forensic Pathology	NA	0.92	0.96	1.00
Gun Shot Residue (GSR)	NA	0.43	0.46	0.50
Marks and Impressions	NA	0.31	0.33	0.36
Serology/Biology	NA	0.25	0.26	0.27
Toxicology ante mortem (excluding BAC)	NA	0.78	0.83	0.89
Toxicology post mortem (excluding BAC)	NA	0.43	0.44	0.48
Trace Evidence	NA	0.11	0.11	0.12

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	1.66	1.77	1.85
Crime Scene Investigation	NA			
Digital evidence	NA	4.12	4.38	4.50
DNA Casework	NA	4.01	4.17	4.37
DNA Database	NA	0.97	1.01	1.05
Document Examination	NA	2.39	2.68	2.80
Drugs - Controlled Substances	NA	2.14	2.21	2.41
Evidence Screening & Processing	NA	4.35	4.39	4.73
Explosives	NA	4.03	4.26	4.41
Fingerprints	NA	2.17	2.31	2.44
Fingerprints Database (including IAFIS)	NA	0.43	0.46	1.00
Fire analysis	NA	1.48	1.57	1.63
Firearms and Ballistics	NA	1.18	1.24	1.29
Firearms Database (including NIBIN)	NA	1.85	2.70	3.55
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	1.43	1.53	1.62
Marks and Impressions	NA	1.40	1.46	1.52
Serology/Biology	NA	1.12	1.17	1.20
Toxicology ante mortem (excluding BAC)	NA	6.64	7.12	7.50
Toxicology post mortem (excluding BAC)	NA	2.52	2.64	2.81
Trace Evidence	NA	1.95	2.03	2.17

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	0.87	0.92	0.98
Crime Scene Investigation	NA	0.12	0.13	0.13
Digital evidence	NA	0.25	0.27	0.28
DNA Casework	NA	0.20	0.21	0.22
DNA Database	NA	0.95	0.99	1.03
Document Examination	NA	0.15	0.16	0.17
Drugs - Controlled Substances	NA	0.31	0.33	0.37
Evidence Screening & Processing	NA	0.28	0.30	0.32
Explosives	NA	0.09	0.10	0.10
Fingerprints	NA	0.24	0.26	0.27
Fingerprints Database (including IAFIS)	NA	0.19	0.20	0.24
Fire analysis	NA	0.16	0.17	0.18
Firearms and Ballistics	NA	0.20	0.21	0.22
Firearms Database (including NIBIN)	NA	0.17	0.26	0.26
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	0.22	0.23	0.25
Marks and Impressions	NA	0.10	0.11	0.11
Serology/Biology	NA	0.05	0.06	0.06
Toxicology ante mortem (excluding BAC)	NA	0.83	0.89	0.94
Toxicology post mortem (excluding BAC)	NA	0.24	0.25	0.27
Trace Evidence	NA	0.06	0.06	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*** increase, 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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	205.25	304.42	549.56	973.63
Crime Scene Investigation	NA	17.71	44.35	78.84
Digital evidence	NA	22.70	39.98	60.89
DNA Casework	150.61	73.69	98.82	132.29
DNA Database	190.41	1,218.83	2,522.25	3,653.48
Document Examination	NA	13.25	21.49	30.61
Drugs - Controlled Substances	1,224.96	296.05	352.32	476.96
Evidence Screening & Processing	NA	132.99	145.56	180.55
Explosives	NA	4.40	6.57	9.96
Fingerprints	10.76	94.18	132.32	174.18
Fingerprints Database (including IAFIS)	NA	170.00	335.78	497.59
Fire analysis	154.91	29.38	54.35	89.01
Firearms and Ballistics	90.62	45.11	63.67	113.41
Firearms Database (including NIBIN)	6,924.44	340.06	802.53	1,492.25
Forensic Pathology	NA	90.64	111.90	211.99
Gun Shot Residue (GSR)	NA	28.85	37.09	57.97
Marks and Impressions	19.36	10.60	15.76	23.09
Serology/Biology	153.62	56.81	112.86	145.49
Toxicology ante mortem (excluding BAC)	159.21	132.98	168.85	254.80
Toxicology post mortem (excluding BAC)	64.55	114.07	138.52	177.44
Trace Evidence	9.68	29.25	35.06	38.13

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	316.04	547.62	1,029.52
Crime Scene Investigation	NA	92.29	269.77	377.89
Digital evidence	NA	57.16	84.41	153.76
DNA Casework	NA	219.70	311.54	409.02
DNA Database	NA	1,870.29	2,872.24	3,748.31
Document Examination	NA	67.18	93.28	123.09
Drugs - Controlled Substances	NA	522.49	637.98	883.57
Evidence Screening & Processing	NA	309.95	359.54	424.39
Explosives	NA	18.10	25.50	36.36
Fingerprints	NA	244.35	344.06	450.23
Fingerprints Database (including IAFIS)	NA	535.47	784.45	1,771.68
Fire analysis	NA	74.13	140.42	224.75
Firearms and Ballistics	NA	134.91	197.31	365.79
Firearms Database (including NIBIN)	NA	1,238.16	3,039.42	3,541.00
Forensic Pathology	NA	203.34	206.18	209.02
Gun Shot Residue (GSR)	NA	59.09	73.03	102.31
Marks and Impressions	NA	27.14	41.82	62.19
Serology/Biology	NA	170.40	320.30	504.07
Toxicology ante mortem (excluding BAC)	NA	158.53	199.56	254.58
Toxicology post mortem (excluding BAC)	NA	238.06	302.02	363.23
Trace Evidence	NA	230.71	271.63	308.82

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	326	536	1,005
Crime Scene Investigation	NA	231	434	656
Digital evidence	NA	80	93	195
DNA Casework	NA	354	476	634
DNA Database	NA	2,364	3,259	4,005
Document Examination	NA	99	138	177
Drugs - Controlled Substances	NA	875	1,033	1,197
Evidence Screening & Processing	NA	295	345	414
Explosives	NA	49	66	95
Fingerprints	NA	372	530	696
Fingerprints Database (including IAFIS)	NA	769	784	2,078
Fire analysis	NA	162	280	384
Firearms and Ballistics	NA	209	281	487
Firearms Database (including NIBIN)	NA	1,084	2,182	3,824
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	110	142	200
Marks and Impressions	NA	81	126	180
Serology/Biology	NA	701	1,078	2,065
Toxicology ante mortem (excluding BAC)	NA	148	179	256
Toxicology post mortem (excluding BAC)	NA	398	495	656
Trace Evidence	NA	422	483	524

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	519	989	1,815
Crime Scene Investigation	NA	295	331	332
Digital evidence	NA	220	391	715
DNA Casework	NA	1,497	1,999	2,661
DNA Database	NA	2,434	3,305	4,033
Document Examination	NA	197	381	474
Drugs - Controlled Substances	NA	1,938	2,241	2,912
Evidence Screening & Processing	NA	1,032	1,278	12,005
Explosives	NA	200	281	401
Fingerprints	NA	795	1,277	1,661
Fingerprints Database (including IAFIS)	NA	961	1,077	1,157
Fire analysis	NA	250	436	630
Firearms and Ballistics	NA	262	346	635
Firearms Database (including NIBIN)	NA	1,863	2,530	2,785
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	175	217	285
Marks and Impressions	NA	126	182	241
Serology/Biology	NA	882	1,478	2,504
Toxicology ante mortem (excluding BAC)	NA	927	1,173	1,471
Toxicology post mortem (excluding BAC)	NA	1,006	1,312	1,625
Trace Evidence	NA	857	980	1,119

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	161	312	549	940
Crime Scene Investigation	NA	22	48	84
Digital evidence	NA	21	39	67
DNA Casework	74	71	98	132
DNA Database	190	1,662	2,911	3,803
Document Examination	NA	14	22	31
Drugs - Controlled Substances	1,123	285	352	440
Evidence Screening & Processing	NA	70	76	82
Explosives	NA	5	7	10
Fingerprints	11	96	130	170
Fingerprints Database (including IAFIS)	NA	143	394	500
Fire analysis	136	27	54	82
Firearms and Ballistics	72	45	66	105
Firearms Database (including NIBIN)	NA	179	348	664
Forensic Pathology	NA	191	197	203
Gun Shot Residue (GSR)	NA	27	34	49
Marks and Impressions	NA	11	16	22
Serology/Biology	3	46	87	129
Toxicology ante mortem (excluding BAC)	154	130	156	228
Toxicology post mortem (excluding BAC)	34	113	135	177
Trace Evidence	10	25	30	34

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	48.58%	66.98%	75.41%	82.90%
Crime Scene Investigation	NA	74.11%	80.04%	89.41%
Digital evidence	NA	65.32%	73.00%	80.42%
DNA Casework	58.86%	68.45%	76.73%	83.47%
DNA Database	59.21%	48.76%	59.03%	70.06%
Document Examination	NA	80.72%	88.30%	94.24%
Drugs - Controlled Substances	59.31%	74.86%	80.79%	85.51%
Evidence Screening & Processing	NA	75.05%	79.93%	84.77%
Explosives	NA	81.82%	86.03%	92.59%
Fingerprints	64.98%	76.01%	83.93%	86.02%
Fingerprints Database (including IAFIS)	NA	77.39%	80.39%	88.48%
Fire analysis	63.35%	77.25%	84.30%	85.95%
Firearms and Ballistics	61.36%	73.35%	77.34%	81.97%
Firearms Database (including NIBIN)	54.40%	69.47%	75.23%	83.12%
Forensic Pathology	NA	81.21%	84.85%	88.38%
Gun Shot Residue (GSR)	NA	77.21%	83.74%	86.82%
Marks and Impressions	65.61%	81.87%	90.84%	91.59%
Serology/Biology	58.86%	84.25%	87.89%	90.46%
Toxicology ante mortem (excluding BAC)	53.08%	66.68%	72.10%	75.85%
Toxicology post mortem (excluding BAC)	60.06%	68.69%	76.79%	82.80%
Trace Evidence	63.35%	75.51%	81.13%	83.62%

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	3.52%	3.23%	5.39%	10.25%
Crime Scene Investigation	NA	1.50%	5.01%	10.96%
Digital evidence	NA	4.31%	10.14%	18.46%
DNA Casework	2.81%	3.68%	6.14%	8.84%
DNA Database	2.79%	4.79%	10.80%	20.76%
Document Examination	NA	0.38%	1.30%	3.31%
Drugs - Controlled Substances	2.78%	3.57%	5.02%	7.15%
Evidence Screening & Processing	NA	2.79%	4.88%	6.82%
Explosives	NA	1.48%	2.99%	5.14%
Fingerprints	2.39%	3.31%	4.07%	4.95%
Fingerprints Database (including IAFIS)	NA	1.47%	4.05%	6.07%
Fire analysis	2.51%	2.74%	3.21%	4.16%
Firearms and Ballistics	2.64%	3.20%	4.74%	6.94%
Firearms Database (including NIBIN)	3.12%	3.82%	5.10%	9.53%
Forensic Pathology	NA	2.18%	2.38%	3.14%
Gun Shot Residue (GSR)	NA	2.86%	4.35%	5.37%
Marks and Impressions	2.35%	1.52%	1.75%	3.42%
Serology/Biology	2.81%	0.80%	1.62%	2.67%
Toxicology ante mortem (excluding BAC)	3.21%	5.30%	9.09%	13.45%
Toxicology post mortem (excluding BAC)	2.73%	3.53%	5.81%	9.04%
Trace Evidence	2.51%	4.93%	6.14%	8.44%

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	6.31%	3.73%	5.56%	10.51%
Crime Scene Investigation	NA	0.21%	0.84%	3.34%
Digital evidence	NA	0.03%	1.25%	4.66%
DNA Casework	5.05%	4.10%	5.92%	9.88%
DNA Database	5.00%	2.36%	4.93%	8.23%
Document Examination	NA	0.41%	0.86%	1.74%
Drugs - Controlled Substances	4.99%	2.71%	3.97%	6.37%
Evidence Screening & Processing	NA	2.27%	3.57%	5.58%
Explosives	NA	1.43%	2.20%	4.14%
Fingerprints	4.29%	1.39%	1.68%	4.29%
Fingerprints Database (including IAFIS)	NA	0.12%	1.95%	8.49%
Fire analysis	4.50%	2.56%	2.96%	5.82%
Firearms and Ballistics	4.74%	2.96%	4.74%	6.67%
Firearms Database (including NIBIN)	5.59%	2.66%	5.61%	8.43%
Forensic Pathology	NA	2.96%	3.24%	4.14%
Gun Shot Residue (GSR)	NA	1.65%	2.20%	3.18%
Marks and Impressions	4.22%	1.13%	1.42%	2.28%
Serology/Biology	5.05%	2.25%	3.00%	5.05%
Toxicology ante mortem (excluding BAC)	5.75%	5.52%	6.88%	8.89%
Toxicology post mortem (excluding BAC)	4.90%	4.19%	5.35%	7.49%
Trace Evidence	4.50%	2.05%	2.51%	3.28%

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 by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	41.59%	4.84%	8.11%	13.57%
Crime Scene Investigation	NA	5.07%	8.72%	15.21%
Digital evidence	NA	5.73%	11.21%	17.90%
DNA Casework	33.28%	4.53%	7.42%	12.72%
DNA Database	33.00%	14.35%	20.09%	25.03%
Document Examination	NA	3.41%	5.68%	12.24%
Drugs - Controlled Substances	32.92%	6.00%	8.07%	11.04%
Evidence Screening & Processing	NA	7.47%	10.04%	14.63%
Explosives	NA	3.81%	5.32%	7.66%
Fingerprints	28.33%	7.60%	9.19%	10.45%
Fingerprints Database (including IAFIS)	NA	4.68%	8.36%	11.04%
Fire analysis	29.65%	6.76%	8.88%	10.39%
Firearms and Ballistics	31.26%	7.44%	11.27%	15.14%
Firearms Database (including NIBIN)	36.89%	4.51%	8.48%	17.25%
Forensic Pathology	NA	6.48%	6.69%	7.85%
Gun Shot Residue (GSR)	NA	7.17%	8.19%	11.17%
Marks and Impressions	27.82%	5.08%	5.78%	6.45%
Serology/Biology	33.28%	5.01%	6.63%	8.01%
Toxicology ante mortem (excluding BAC)	37.96%	8.02%	10.91%	13.33%
Toxicology post mortem (excluding BAC)	32.31%	6.73%	9.54%	12.33%
Trace Evidence	29.65%	7.51%	9.14%	10.85%

Turn-around Time

Note that 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 (Timed in days from last submission of evidence to Report submission)

Table 32: Turnaround Time from Last Item Received by Investigative Area

Turnaround Time from Last Item Received by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	NA	6	10	19
Crime Scene Investigation	NA	19	24	29
Digital evidence	NA			
DNA Casework	NA	16	41	94
DNA Database	NA	105	202	300
Document Examination	NA	16	24	32
Drugs - Controlled Substances	NA	9	22	42
Evidence Screening & Processing	NA			
Explosives	NA	22	35	49
Fingerprints	NA	4	8	17
Fingerprints Database (including IAFIS)	NA	1	1	14
Fire analysis	NA	19	31	55
Firearms and Ballistics	NA	10	15	44
Firearms Database (including NIBIN)	NA	1	2	33
Forensic Pathology	NA			
Gun Shot Residue (GSR)	NA	51	205	213
Marks and Impressions	NA	44	64	84
Serology/Biology	NA	22	27	37
Toxicology ante mortem (excluding BAC)	NA	36	48	58
Toxicology post mortem (excluding BAC)	NA	35	42	44
Trace Evidence	NA	18	36	133

Turn-around Time (Timed in days from first submission of evidence to Report submission)

Table 33: Turnaround Time from First Item Received by Investigative Area

Turnaround Time from First Item Received by Investigative Area				
Area of Investigation	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	37	22	28	37
Crime Scene Investigation	NA	30	40	51
Digital evidence	NA	24	75	149
DNA Casework	145	103	133	152
DNA Database	NA	47	61	72
Document Examination	NA	55	65	80
Drugs - Controlled Substances	53	57	70	86
Evidence Screening & Processing	NA	26	40	47
Explosives	NA	87	106	128
Fingerprints	NA	54	69	82
Fingerprints Database (including IAFIS)	NA	8	12	27
Fire analysis	NA	68	102	126
Firearms and Ballistics	78	56	72	85
Firearms Database (including NIBIN)	NA	5	7	25
Forensic Pathology	NA	56	62	67
Gun Shot Residue (GSR)	NA	80	92	110
Marks and Impressions	66	83	101	118
Serology/Biology	NA	54	65	80
Toxicology ante mortem (excluding BAC)	37	51	66	77
Toxicology post mortem (excluding BAC)	30	67	81	90
Trace Evidence	NA	168	204	242

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 34: 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	**North Louisiana**	**25th percentile**	**Median**	**75th percentile**
Blood Alcohol	3.8%	0.0%	0.6%	2.1%
Crime Scene Investigation	NA	1.1%	6.8%	12.0%
Digital evidence	NA	0.2%	23.0%	73.4%
DNA Casework	41.4%	9.6%	52.2%	99.1%
DNA Database	NA	1.4%	2.8%	43.3%
Document Examination	NA	13.6%	23.4%	33.1%
Drugs - Controlled Substances	4.1%	0.9%	5.2%	18.6%
Evidence Screening & Processing	NA	3.4%	4.0%	4.7%
Explosives	NA	17.2%	23.3%	36.5%
Fingerprints	NA	2.7%	6.8%	21.7%
Fingerprints Database (including IAFIS)	NA	0.0%	0.1%	2.7%
Fire analysis	6.3%	0.0%	3.5%	6.4%
Firearms and Ballistics	16.8%	4.6%	11.2%	108.0%
Firearms Database (including NIBIN)	NA	0.0%	0.0%	0.7%
Forensic Pathology	NA	14.4%	15.9%	17.4%
Gun Shot Residue (GSR)	NA	24.2%	54.8%	113.9%
Marks and Impressions	NA	33.3%	233.3%	300.0%
Serology/Biology	NA	3.1%	17.5%	60.2%
Toxicology ante mortem (excluding BAC)	3.0%	2.4%	4.9%	58.8%
Toxicology post mortem (excluding BAC)	0.0%	2.4%	3.4%	4.8%
Trace Evidence	NA	40.6%	76.3%	128.0%

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.

Using the Project FORESIGHT benchmark data from fiscal years 2014-2020, we note some of the trends following this systemic stress prior to the COVID-19 pandemic.[5]

[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. (2021). Project FORESIGHT Annual Report, 2019-2020. https://researchrepository.wvu.edu/faculty_publications/3008/

Speaker, P. J. (2020). Project FORESIGHT Annual Report, 2018-2019. https://researchrepository.wvu.edu/faculty_publications/2910/

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Speaker, P. J. (2015). Project FORESIGHT Benchmark Data 2013-2014. https://researchrepository.wvu.edu/faculty_publications/1142/

Table 35: Time Trend--Average Annual Growth in Costs, 2013-2020

Average Annual growth in Costs 2013-2020	
Blood Alcohol	4.3%
Crime Scene Investigation	12.2%
Digital evidence	38.1%
DNA Casework	1.5%
Fingerprints	9.9%
Fire analysis	3.7%
Toxicology (antemortem, excluding BAC)	10.0%
Toxicology (postmortem, excluding BAC)	3.4%
Trace Evidence	2.6%

Table 36: Time Trend--Average Annual Growth in TAT, 2013-2020

Average Annual growth in Turnaround Time 2013-2020	
Blood Alcohol	29.1%
Crime Scene Investigation	17.6%
Digital evidence	2.8%
DNA Casework	7.1%
Fingerprints	11.6%
Fire analysis	19.8%
Toxicology (antemortem, excluding BAC)	10.5%
Toxicology (postmortem, excluding BAC)	14.9%
Trace Evidence	20.6%

Table 37: Time Trend—Average Annual Growth in Backlog, 2013-2020

Average Annual growth in backlog 2013-2020	
Blood Alcohol	190.3%
Crime Scene Investigation	628.5%
Digital evidence	61.1%
DNA Casework	70.1%
Fingerprints	88.5%
Fire analysis	70.6%
Toxicology (antemortem, excluding BAC)	110.3%
Toxicology (postmortem, excluding BAC)	108.5%
Trace Evidence	41.5%

Table 38: Time Trend Observations, 2013-2020

Blood Alcohol
Case submissions growing at 6.6% annual trend
Case reports only growing at 0.8% average
Case completions growing at 6.5% average annually
Laboratory resources shifted away from BAC during opioid crisis & attention to untested SAKs
Case productivity relatively constant year to year

Crime Scene Investigation
Cost per case rising at 12.2% average annually
Case submissions relatively stable, but more complex cases as seen in 13.8% in cost per item examined
Productivity rising by annual rate of 19.7%
Laboratory resources shifted away from CSI during opioid crisis & attention to untested SAKs

Digital evidence
Case submissions growing at 8.8% annually
Items submitted growing at 38.3% annually
Cost per case rising at 38.1% average annually
Cost per item examined rising at 62.5% average annually
Case complexity growing rapidly, requiring large increases in resources

DNA Casework
Backlog growing nearly 27% annually
Productivity increasing at 3.1% per year
Items examined per analyst up 19.3% per year
Turnaround time growing 7.1% annually
Average costs rising slowly due to economies of scale
Cost per report growing 4.1% annually

Fingerprint Identification
Case submissions falling as DNA cases rise
Declining requests result in average costs rising with diseconomies of scale
The diseconomies correspond with expected declines in productivity

Fire analysis
Slight decline in case submissions
The diseconomies correspond with expected declines in productivity
The increased complexity of cases from increased items results in rising average costs
Slight increase in item submission

Firearms & Ballistics
Slight decline in case submissions
Cost per case rising at 11.1% average annually
Backlog increasing dramatically as resources are shifted from renewed attention to SAKs and opioids
Turnaround time is stable
Slight increase in item submission

Toxicology ante mortem (excluding BAC)
Case submissions rising at a 8.2% annual rate
Case output rising at a 8.3% annual rate
Costs rising annually at 10% with complexity of cases
Resources diverted during opioid crisis period, yet can't keep up with demand for services and case complexity

Toxicology ante mortem (excluding BAC)
Case submissions rising at a 11.9% annual rate
Case output rising at a 10% annual rate
The input/output gap increases TAT and backlog
Resources diverted during opioid crisis period, yet can't keep up with demand for services and case complexity

Trace Evidence
Case submissions falling, but case complexity sees an 8.4% rise in items examined
Productivity rising with 6.8% in cases/FTE
Productivity effects are most dramatic with the items examined per FTE rising at 22.1% annually
Laboratory resources shifted away from Trace evidence during opioid crisis & attention to untested SAKs

Efficiency and Cost Effectiveness of Forensic Science Services—FORESIGHT 2020-2021 Benchmark Data

The summary statistics offer a one-dimensional view of performance. In this section, that view is expanded through a 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.

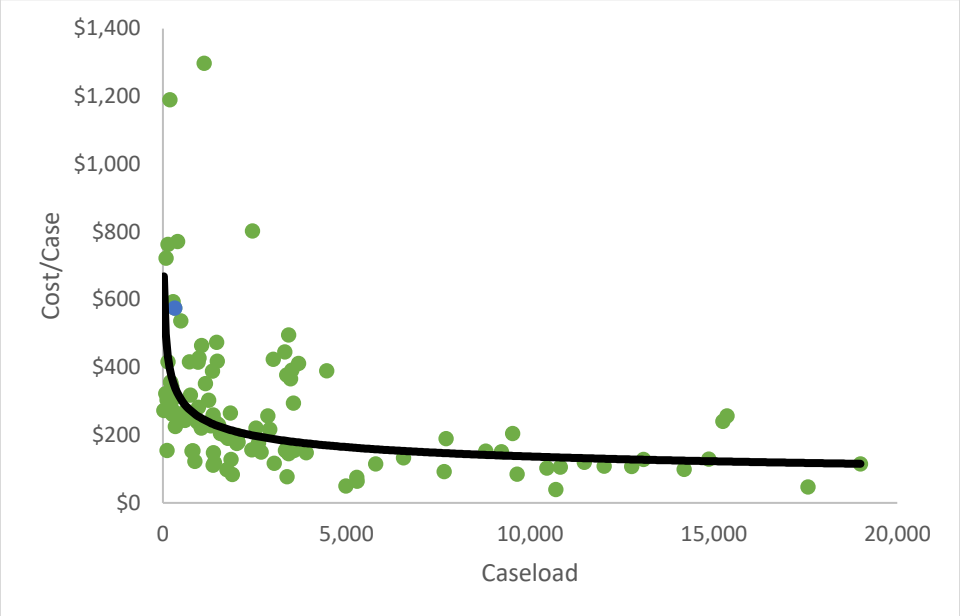
For each investigative area, the industry average total cost curve has been estimated by a series of non-linear regressions. When a laboratory performs on or near the curve, it is an indication of efficiency for the corresponding caseload. For an efficient performance that is near the bottom of the U-shaped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



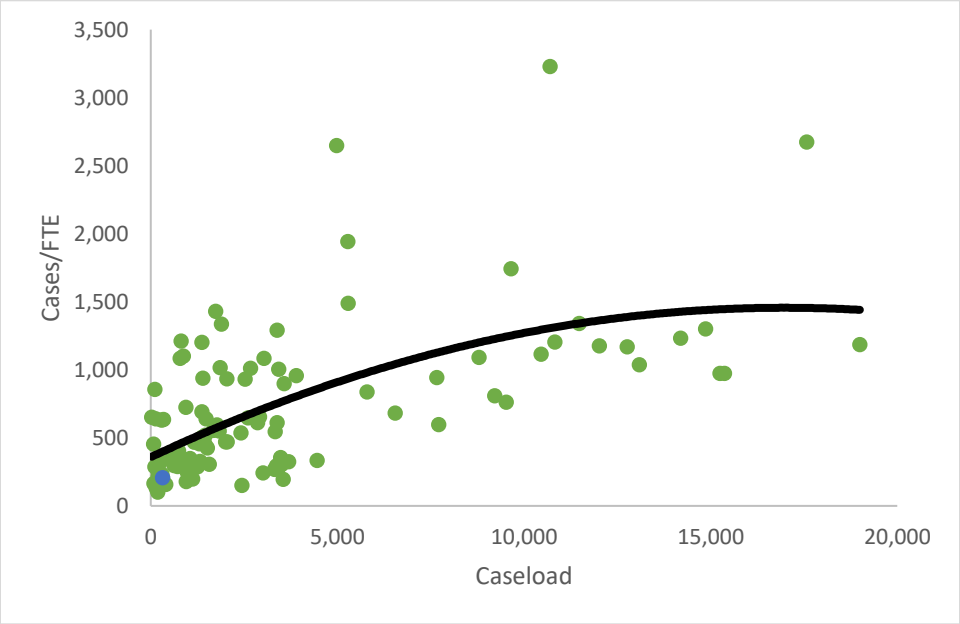


Figure 4: Efficient Frontier for Blood Alcohol Analysis—Cases/FTE v. Cases Processed

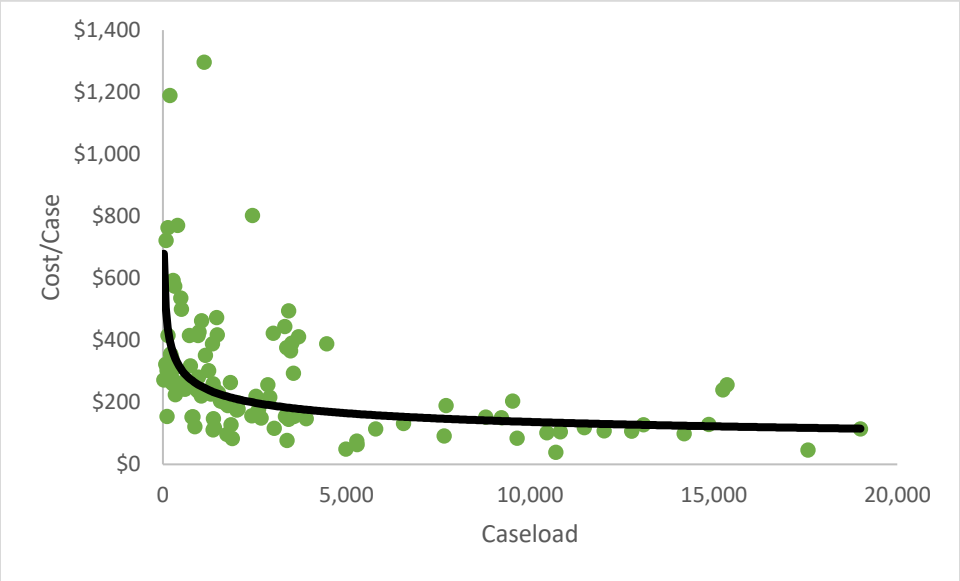
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 39: 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	$467.00	371	5,000	$164.65	909
200	$388.23	384	6,000	$156.84	997
300	$348.47	396	7,000	$150.52	1,077
400	$322.75	409	8,000	$145.26	1,149
500	$304.12	422	9,000	$140.77	1,214
600	$289.70	434	10,000	$136.88	1,271
700	$278.04	447	11,000	$133.44	1,320
800	$268.32	459	12,000	$130.38	1,362
900	$260.03	471	13,000	$127.63	1,396
1,000	$252.83	483	14,000	$125.14	1,422
1,250	$238.23	514	15,000	$122.86	1,441
1,500	$226.93	543	16,000	$120.76	1,452
1,750	$217.80	573	17,000	$118.83	1,456
2,000	$210.18	601	18,000	$117.03	1,452
2,250	$203.69	630	19,000	$115.36	1,440
2,500	$198.05	657	20,000	$113.79	1,421
2,750	$193.08	685	21,000	$112.32	1,394
3,000	$188.66	712	22,000	$110.94	1,360
3,250	$184.67	738	23,000	$109.63	1,318
3,500	$181.06	764	24,000	$108.39	1,268
3,750	$177.76	789	25,000	$107.22	1,211
4,000	$174.73	814	26,000	$106.11	1,146
4,500	$169.33	863	27,000	$105.04	1,073

Crime Scene Investigation

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



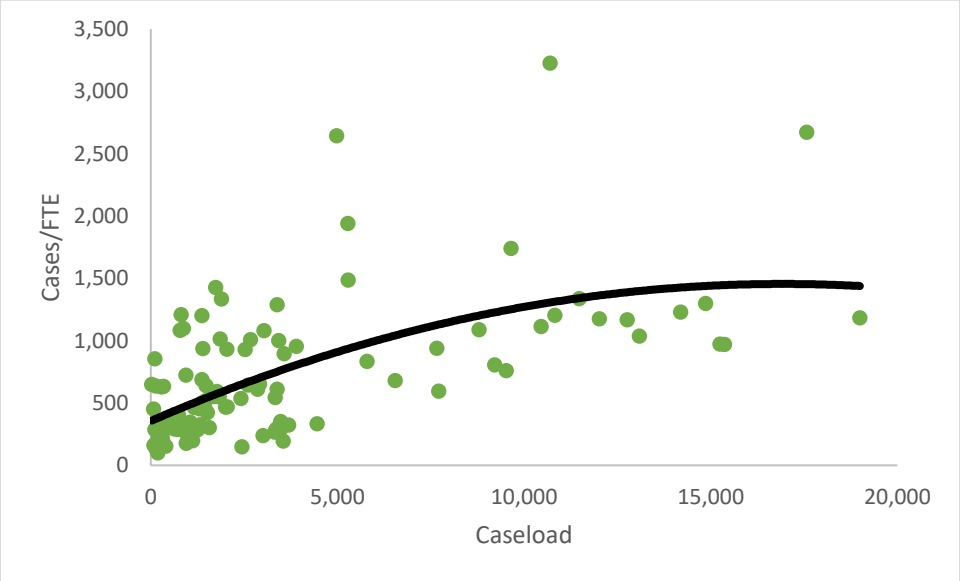


Figure 6: Efficient Frontier Crime Scene Investigation—Cases/FTE v. Caseload

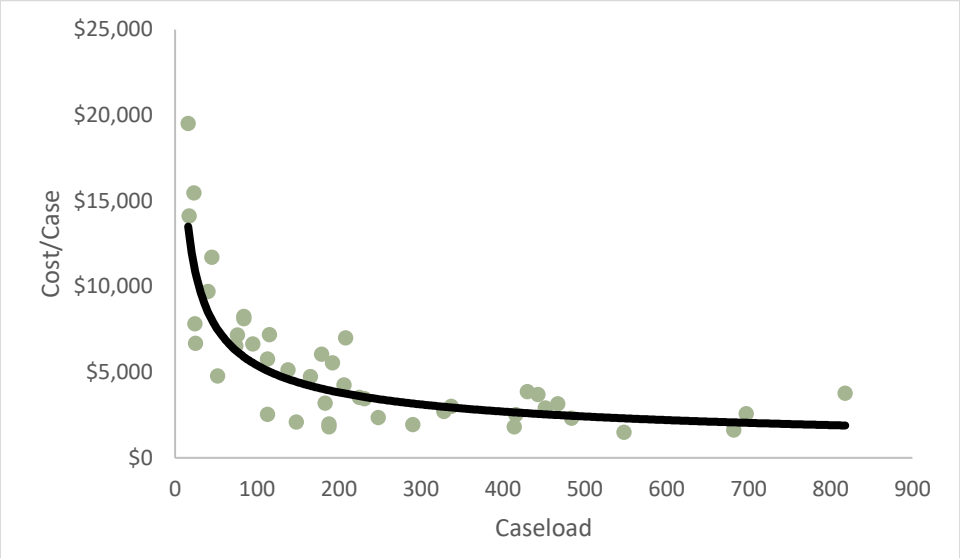
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 40: 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
15	$8,920	13	500	$1,733	60
25	$7,026	16	600	$1,592	65
35	$6,004	19	700	$1,481	69
45	$5,339	21	800	$1,391	74
55	$4,861	23	900	$1,317	77
65	$4,496	25	1,000	$1,254	81
75	$4,205	26	1,250	$1,129	89
85	$3,966	28	1,500	$1,037	97
95	$3,765	29	1,750	$965	103
105	$3,593	31	2,000	$907	110
115	$3,444	32	2,250	$858	115
125	$3,312	33	2,500	$817	121
150	$3,042	36	2,750	$781	126
175	$2,830	38	3,000	$750	131
200	$2,659	40	3,500	$698	140
225	$2,517	42	4,000	$656	148
250	$2,396	44	4,500	$621	156
275	$2,292	46	5,000	$591	163
300	$2,200	48	5,500	$565	170
325	$2,119	50	6,000	$543	177
350	$2,047	51	6,500	$523	183
375	$1,982	53	7,000	$505	189
400	$1,924	55	7,500	$489	195

Digital Evidence Analysis

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



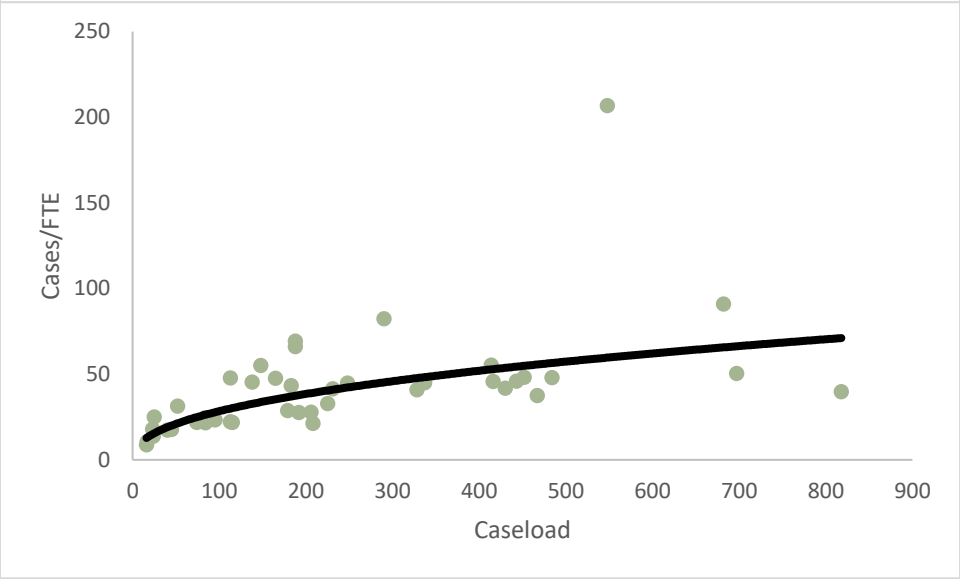


Figure 8: Efficient Frontier Digital Evidence Analysis—Cases/FTE v. Caseload

Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 41: 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	$15,353	9	500	$1,705	79
25	$11,147	13	600	$1,521	88
35	$9,028	15	700	$1,381	97
45	$7,712	18	800	$1,270	105
55	$6,801	20	900	$1,180	113
65	$6,125	23	1,000	$1,104	120
75	$5,599	25	1,250	$960	138
85	$5,177	27	1,500	$857	154
95	$4,828	28	1,750	$778	169
105	$4,535	30	2,000	$715	184
115	$4,283	32	2,250	$664	197
125	$4,065	34	2,500	$622	211
150	$3,626	38	2,750	$586	223
175	$3,292	41	3,000	$555	235
200	$3,028	45	3,500	$504	259
225	$2,813	48	4,000	$463	281
250	$2,633	51	4,500	$430	302
275	$2,480	55	5,000	$403	322
300	$2,349	57	5,500	$379	341
325	$2,234	60	6,000	$359	360
350	$2,132	63	6,500	$342	378
375	$2,042	66	7,000	$326	396
400	$1,961	69	7,500	$312	413

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

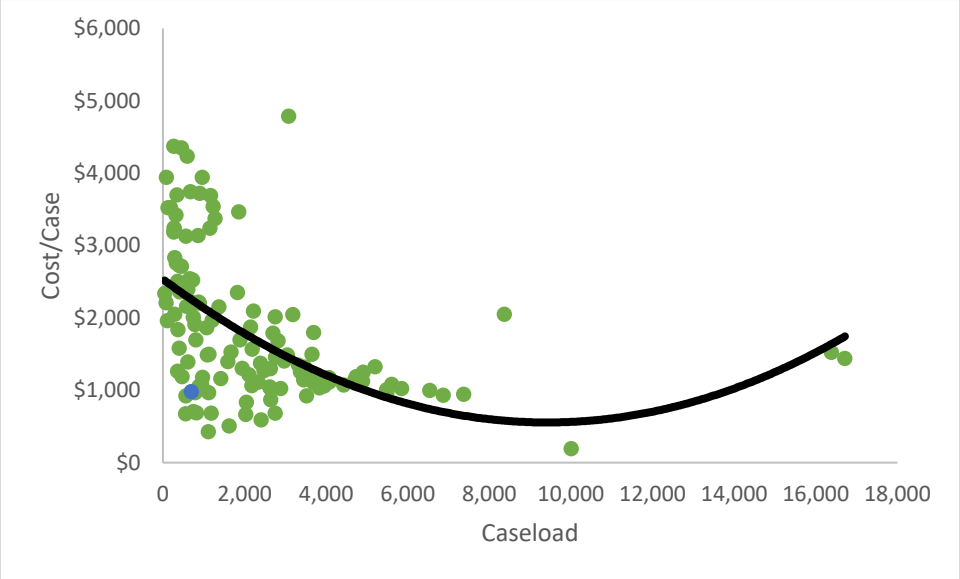


Figure 10: Efficient Frontier DNA Casework Analysis—Cases/FTE v. Caseload

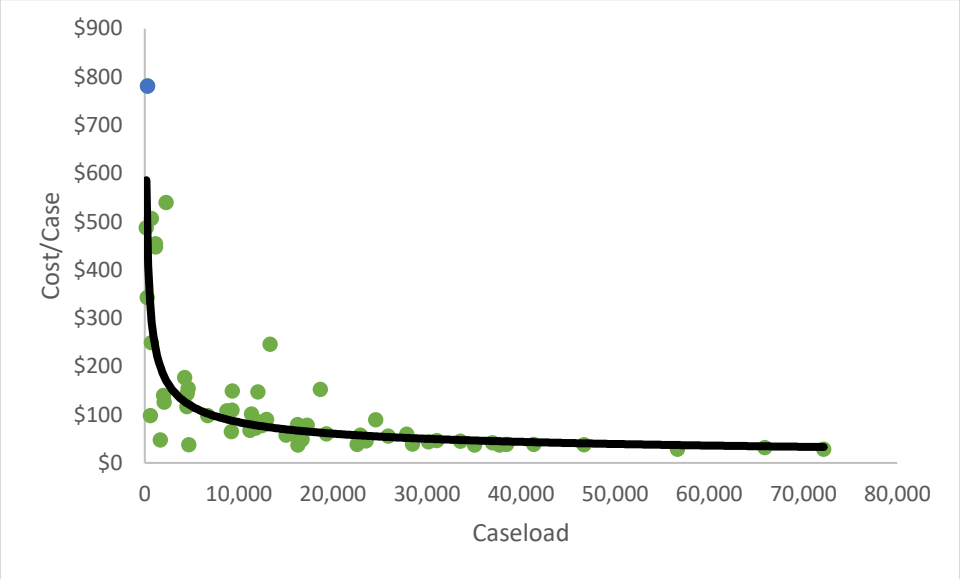
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 42: Efficient Frontier for DNA Casework Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
125	$2,932	62	2,500	$1,353	111
150	$2,797	64	2,750	$1,320	113
175	$2,688	66	3,000	$1,291	115
200	$2,597	68	3,250	$1,264	116
250	$2,452	71	3,500	$1,240	118
300	$2,339	74	4,000	$1,198	121
350	$2,248	76	4,500	$1,162	124
400	$2,172	78	5,000	$1,131	126
450	$2,107	80	5,500	$1,104	129
500	$2,050	81	6,000	$1,079	131
600	$1,956	84	6,500	$1,057	133
700	$1,879	87	7,000	$1,037	135
800	$1,816	89	7,500	$1,019	137
900	$1,761	91	8,000	$1,002	138
1,000	$1,714	93	8,500	$986	140
1,100	$1,672	94	9,000	$972	141
1,200	$1,635	96	10,000	$946	144
1,300	$1,602	98	11,000	$923	147
1,400	$1,571	99	12,000	$902	149
1,500	$1,544	100	13,000	$841	150
1,750	$1,484	103	14,000	$1,023	142
2,000	$1,433	106	15,000	$1,250	132
2,250	$1,390	108	16,000	$1,522	120

DNA Database

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



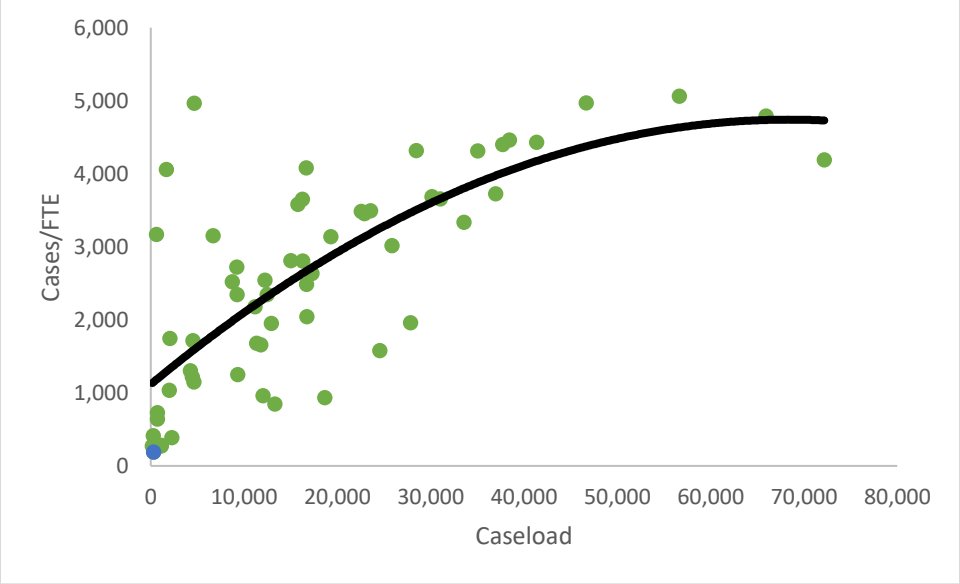


Figure 12: Efficient Frontier DNA Database—Cases/FTE v. Caseload

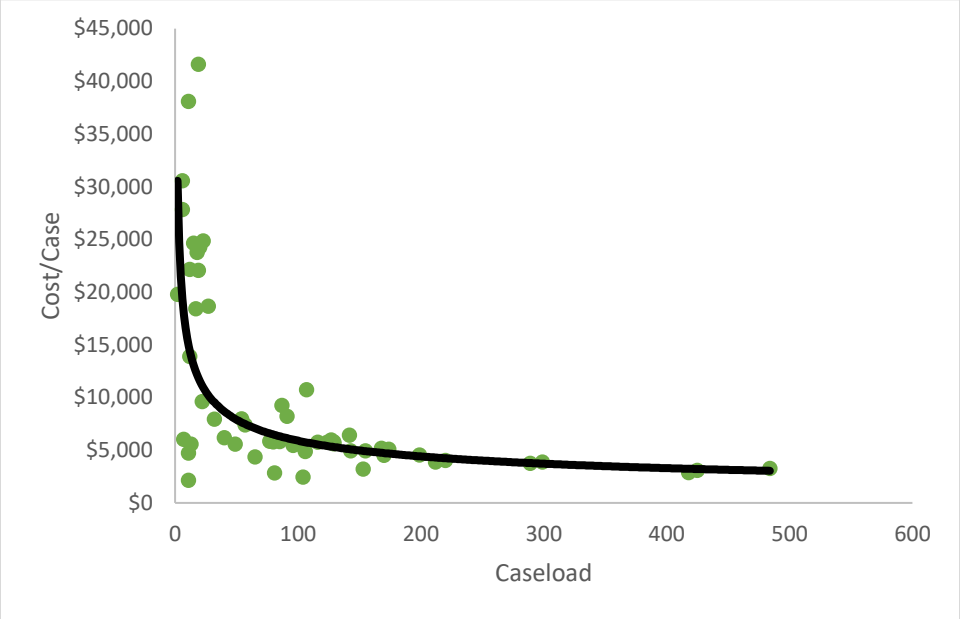
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 43: Efficient Frontier for DNA Database—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
100	$756	263	5,000	$117	1,507
125	$680	291	6,000	$108	1,635
150	$624	315	7,000	$100	1,751
200	$544	359	8,000	$94	1,859
250	$489	396	9,000	$89	1,959
300	$448	430	10,000	$84	2,053
350	$417	460	11,000	$81	2,143
400	$391	489	12,000	$77	2,227
500	$351	540	14,000	$72	2,386
600	$322	585	16,000	$67	2,532
700	$299	627	18,000	$64	2,669
800	$281	666	20,000	$61	2,797
900	$266	702	25,000	$55	3,090
1,000	$253	735	30,000	$50	3,352
1,100	$241	767	35,000	$46	3,590
1,200	$232	798	40,000	$44	3,811
1,300	$223	827	45,000	$41	4,016
1,400	$215	854	50,000	$39	4,210
1,500	$208	881	55,000	$37	4,392
2,000	$182	1,002	60,000	$36	4,566
2,500	$163	1,106	65,000	$35	4,731
3,000	$150	1,200	70,000	$33	4,738
4,000	$131	1,365	75,000	$32	4,707

Document Examination

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



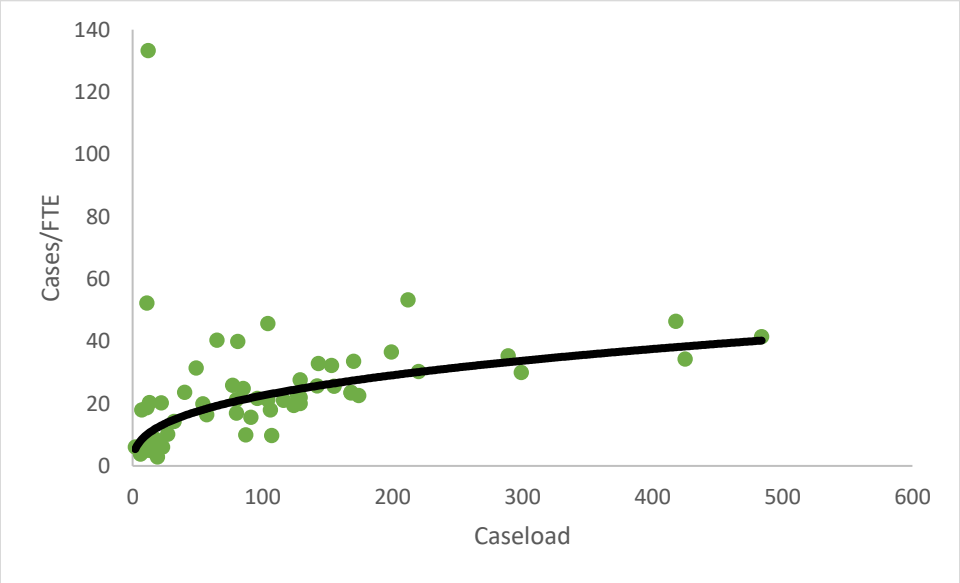


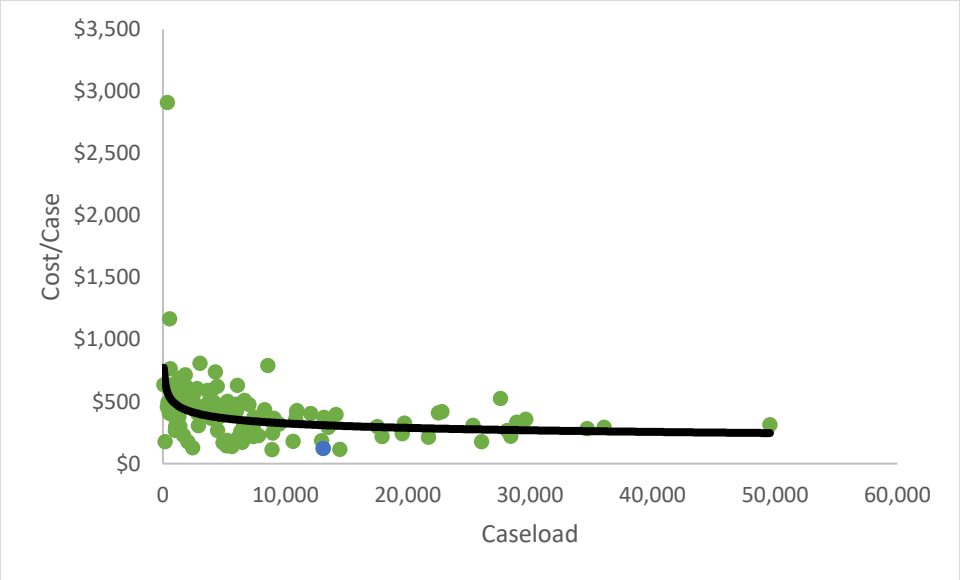
Figure 14: Efficient Frontier Document Examination—Cases/FTE v. Caseload

Table 44: Efficient Frontier for Document Examination—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
5	$20,796	3	150	$4,981	56
10	$15,541	5	175	$4,668	66
15	$13,106	7	200	$4,413	75
20	$11,614	9	225	$4,200	84
25	$10,574	11	250	$4,018	93
30	$9,795	12	275	$3,861	102
35	$9,180	14	300	$3,722	111
40	$8,679	16	325	$3,599	120
45	$8,260	18	350	$3,489	130
50	$7,903	20	375	$3,389	139
55	$7,592	22	400	$3,298	148
60	$7,320	23	425	$3,215	157
65	$7,078	25	450	$3,139	166
70	$6,861	27	475	$3,068	175
75	$6,665	29	500	$3,003	185
80	$6,486	31	525	$2,942	194
85	$6,323	33	550	$2,885	203
90	$6,173	34	575	$2,832	212
95	$6,034	36	600	$2,782	221
100	$5,906	38	625	$2,734	230
110	$5,674	42	650	$2,690	239
120	$5,470	45	675	$2,647	249
130	$5,289	49	700	$2,607	258

Drugs—Controlled Substances Analysis

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



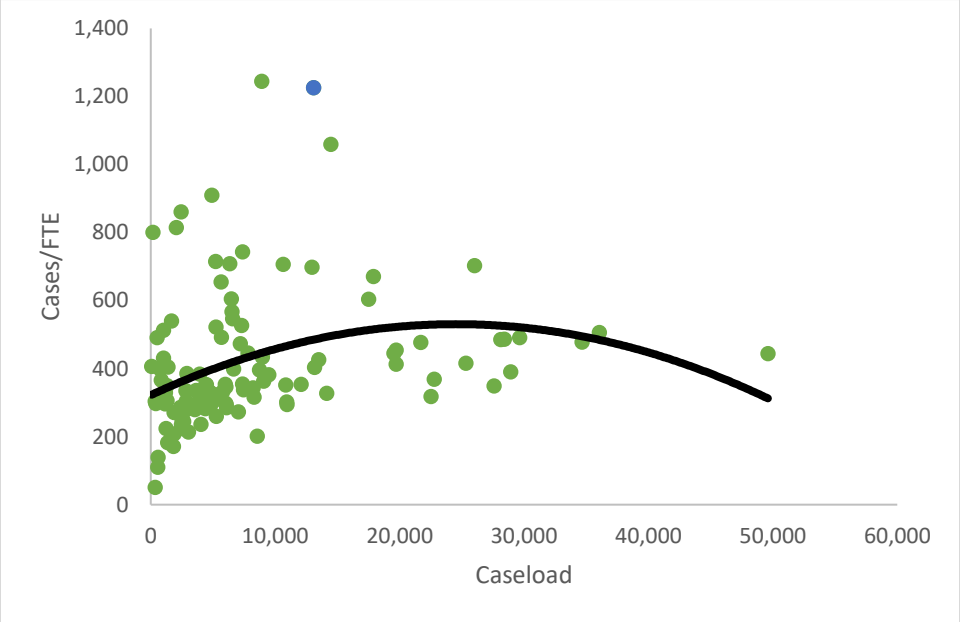


Figure 16: Efficient Frontier Drugs-Controlled Substances Analysis—Cases/FTE v. Caseload

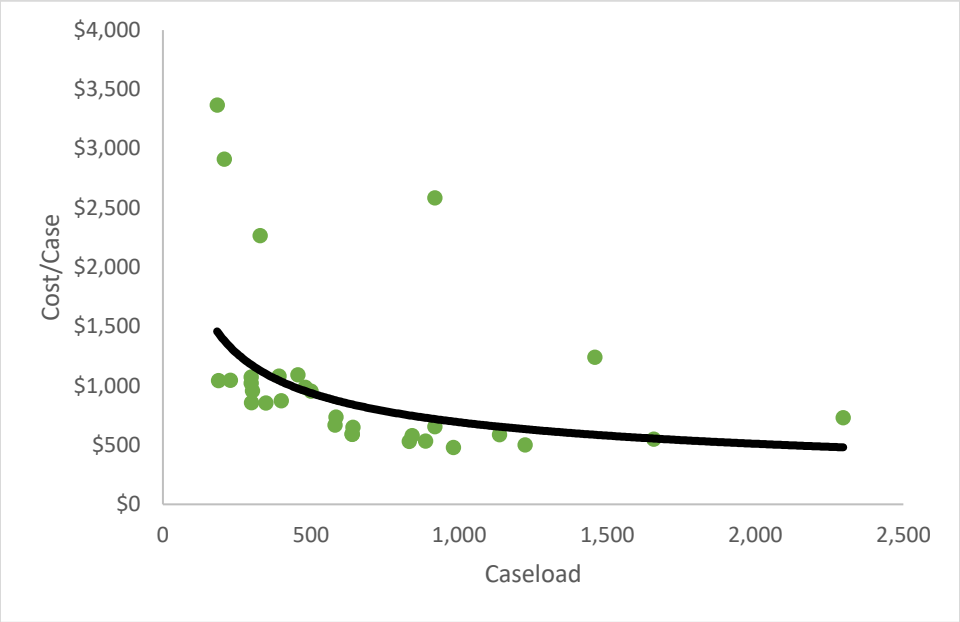
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 45: 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
750	$508	291	8,000	$338	400
1,000	$483	302	9,000	$331	407
1,250	$465	312	10,000	$325	413
1,500	$450	319	12,000	$315	423
1,750	$439	326	14,000	$307	432
2,000	$429	332	16,000	$300	440
2,250	$420	337	18,000	$294	447
2,500	$413	342	20,000	$288	453
2,750	$406	347	22,000	$284	459
3,000	$400	351	24,000	$279	464
3,250	$394	354	26,000	$276	469
3,500	$389	358	28,000	$272	474
3,750	$385	361	30,000	$269	479
4,000	$380	365	32,000	$266	511
4,250	$376	368	34,000	$263	499
4,500	$373	370	36,000	$261	485
4,750	$369	373	38,000	$258	468
5,000	$366	376	40,000	$256	448
5,250	$363	378	42,000	$254	425
5,500	$360	381	44,000	$252	399
5,750	$357	383	46,000	$250	371
6,000	$355	385	48,000	$248	339
7,000	$345	393	50,000	$246	306

Evidence Screening & Processing

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



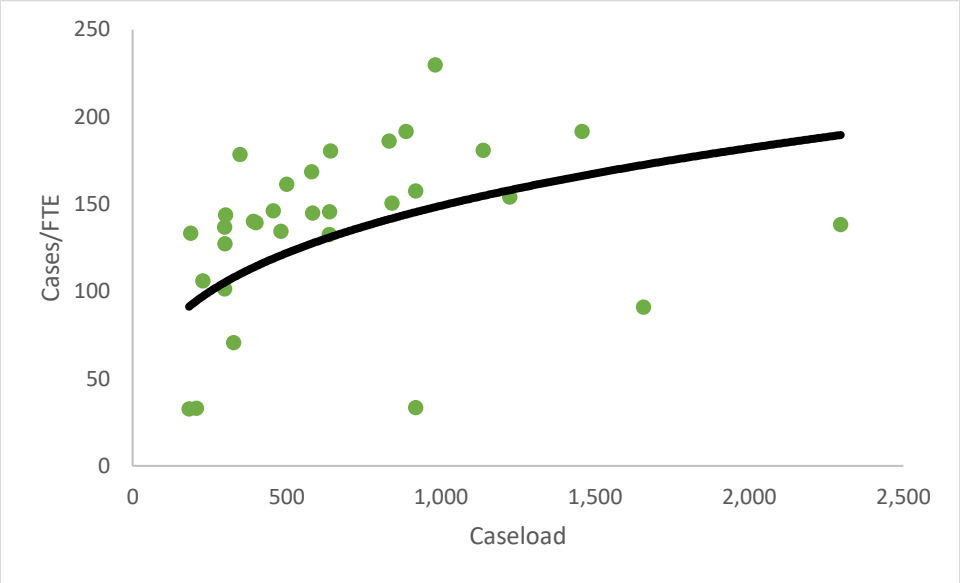


Figure 18: Efficient Frontier for Evidence Screening & Processing — Cases/FTE v. Caseload

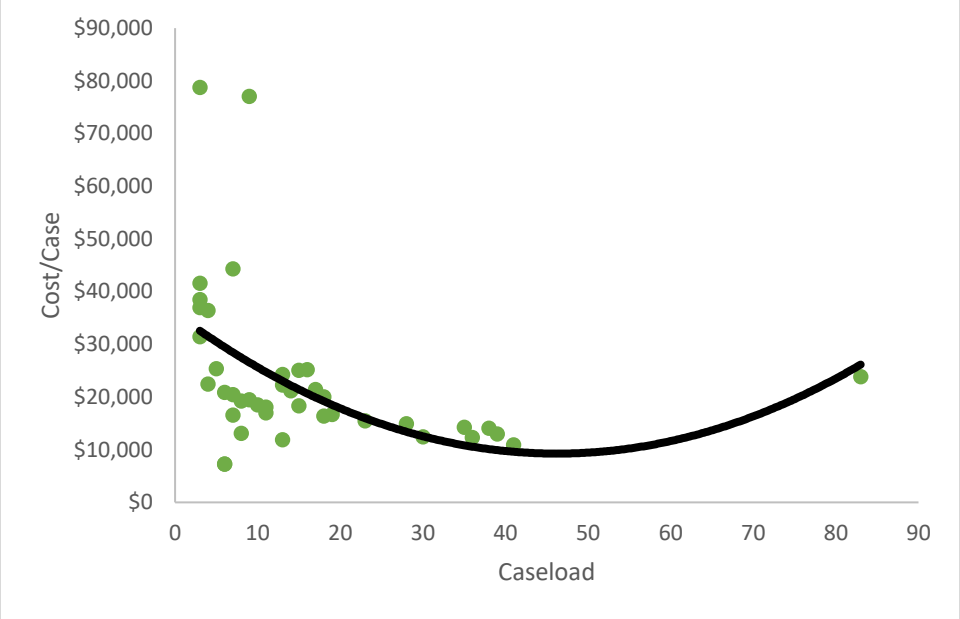
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 46: 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	$2,220	60	750	$585	181
200	$1,964	66	775	$567	186
225	$1,763	73	800	$551	190
250	$1,601	79	825	$536	195
275	$1,467	85	850	$521	199
300	$1,354	90	875	$508	203
325	$1,258	96	900	$495	208
350	$1,176	102	925	$482	212
375	$1,104	107	950	$471	216
400	$1,040	112	975	$460	221
425	$984	118	1,000	$449	225
450	$934	123	1,025	$439	229
475	$889	128	1,050	$429	234
500	$848	133	1,075	$420	238
525	$811	138	1,100	$412	242
550	$777	143	1,125	$403	246
575	$746	148	1,150	$395	250
600	$717	153	1,175	$387	254
625	$691	158	1,200	$380	258
650	$667	162	1,225	$373	263
675	$644	167	1,250	$366	267
700	$623	172	1,275	$359	271
725	$603	176	1,300	$353	275

Explosives Analysis

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



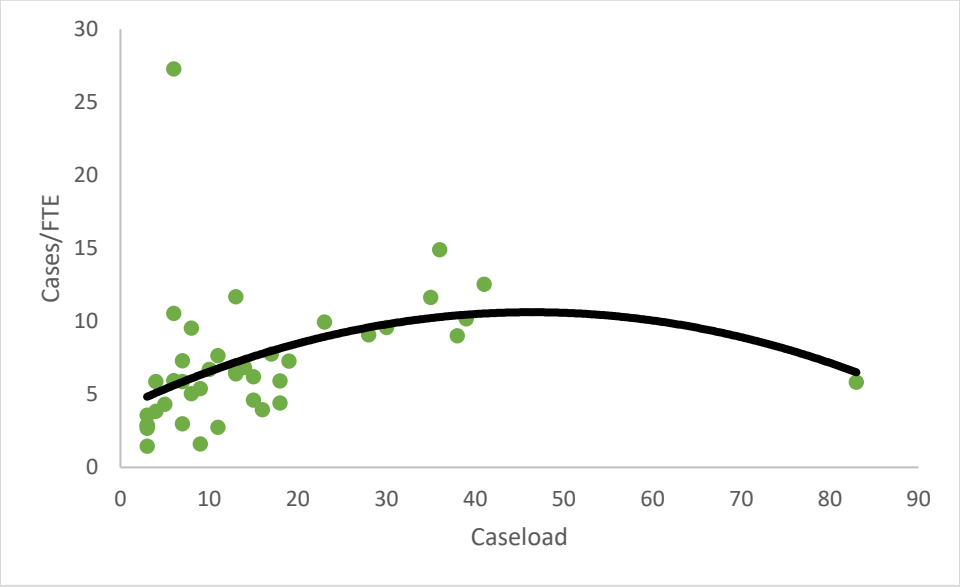


Figure 20 : Efficient Frontier for Explosives Analysis—Cases/FTE v. Caseload

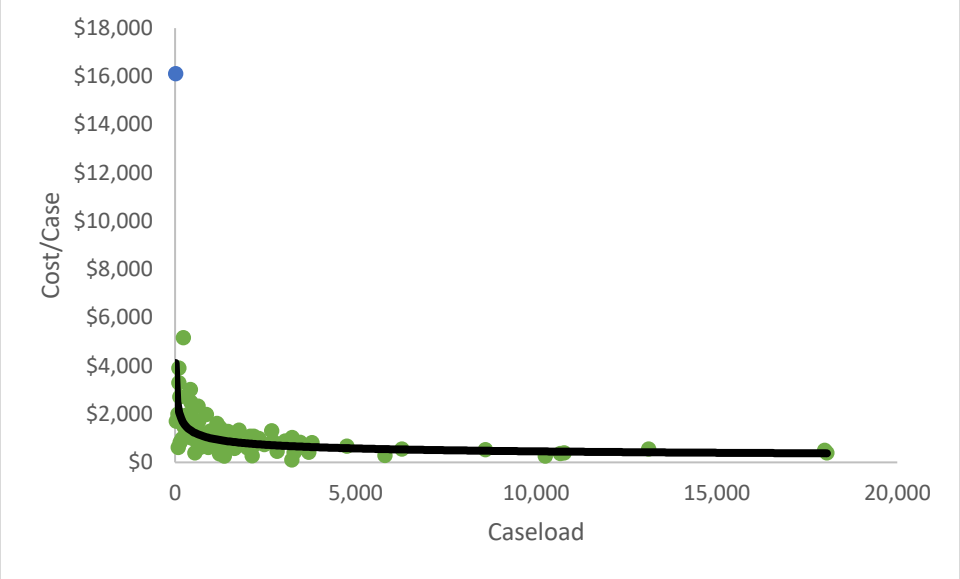
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 47: Efficient Frontier for Explosives Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
1	$41,761	2.5	24	$16,276	7.9
2	$34,003	3.2	25	$16,080	8.0
3	$30,151	3.7	26	$15,894	8.2
4	$27,686	4.1	28	$15,549	8.4
5	$25,914	4.5	30	$15,234	8.6
6	$24,550	4.8	32	$14,945	8.8
7	$23,453	5.0	34	$14,679	9.0
8	$22,543	5.3	36	$14,432	9.2
9	$21,769	5.5	38	$14,203	9.4
10	$21,100	5.7	40	$13,989	9.6
11	$20,512	5.9	42	$13,788	9.7
12	$19,990	6.1	44	$13,599	9.9
13	$19,521	6.3	46	$13,421	10.1
14	$19,096	6.5	48	$13,252	10.2
15	$18,710	6.7	50	$13,093	10.4
16	$18,355	6.8	52	$12,942	10.5
17	$18,028	7.0	54	$12,798	10.4
18	$17,725	7.1	56	$12,660	10.3
19	$17,443	7.3	58	$12,529	10.2
20	$17,180	7.4	60	$12,404	10.1
21	$16,933	7.5	62	$12,284	9.9
22	$16,701	7.7	64	$12,169	9.7
23	$16,483	7.8	66	$12,058	9.4

Fingerprint ID

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



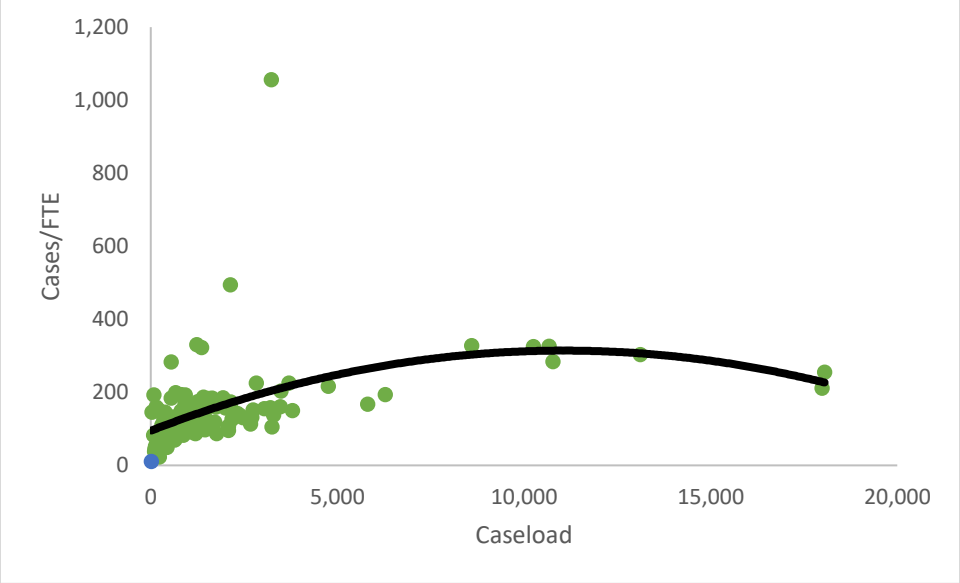


Figure 22: Efficient Frontier for Fingerprint Identification—Cases/FTE v. Caseload

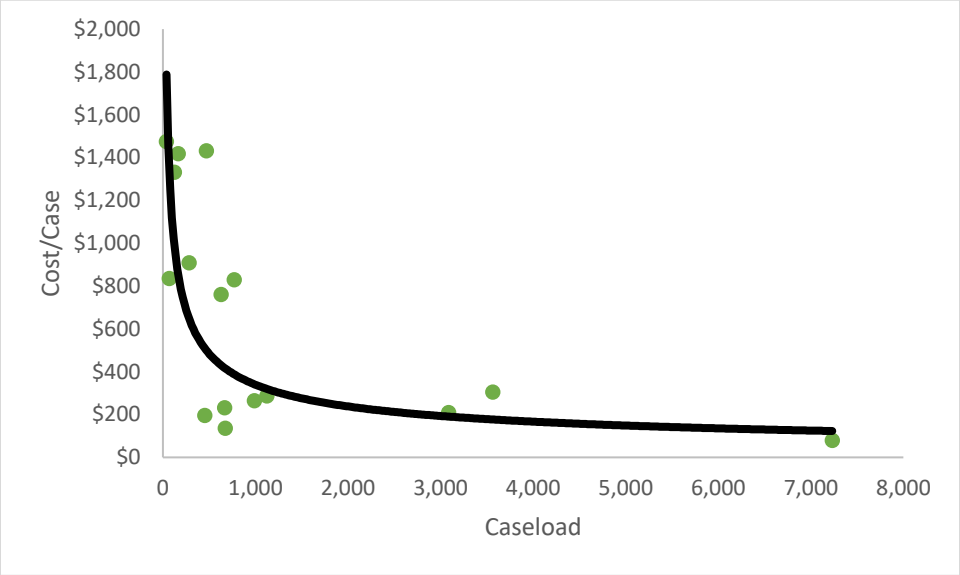
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 48: Efficient Frontier for Fingerprint Identification—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
30	$3,260	52	1,400	$890	147
40	$2,958	56	1,500	$869	150
50	$2,743	60	1,750	$825	159
75	$2,392	66	2,000	$789	167
100	$2,170	71	2,250	$758	175
125	$2,013	75	2,500	$731	183
150	$1,892	79	3,000	$688	198
175	$1,796	82	3,500	$653	212
200	$1,717	85	4,000	$624	225
250	$1,592	90	4,500	$600	237
300	$1,497	95	5,000	$579	248
350	$1,421	98	6,000	$544	268
400	$1,358	102	7,000	$516	285
450	$1,305	105	8,000	$494	297
500	$1,260	108	9,000	$474	307
600	$1,184	113	10,000	$458	312
700	$1,124	118	11,000	$443	314
800	$1,075	122	12,000	$430	313
900	$1,033	126	13,000	$419	308
1,000	$997	133	14,000	$409	299
1,100	$965	136	16,000	$391	271
1,200	$937	140	18,000	$375	228
1,300	$912	143	20,000	$362	171

Fingerprint Database

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



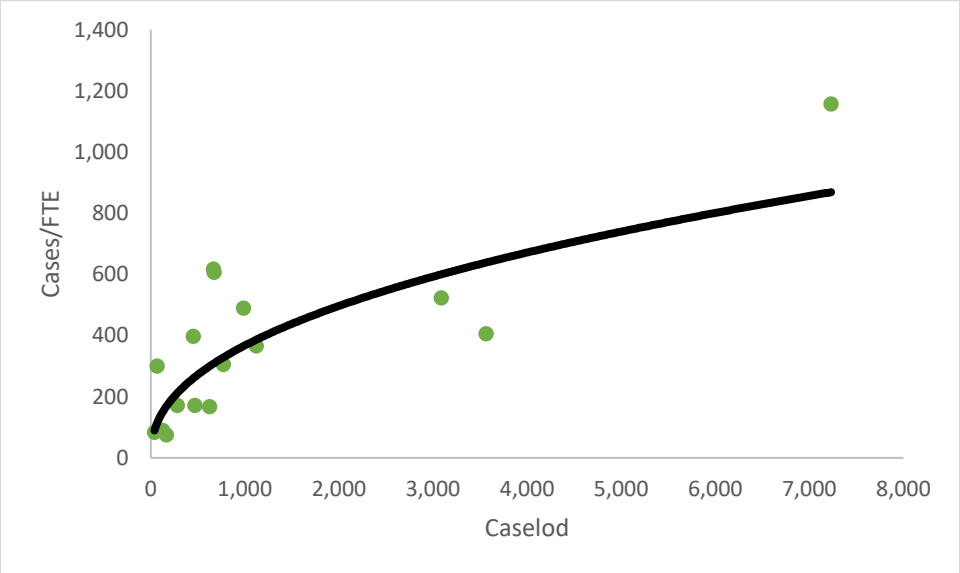


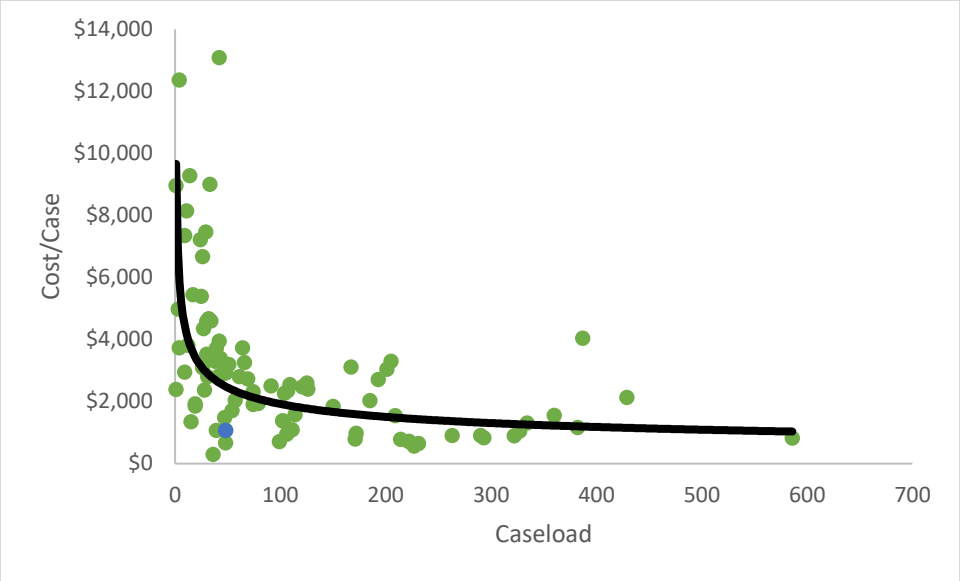
Figure 24: Efficient Frontier for Fingerprint Database—Cases/FTE v. Caseload

Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Note: This is the second year collecting details from the use of the fingerprint database. The number of responses was too small for accurate estimation of the efficient frontiers for Cost/Case or Cases/FTE. The curves in the two figures are illustrative only.

Fire Analysis

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



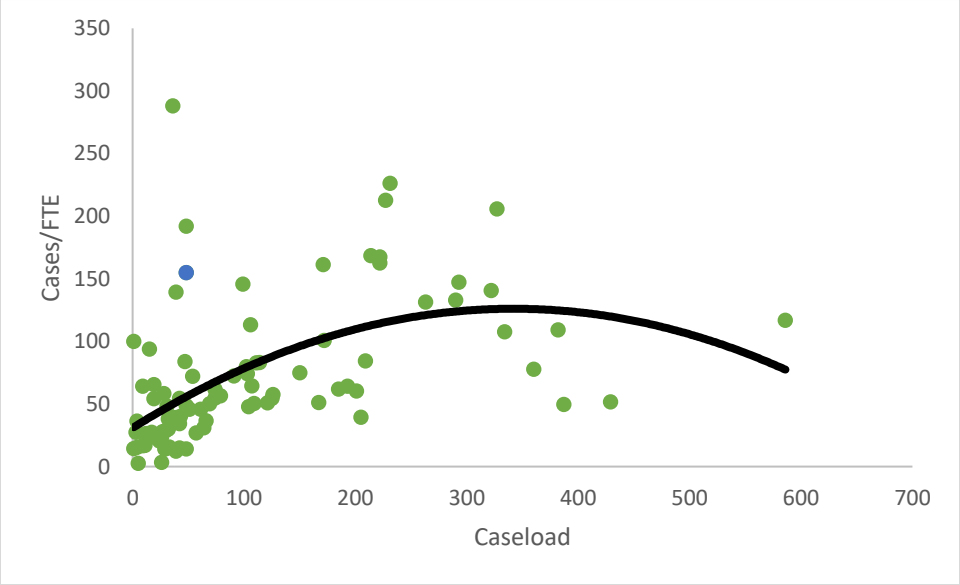


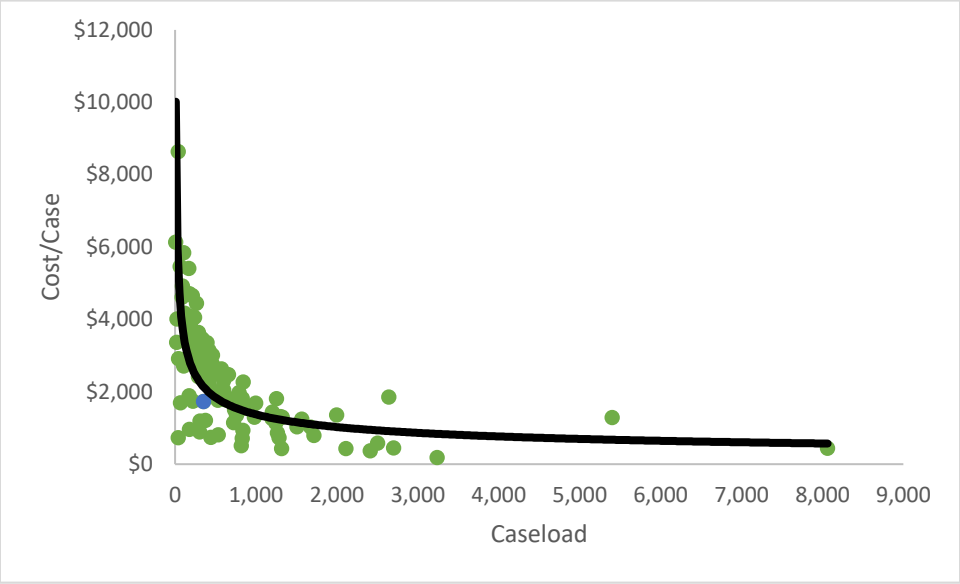
Figure 26: Efficient Frontier for Fire Analysis—Cases/FTE v. Caseload

Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 49: Efficient Frontier for Fire Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
3	$7,960	17	48	$2,636	52
4	$7,098	19	50	$2,593	53
6	$6,039	22	55	$2,497	55
8	$5,384	24	60	$2,412	57
10	$4,926	27	65	$2,336	59
12	$4,581	28	70	$2,268	61
14	$4,308	30	75	$2,206	62
16	$4,084	32	80	$2,150	64
18	$3,897	33	90	$2,052	68
20	$3,737	34	100	$1,967	71
22	$3,598	36	110	$1,894	74
24	$3,475	40	120	$1,829	77
26	$3,366	41	130	$1,772	80
28	$3,268	43	140	$1,720	82
30	$3,179	44	150	$1,674	85
32	$3,098	45	200	$1,492	96
34	$3,024	46	250	$1,365	105
36	$2,956	46	300	$1,270	110
38	$2,893	47	350	$1,194	114
40	$2,835	48	400	$1,132	115
42	$2,780	49	450	$1,080	114
44	$2,729	50	500	$1,036	111
46	$2,681	51	600	$963	98

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



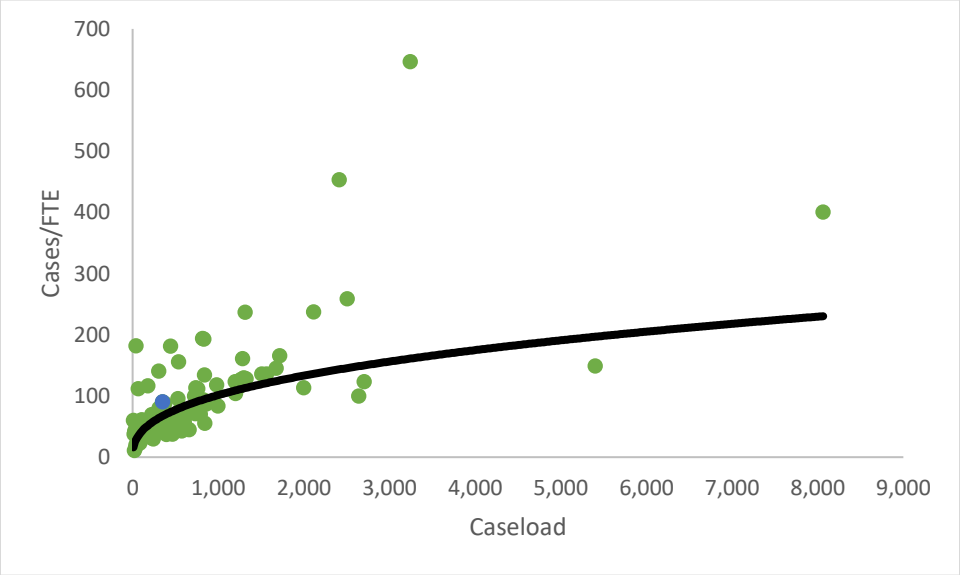
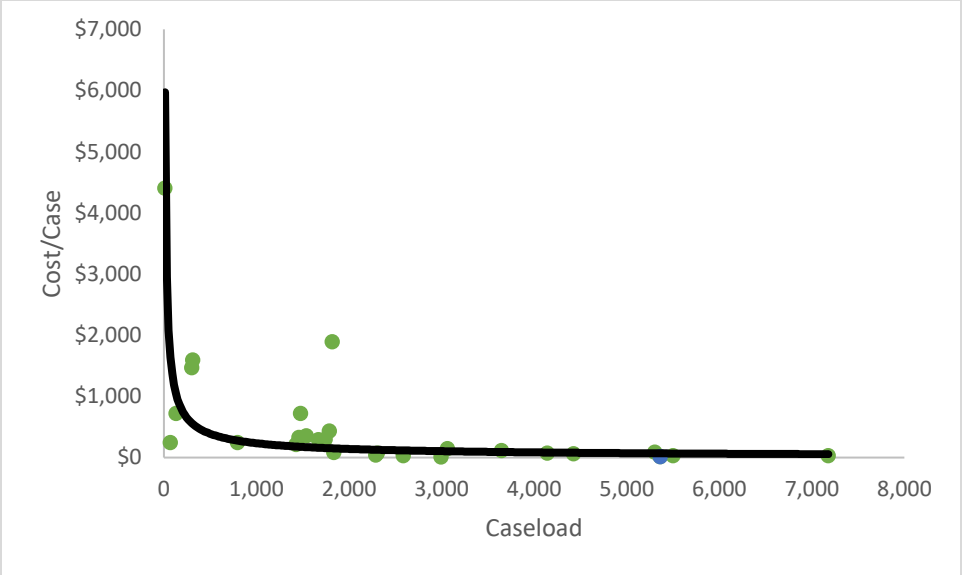


Figure 28: Efficient Frontier for Firearms & Ballistics Analysis—Cases/FTE v. Caseload

Table 50: 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	$7,202	24	1,000	$1,359	120
50	$5,265	31	1,200	$1,251	137
75	$4,383	37	1,400	$1,167	152
100	$3,848	41	1,600	$1,099	168
125	$3,479	45	1,800	$1,042	182
150	$3,204	48	2,000	$993	196
175	$2,988	51	2,200	$951	210
200	$2,813	54	2,400	$915	223
225	$2,667	57	2,600	$882	235
250	$2,543	59	2,800	$853	247
300	$2,342	63	3,000	$827	258
350	$2,184	67	3,200	$803	269
400	$2,056	71	3,400	$781	279
450	$1,950	74	3,600	$761	289
500	$1,859	77	3,800	$743	298
550	$1,781	82	4,000	$726	306
600	$1,712	86	4,500	$688	325
650	$1,651	90	5,000	$656	340
700	$1,597	95	5,500	$629	352
750	$1,548	99	6,000	$604	360
800	$1,503	103	7,000	$564	367
850	$1,462	108	8,000	$531	359
900	$1,425	112	9,000	$503	337

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



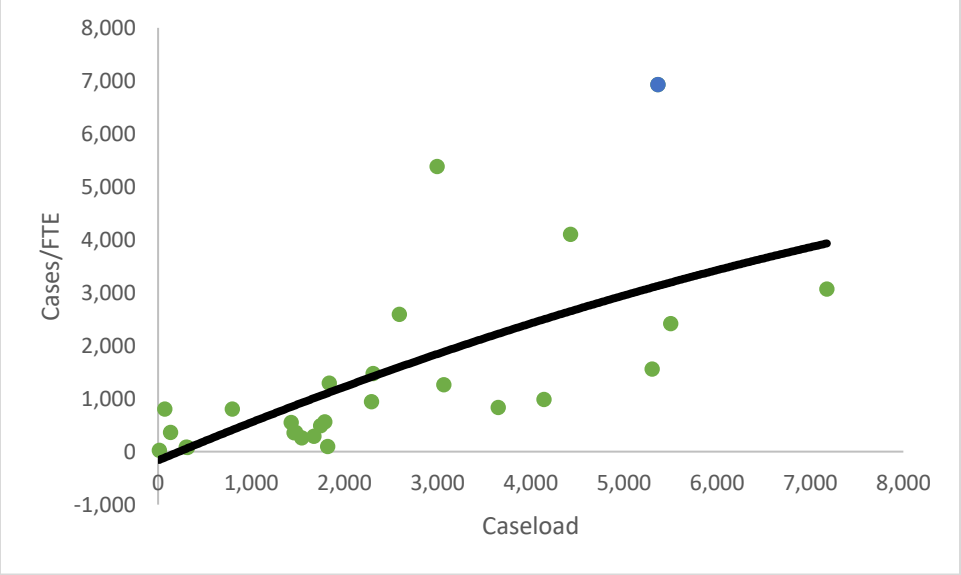


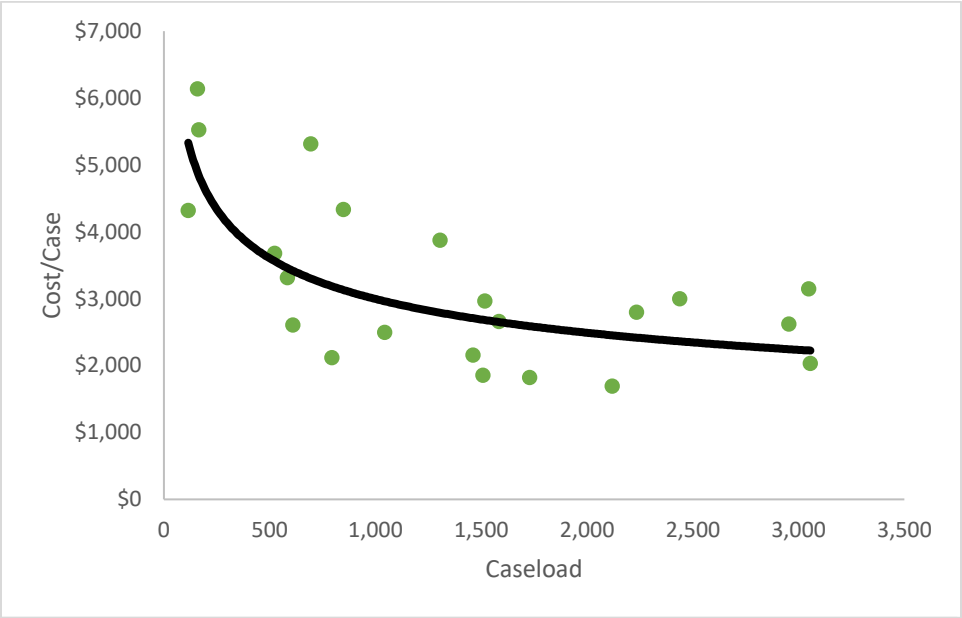
Figure 30: Efficient Frontier for Firearms Database—Cases/FTE v. Caseload

Table 51: Efficient Frontier for Firearms Database—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
500	$389	199	1,900	$146	1,157
525	$375	217	2,000	$141	1,222
550	$363	234	2,250	$129	1,382
575	$351	252	2,500	$120	1,539
600	$340	270	2,750	$112	1,693
625	$330	288	3,000	$105	1,845
650	$321	306	3,250	$99	1,993
675	$312	324	3,500	$94	2,138
700	$304	341	3,750	$89	2,280
725	$296	359	4,000	$85	2,420
750	$289	377	4,250	$81	2,556
775	$282	394	4,500	$78	2,689
800	$276	412	4,750	$75	2,819
900	$253	482	5,000	$72	2,947
1,000	$234	552	5,250	$70	3,071
1,100	$218	621	5,500	$67	3,192
1,200	$205	690	5,750	$65	3,311
1,300	$193	758	6,000	$63	3,426
1,400	$183	826	6,250	$61	3,539
1,500	$174	893	6,500	$59	3,648
1,600	$166	960	7,000	$56	3,858
1,700	$159	1,026	7,500	$54	4,056
1,800	$152	1,092	8,000	$51	4,242

Forensic Pathology

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



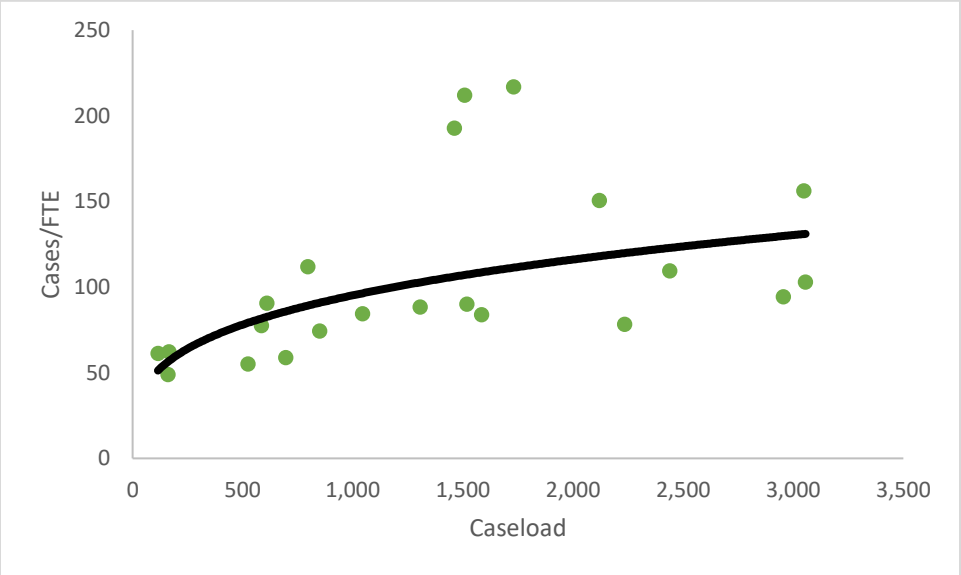


Figure 32: Efficient Frontier for Forensic Pathology—Cases/FTE v. Caseload

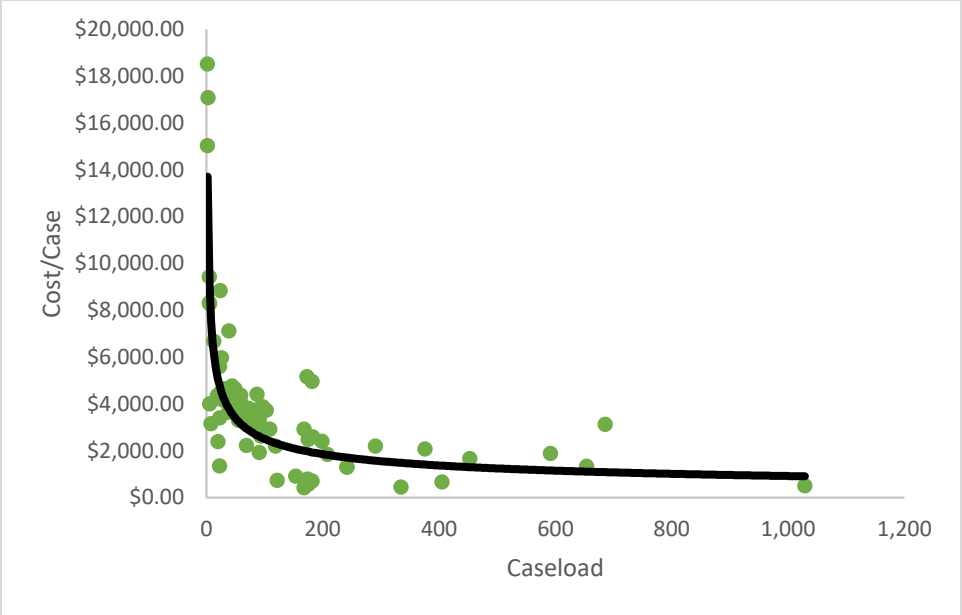
Foresight Project 2020-2021, West Virginia University, Morgantown, WV, USA

Table 52: Efficient Frontier for Forensic Pathology—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
100	$5,534	49	850	$3,129	91
125	$5,215	53	900	$3,081	92
150	$4,967	55	1,000	$2,996	95
175	$4,767	58	1,100	$2,921	98
200	$4,601	60	1,200	$2,854	100
225	$4,459	62	1,300	$2,794	103
250	$4,335	64	1,400	$2,739	105
275	$4,226	66	1,500	$2,689	107
300	$4,129	67	1,600	$2,643	109
325	$4,042	69	1,700	$2,601	111
350	$3,963	70	1,800	$2,562	113
375	$3,891	72	1,900	$2,525	114
400	$3,825	73	2,000	$2,491	116
425	$3,763	75	2,250	$2,414	120
450	$3,706	76	2,500	$2,347	124
475	$3,653	77	2,750	$2,288	127
500	$3,604	78	3,000	$2,236	130
550	$3,513	80	3,250	$2,188	133
600	$3,433	82	3,500	$2,146	136
650	$3,360	84	3,750	$2,106	139
700	$3,295	86	4,250	$2,037	144
750	$3,235	88	4,750	$1,978	149
800	$3,180	89	5,250	$1,926	153

Gunshot Residue Analysis

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



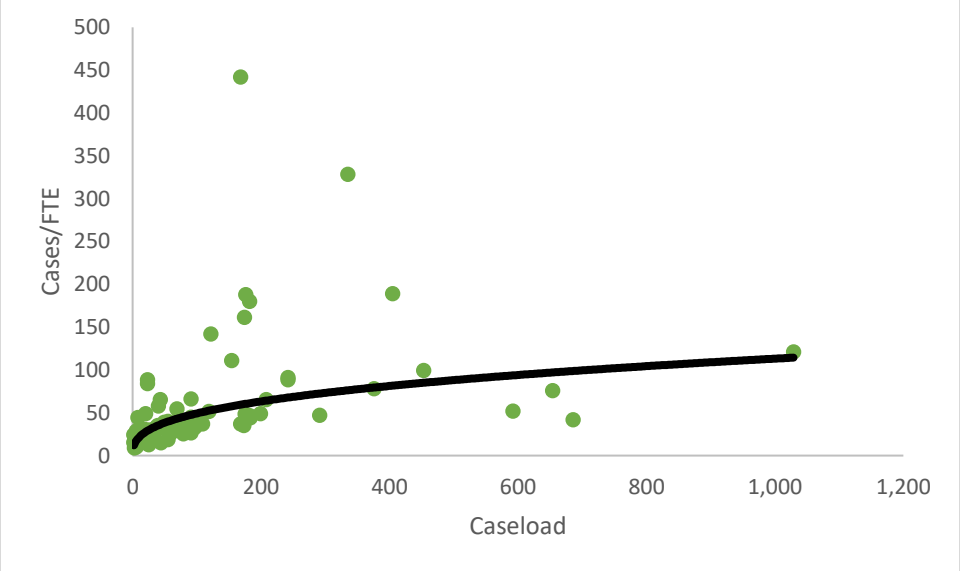


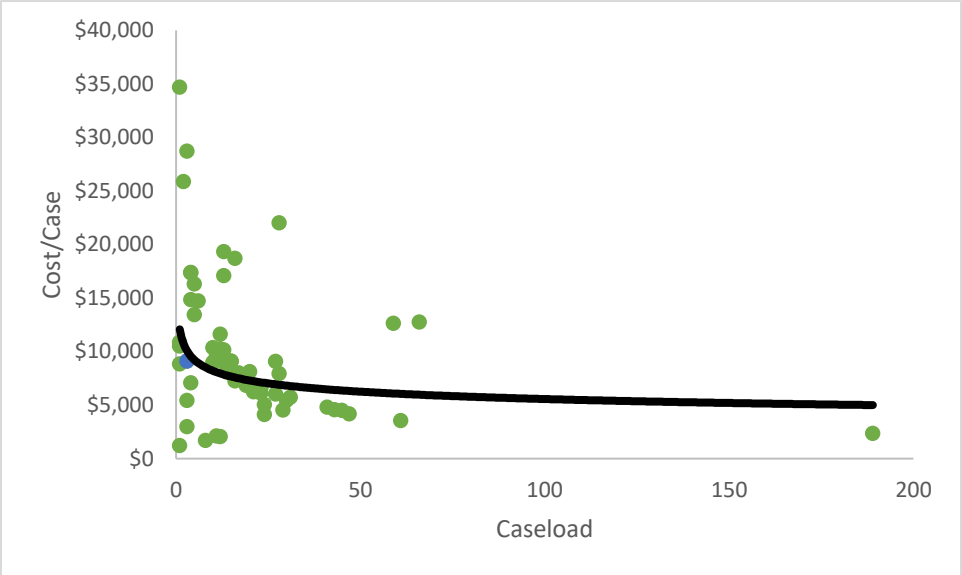
Figure 34: Efficient Frontier for Gunshot Residue Analysis—Cases/FTE v. Caseload

Table 53: 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	$13,707	23	60	$3,128	45
4	$10,143	23	65	$3,021	47
6	$8,505	24	70	$2,926	49
8	$7,506	25	80	$2,761	53
10	$6,813	26	90	$2,623	56
12	$6,294	27	100	$2,506	60
14	$5,886	28	110	$2,404	63
16	$5,555	28	120	$2,315	66
18	$5,278	29	130	$2,236	70
20	$5,042	30	140	$2,165	73
22	$4,837	31	150	$2,101	76
24	$4,658	32	175	$1,965	83
26	$4,498	32	200	$1,854	90
28	$4,356	33	225	$1,762	96
30	$4,227	34	250	$1,683	102
32	$4,111	35	300	$1,555	113
34	$4,004	36	400	$1,372	128
36	$3,906	36	500	$1,245	136
38	$3,815	37	600	$1,151	136
40	$3,731	38	700	$1,076	129
45	$3,545	40	800	$1,015	114
50	$3,386	42	900	$965	91
55	$3,249	44	1,000	$922	61

Marks & Impressions Analysis

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



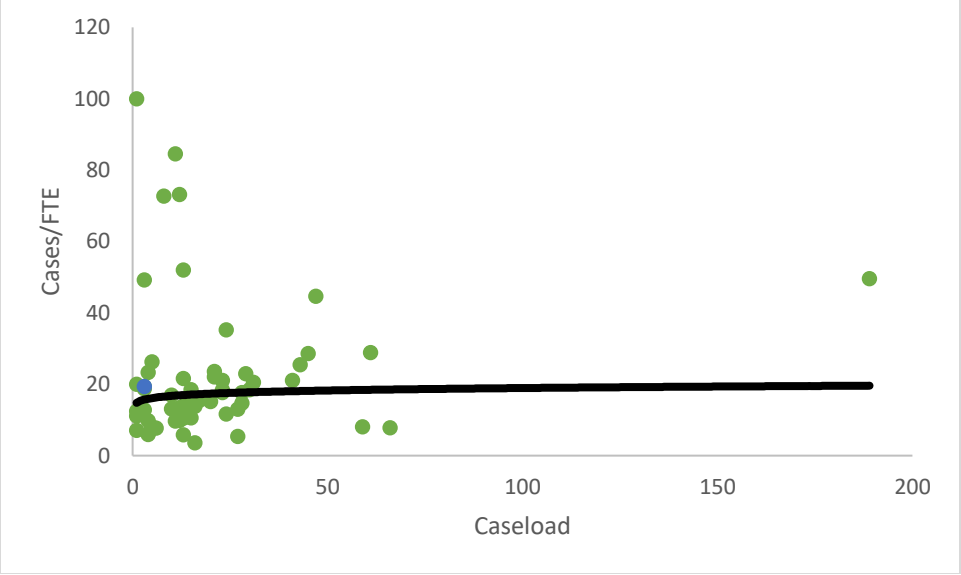


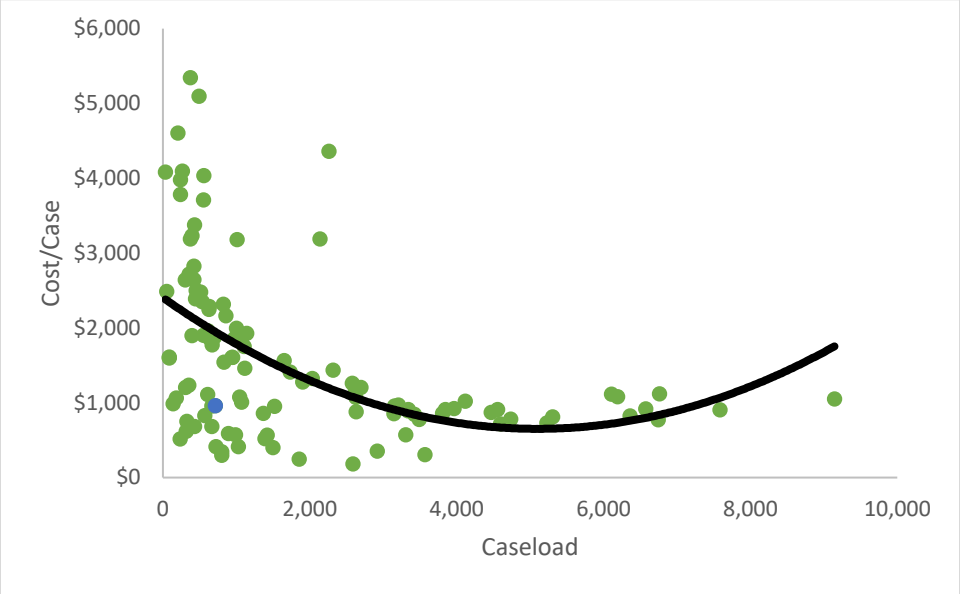
Figure 36: Efficient Frontier for Marks & Impressions Analysis—Cases/FTE v. Caseload

Table 54: Efficient Frontier for Marks & Impressions Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
1	$17,063	19.3	46	$5,855	21.4
2	$14,059	19.3	48	$5,786	21.6
4	$11,584	19.3	50	$5,720	21.8
6	$10,343	19.4	55	$5,570	22.2
8	$9,545	19.4	60	$5,436	22.7
10	$8,968	19.5	65	$5,316	23.3
12	$8,522	19.5	70	$5,207	23.8
14	$8,163	19.6	75	$5,107	24.5
16	$7,864	19.7	80	$5,016	25.1
18	$7,610	19.7	85	$4,932	25.8
20	$7,389	19.8	90	$4,854	26.5
22	$7,195	19.9	95	$4,781	27.3
24	$7,022	20.0	100	$4,713	28.1
26	$6,867	20.1	110	$4,589	29.8
28	$6,726	20.2	120	$4,479	31.6
30	$6,598	20.3	130	$4,380	33.6
32	$6,480	20.4	140	$4,290	35.8
34	$6,371	20.6	150	$4,208	38.1
36	$6,270	20.7	160	$4,133	40.5
38	$6,176	20.8	170	$4,064	43.2
40	$6,088	21.0	180	$3,999	45.9
42	$6,006	21.1	190	$3,939	48.8
44	$5,928	21.3	200	$3,883	51.9

Serology/Biology Analysis

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



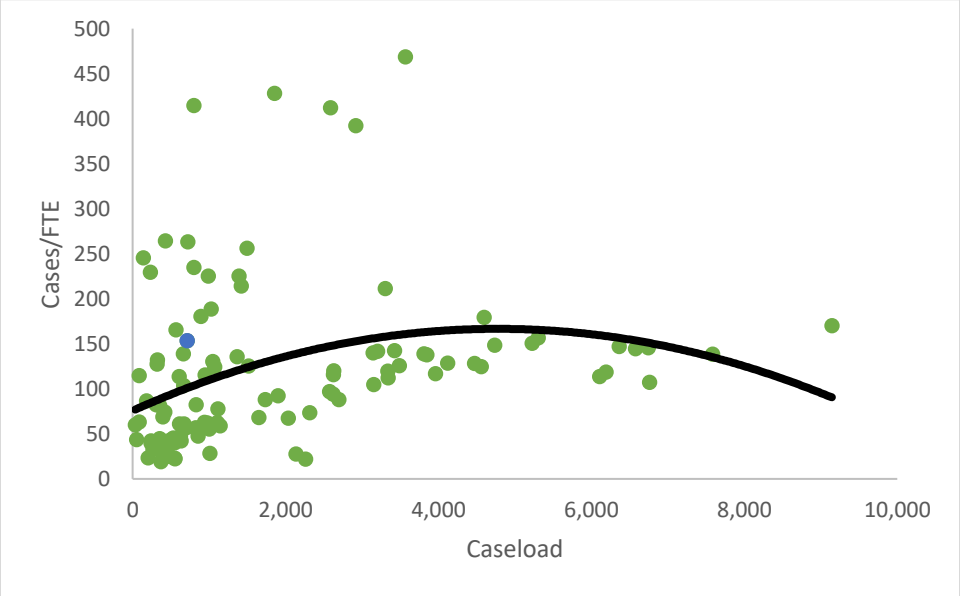


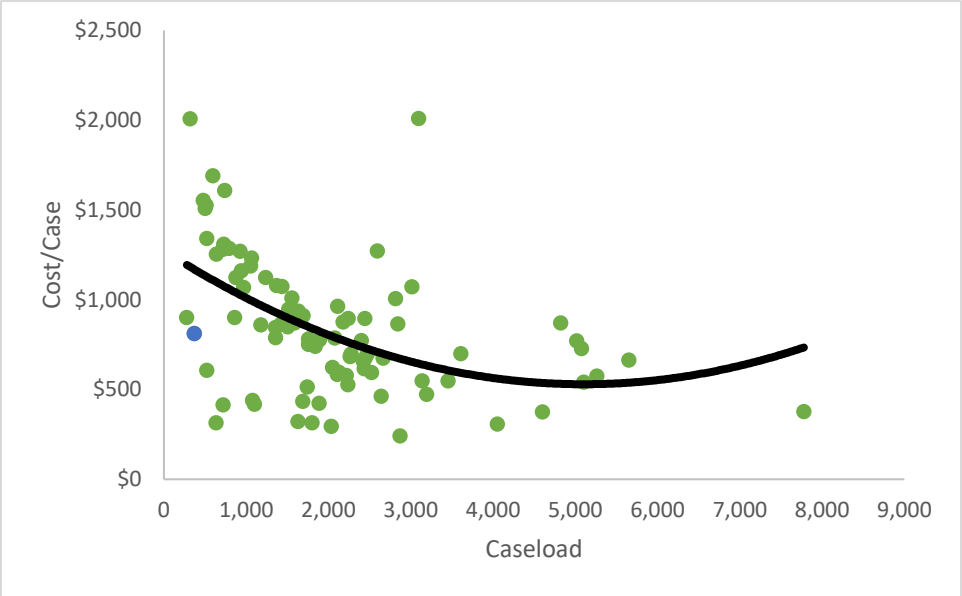
Figure 38: Efficient Frontier for Serology/Biology Analysis—Cases/FTE v. Caseload

Table 55: 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	$2,832	51	700	$1,324	90
30	$2,469	57	750	$1,306	91
45	$2,279	60	800	$1,289	92
60	$2,153	63	900	$1,260	94
75	$2,060	65	1,000	$1,234	95
90	$1,987	67	1,100	$1,211	97
105	$1,927	68	1,200	$1,190	98
120	$1,877	70	1,300	$1,171	99
140	$1,820	71	1,400	$1,154	100
160	$1,773	73	1,500	$1,139	101
180	$1,732	74	1,750	$1,104	104
200	$1,696	75	2,000	$1,076	106
225	$1,657	76	2,250	$1,051	108
250	$1,623	78	2,500	$1,029	109
275	$1,593	79	3,000	$985	112
300	$1,566	80	3,500	$872	115
350	$1,519	82	4,000	$787	117
400	$1,479	83	5,000	$703	121
450	$1,445	85	6,000	$735	124
500	$1,415	86	7,000	$881	127
550	$1,389	87	8,000	$1,143	130
600	$1,365	88	9,000	$1,519	122
650	$1,343	89	10,000	$2,011	101

Toxicology Analysis ante-mortem Analysis

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



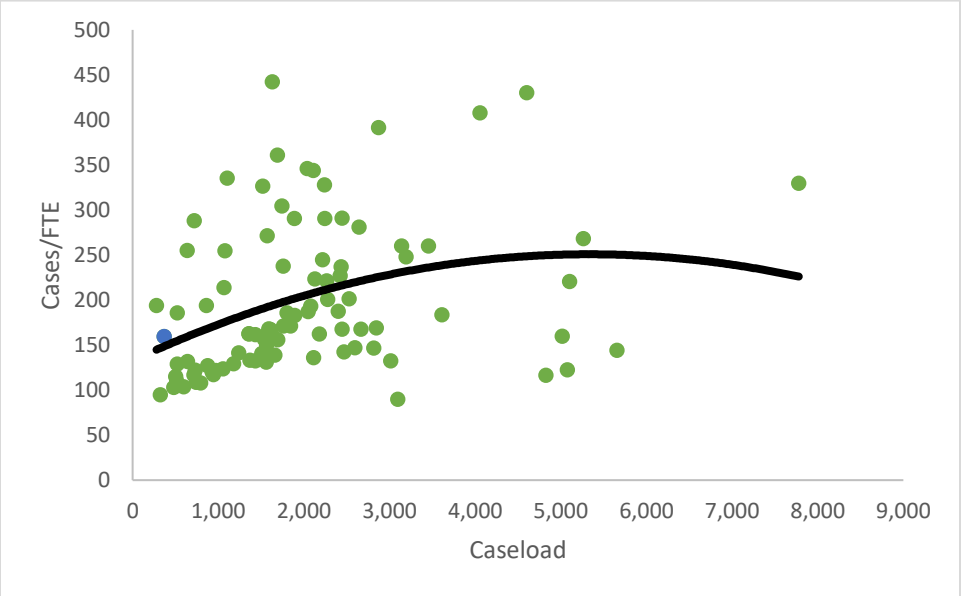


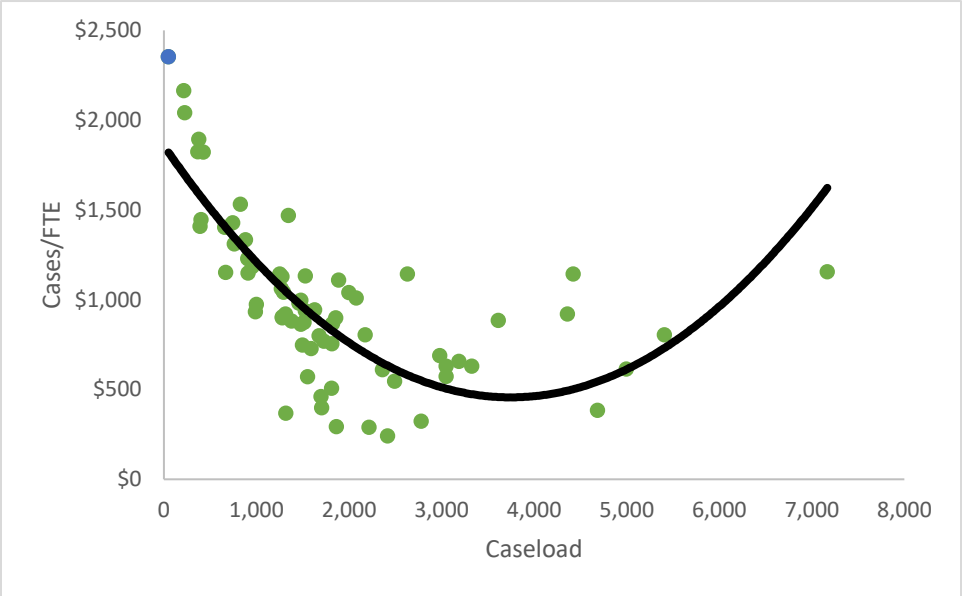
Figure 40: Efficient Frontier for Toxicology Analysis (antemortem)—Cases/FTE v. Caseload

Table 56: Efficient Frontier for Toxicology ante-mortem—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
275	$1,334	123	1,050	$998	170
300	$1,300	126	1,100	$987	176
325	$1,268	128	1,150	$975	178
350	$1,240	130	1,200	$964	180
375	$1,214	132	1,250	$953	182
400	$1,191	134	1,300	$942	183
425	$1,169	136	1,350	$931	185
450	$1,147	138	1,400	$921	187
475	$1,141	139	1,450	$910	188
500	$1,134	141	1,500	$900	190
525	$1,128	142	1,750	$850	198
550	$1,121	144	2,000	$804	205
575	$1,115	145	2,250	$762	211
600	$1,108	147	2,500	$723	218
625	$1,102	148	3,000	$656	228
650	$1,095	149	3,500	$603	237
700	$1,083	152	4,000	$564	243
750	$1,070	159	5,000	$530	250
800	$1,058	161	6,000	$552	249
850	$1,046	163	7,000	$632	239
900	$1,034	165	8,000	$769	221
950	$1,022	167	9,000	$963	195
1,000	$1,010	169	10,000	$1,215	160

Toxicology Analysis post-mortem Analysis

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



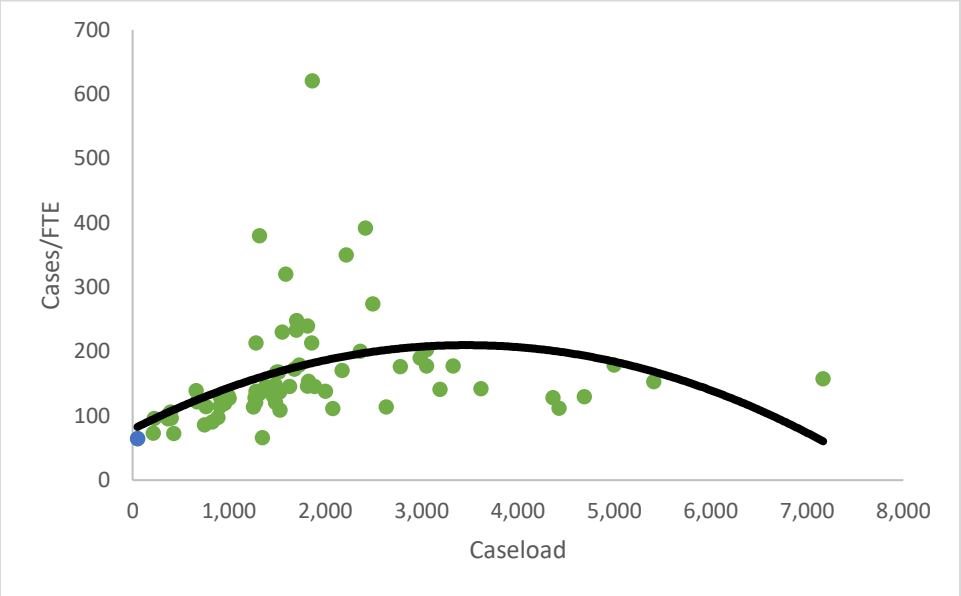


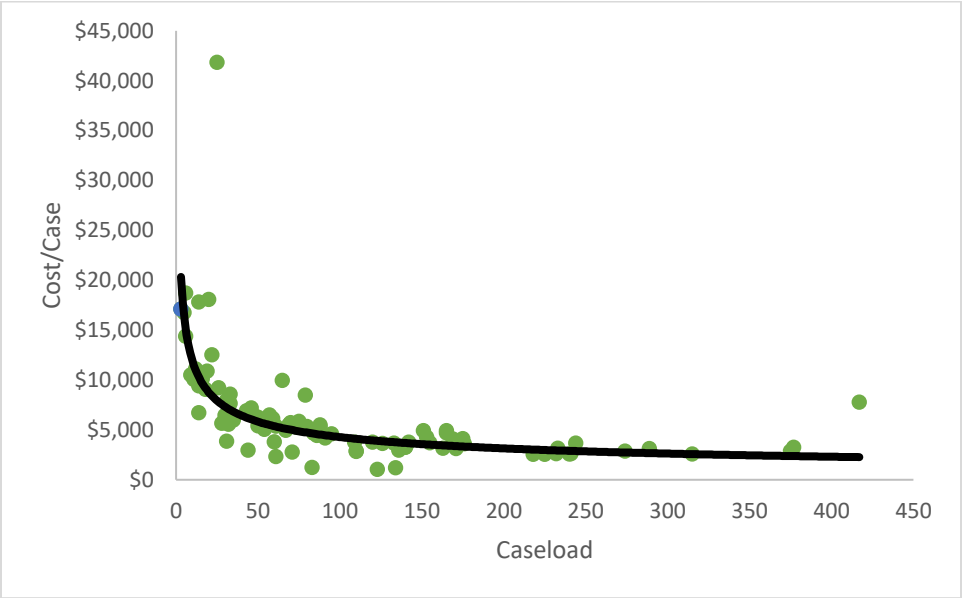
Figure 42: Efficient Frontier for Toxicology Analysis (postmortem)—Cases/FTE v. Caseload

Table 57: Efficient Frontier for Toxicology post-mortem—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
50	$3,142	62	800	$1,323	130
75	$2,696	69	850	$1,294	135
100	$2,419	75	900	$1,265	138
125	$2,223	79	950	$1,237	141
150	$2,075	83	1,000	$1,209	144
175	$1,958	86	1,050	$1,182	146
200	$1,862	89	1,100	$1,156	149
225	$1,694	92	1,150	$1,129	151
250	$1,677	94	1,200	$1,104	154
275	$1,659	97	1,250	$1,079	156
300	$1,642	99	1,500	$960	168
325	$1,625	101	1,750	$854	178
350	$1,608	103	2,000	$761	187
375	$1,591	105	2,250	$680	194
400	$1,574	107	2,500	$612	200
425	$1,558	108	2,750	$556	204
450	$1,541	110	3,000	$512	208
500	$1,508	113	3,250	$481	209
550	$1,476	116	3,500	$462	210
600	$1,445	119	3,750	$456	209
650	$1,413	122	4,000	$463	207
700	$1,383	125	4,250	$481	203
750	$1,353	127	4,500	$513	198

Trace Evidence Analysis

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



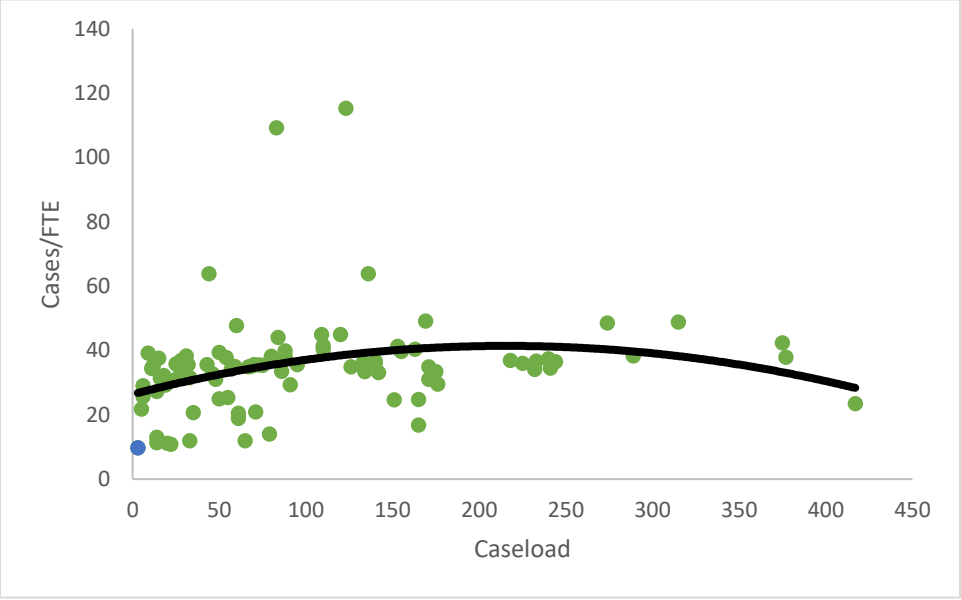


Figure 44: Efficient Frontier for Trace Evidence Analysis—Cases/FTE v. Caseload

Table 58: Efficient Frontier for Trace Evidence Analysis—Efficient Cost/Case for Various Caseloads

Cases	Efficient Cost/Case	Cases/ FTE	Cases	Efficient Cost/Case	Cases/ FTE
1	$33,135	17	24	$8,067	28
2	$24,348	19	26	$7,785	30
3	$20,332	20	28	$7,533	30
4	$17,891	21	30	$7,305	30
5	$16,202	21	35	$6,821	31
6	$14,940	22	40	$6,428	31
7	$13,951	23	45	$6,100	32
8	$13,147	23	50	$5,821	33
9	$12,476	23	55	$5,580	33
10	$11,905	24	60	$5,368	34
11	$11,411	24	70	$5,012	35
12	$10,978	25	80	$4,723	35
13	$10,594	25	90	$4,482	36
14	$10,251	25	100	$4,277	37
15	$9,941	25	125	$3,873	39
16	$9,660	26	150	$3,572	40
17	$9,403	26	175	$3,335	41
18	$9,167	26	200	$3,143	41
19	$8,950	26	250	$2,846	41
20	$8,748	27	300	$2,625	39
21	$8,560	28	350	$2,451	36
22	$8,385	28	400	$2,310	30
23	$8,221	28	450	$2,192	24

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

FORESIGHT: A Business Approach to Improving Forensic Science Services, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 2, 2009, Max M. Houck, Richard A. Riley, Paul J. Speaker, & Tom S. Witt, pages 85-95

Abstract: Managers of scientific laboratories see themselves as scientists first and managers second; consequently, they tend to devalue the managerial aspects of their jobs. Forensic laboratory managers are no different, but the stakes may be much higher given the importance of quality science to the criminal justice system. The need for training and support in forensic laboratory management has been recognized for many years, but little has been done to transition the tools of business to the forensic laboratory environment. FORESIGHT is a business-guided self-evaluation of forensic science laboratories across North America. The participating laboratories represent local, regional, state, and national agencies. Economics, accounting, finance, and forensic faculty provide assistance, guidance, and analysis. The process involves standardizing 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 is to measure, preserve what works, and change what does not. A project of this magnitude for forensic laboratories has not been carried out anywhere.

Key Performance Indicators and Managerial Analysis for Forensic Laboratories, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 1, 2009, Paul J. Speaker, pages 32-42

Abstract: Forensic laboratories generate a great deal of data from casework activities across investigative areas, personnel and budget allocations, and corresponding expenditures. This paper investigates ways in which laboratories can make data-driven managerial decisions through the regular extraction of key performance indicators from commonly available data sources. A laboratory's performance indicators can then be compared to peer laboratory performance to search for best practices, determine in-house trends, manage scarce resources, and provide quantitative support for the justification of additional resources.

The Decomposition of Return on Investment for Forensic Laboratories, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 2, 2009, Paul J. Speaker, pages 96-102

Abstract: For forensic laboratories, a detailed understanding of return on investment (ROI) is necessary for routine assessment, consideration of new legislative alternatives, and cost-benefit analysis for decision making. Converting performance data to ratio measures provides useful comparisons between an individual laboratory and the standards for excellence for the industry; these measures also permit an evaluation across time. Unfortunately, these same ROI measures are subject to abuse when overemphasis on a single measure leads to unintended consequences. In this paper, the ROI measure is broken down into various parts that can be tracked on a regular basis to reveal how a laboratory achieves its results. The tradeoffs between return and risk, efficiency, analytical process, and market conditions are outlined. The end product is a series of easily monitored metrics that a laboratory director may examine on a regular basis for continuous improvement.

Benchmarking and Budgeting Techniques for Improved Forensic Laboratory Management, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 4, 2010, Paul J. Speaker & A. Scott Fleming, pages 199-208

Abstract: Forensic laboratories are not immune from downturns in the worldwide economy. Recession and economic slowdowns, when coupled with the publics' heightened sense of the capabilities of forensic science, put stress on the effectiveness of forensic laboratories. The resources available to forensic laboratories are limited, and managers are under greater pressure to improve efficiency and effectiveness. To this end, the use of internal and external financial and accounting metrics to plan, control, evaluate, and communicate performance is examined. Using data from the QUADRUPOL and FORESIGHT studies, we illustrate the use of external benchmarking through a calculation of laboratory return on investment and the internal development and use of a budget to enhance laboratory performance in light of limited resources.

Forensic Science Staffing: Creating a Working Formula, *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 1, 2011, Joyce Thompson Heames & Jon Timothy Heames, pages 5-10

Abstract: The key issue facing forensic labs is "the classic economic problem—how to allocate limited resources with increasing demand for services, while maintaining high quality standards" (Speaker 2009). Employees are the biggest expense and most valuable resource that forensic labs possess, thus the question arises as to how to maximize human resource functions to best allocate resources through personnel. As the search is on to look for better practices to improve the operations as well as technical expertise of labs, human capital management is crucial to that objective. The purpose of this article is to process map some of the staffing issues facing forensic science labs, whether public or private, and to identify metrics from the FORESIGHT study (Houck et al. 2009) that might help lab directors create a working formula to better manage staffing (e.g., recruiting and selection) issues.

Managing Performance in the Forensic Sciences: Expectations in Light of Limited Budgets, *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 1, 2011, Hilton Kobus, Max Houck, Paul J. Speaker & Richard Riley, pages 36-43

Abstract: For forensic service providers worldwide, the demand for high-quality services greatly outpaces available resources to meet those requests. The gap between the demand for services and the resource-restricted supply of those services has implications for managing performance: the effectiveness and efficiency of forensic science. The effectiveness of forensic science is directly related to the quality of the scientific analysis and the timeliness with which that analysis is provided, while efficiency is associated with attempts to minimize costs without negatively impacting quality. An inevitable result of the demand and supply gap is a backlog that results in downstream effects on timeliness, service, and quality. One important strategy to respond to the demand-supply imbalance is continual process improvement. Collaborative benchmarking as a basis for process improvement is another approach. This paper discusses the disjunction between perceived and actual value for forensic services and the rationale for providers to evaluate, improve, and re-tool their processes toward continual improvement given limited resources.

Strategic Management of Forensic Laboratory Resources: From Project FORESIGHT Metrics to the Development of Action Plans, *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 4, 2011, Jonathan Newman, David Dawley, & Paul J. Speaker, pages 164-174

Abstract: The project FORESIGHT stated objectives begin with the development of metrics applicable to the activity of forensic science laboratories. These metrics enable a laboratory to assess how they fit within the forensic science industry and offer a glance at the levels of performance that they might be able to achieve. FORESIGHT's mission goes on to state the intent for laboratories to use those measurements to "preserve what works, and change what does not" (Houck et al. 2009, p. 85). This paper addresses the strategic implications of those additional aspects of the FORESIGHT mandate with a view of the strategic planning process for a forensic science laboratory. The keys to the development of an ongoing strategic planning and execution process are outlined, and then the actions of one laboratory, Ontario's Centre of Forensic Sciences, are examined to demonstrate the move from metrics to action. While there cannot yet be made a claim of "best practices," this Canadian example offers some guidance to "better practices" in the quest for continual improvement in the provision of forensic science services.

The Power of Information, *Forensic Magazine* April 10, 2012, Tom S. Witt & Paul J. Speaker

Abstract: When it comes to cost, the Foresight model was designed to overlook nothing. When we talk about the cost of doing something, we look at everything from equipment, telecommunications, heating, lighting, facility rent … everything. If a participant doesn't have access to the data, we can estimate those costs from other labs in our studies. We come up with an all-inclusive figure that tells participants what it costs to process a case. This leads to informed decisions. Take trace evidence cases, for example. You might find that processing one trace evidence case costs the same as processing two, three, or even four traditional DNA cases. While trace evidence is wonderful and powerful, if DNA alone will get you where you need to be, this cost factor will heavily affect your decision-making process. Foresight is not about cutting where it matters. It's about using resources wisely so that labs can do more and enhance the services they provide. Once you know the key metrics, you can make informed decisions.

Is Privatization Inevitable for Forensic Science Laboratories?, *Forensic Science Policy & Management: An International Journal* Volume 3, Issue 1, 2012, William McAndrew, pages 42-52

Abstract: Given the recent global recession, many national governments have been forced to implement austerity measures, and the forensic science industry has not been immune from such changes. Proposals to privatize some or all aspects of forensic science services have been bantered about for decades, but the recent economic climate has brought this idea back to the forefront of public debates. Although privatization has been shown to have many benefits in the provision of other goods and services, the idea of privatizing forensic services has been harshly criticized by scholars and practitioners. This paper explores some of those criticisms through the lens of economics, and arguments are offered regarding why market approaches in forensic science may be more successful than might have originally been imagined under certain conditions. On the other hand, recognition of those economic forces and reaction by forensic laboratories to address inefficiencies may provide the effective delivery of forensic services that forestalls privatization efforts.

The Balanced Scorecard: Sustainable Performance Assessment for Forensic Laboratories, *Science and Justice* Volume 52, 2012, Max Houck, Paul J. Speaker, Richard Riley, & A. Scott Fleming, pages 209-216.

Abstract: The purpose of this article is to introduce the concept of the balanced scorecard into the laboratory management environment. The balanced scorecard is a performance measurement matrix designed to capture financial and non-financial metrics that provide insight into the critical success factors for an organization, effectively aligning organization strategy to key performance objectives. The scorecard helps organizational leaders by providing balance from two perspectives. First, it ensures an appropriate mix of performance metrics from across the organization to achieve operational excellence; thereby the balanced scorecard ensures that no single or limited group of metrics dominates the assessment process, possibly leading to long-term inferior performance. Second, the balanced scorecard helps leaders offset short term performance pressures by giving recognition and weight to long-term laboratory needs that, if not properly addressed, might jeopardize future laboratory performance.

Efficiency and the Cost Effective Delivery of Forensic Science Services: In-Sourcing, Out-Sourcing, and Privatization, *Forensic Science Policy & Management: An International Journal* Volume 3, Issue 2, 2012, Chris Maguire, Max Houck, Robin Williams, & Paul J. Speaker, pages 62-69

Abstract: Given the recent global recession, many national governments have been forced to implement austerity measures, and the forensic science industry has not been immune from such changes. Proposals to privatize some or all aspects of forensic science services have been bantered about for decades, but the recent economic climate has brought this idea back to the forefront of public debates. Although privatization has been shown to have many benefits in the provision of other goods and services, the idea of privatizing forensic services has been harshly criticized by scholars and practitioners. This paper explores some of those criticisms through the lens of economics, and arguments are offered regarding why market approaches in forensic science may be more successful than might have originally been imagined under certain conditions. On the other hand, recognition of those economic forces and reaction by forensic laboratories to address inefficiencies may provide the effective delivery of forensic services that forestalls privatization efforts.

Enhancing Employee Outcomes in Crime Labs: Test of a Model, *Forensic Science Policy and Management: An International Journal* Volume 3, Issue 4, 2012, David Dawley.

Abstract: This paper developed and tested a model identifying determinants of employee turnover intentions and desirable performance behaviors, including helping others and engaging in knowledge sharing. Data collected from 798 employees at ten FORESIGHT laboratories suggest that job satisfaction and embeddedness are the primary antecedents of turnover intentions and knowledge sharing, and that embeddedness is a stronger predictor variable of both outcomes. Embeddedness is driven by the employees' understanding of the lab's strategic vision. Moreover, job satisfaction and embeddedness are positively associated with helping behavior. Finally, we identified job autonomy as a primary determinant of job satisfaction. We discuss practical implications of these findings for managers.

Are Forensic Science Services Club Goods? An Analysis of the Optimal Forensic Science Service Delivery Model, *Forensic Science Policy and Management: An International Journal* Volume 3, Issue 4, 2012, William P. McAndrew, pages 151 – 158.

Abstract: Forensic science has been described as a public good by practitioners, legal professionals, and scholars, many of whom were suggesting that forensic science is simply something good for the public. It would indeed be difficult to argue otherwise. In an economic sense, the concept of a public good is defined differently from this colloquial meaning, however, leading to confusion in discussions between forensic scientists and business consultants concerning how to evaluate laboratory performance and ultimately consider strategic change from an economic or efficiency perspective. This article discusses what economists mean by a public or private good, with an application using the forensic science industry. Forensic science is likely neither a purely public or purely private good, but rather a club good that contains a degree of both the public and private. When calculated, the degree of publicness of this club good will aid in determining the appropriate institutional framework from which to provide forensic science services, as well as its optimal jurisdiction size and production level.

The Effects of Politics on Job Satisfaction in Crime Lab Employees, *Forensic Science Policy and Management: An International Journal* Volume 3, Issue 4, 2012, David Dawley & Timothy P. Munyun, pages 159 – 164.

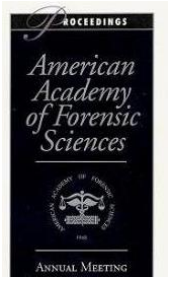
Abstract: This study examined the effects of crime lab workers' perceptions of intra-lab politics on job satisfaction. In addition to finding that political behavior reduces employee job satisfaction, the study also identified ways in which crime lab managers can mitigate the negative effects of political behavior, increasing employee job satisfaction when political behavior is high within a given unit. Data collected from 874 employees at twelve FORESIGHT laboratories suggest that increasing crime lab worker job autonomy, job efficiency, strategic vision, and task significance are especially effective interventions that increase job satisfaction when political behavior is high. We discuss practical implications of these findings for crime lab managers. The purpose of this paper is to investigate how perceived political behavior affects the job satisfaction, or morale, of crime lab workers. The study was motivated by several interactions we had with forensic crime lab managers at the 2013 American Society of Crime Lab Directors (ASCLD) meeting. In ASCLD human resources and FORESIGHT meetings, we received consistent inquiries concerning the potential role of organizational politics as a detrimental factor on employee attitudes. These conversations highlight the unfortunate ubiquity of political behavior at work, including work in crime labs. Organizational politics often create disharmony among employees and can negatively affect employee job satisfaction and other attitudes (Breaux et al. 2009; Ferris et al. 1996). Thus, we sought to explore how political behavior affects the job satisfaction of crime lab employees, and potential managerial strategies that could be useful in mitigating for this potential negative effect.

Expanding Budgets via Strategic Use of Leasing, *Forensic Science Policy and Management: An International Journal,* Volume 3, Issue 4*, 2012,* William P. McAndrew & Paul J. Speaker, pages 169 - 179.

Abstract: An examination of the budgets of forensic laboratories reveals an unused or underused tool at the disposal of forensic laboratories. Equipment leasing offers an opportunity for a unilateral increase in the purchasing power of existing laboratory budgets and an immediate response to austerity measures. Rather than react to budget tightening with reductions in force, shared furloughs, or the forfeiture of unfilled positions, a laboratory director can forestall such measures and even see an effective increase in disposable income through a planned use of operating leases. If a public laboratory makes an equipment purchase, the cost to the laboratory will be the full list price from the equipment supplier. However, when a private laboratory makes the same equipment purchase, it pays the supplier the full list price, but is able to deduct the expense from its income when it calculates its corporate income tax and ends up with a final expense, net of taxes, that is considerably less than the cost to the public laboratory. Leasing offers the opportunity for a private entity to purchase equipment and pass on some of the tax savings to the public laboratory through an operating lease. In this manuscript the leasing gains are explained and accompanied by a detailed example to illustrate the potential magnitudes of the gains.

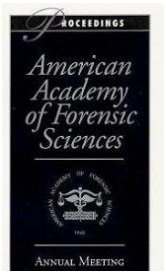
Forensic Science Service Provider Models: Data-Driven Support for Better Delivery Options, *Australian Journal of Forensic Sciences* Volume 45, Issue 2, 2013, Paul J. Speaker.

Abstract: There are a variety of models for the delivery of forensic science analysis in service to the justice system. In answer to the question as to whether there is a 'best' option for the delivery of forensic science services, New Zealand's Institute of Environmental Science and Research (ESR) has been offered as a model which demonstrates a comparative advantage over the delivery of forensic services in more traditional models. The support for that assertion rests in the ability of the ESR to react at the speed of business and avoid bureaucratic drag found too often in the public sector. This efficiency argument addresses one dimension of the search for 'best' delivery. The second dimension involves the discovery of the optimal scale of operation to take efficiency and turn it into cost effectiveness.



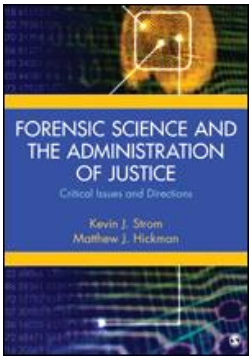
Improving the Effectiveness of Forensic Service: Using the Foresight Project as a Platform for Quality, *Proceedings of the American Academy of Forensic Sciences,* Volume XIX, Max M. Houck, Jay W. Henry, and Paul J. Speaker, February 2013, p.21.

Abstract: Forensic service providers are—in essence—non-profit, production-oriented organizations staffed largely by knowledge workers. Forensic scientists as knowledge workers take evidence and data and convert them into knowledge in the form of reports and testimony. They specialize in these transactions and, therefore, simplify them for the benefit of the criminal justice system; the investigators or attorneys do not need to find numerous individuals to conduct the specific examinations required for a case. As long as the costs of providing these services externally do not exceed the costs of their internal provision, for example, by a government forensic laboratory, then the organization can prosper. If the government laboratory costs are greater than the cost of finding private laboratories to provide services, then the organization may be reevaluated. Comparatively, non-profit and for-profit organizations are similar in some ways, yet different. Non-profits must therefore measure success in other ways. Forensic service providers and their parent organizations use terms such as "cost-effective" vaguely without reference to other disciplines, which use these as well-defined technical terms. Despite the administrative angst over forensic service providers' "performance" and "capacity," these metrics go undefined as industry standards.



Determinants of Turnover Intentions, Helping, and Knowledge Sharing in Crime Laboratories, *Proceedings of the American Academy of Forensic Sciences,* Volume XIX, David Dawley, February 2013, p.230.

Abstract: Forensic scientists are knowledge workers and are a laboratory's single greatest enduring expense. Therefore, it is imperative for forensic managers to find ways to retain employees, share knowledge, and create a cohesive, coherent team perspective. Based on a discussion with a group of FORESIGHT forensic laboratory directors in 2011, four major areas of research interest were identified: (1) reducing employee turnover; (2) increasing employees' helping behaviors with colleagues; (3) knowledge sharing among employees; and, (4) creating and disseminating a strategic vision to all employees.



Developing New Business Models for Forensic Laboratories, Chapter 13 in *Forensic Science and the Administration of Justice*, Kevin J. Strom & Matthew J. Hickman editors, Max M. Houck & Paul J. Speaker, April 2014.

Abstract: Forensic service providers inhabit a unique, central place in the criminal justice system. Stakeholders in the forensic enterprise abound, from law enforcement to attorneys to the courts and even the public they all serve. The public orientation of these services and stakeholders necessitates forensic managers rely on providing sound performance at a reasonable cost. Certainly, the laboratory's jurisdiction will judge them on criteria such as accuracy, timeliness, and cost. Too much emphasis on quantitative outcomes, however, can create an imbalance that ignores longer-term issues, such as quality and value. Thus, efficiency, the extent to which time and effort are used to produce the desired outcome, can be mistaken for effectiveness, the attainment of that desired outcome, but they are intimately connected.

A Novel Approach to Forensic Molecular Biology Education and Training: It's Impact on the Criminal Justice System, *Australian Journal of Forensic Sciences* 47 (2), 182 – 193, 2015, Khalid M. Lodhi, Robert L. Grier, and Paul J. Speaker.

Abstract: The managers of crime laboratories face significant hurdles when preparing new hires to become productive members of the laboratory. New hires require six months of training/experience in the crime laboratory before becoming a productive member of the Biology (DNA) section. To address this deficiency in forensic DNA education, a novel forensic education curriculum was developed and tested for three consecutive years in the forensic science program at Fayetteville State University, Fayetteville, NC. The curriculum used a CTS proficiency kit which is the same kit used to validate the proficiency of forensic scientists in crime laboratories in the US. A cost benefit analysis suggests that training students in a classroom instead of in a crime laboratory provides both direct savings to the laboratory and significant societal savings as more DNA profiles are entered into the database. The societal benefit from the combined reduction in the amount of training in a crime laboratory and increasing the number of DNA database profiles entered into a database suggests a societal saving of $8.28 million for each of these months of reduced training.

鑑識科學綜論
FORENSIC SCIENCE REVIEW

A Review of Forensic Science Management Literature, *Forensic Science Review 27,* Max M. Houck, William P McAndrew & B. Daview, 2015, 53-68.

Abstract: The science in forensic science has received increased scrutiny in recent years, but interest in how forensic science is managed is a relatively new line of research. This paper summarizes the literature in forensic science management generally from 2009 to 2013, with some recent additions, to provide an overview of the growth of topics, results, and improvements in the management of forensic services in the public and private sectors. This review covers only the last three years or so and a version of this paper was originally produced for the 2013 Interpol Forensic Science Managers Symposium and is available at *interpol.int*.

Financial Management of Forensic Science Laboratories: Lessons from Project FORESIGHT 2011-2012, *Forensic Science Policy and Management: An International Journal 6(1-2),* Paul J Speaker, 2015.

Abstract: Critical to the decision-making within an individual forensic science laboratory is an understanding of their efficiency and effectiveness. The NIJ-funded project, FORESIGHT, applies financial management techniques to avowed public sector goals and offers a common starting point for the comparison of individual forensic laboratories to the established standards in the industry through a review of financial ratios. Such ratios adjust for size differences and allow insight into several aspects of the operation including evaluation of efficiency, quality, risk, market nuances, and return on investment. This study offers insight into the financial performance, productivity, efficiency, and effectiveness of forensic science laboratories. Using data from the National Institute of Justice's Project FORESIGHT for 2011-2012, a variety of benchmark performance data is presented with analytical insight into the nature of that performance. The tabular and graphic presentations offer some insight into the current status of the forensic science industry in general and provide a basis by which individual laboratories may begin to assess their own performance with respect to both analytical efficiency and cost effectiveness.

Forensic Laboratory Financial Management, *ASCLD Crime Lab Minute*, Paul J. Speaker, July 2015.

Abstract: The National Institute of Justice's Office of Justice Programs has supported laboratories for the last several years with analysis of performance via Project FORESIGHT. Project FORESIGHT has collected data from the 2006 fiscal year, growing from a handful of laboratories to over 100 participating laboratories in the most recently completed fiscal year. There is no cost to participants, and all forensic laboratories are invited to join the program. In return for data submissions, each laboratory receives a customized report comparing their performance in each forensic investigative area to the industry standards obtained from the project.

Project FORESIGHT and Return on Investment: Forensic Science Laboratories and Public Health Laboratories, *Forensic Science Policy and Management: An International Journal 8(1-2)*, Paul J Speaker, 2017.

Abstract: Project FORESIGHT developed business guided metrics for use by forensic science laboratories. Since the introduction of the project nearly a decade ago, much has been learned about the efficiency and effectiveness of the forensic laboratory industry and laboratory management has been forewarned and forearmed as they develop strategic initiatives to deal with the economic problem of limited resources available for a seemingly unlimited demand for services. The success of forensic science laboratories in the application of best practices has not gone unnoticed. Public health laboratories face similar problems and the laboratories in that industry have joined forces through the Association of Public Health Laboratories and the Centers for Disease Control and Prevention to follow the guidance of Project FORESIGHT and develop business metrics to improve the efficiency and effectiveness of this public sector service. In this paper, the project development process is highlight towards an expanded set of outcomes that offers insight into efficiency and effectiveness and connects that performance to societal outcomes through development of return on investment metrics for the industry.

National versus Local Production: Finding the Balance between Fiscal Federalism and Economies of Scale, *Public Finance Review*, pages 1-23, William P. McAndrew, 2017.

Abstract: Public finance and public choice economists have contrasting views on the determinants of public sector size. This article makes a unique contribution to this literature by exploring an integer count of output, rather than the commonly used dollar approximation of output, using data that are homogeneous across the levels of government, where a unit of observation is not a governing body, but rather a service provider. Specifically, this article explores the counteracting effects of fiscal federalism and economies of scale using data from the National Institute of Justice with an application of data envelopment analysis and stochastic frontier analysis. I determine that provision of forensic science services at the national level rather than local level does not lead to higher relative cost, and national production may be relatively more efficient. In general, however, neither locally nor nationally operated laboratories are operating at an efficient scale, a potential argument for privatization, insourcing, or outsourcing.

Process Improvement and the Efficient Frontier: Forecasting the Limits to Strategic Change across Crime Laboratory Areas of Investigation, *Forensic Science Policy & Management: An International Journal 8 (3-4),* 109-127, Paul J Speaker, 2017.

Abstract: Undertaking programs for process improvement, such as Lean Six Sigma, permit a laboratory to do more with their limited resources. The Netherlands Forensic Institute (NFI) embraced a Lean Six Sigma change process that led to dramatic increases in capacity, while simultaneously reducing turnaround time (TAT) to a fraction of their historical experience. As other laboratories adopt similar process improvement programs, will those laboratories also experience similar results with higher productivity across the laboratory and reduced turnaround time in every area of scientific investigation? We demonstrate that similar success may be expected with a laboratory's current caseload, but the degree of improvement is related to the size of the political jurisdiction, crime rates, and the resulting caseload; and the degree of inefficiencies at the start of the process improvement program. An understanding of the economic forces at play enables laboratory management to better forecast outcomes and plan for the eventualities.

Strategic leadership through performance management: FORESIGHT as PerformanceStat, *Australian Journal of Forensic Sciences* 51(3), 1-11, Max M Houck, 2019.

Abstract: Unlike the private sector, no single overarching metric exists to evaluate public sector performance. Without concepts such as profit, it can be difficult for government agencies to be accountable to stakeholders. Unless organizations have a clear strategy that holds performance to account, the organization can become pathological and never truly succeed. Momentum has been building towards evidence-based evaluations and management in government, inspired by the use of evidence-based decision-making, made popular by Michael Lewis' book Moneyball. This article presents a platform for adopting the forensic version of 'Moneyball', the FORESIGHT Project, as a strategic tool to set metrics as goals, develop ways to achieve them, and improve the performance of public forensic service providers.

The jurisdictional return on investment from processing the backlog of untested sexual assault kits, *Forensic Science International: Synergy* 1, 18-23, Paul J Speaker, 2019.

Abstract: The economic problem for the forensic laboratory is a problem faced in all arenas; limited resources are available to address seemingly unlimited desires. This is as true for entities in the public sector as it is for any private concern. To assist decision-makers in the allocation of those scarce resources, we synthesize existing research on the benefits of additions to the DNA Database and the potential benefits from diverting resources to analysis of the backlog of sexual assault kits. We offer some guidance for the optimum use of limited resources, through the measurement of the return on investment (ROI) at the jurisdictional level (i.e., that is, the net benefits to society relative to the investment itself). Such metrics surrounding ROI will assist the public sector in the optimal allocation of scarce resources to the justice system by providing a measure of the marginal social welfare improvement from alternative allocations of these scarce resources in light of objectives of public sector entities. The analysis demonstrates that the societal return on investment from the testing of all sexual assault kits ranges from 9,874% to 64,529%, depending on the volume of activity for the laboratory conducting the analysis. There are extreme economies of scale in effect that are suggestive of some policy alternatives.

The Economic Impact of the Opioid Crisis on Forensic Laboratories and Related Entities, *Forensic Science International: Synergy* S1, S9-S10, Paul J Speaker, 2019.

Abstract: The Economic Impact of the Opioid Crisis on Forensic Laboratories and Related Entities Prior to November 2017, the magnitude of the opioid crisis nationally was estimated to have an annual cost of nearly 0.33% of GDP. However, the release of the White House report (The Council of Economic Advisers, 2017) on the opioid crisis suggests that indirect costs, not previously considered, increase estimates of the annual cost of the crisis by nearly 600% to an annual cost of $504 Billion or 2.2% annually of GDP (Florence, Zhou, Luo, & Xu, 2016). When those considerations are examined at the individual state level, the "crisis" states (i.e., the states with the worst per capita overdose deaths) experience a cost approaching 15% of Gross State Product.

Strategic Leadership Through Performance Management: FORESIGHT as PerformanceStat, *Forensic Science International: Synergy* S1, S13, Max M Houck, 2019.

Abstract: Unlike the private sector, no single overarching metric exists to evaluate public sector performance. Without concepts such as profit, it can be difficult for government agencies to be accountable to stakeholders. Unless organizations have a clear strategy that holds performance to account, the organization can become pathological and never truly succeed. Momentum has been building towards evidence-based evaluations and management in government, inspired by the use of evidence-based decision-making, made popular by Michael Lewis' book Moneyball. This article presents a platform for adopting the forensic version of 'Moneyball', the FORESIGHT Project, as a strategic tool to set metrics as goals, develop ways to achieve them, and improve the performance of public forensic service providers.

The Jurisdictional Return on Investment for DNA Database, *Forensic Science International: Synergy* S1, S13-S14, Paul J Speaker, 2019.

Abstract: In her review of social science research on forensic science, Browning (2015) concludes with the observation that "resources are decreasing. We must keep learning how to be more efficient in using ever-evolving forensics technologies and examining the actual justice outcomes resulting from forensic evidence so that limited resources can be used wisely." The economic problem for the forensic laboratory is a problem faced in all areas; limited resources are available to address seemingly unlimited desires. This is as true for entities in the public sector as it is for any private concern. To assist decision-makers in the allocation of those scarce resources, we synthesize existing research on the benefits of additions to the DNA Database and the potential benefits from diverting resources to analysis of the backlog of sexual assault kits. Through the measurement of the return on investment (ROI) at the jurisdictional level, we offer some guidance for the optimum use of limited resources. Such metrics will assist the public sector in the optimal allocation of scarce resources to the justice system by providing a measure of the marginal social welfare improvement from alternative allocations of these scarce resources in light of objectives of public sector entities.

FORESIGHT: Problems, Arguments, and Solutions, *Forensic Science International: Synergy* S2, S5, Max M Houck, 2019.

Abstract: FORESIGHT, the global standard for forensic laboratory benchmarking, can benefit the forensic community, not just individual laboratories. With over a decade of data from more than 160 laboratories worldwide, the FORESIGHT Project can provide support for requesting resources. Using the opioid crisis and backlogged sexual assault kits as examples, this presentation shows how FORESIGHT's "big data" approach can give you the information you need to secure resources to improve your laboratory's performance.

The hidden costs of the opioid crisis and the implications for financial management in the public sector, *Forensic Science International: Synergy* 1, 227-238, Jeri D. Ropero-Miller, Paul J Speaker, 2019.

Abstract: The November 2017 release of the Council of Economic Advisers' White House report on the opioid crisis suggests that prior consideration of expenses severely underestimated the economic costs of the opioid crisis. When corrected for these losses, the annual cost from the opioid crisis leapt nearly 600%. The cost to the criminal justice system was estimated at $8 Billion of which $270 million is borne by crime laboratories. However, laboratory budgets have not grown at a rate capable of meeting this increased demand for forensic science services. The hidden costs of the opioid crisis borne by the forensic crime laboratories comes as funds are diverted in the laboratory to meet the increased demands for services in drug chemistry and toxicology. Dramatic increases in turnaround times across other areas of investigation continue to grow as the crisis accelerates.

Project FORESIGHT: A Ten-Year Retrospective, *Forensic Science International: Synergy* 2, Max M. Houck & Paul J Speaker, 2020.

Abstract: Forensic service providers fulfill a fundamental role in a criminal justice system by providing scientific information that aids investigations and court proceedings. While the focus is often on the science aspect of these organizations, the provision is also of paramount importance. Historically, calls for more and better information about forensic laboratory performance (in essence, benchmarking) have gone unheard. Project FORESIGHT, created in 2008, and filled this need through engagement with the forensic management community to build a needs-based process for providing operational data that can be used to enhance a laboratory's performance. With over 10 years of industry data, Project FORESIGHT is the *de facto* standard for benchmarking forensic service provision.

An Independent Evaluation of Laboratory Staffing Needs: Launching the Forensic Laboratory Workforce Calculator, *Forensic Science International: Synergy* 3, Paul J Speaker, 2021.

Abstract: The 2019 NIJ Report to Congress on the needs of the forensic science community highlighted the staffing deficit of forensic scientists by more than 900 positions. The Report emphasized the impact of the opioid crisis and the evolution of synthetic opioids on the demands for forensic laboratories. The resource drain attributable to the opioid crisis has filtered into all other areas of investigation as laboratories divert limited resources from other uses to meet the high demand in drug chemistry and toxicology from opioid abuse. We introduce the forensic laboratory workforce calculator, a tool that any forensic laboratory may use to evaluate their current personnel allocation and estimate any under- or over-staffing to meet current or estimated caseloads. The forensic laboratory workforce calculator is available free to any laboratory through the Forensic Technology Center of Excellence website.

FORESIGHT 101: What is it, how do I get started, and what will it do for my lab? *Forensic Science International: Synergy* 3(S1), Max M. Houck & Paul J Speaker, 2021.

Abstract: Forensic laboratories face the classic economic problem – how to allocate limited resources with increasing demand for services while maintaining high-quality standards. The FORESIGHT Project is a benchmarking project to identify, adapt, and refined standardized metrics to forensic laboratory managers to measure, and assess performance for improving efficiencies, quality, and service. Benchmarking is improving performance by recognizing, understanding, and integrating best – or at least better – practices from either inside the organization or from outside entities. Data entry can be performed at various levels of competence, with greater detail leading to more tailored results but lower levels of completeness mean ease of entry into the project. Software is also available to automate the data process. Participation in FORESIGHT can help laboratory managers answer questions like: Are resources appropriately allocated? Is the laboratory performance efficient? Will alternative practices result in improved, high-quality services? Are sufficient safeguards in place to assure the quality of analysis? Is investment in equipment, training, and development to enhance performance sufficient? Is the laboratory optimizing the return on investment for its constituency? Hundreds of forensic laboratories around the world have participated in FORESIGHT for over a decade. This workshop will orient interested laboratories to the FORESIGHT Project and give them the necessary information to begin benchmarking their processes and performance.

FORESIGHT Interpretation: What do I do with all this Data? *Forensic Science International: Synergy* 3(S1), Max M. Houck & Paul J Speaker, 2021.

Abstract: Participation in FORESIGHT can have a significant impact on a laboratory's performance--but only if managers know what the data mean and how to use it. This workshop is for laboratory managers who want to know what a laboratory can and should do with their FORESIGHT data for improved laboratory performance. The workshop will cover discussions of strategic missions, key performance indicators, budgeting, and specific short-term and long-term problems in the management of forensic laboratories at the tactical, operational, and strategic levels. The workshop will show managers how to combine a review of mission, vision, and values to connect the budget allocation process to a feedback loop through which the laboratory uses the FORESIGHT metrics to evaluate performance and reformulate strategic plans. These metrics offer insight into each of the areas of concern and include measures of return, quality, efficiency, analytical process, and recognition of the laboratory's local economic conditions. The data offer the ability to correct for differences in population, geographical areas served, and asset allocation. The workshop will detail how a laboratory might detect an explanation for its performance and identify potential red flags to address areas of concern. Armed with viable metrics and the means to analyze them, a foundation for the important planning stages of performance review and coordination with strategic goals can be created. The initial adoption of a strategic management process will enable a laboratory to set the stage for continual improvement. The combination of these basic management tools with the FORESIGHT data being generated industry-wide will enable a laboratory to manage that process from production through quality assurance and budget allocation.

Forensic Intelligence: Data Analytics as the Bridge between Forensic Science and Investigation, *Forensic Science International: Synergy* 3, Yaneisy Delgado, Bradley S. Price, Paul J Speaker, & Stephanie L. Stoiloff, 2021.

Abstract: Scientists should not play a role in investigations nor should investigators play a role in the scientific analyses. One way to bridge the relationship between the forensic scientist and the police investigator is through an Intelligence Analyst (IA) who is part of the forensic services operation. The IA offers the ability to walk between the role of scientist and law enforcement, receiving data after completion of scientific analyses and translating the information into actionable intelligence. The additional bridging and translating services represent a paradigm shift with increased emphasis on investigative contributions from forensic analysis. Forensic intelligence incorporates forensic data early in an investigation in a holistic case approach that incorporates possible datasets and information that could be relevant to the investigation. We present a brief review of the value added when an IA provides the bridge between the forensic laboratory and police investigators to enhance the use of forensic evidence.

Medical Research Archives

The Return on Investment from Rapid DNA Testing of Sexual Assault Kits: The Kentucky State Police Forensic Laboratory Experience, *Medical Research Archives* 9(11), Paul J Speaker, & Regina Wells, 2021.

Abstract: The growing queue for DNA analysis in crime laboratories has prevented the analysis from providing investigative leads as turnaround time has grown, limiting the analytical results to a confirmatory role in the courtroom. Rapid DNA technology offers an opportunity to employ an automated system for the development of a DNA profile. The Rapid DNA technology permits a police booking station to take a buccal swab obtained from an arrestee, acquire a DNA profile, and test that profile against a DNA database, all while the arrestee remains in police custody during the booking process. Rapid DNA technologies are a capital-intensive system enabling sophisticated equipment designed for operation by individuals with limited technical training to provide investigative leads with immediate support. We present the testing of rapid DNA technology in a trial program conducted by the Kentucky State Police Forensic Laboratory. The Kentucky test confirms the efficacy of the rapid DNA testing as consistent with the findings from traditional laboratory testing. The economic analysis related to testing indicates that the time saving from the rapid DNA analysis yields benefits that far outweigh the costs from the change in technology.

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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Because the good management of science can be as important as the science itself, the journal welcomes articles on issues related to forensic science policy and management. Management, human resources, economic studies, policy implications of new methods or technology, and any other work intended to improve the effectiveness, efficiency, quality, and operations of forensic science laboratories as well as to the education and training of forensic scientists. In addition, the journal welcomes manuscripts on the governmental and institutional policies that affect the practice and management of forensic science.

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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.