Project FORESIGHT Annual Report, 2012-2013

Forensic Science Initiative, College of Business & Economics, West Virginia University

FORESIGHT
Laboratory
Participant ABC

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FORESIGHT Benchmark Data 2012-2013

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 2012-2013 performance period includes laboratory submissions for a variety of fiscal year definitions. However, all submissions have December 31, 2012 as part of their fiscal year accounting. The majority of submissions follow a July 1, 2012 through June 30, 2013 convention. Others follow a year that begins as early as April 1, 2012 (ending March 31, 2013) while the other extreme includes laboratories with a fiscal year originating October 1, 2012 and ending September 30, 2013.

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, seventy-nine laboratories contributed data to the project in 2012-2013. For most areas of investigation, the submitted data offers a large enough sample to elicit good statistical properties. However, for Crime Scene Investigation, Digital, Evidence, and Pathology, the number of reporting laboratories in these areas is too small to draw meaningful conclusions. As such, the metrics in these four areas of investigation offer limited inference.

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 (paul.speaker@mail.wvu.edu).

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 1: Cost per Case by Investigative Area

Cost per Case	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		$90	$120	$174
Crime Scene Investigation		$783	$5,277	$6,972
Digital evidence - Audio & Video		$4,074	$6,733	$8,792
DNA Casework		$1,709	$1,993	$2,332
DNA Database		$57	$65	$82
Document Examination		$5,730	$6,756	$7,565
Drugs - Controlled Substances		$214	$274	$316
Evidence Screening & Processing		$1,502	$1,655	$1,919
Explosives		$12,021	$14,102	$15,296
Fingerprints		$377	$527	$730
Fire analysis		$968	$1,368	$2,271
Firearms and Ballistics		$528	$722	$1,544
Forensic Pathology		$2,003	$2,217	$3,204
Gun Shot Residue (GSR)		$1,927	$2,257	$2,557
Marks and Impressions		$5,752	$9,421	$10,094
Serology/Biology		$1,218	$2,182	$2,651
Toxicology ante mortem (excluding BAC)		$442	$501	$602
Toxicology post mortem (excluding BAC)		$427	$643	$772
Trace Evidence		$2,898	$4,007	$6,334

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 2: Cost per Item by Investigative Area

Cost per Item	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		$79	$112	$157
Crime Scene Investigation		$1,804	$3,603	$5,402
Digital evidence - Audio & Video		$4,165	$5,687	$6,381
DNA Casework		$698	$893	$1,041
DNA Database		$52	$65	$76
Document Examination		$1,821	$2,133	$2,487
Drugs - Controlled Substances		$117	$145	$182
Evidence Screening & Processing		$406	$449	$491
Explosives		$7,287	$7,858	$8,490
Fingerprints		$174	$228	$307
Fire analysis		$437	$611	$831
Firearms and Ballistics		$155	$321	$513
Forensic Pathology		$2,003	$2,211	$3,258
Gun Shot Residue (GSR)		$891	$1,025	$1,175
Marks and Impressions		$1,558	$2,801	$3,507
Serology/Biology		$326	$566	$685
Toxicology ante mortem (excluding BAC)		$345	$374	$455
Toxicology post mortem (excluding BAC)		$200	$287	$405
Trace Evidence		$1,308	$1,928	$3,272

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 and average cost measure that is intuitively comparable in cross sectional commentary.

Table 3: Cost per Sample by Investigative Area

Cost per Sample	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		$57	$76	$119
Crime Scene Investigation				
Digital evidence - Audio & Video		$1,180	$1,647	$2,683
DNA Casework		$215	$260	$340
DNA Database		$50	$63	$77
Document Examination		$726	$831	$862
Drugs - Controlled Substances		$59	$72	$95
Evidence Screening & Processing		$95	$105	$117
Explosives		$1,997	$2,131	$2,272
Fingerprints		$80	$105	$174
Fire analysis		$163	$253	$329
Firearms and Ballistics		$173	$317	$467
Forensic Pathology		$1,670	$2,458	$3,003
Gun Shot Residue (GSR)		$212	$233	$259
Marks and Impressions		$777	$960	$1,018
Serology/Biology		$76	$87	$97
Toxicology ante mortem (excluding BAC)		$212	$243	$274
Toxicology post mortem (excluding BAC)		$111	$169	$204
Trace Evidence		$679	$1,014	$1,578

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 4: Cost per Test by Investigative Area

Cost per Test	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		$33.36	$52.34	$71.50
Crime Scene Investigation				
Digital evidence - Audio & Video		$158.08	$211.25	$233.03
DNA Casework		$141.29	$182.86	$224.40
DNA Database		$47.38	$57.73	$76.33
Document Examination		$535.70	$596.86	$669.81
Drugs - Controlled Substances		$40.26	$50.90	$66.88
Evidence Screening & Processing		$154.49	$172.79	$181.36
Explosives		$865.83	$962.17	$1,057.95
Fingerprints		$52.48	$79.94	$115.71
Fire analysis		$164.39	$224.41	$345.89
Firearms and Ballistics		$64.32	$153.15	$186.95
Forensic Pathology		$424.59	$655.60	$1,117.14
Gun Shot Residue (GSR)		$279.70	$341.52	$393.87
Marks and Impressions		$527.88	$877.03	$1,001.33
Serology/Biology		$59.95	$92.29	$115.13
Toxicology ante mortem (excluding BAC)		$55.93	$62.67	$80.88
Toxicology post mortem (excluding BAC)		$35.80	$49.75	$70.38
Trace Evidence		$228.04	$360.91	$689.55

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 5: Average Compensation by Investigative Area

Average Compensation	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		$54,178	$66,799	$78,088
Crime Scene Investigation		$72,602	$79,739	$90,373
Digital evidence - Audio & Video		$75,804	$88,307	$94,407
DNA Casework		$47,136	$57,295	$77,330
DNA Database		$62,964	$85,266	$97,721
Document Examination		$60,205	$64,992	$71,845
Drugs - Controlled Substances		$67,153	$72,870	$81,173
Evidence Screening & Processing		$59,878	$65,805	$70,685
Explosives		$78,692	$85,150	$89,971
Fingerprints		$53,686	$63,223	$88,425
Fire analysis		$55,904	$65,549	$90,563
Firearms and Ballistics		$64,723	$76,975	$93,057
Forensic Pathology		$70,025	$95,433	$97,502
Gun Shot Residue (GSR)		$69,851	$75,443	$82,444
Marks and Impressions		$67,183	$74,651	$81,477
Serology/Biology		$61,997	$65,140	$71,082
Toxicology ante mortem (excluding BAC)		$57,536	$61,130	$67,336
Toxicology post mortem (excluding BAC)		$41,120	$47,418	$71,531
Trace Evidence		$52,548	$75,324	$95,275

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 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 6: Items per Case by Investigative Area

Items per Case	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		0.95	1.02	1.13
Crime Scene Investigation		0.98	1.00	63.28
Digital evidence - Audio & Video		1.21	1.44	1.66
DNA Casework		2.12	2.34	2.60
DNA Database		0.94	0.99	1.03
Document Examination		3.09	3.34	3.61
Drugs - Controlled Substances		1.74	1.90	2.14
Evidence Screening & Processing		3.57	4.08	4.21
Explosives		1.63	1.73	1.88
Fingerprints		2.08	2.21	2.41
Fire analysis		2.36	2.53	2.76
Firearms and Ballistics		1.97	2.48	5.96
Forensic Pathology		1.00	1.00	1.01
Gun Shot Residue (GSR)		1.98	2.18	2.35
Marks and Impressions		2.89	3.19	3.52
Serology/Biology		3.54	3.82	4.24
Toxicology ante mortem (excluding BAC)		1.23	1.32	1.42
Toxicology post mortem (excluding BAC)		1.91	2.08	2.19
Trace Evidence		1.94	2.16	2.31

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 7: Samples per Case by Investigative Area

Samples per Case	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		1.41	1.56	1.69
Crime Scene Investigation		125.56	125.56	125.56
Digital evidence - Audio & Video		1.81	3.75	5.53
DNA Casework		4.76	8.76	9.36
DNA Database		0.96	0.99	1.04
Document Examination		8.24	8.78	9.52
Drugs - Controlled Substances		2.66	4.07	4.41
Evidence Screening & Processing		14.49	15.77	16.87
Explosives		6.31	7.00	7.25
Fingerprints		4.54	4.97	5.52
Fire analysis		6.15	6.95	7.75
Firearms and Ballistics		2.00	3.53	6.51
Forensic Pathology		0.98	1.09	2.71
Gun Shot Residue (GSR)		8.53	9.22	10.74
Marks and Impressions		8.13	10.35	11.88
Serology/Biology		13.53	28.73	30.53
Toxicology ante mortem (excluding BAC)		1.99	2.20	2.35
Toxicology post mortem (excluding BAC)		3.81	4.39	4.67
Trace Evidence		3.96	4.43	4.86

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 8: Tests per Case by Investigative Area

Tests per Case	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		2.04	2.29	2.61
Crime Scene Investigation				
Digital evidence - Audio & Video		33.38	43.54	53.53
DNA Casework		10.03	11.52	13.01
DNA Database		0.97	1.09	1.16
Document Examination		11.07	11.83	13.10
Drugs - Controlled Substances		4.51	5.20	5.81
Evidence Screening & Processing		9.50	10.35	10.89
Explosives		13.34	14.91	16.51
Fingerprints		5.60	6.20	7.03
Fire analysis		5.67	6.38	7.04
Firearms and Ballistics		3.76	5.20	26.32
Forensic Pathology		3.86	5.27	8.19
Gun Shot Residue (GSR)		6.05	6.56	7.69
Marks and Impressions		9.47	10.45	12.53
Serology/Biology		19.42	21.97	25.29
Toxicology ante mortem (excluding BAC)		7.02	7.93	8.88
Toxicology post mortem (excluding BAC)		11.36	12.52	13.75
Trace Evidence		10.37	10.94	12.43

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 9: Tests per Sample by Investigative Area

Tests per Sample	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		1.37	1.59	1.82
Crime Scene Investigation				
Digital evidence - Audio & Video		6.10	7.73	26.57
DNA Casework		1.16	1.28	1.55
DNA Database		0.99	1.09	1.16
Document Examination		1.24	1.34	1.45
Drugs - Controlled Substances		1.18	1.32	2.00
Evidence Screening & Processing		0.58	0.63	0.72
Explosives		2.06	2.26	2.37
Fingerprints		1.10	1.25	1.46
Fire analysis		0.88	0.95	1.03
Firearms and Ballistics		1.32	2.79	3.64
Forensic Pathology		1.85	3.49	4.93
Gun Shot Residue (GSR)		0.63	0.69	0.85
Marks and Impressions		0.91	1.04	2.32
Serology/Biology		0.69	0.78	1.61
Toxicology ante mortem (excluding BAC)		3.07	3.61	3.99
Toxicology post mortem (excluding BAC)		2.59	2.79	3.13
Trace Evidence		2.19	2.58	3.02

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 10: Cases per FTE by Investigative Area

Cases per FTE	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		651.65	722.18	790.53
Crime Scene Investigation		14.63	18.97	89.23
Digital evidence - Audio & Video		11.65	16.60	21.66
DNA Casework		32.64	36.63	59.23
DNA Database		2,296.80	2,444.19	2,573.77
Document Examination		9.05	9.70	10.97
Drugs - Controlled Substances		299.44	324.28	391.92
Evidence Screening & Processing		40.81	43.15	44.77
Explosives		6.87	7.32	7.87
Fingerprints		121.65	130.18	225.52
Fire analysis		55.41	59.39	68.27
Firearms and Ballistics		73.21	123.65	167.81
Forensic Pathology		40.40	48.80	55.38
Gun Shot Residue (GSR)		35.65	38.70	44.54
Marks and Impressions		7.23	8.33	11.03
Serology/Biology		26.65	30.10	57.20
Toxicology ante mortem (excluding BAC)		162.99	173.19	178.47
Toxicology post mortem (excluding BAC)		82.44	91.79	108.45
Trace Evidence		18.31	20.35	22.02

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 11: Items examined per FTE by Investigative Area

Items per FTE	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		654.72	743.24	825.90
Crime Scene Investigation		18.72	22.22	7,015.20
Digital evidence - Audio & Video		16.08	17.12	25.38
DNA Casework		77.08	85.19	133.02
DNA Database		2,213.21	2,356.55	2,521.16
Document Examination		28.88	32.04	34.41
Drugs - Controlled Substances		543.54	599.65	719.10
Evidence Screening & Processing		146.03	168.23	183.32
Explosives		11.81	12.96	13.56
Fingerprints		262.07	288.33	498.99
Fire analysis		142.83	154.97	172.62
Firearms and Ballistics		221.16	279.87	501.04
Forensic Pathology		40.99	48.80	55.52
Gun Shot Residue (GSR)		78.26	84.79	94.76
Marks and Impressions		23.46	26.63	41.29
Serology/Biology		104.40	113.80	226.28
Toxicology ante mortem (excluding BAC)		214.56	224.39	236.11
Toxicology post mortem (excluding BAC)		171.13	188.36	211.97
Trace Evidence		38.46	43.71	47.61

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 12: Samples per FTE by Investigative Area

Samples per FTE	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		961	1,107	1,202
Crime Scene Investigation		14,008	14,008	14,008
Digital evidence - Audio & Video		42	54	61
DNA Casework		295	318	357
DNA Database		2,170	2,467	2,566
Document Examination		79	83	89
Drugs - Controlled Substances		1,108	1,251	1,415
Evidence Screening & Processing		636	692	714
Explosives		47	48	52
Fingerprints		618	653	745
Fire analysis		392	412	450
Firearms and Ballistics		263	330	500
Forensic Pathology		43	50	414
Gun Shot Residue (GSR)		338	371	450
Marks and Impressions		78	86	96
Serology/Biology		767	846	923
Toxicology ante mortem (excluding BAC)		342	382	398
Toxicology post mortem (excluding BAC)		369	374	430
Trace Evidence		77	90	97

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 13: Tests per FTE by Investigative Area

Tests per FTE	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		1,519	1,701	1,852
Crime Scene Investigation				
Digital evidence - Audio & Video		359	486	827
DNA Casework		357	417	518
DNA Database		2,314	2,622	2,929
Document Examination		99	114	126
Drugs - Controlled Substances		1,483	1,691	2,107
Evidence Screening & Processing		418	428	479
Explosives		100	106	119
Fingerprints		753	860	1,791
Fire analysis		358	380	415
Firearms and Ballistics		389	803	1,551
Forensic Pathology		160	206	958
Gun Shot Residue (GSR)		231	268	299
Marks and Impressions		75	85	103
Serology/Biology		572	708	1,123
Toxicology ante mortem (excluding BAC)		1,207	1,364	1,483
Toxicology post mortem (excluding BAC)		990	1,133	1,374
Trace Evidence		202	215	248

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 14: Reports per FTE by Investigative Area

Reports per FTE	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		740.87	831.70	901.99
Crime Scene Investigation		14.88	19.86	89.43
Digital evidence - Audio & Video		13.55	18.75	23.34
DNA Casework		74.09	82.54	89.73
DNA Database		2,260.51	2,432.80	2,607.13
Document Examination		23.71	25.27	28.15
Drugs - Controlled Substances		472.44	531.94	560.60
Evidence Screening & Processing		147.91	160.51	165.08
Explosives		30.84	32.75	34.84
Fingerprints		317.56	346.94	370.69
Fire analysis		85.49	94.81	99.12
Firearms and Ballistics		82.95	126.46	183.41
Forensic Pathology		42.75	48.80	55.52
Gun Shot Residue (GSR)		102.22	111.58	119.47
Marks and Impressions		22.24	24.65	26.70
Serology/Biology		141.13	150.38	165.58
Toxicology ante mortem (excluding BAC)		178.41	196.29	216.94
Toxicology post mortem (excluding BAC)		129.90	139.77	151.60
Trace Evidence		31.39	34.70	39.21

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 15: Personnel Expenditures/Total Expenditures by Investigative Area

Personnel Expenditures/Total Expenditures	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		64.15%	75.15%	81.95%
Crime Scene Investigation		67.36%	76.16%	86.30%
Digital evidence - Audio & Video		81.75%	88.56%	95.71%
DNA Casework		63.61%	68.76%	71.03%
DNA Database		50.78%	55.21%	58.78%
Document Examination		85.80%	93.10%	95.05%
Drugs - Controlled Substances		73.52%	80.65%	83.97%
Evidence Screening & Processing		81.16%	90.80%	95.60%
Explosives		78.28%	84.87%	87.64%
Fingerprints		77.99%	85.13%	91.04%
Fire analysis		67.52%	80.96%	96.47%
Firearms and Ballistics		76.33%	84.01%	87.95%
Forensic Pathology		64.33%	80.51%	89.74%
Gun Shot Residue (GSR)		76.12%	80.96%	90.28%
Marks and Impressions		85.15%	93.37%	98.26%
Serology/Biology		84.85%	92.69%	95.25%
Toxicology ante mortem (excluding BAC)		62.92%	69.59%	76.32%
Toxicology post mortem (excluding BAC)		62.79%	65.60%	70.46%
Trace Evidence		69.26%	74.60%	79.84%

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 16: Capital Expenditures/Total Expenditures by Investigative Area

Capital Expenditures/Total Expenditures	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		1.37%	3.24%	5.00%
Crime Scene Investigation		0.27%	1.36%	9.31%
Digital evidence - Audio & Video		4.90%	6.81%	12.44%
DNA Casework		1.39%	7.80%	11.00%
DNA Database		1.03%	1.60%	6.02%
Document Examination		0.22%	0.38%	0.59%
Drugs - Controlled Substances		1.05%	5.69%	10.55%
Evidence Screening & Processing		0.46%	1.54%	2.00%
Explosives		0.53%	1.67%	4.45%
Fingerprints		0.71%	1.84%	5.99%
Fire analysis		1.63%	3.32%	6.26%
Firearms and Ballistics		3.57%	7.21%	13.06%
Forensic Pathology		2.31%	5.21%	7.26%
Gun Shot Residue (GSR)		0.50%	2.08%	6.47%
Marks and Impressions		0.20%	0.93%	3.59%
Serology/Biology		0.27%	0.94%	2.69%
Toxicology ante mortem (excluding BAC)		1.00%	2.26%	8.52%
Toxicology post mortem (excluding BAC)		1.28%	8.29%	9.68%
Trace Evidence		1.70%	9.95%	12.08%

Consumables Expense as a proportion of Total Expense

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

Table 17: Consumables Expenditures/Total Expenditures by Investigative Area

Consumables Expenditures/Total Expenditures	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		6.16%	6.78%	8.60%
Crime Scene Investigation		1.51%	1.58%	1.65%
Digital evidence - Audio & Video		2.41%	2.41%	2.41%
DNA Casework		9.52%	11.46%	13.23%
DNA Database		9.56%	10.66%	11.76%
Document Examination		0.28%	0.43%	0.74%
Drugs - Controlled Substances		3.44%	4.53%	6.56%
Evidence Screening & Processing		0.98%	2.12%	4.64%
Explosives		1.26%	1.96%	2.48%
Fingerprints		0.64%	0.98%	1.42%
Fire analysis		2.95%	4.87%	6.99%
Firearms and Ballistics		0.82%	1.88%	3.86%
Forensic Pathology		2.67%	3.18%	3.57%
Gun Shot Residue (GSR)		1.15%	2.09%	3.07%
Marks and Impressions		0.26%	0.48%	1.49%
Serology/Biology		1.38%	2.07%	5.15%
Toxicology ante mortem (excluding BAC)		7.31%	8.43%	11.53%
Toxicology post mortem (excluding BAC)		6.38%	6.95%	7.77%
Trace Evidence		2.11%	2.61%	2.96%

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.

Median Turn-around Time (Timed in days from **last** submission of evidence to Report submission)

Table 18: Turnaround time from Last Item Received by Investigative Area

Turnaround Time from Last Item Received	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		7	12	14
Crime Scene Investigation		14	21	27
Digital evidence - Audio & Video		28	29	38
DNA Casework		53	60	69
DNA Database		68	79	84
Document Examination		34	37	41
Drugs - Controlled Substances		35	38	43
Evidence Screening & Processing		19	27	32
Explosives		29	35	39
Fingerprints		28	33	39
Fire analysis		33	39	46
Firearms and Ballistics		12	33	48
Forensic Pathology		26	31	59
Gun Shot Residue (GSR)		23	28	35
Marks and Impressions		36	39	46
Serology/Biology		25	33	39
Toxicology ante mortem (excluding BAC)		21	26	32
Toxicology post mortem (excluding BAC)		20	24	27
Trace Evidence		65	69	77

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

Turnaround Time from First Item Received	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		13	18	21
Crime Scene Investigation				
Digital evidence - Audio & Video		41	56	80
DNA Casework		58	67	75
DNA Database		60	76	91
Document Examination		56	61	67
Drugs - Controlled Substances		41	48	53
Evidence Screening & Processing		21	28	38
Explosives		50	51	53
Fingerprints		36	45	52
Fire analysis		34	47	52
Firearms and Ballistics		25	46	83
Forensic Pathology		32	35	38
Gun Shot Residue (GSR)		33	36	48
Marks and Impressions		46	55	119
Serology/Biology		43	50	61
Toxicology ante mortem (excluding BAC)		37	39	47
Toxicology post mortem (excluding BAC)		30	35	38
Trace Evidence		77	87	106

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 19: Backlog Cases as a Percent of Total Cases by Investigative Area

Backlog Cases/Annual Caseload	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		0.33%	0.50%	0.78%
Crime Scene Investigation		0.13%	0.19%	0.25%
Digital evidence - Audio & Video		6.21%	8.33%	10.98%
DNA Casework		5.82%	8.94%	13.28%
DNA Database		16.93%	31.91%	39.92%
Document Examination		12.59%	16.67%	25.29%
Drugs - Controlled Substances		3.08%	4.39%	7.75%
Evidence Screening & Processing		21.65%	33.40%	48.40%
Explosives		14.05%	27.95%	36.48%
Fingerprints		4.22%	7.08%	9.22%
Fire analysis		5.26%	8.38%	11.12%
Firearms and Ballistics		4.77%	9.33%	29.30%
Forensic Pathology		12.83%	13.46%	37.43%
Gun Shot Residue (GSR)		3.80%	5.29%	6.82%
Marks and Impressions		23.95%	41.52%	48.61%
Serology/Biology		3.98%	8.04%	11.81%
Toxicology ante mortem (excluding BAC)		2.89%	5.42%	7.23%
Toxicology post mortem (excluding BAC)		5.72%	8.54%	14.44%
Trace Evidence		18.75%	23.81%	30.54%

Time in Casework

The next table presents the percentage of time that is dedicated to casework. Alternatives to time spent in casework include testimony (including preparation and wait time), research & development activities, teaching to the profession, teaching for customers, taking continuing education/training sessions, participating in international and/or interagency cooperative efforts, and developing materials for publication.

Percentage of Time in Casework

Table 20: Percentage of Time in Casework by Investigative Area

Percent time in Casework	Laboratory	25th Percentile	Median	75th Percentile
Blood Alcohol		71.84%	78.45%	86.68%
Crime Scene Investigation		48.68%	73.18%	78.69%
Digital evidence - Audio & Video		37.74%	62.38%	83.52%
DNA Casework		73.43%	81.17%	86.26%
DNA Database		67.69%	80.61%	84.44%
Document Examination		72.75%	78.85%	90.33%
Drugs - Controlled Substances		72.12%	80.47%	88.66%
Evidence Screening & Processing		70.50%	73.58%	87.11%
Explosives		77.18%	80.12%	83.30%
Fingerprints		70.72%	76.90%	86.18%
Fire analysis		73.58%	80.10%	86.45%
Firearms and Ballistics		46.40%	60.10%	68.51%
Forensic Pathology		77.59%	78.91%	79.38%
Gun Shot Residue (GSR)		75.30%	81.10%	92.65%
Marks and Impressions		68.11%	78.18%	87.46%
Serology/Biology		73.55%	78.70%	84.60%
Toxicology ante mortem (excluding BAC)		73.18%	78.49%	83.68%
Toxicology post mortem (excluding BAC)		72.09%	79.35%	87.53%
Trace Evidence		73.24%	79.11%	90.16%

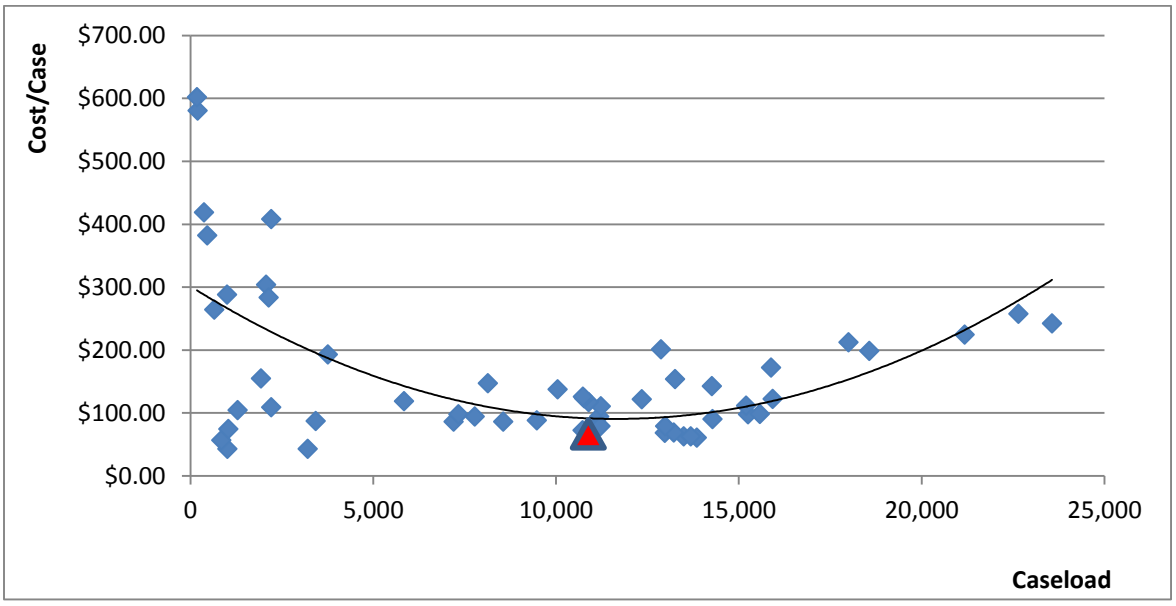
Efficiency and Cost Effectiveness of Forensic Science Services—FORESIGHT 2012-2013 Benchmark Data

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 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.

In addition to this cross–sectional comparison, average cost and productivity are illustrated for all past FORESIGHT submissions. The term "real" indicates that costs have been adjusted for inflation and converted to the most recent year's price index.

Blood Alcohol Analysis



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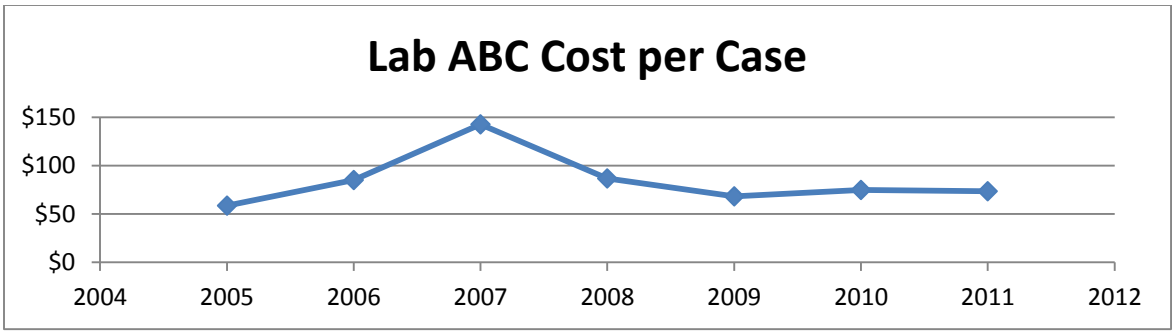
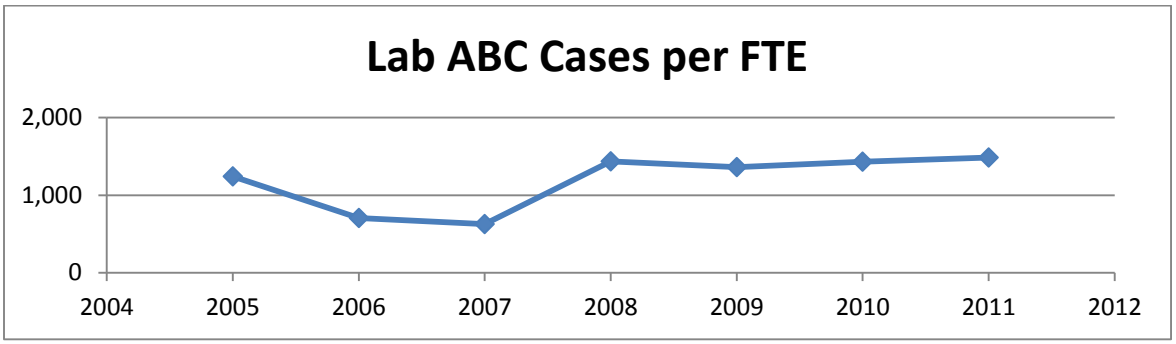
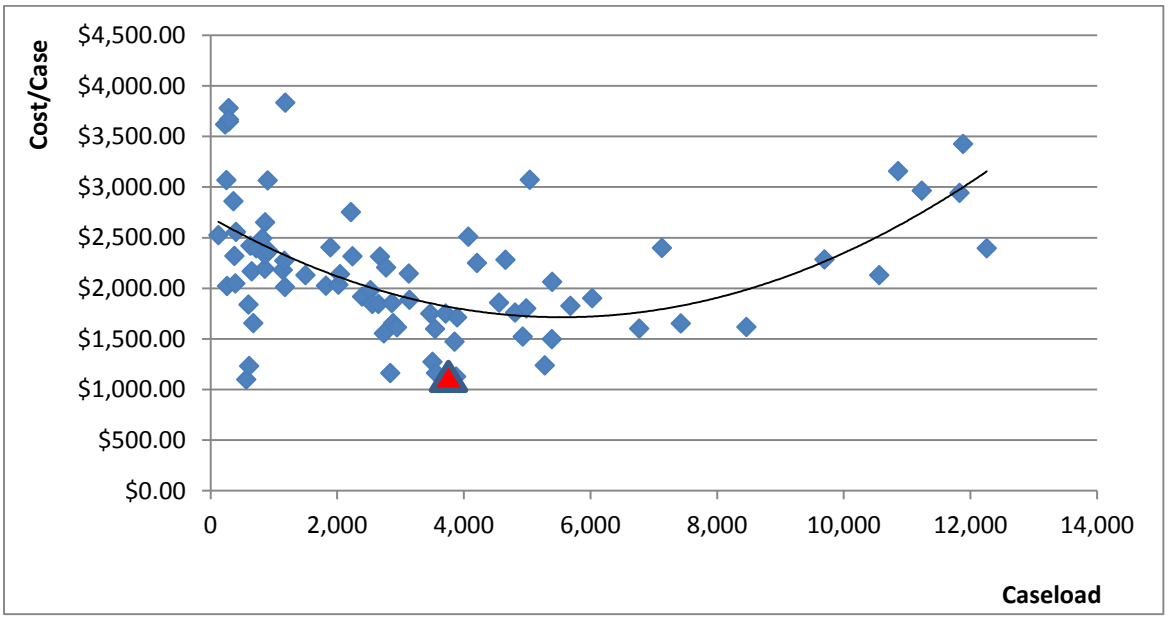




DNA Casework Analysis



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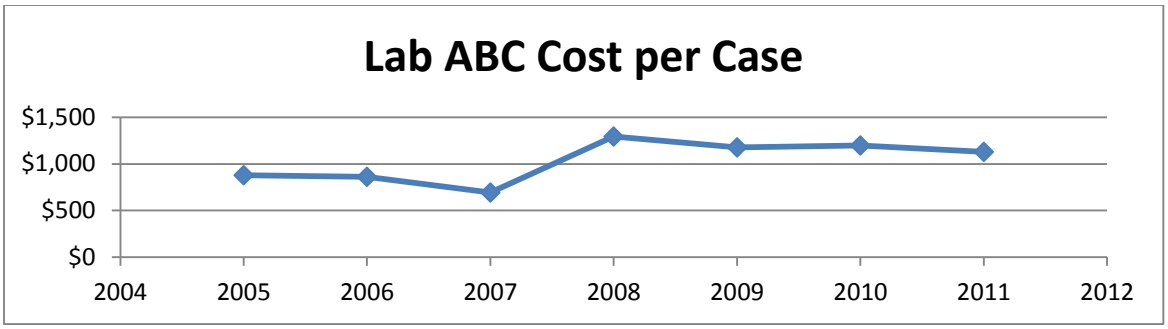
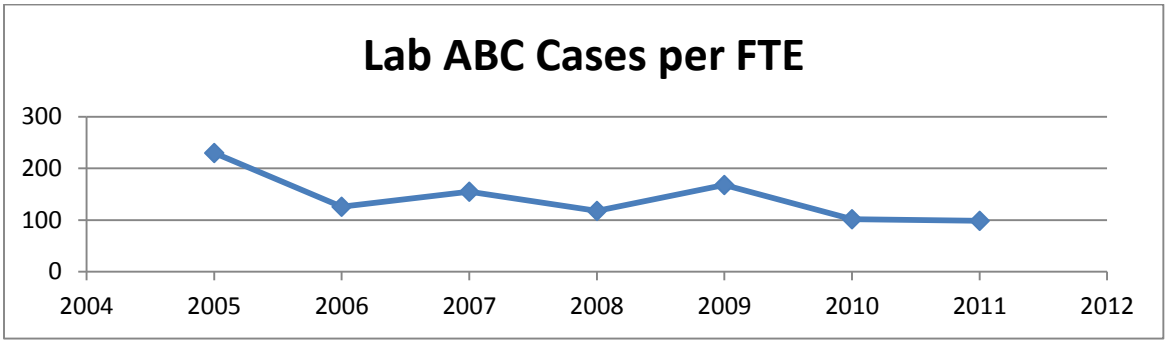
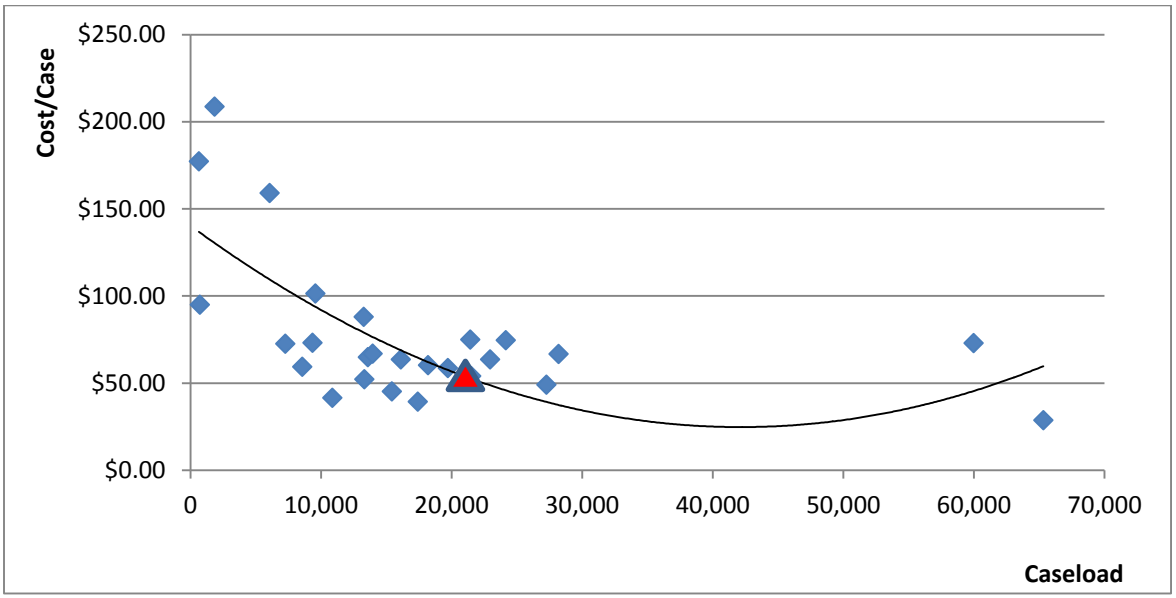

Lab ABC Cost per Case
$1,500
$1,000
$500
$0
2004
2005
2006
2007
2008
2009
2010
2011
2012


Lab ABC Cases per FTE
300
200
100
0
2004
2005
2006
2007
2008
2009
2010
2011
2012

DNA Database



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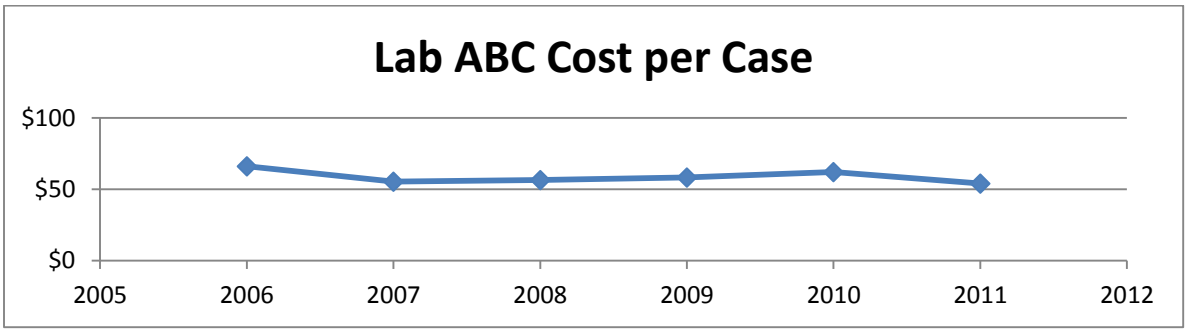
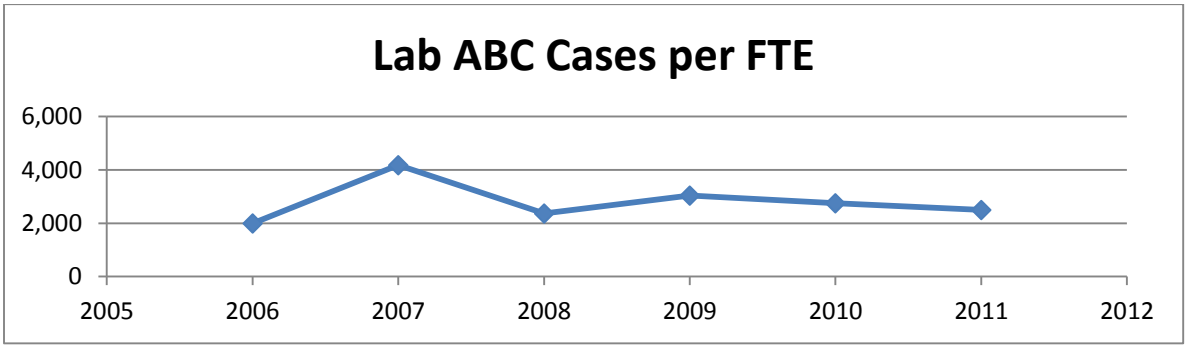
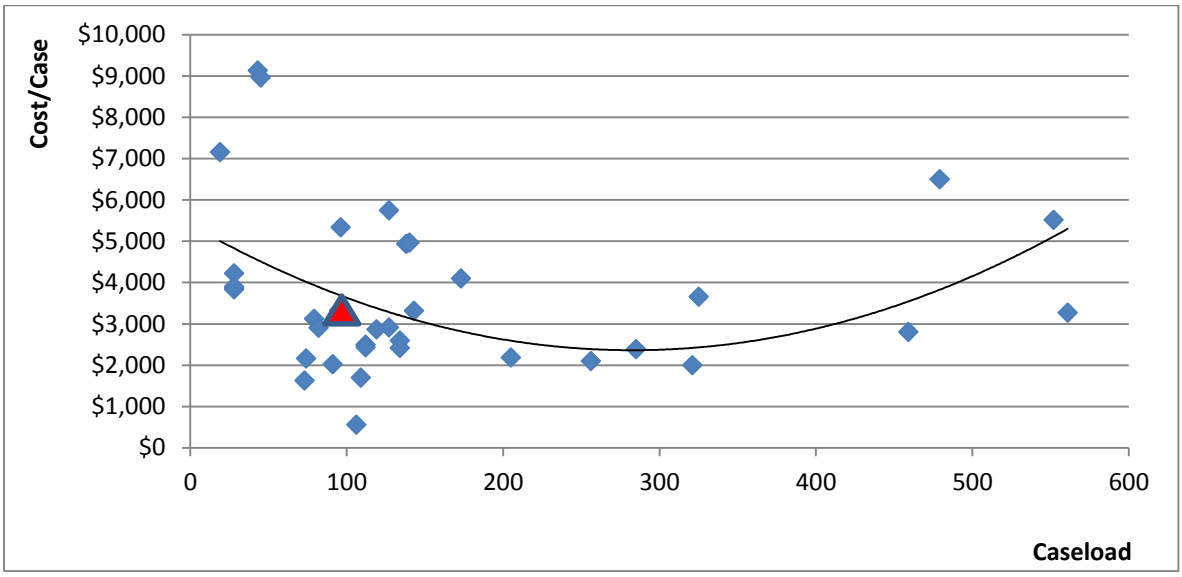




Document Examination



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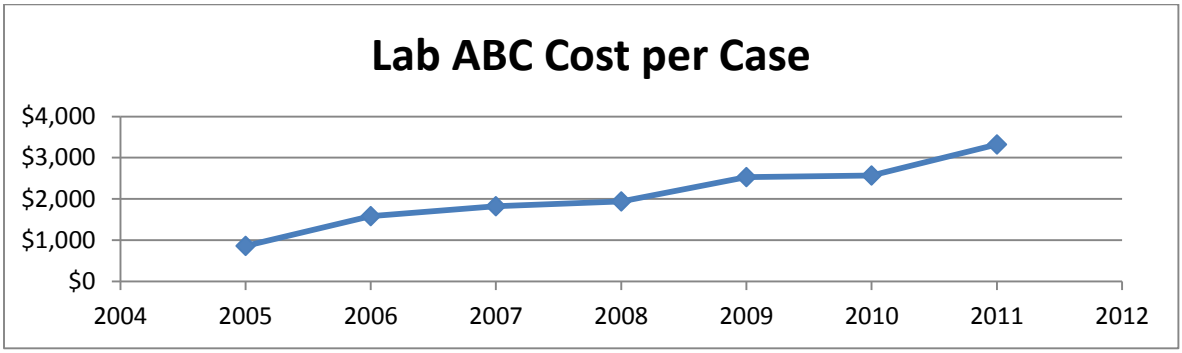
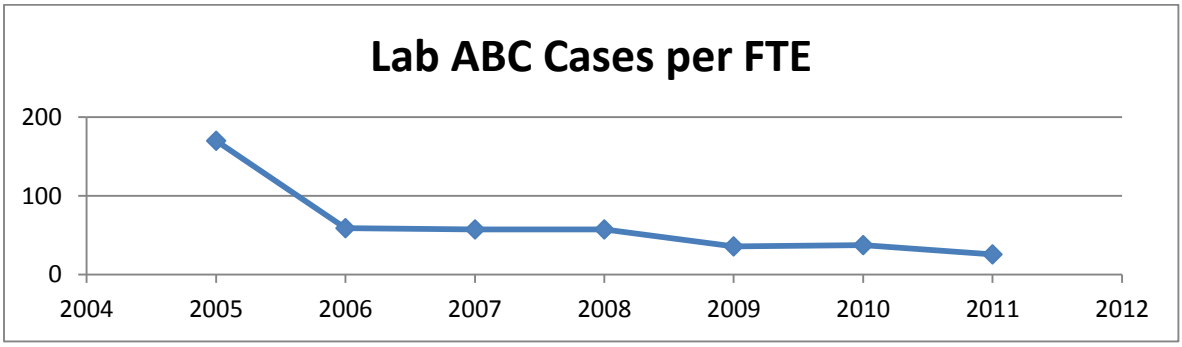
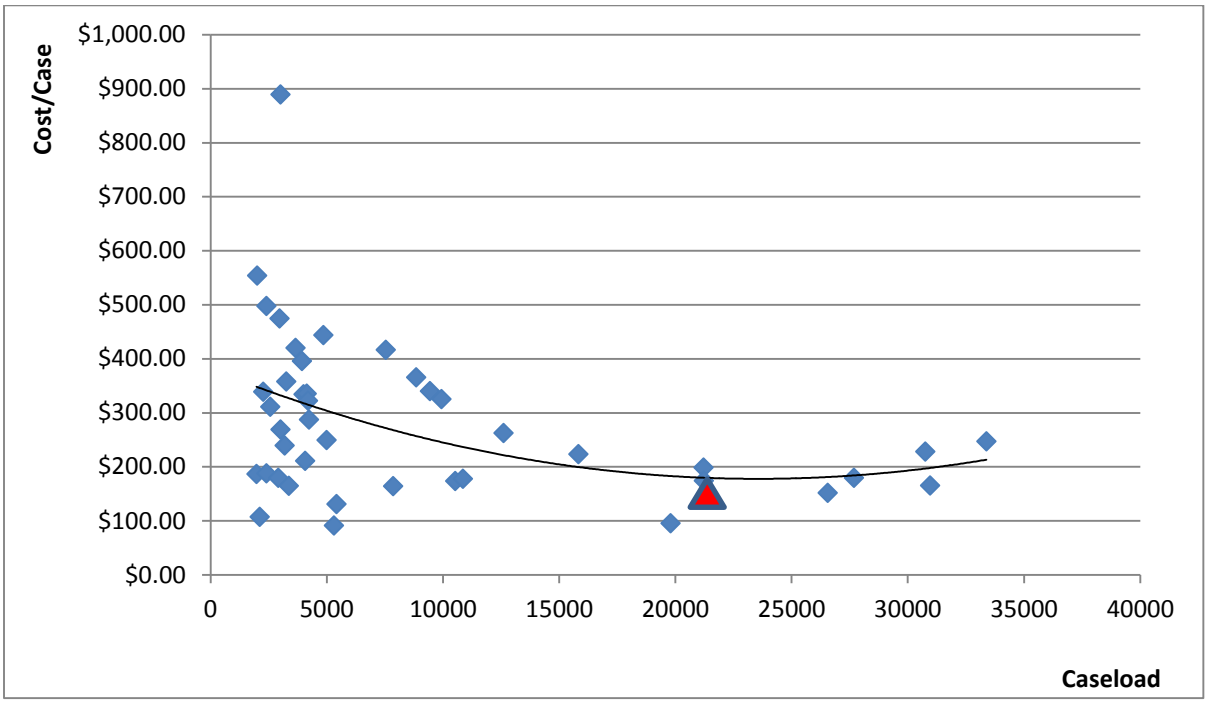




Drugs—Controlled Substance Analysis



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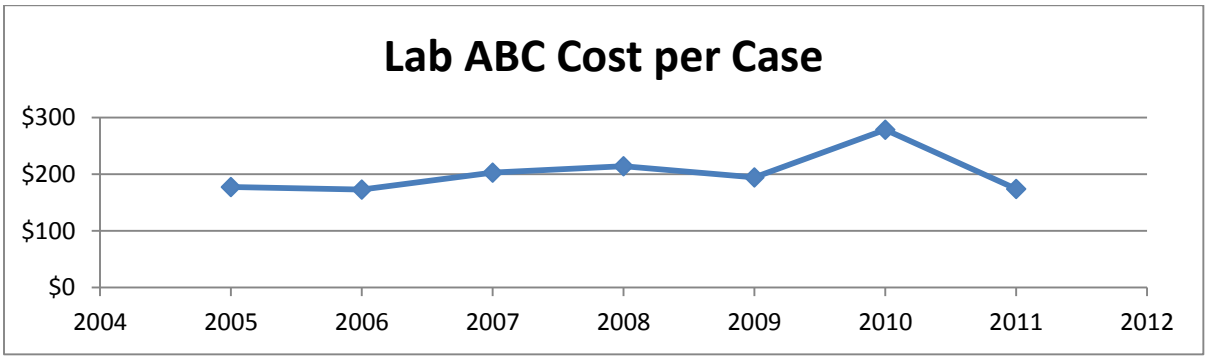
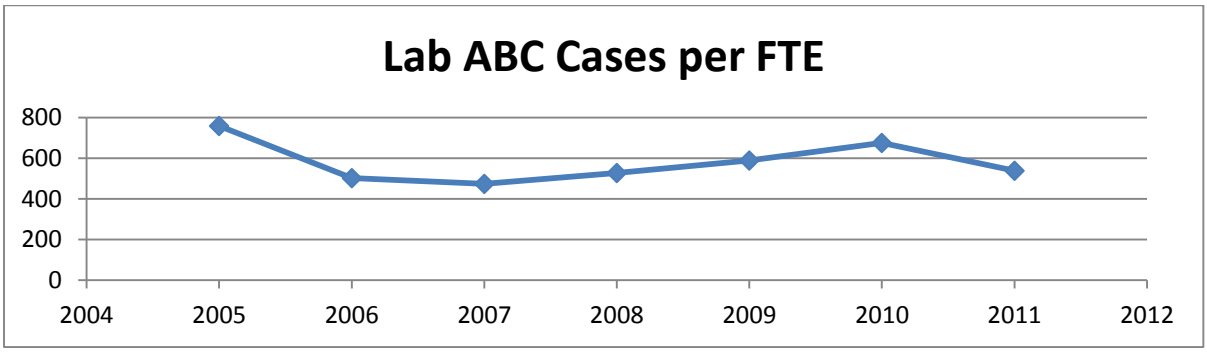
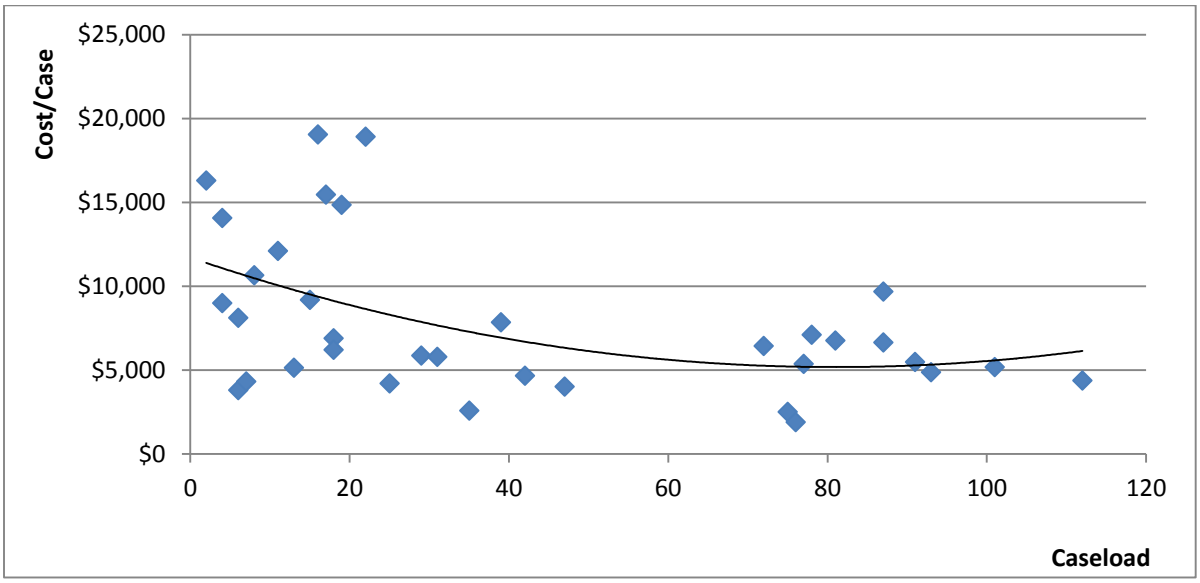




Explosives Analysis



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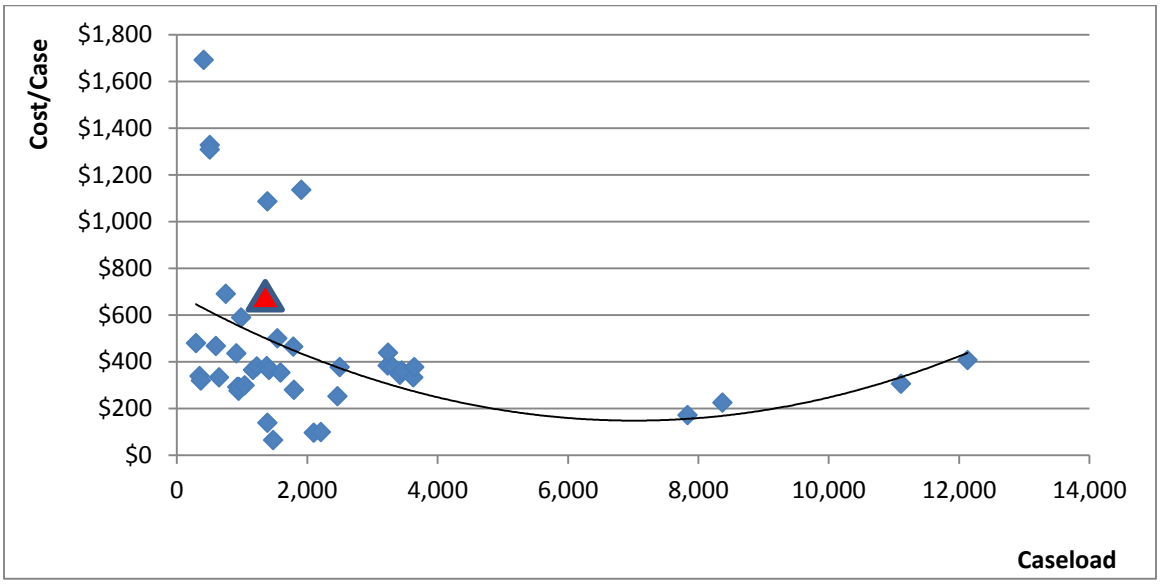

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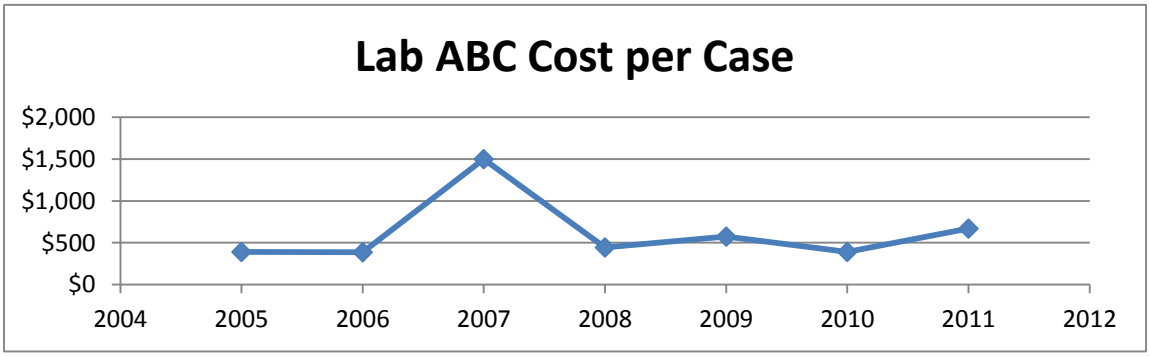
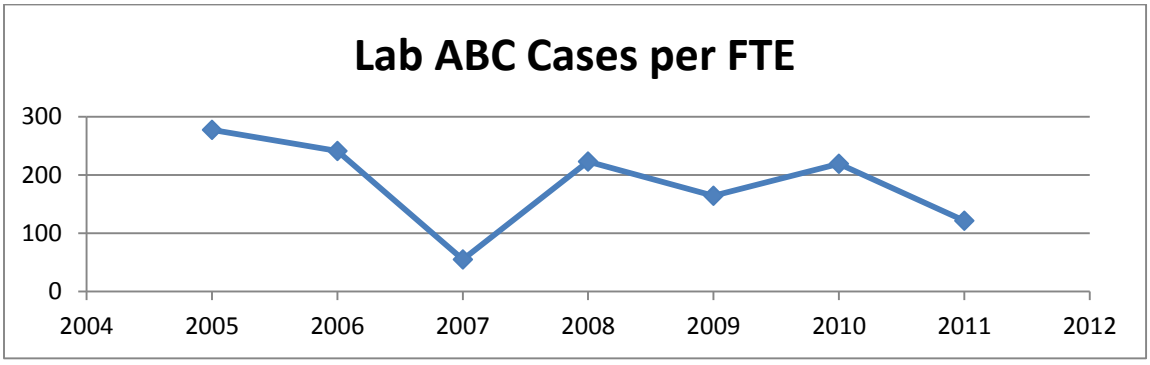
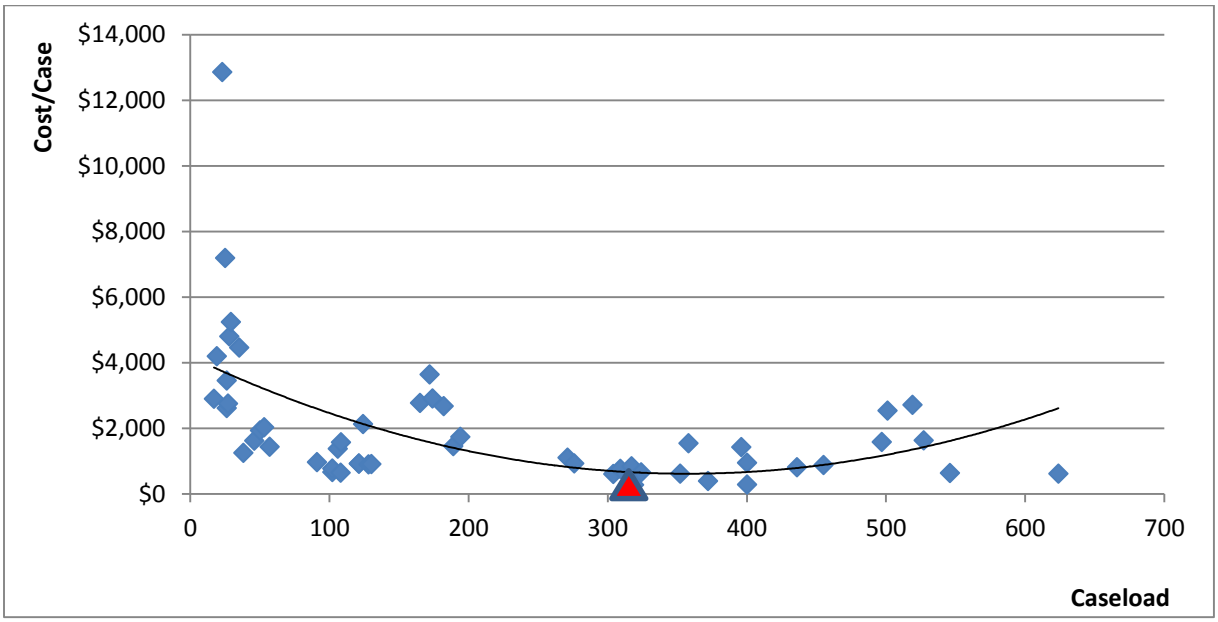




Fire Analysis



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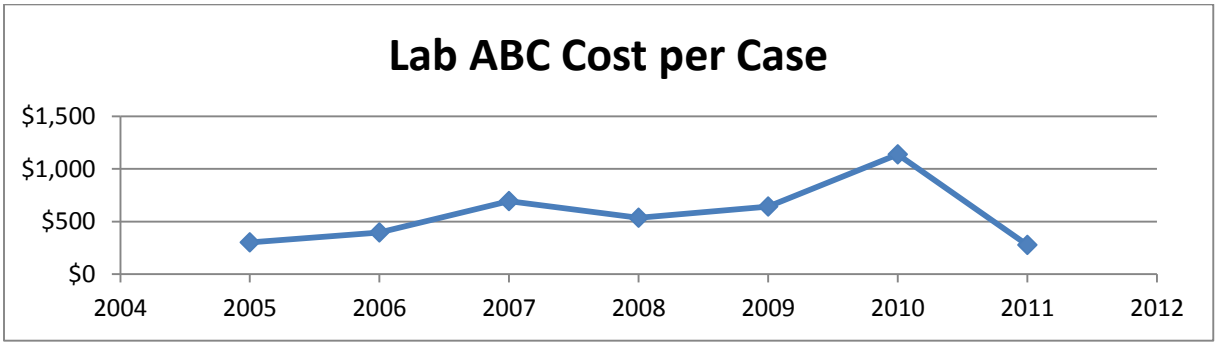
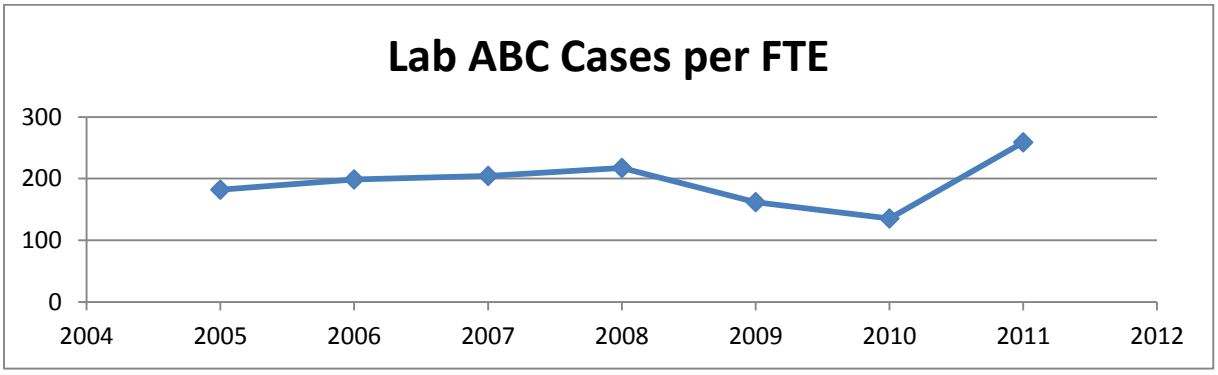
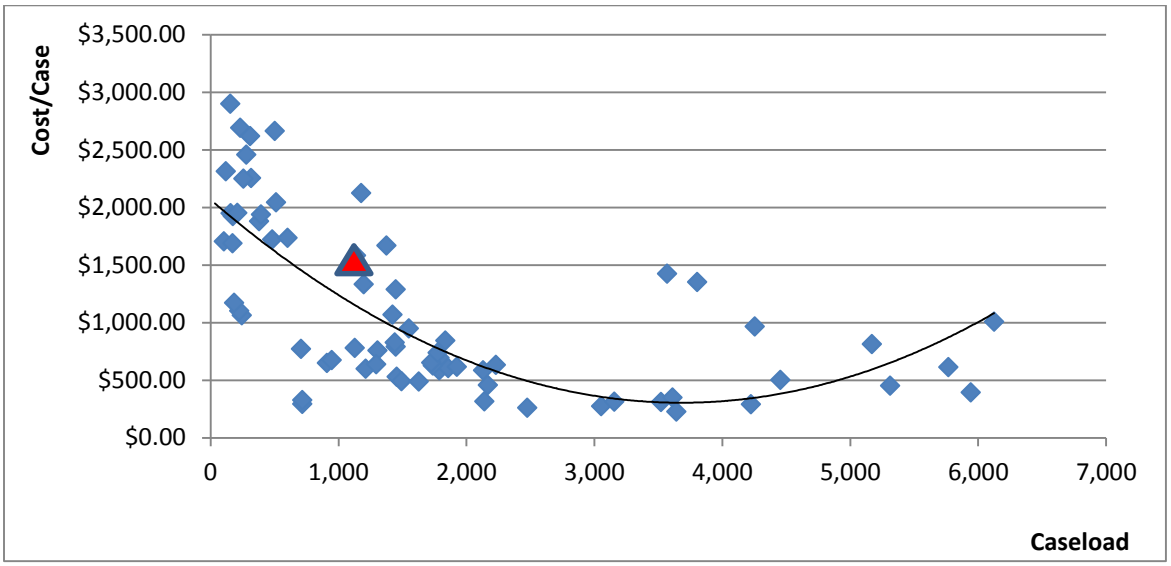




Firearms & Ballistics Analysis



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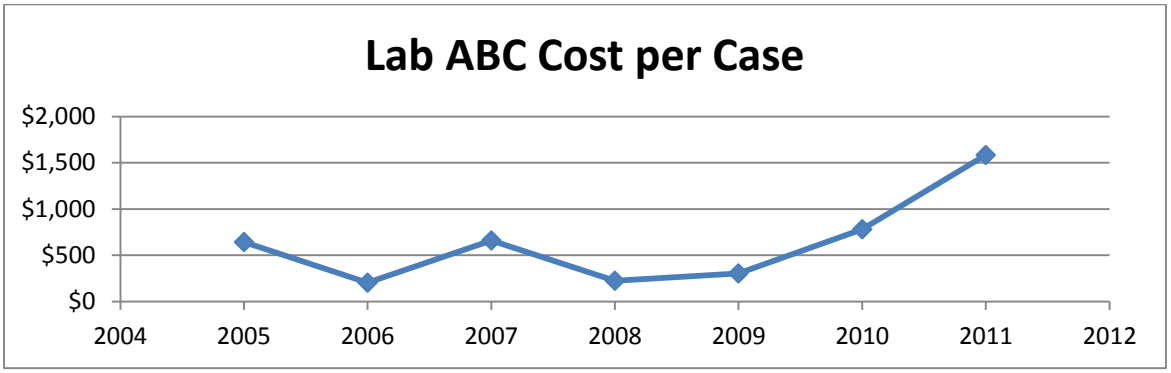
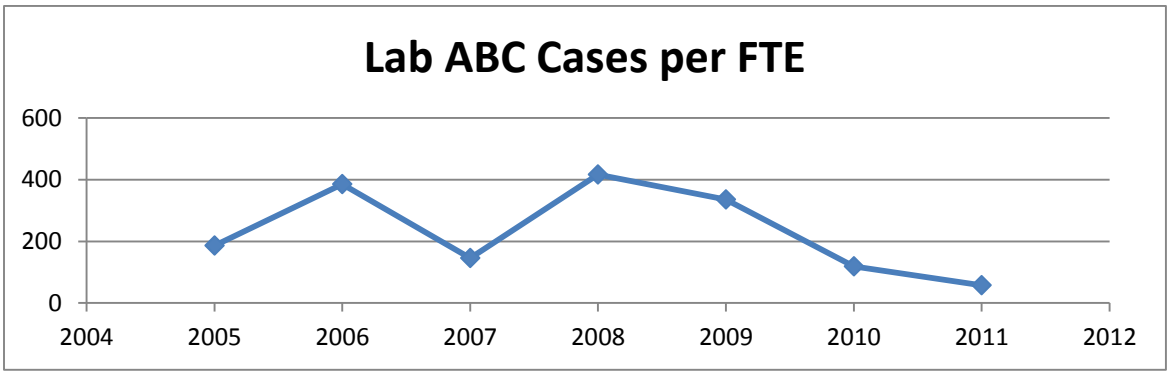
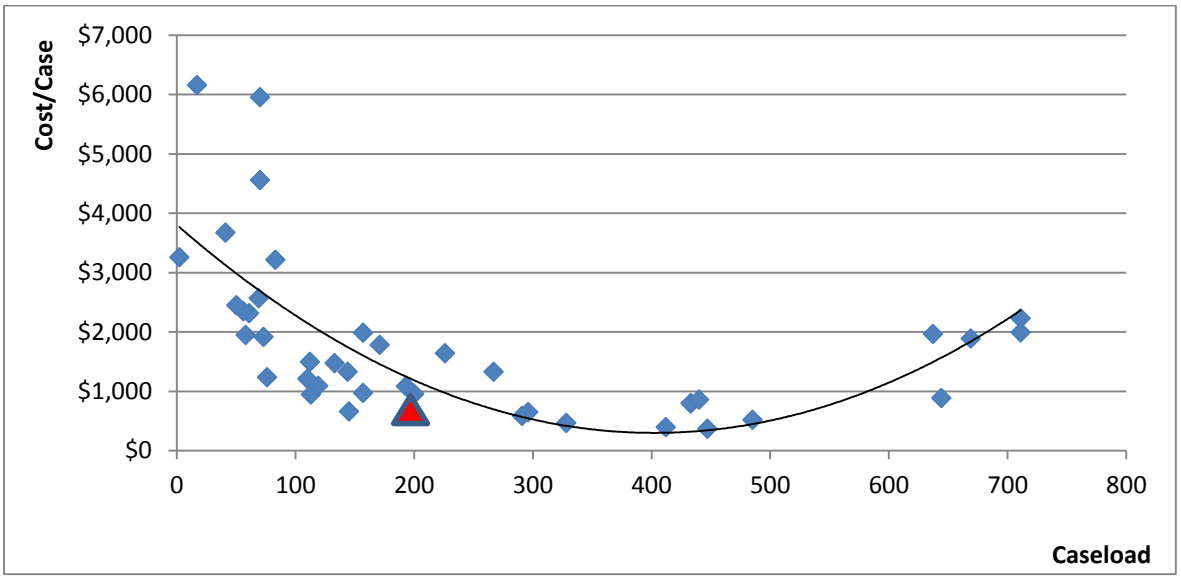




Gun Shot Residue Analysis



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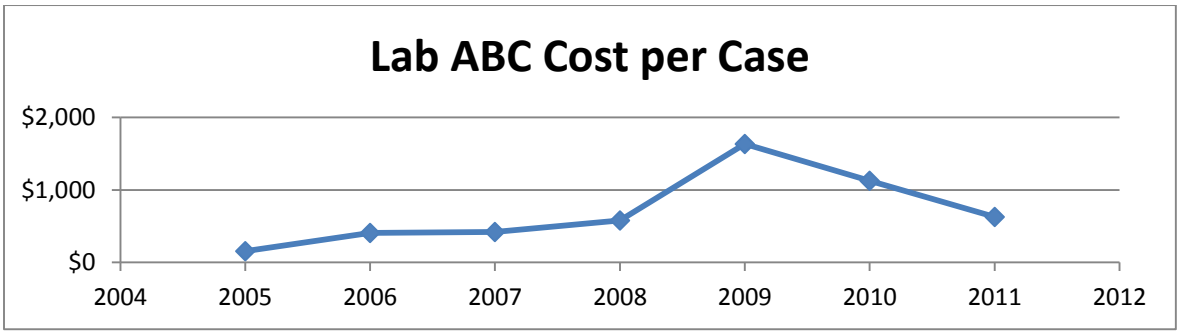
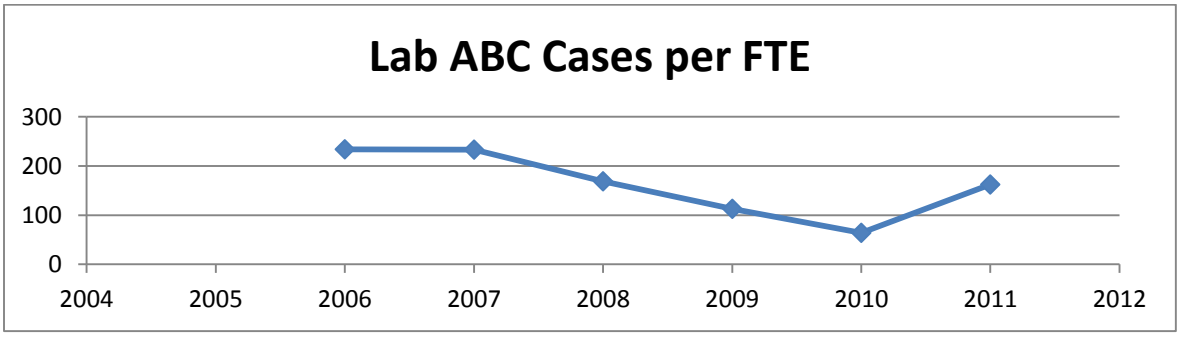
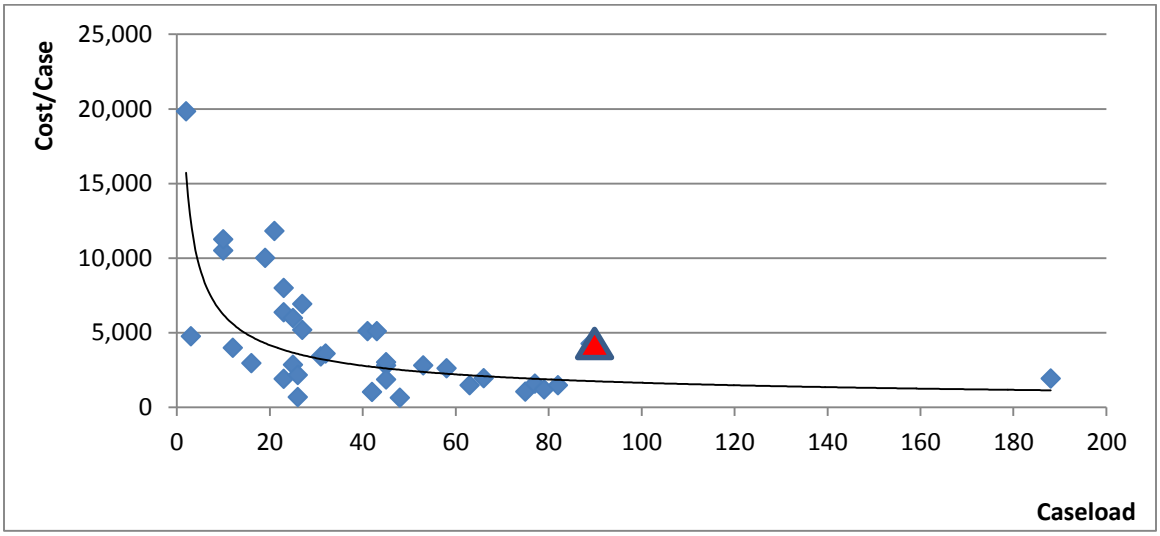




Marks & Impressions Analysis



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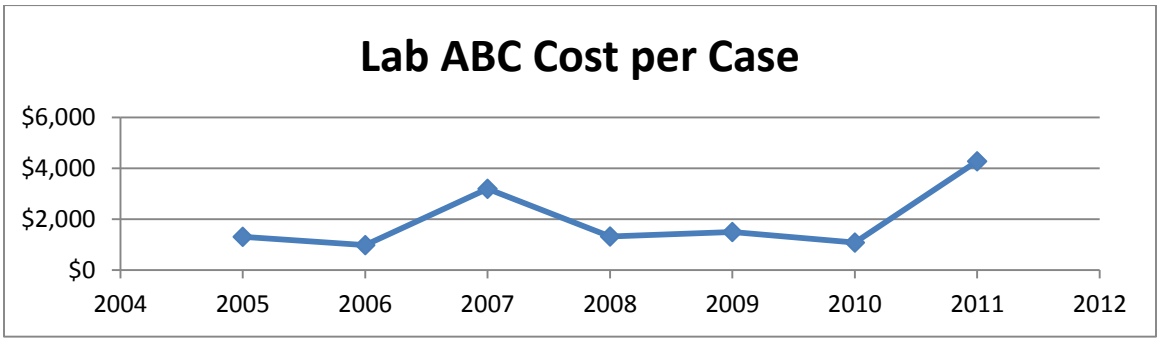
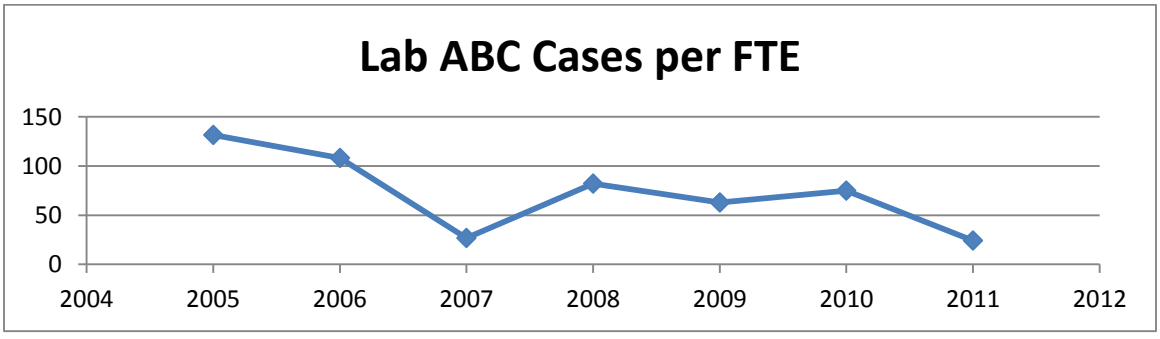
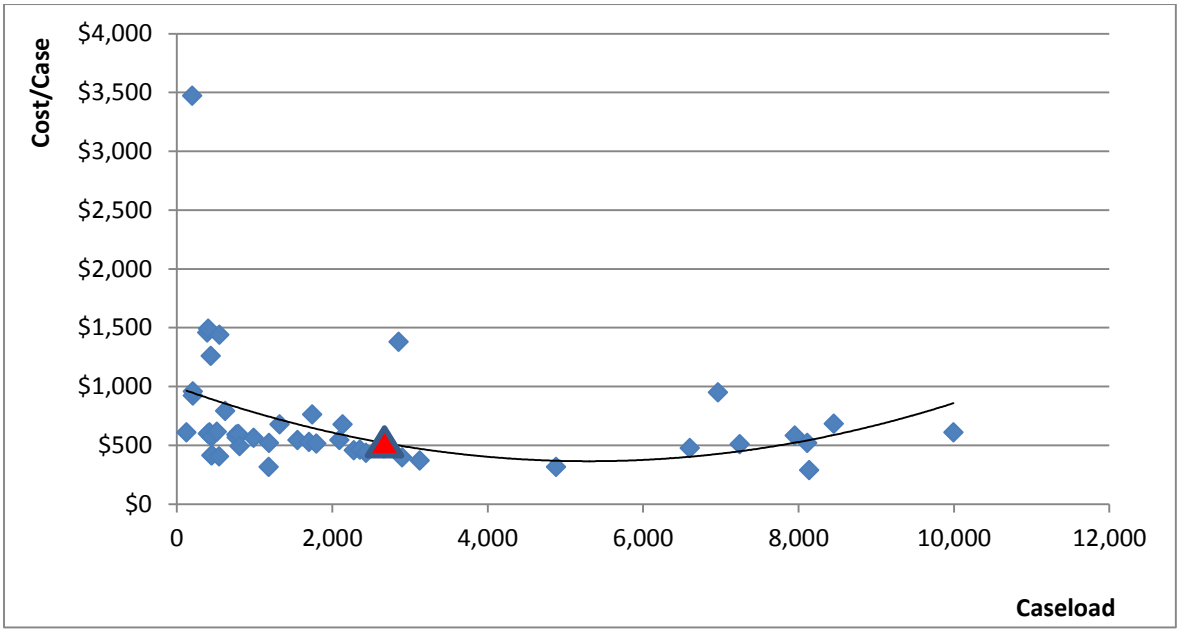
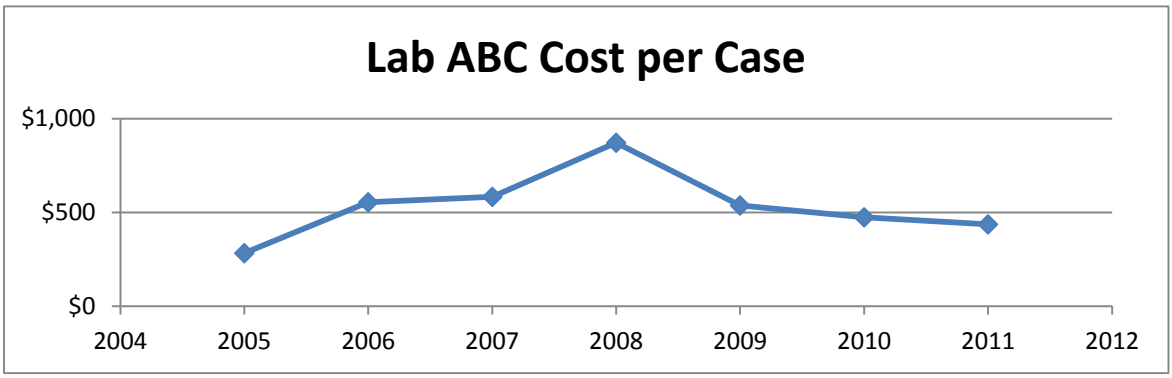


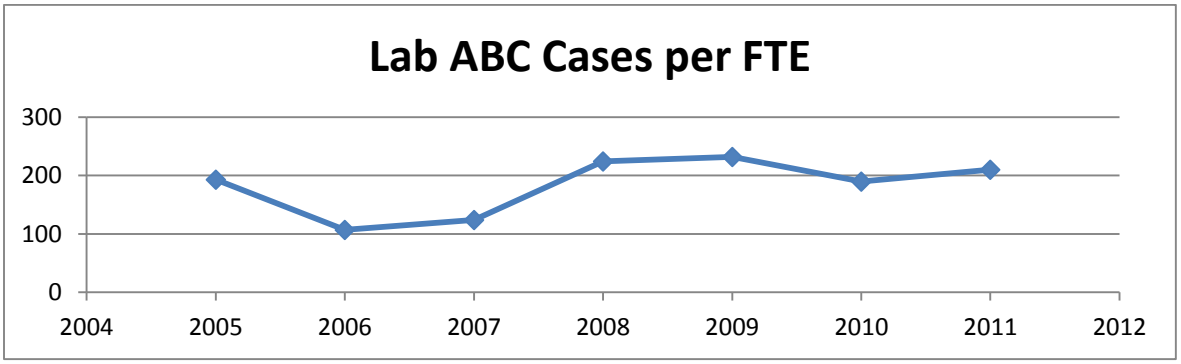


Serology/Biology

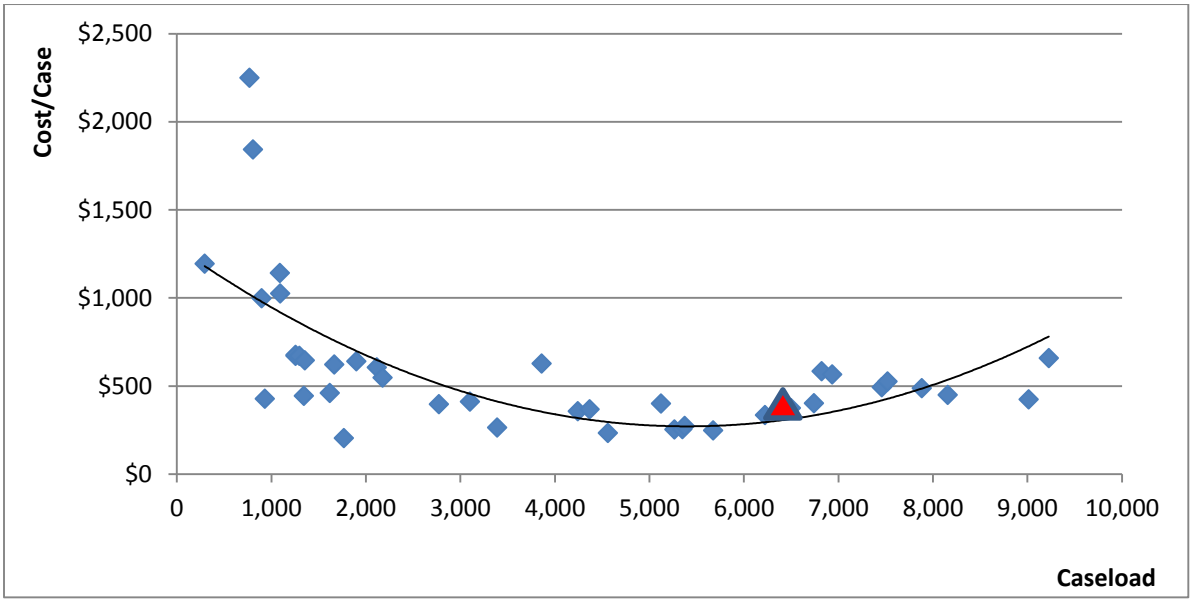


Foresight Project 2011-2012, West Virginia University, Morgantown, WV, USA

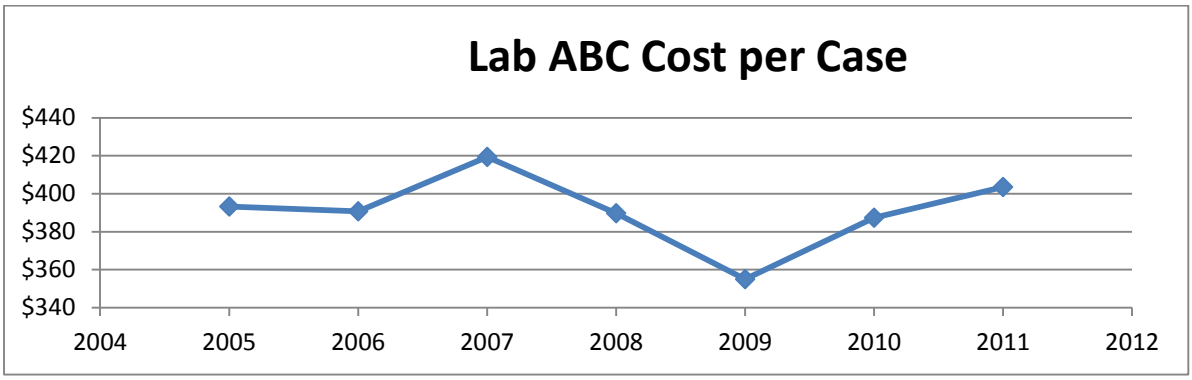


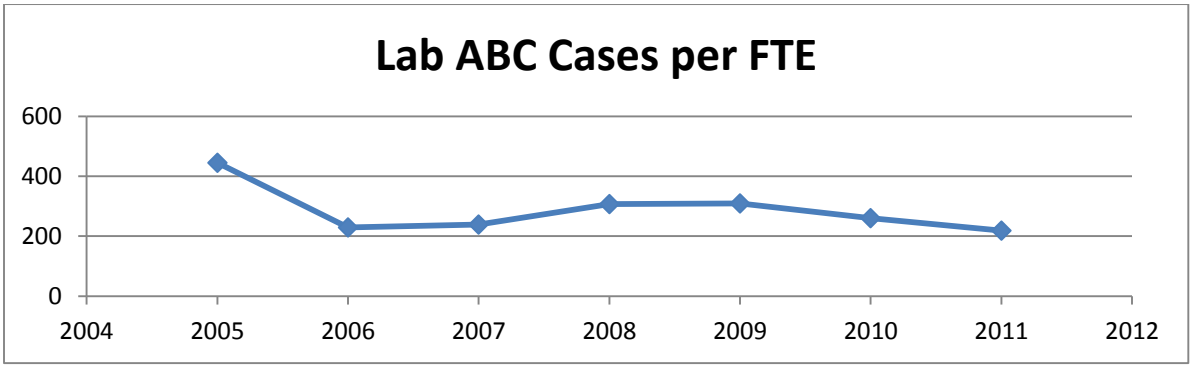


Toxicology Analysis ante mortem

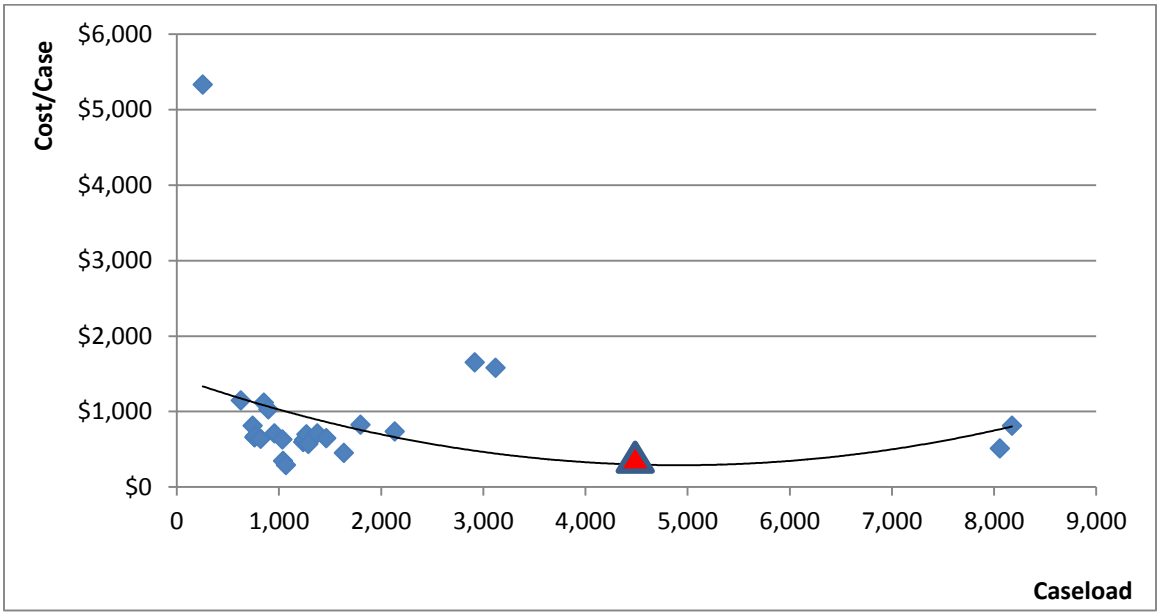


Foresight Project 2011-2012, West Virginia University, Morgantown, WV, USA

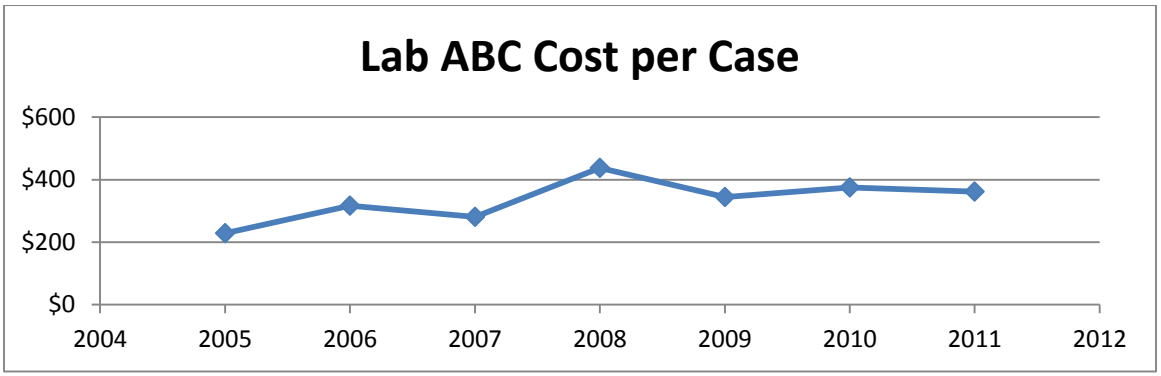


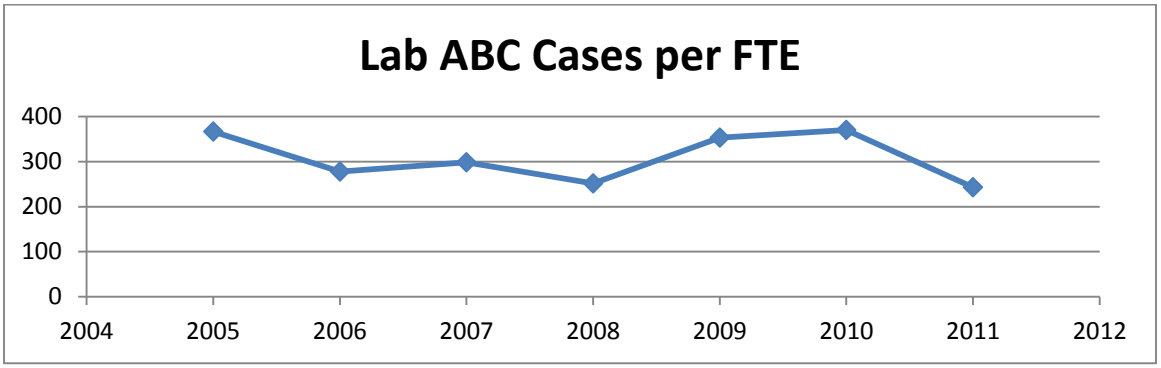


Toxicology Analysis post mortem

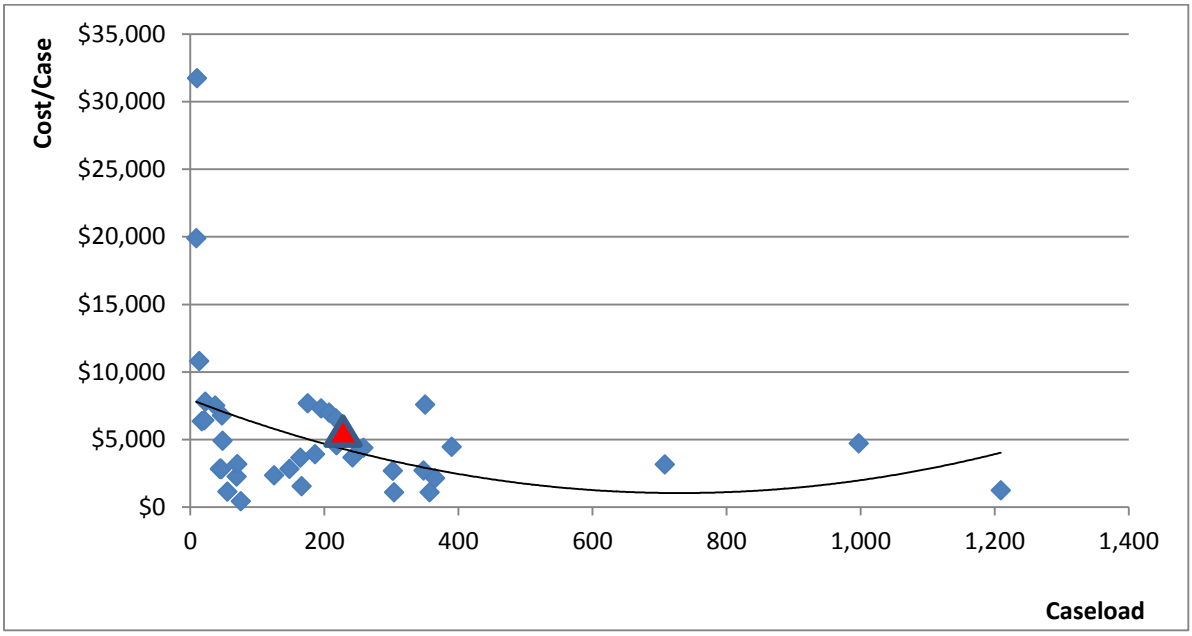


Foresight Project 2011-2012, West Virginia University, Morgantown, WV, USA

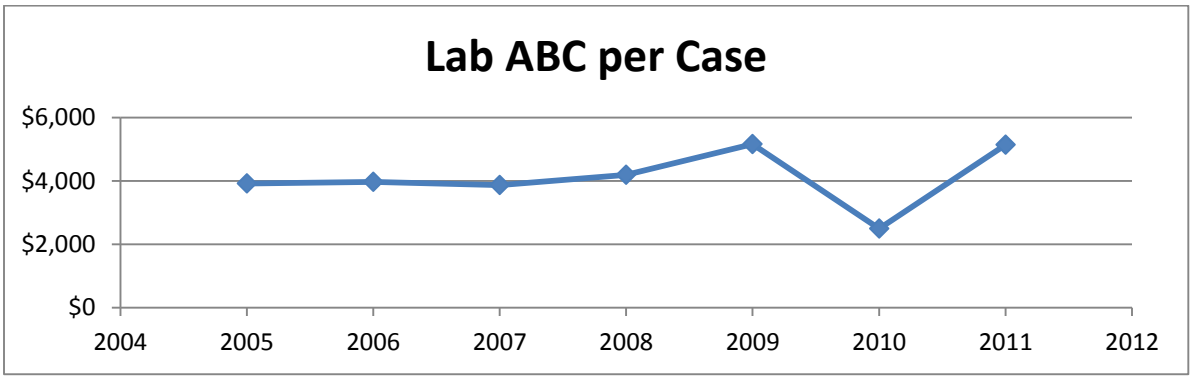


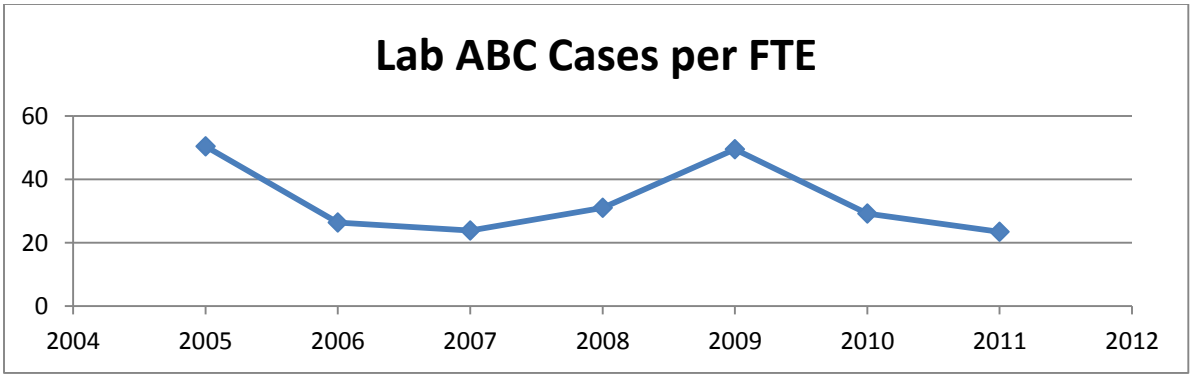


Trace Evidence Analysis



Foresight Project 2011-2012, West Virginia University, Morgantown, WV, USA





For more detail on Project FORESIGHT and its output see:

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 public's 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, 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.

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.