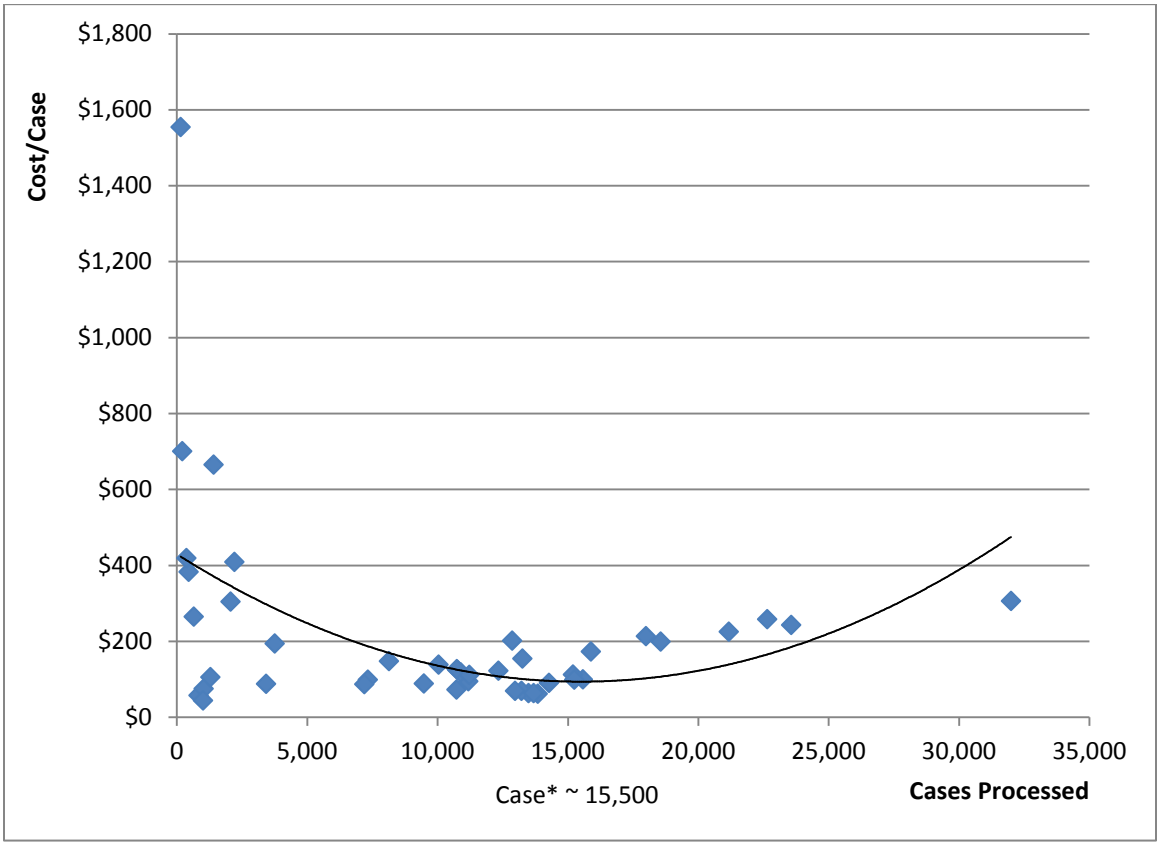
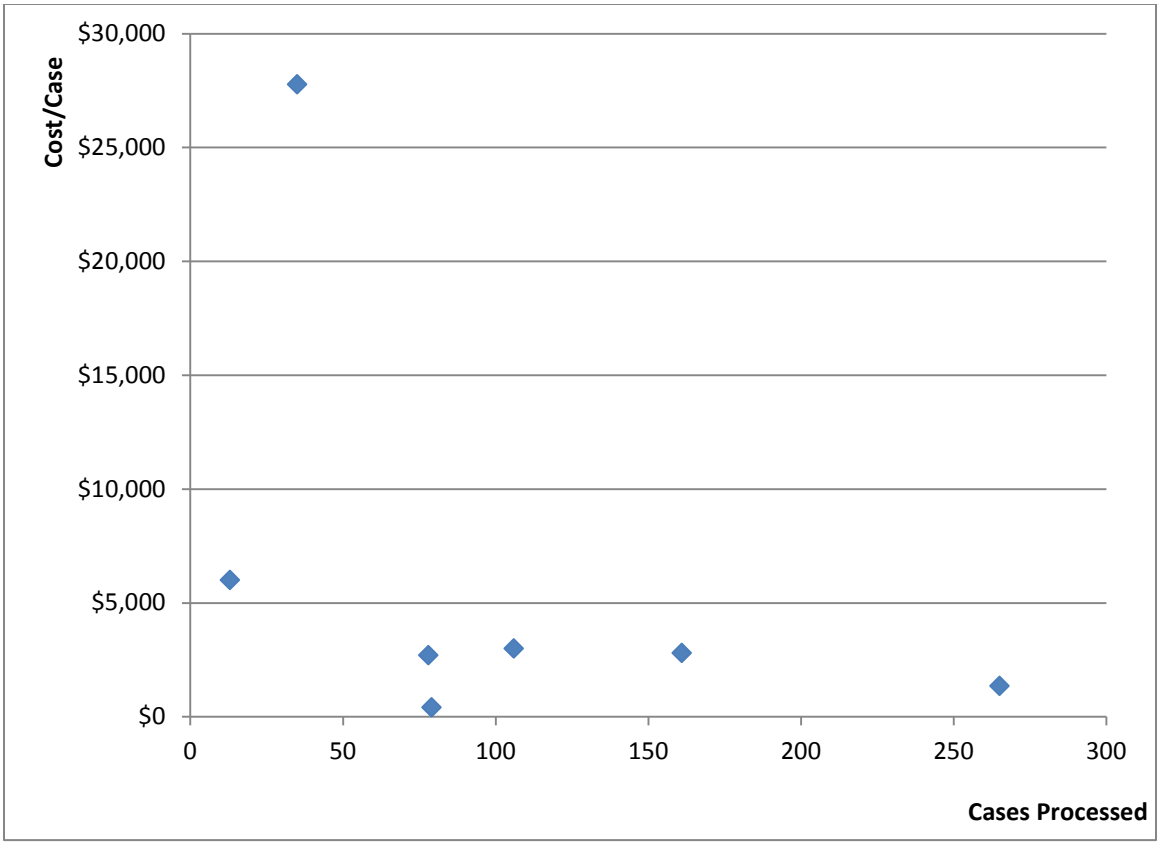
Efficiency and Cost Effectiveness of Forensic Science Services
FORESIGHT 2010-2011 Benchmark Data

Blood Alcohol Analysis



Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

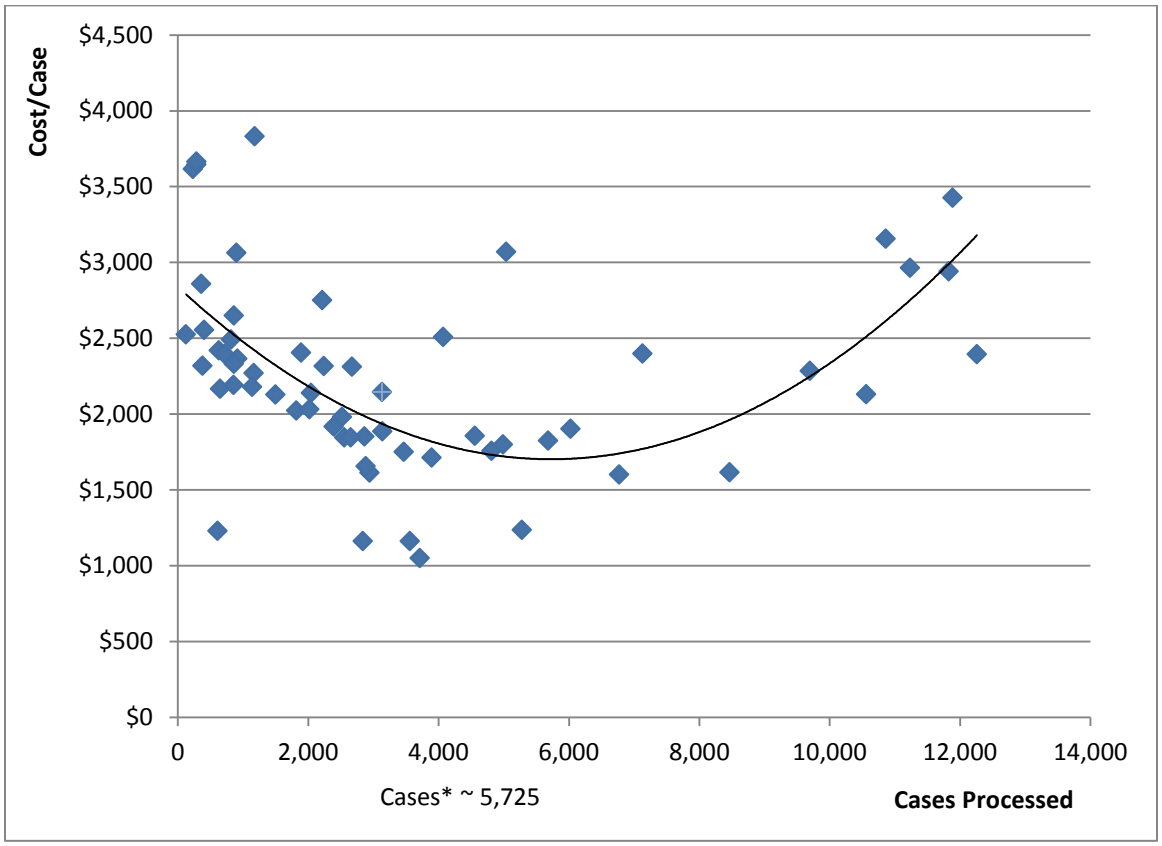
Digital Evidence Analysis - Computer, Audio & Video



Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

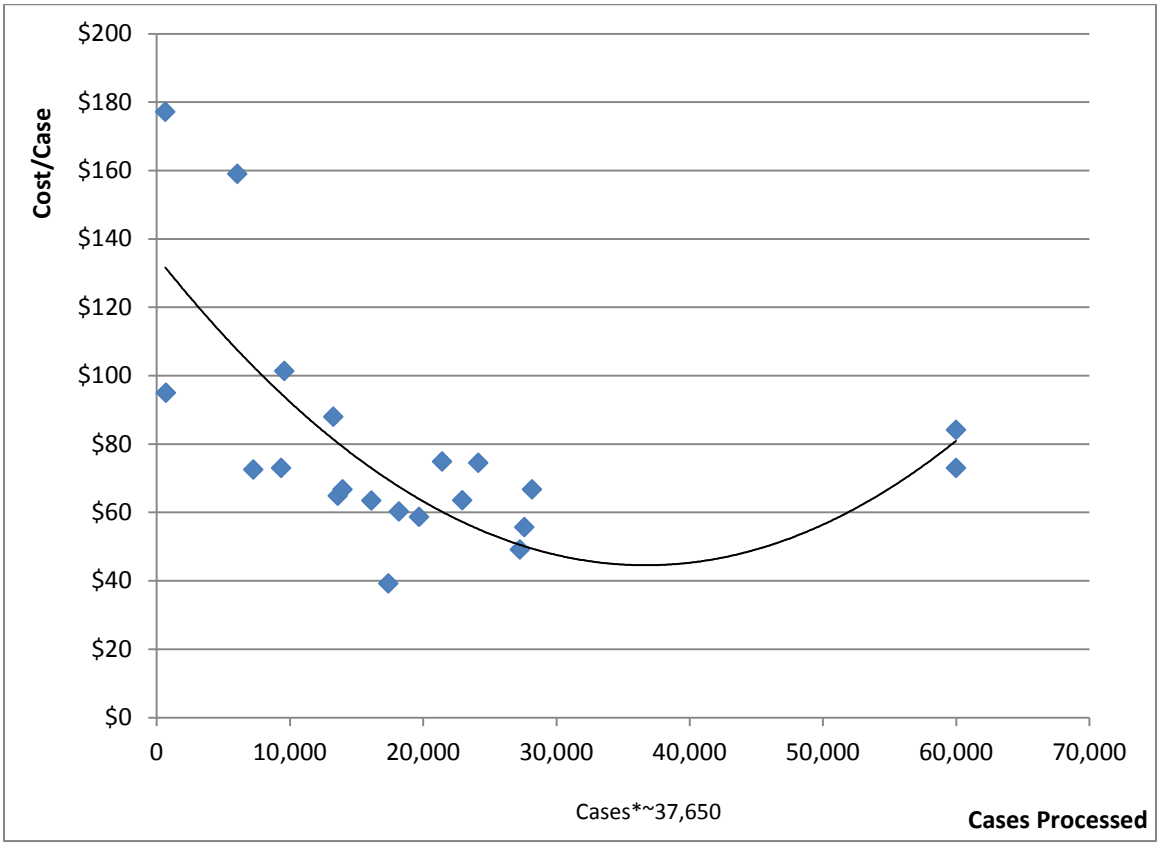
Sample size is too small to estimate the average total cost curve.

DNA Casework Analysis



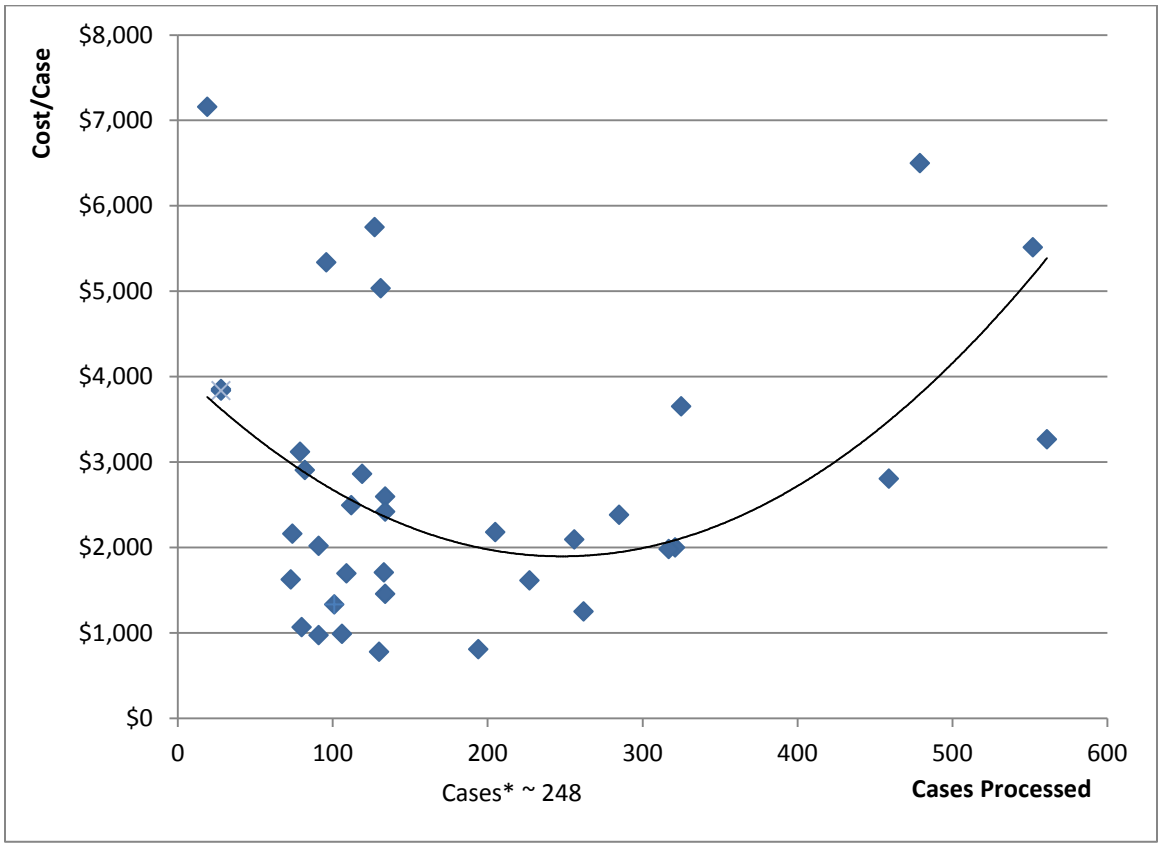
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

DNA Database Analysis



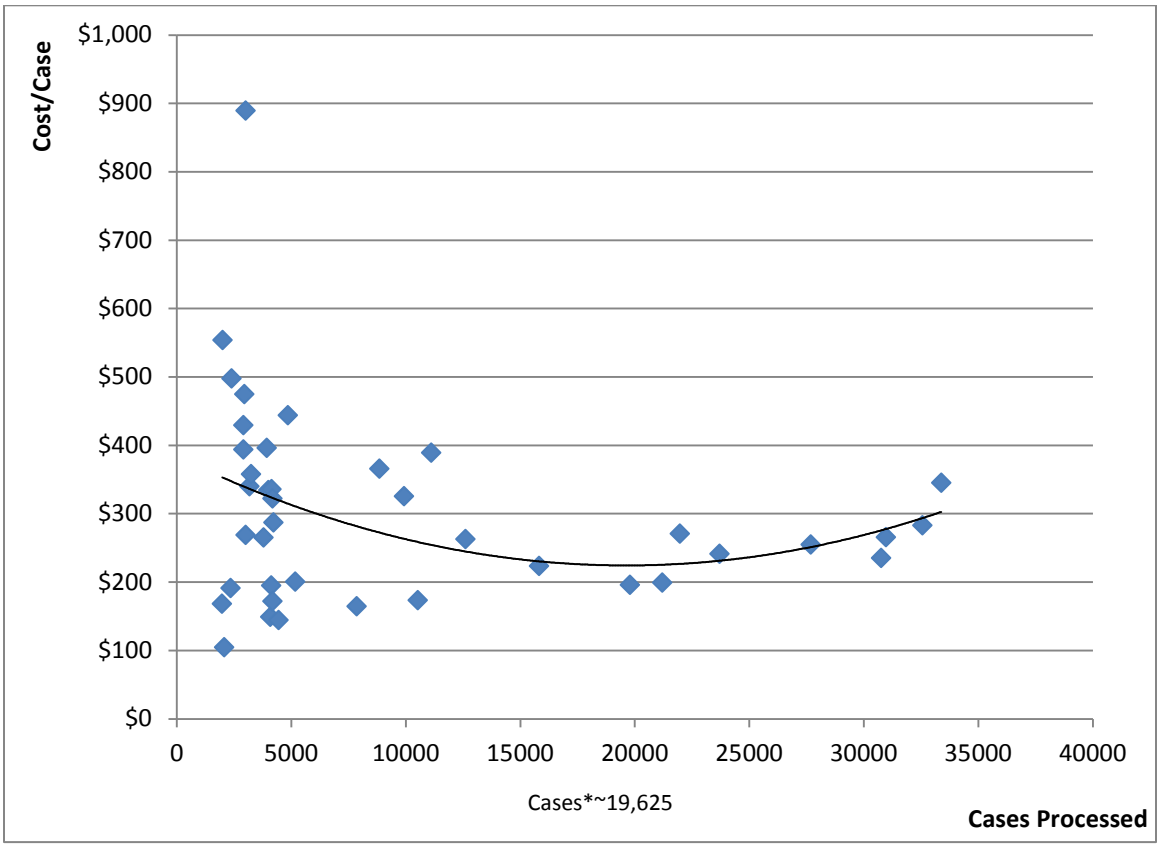
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Document Examination



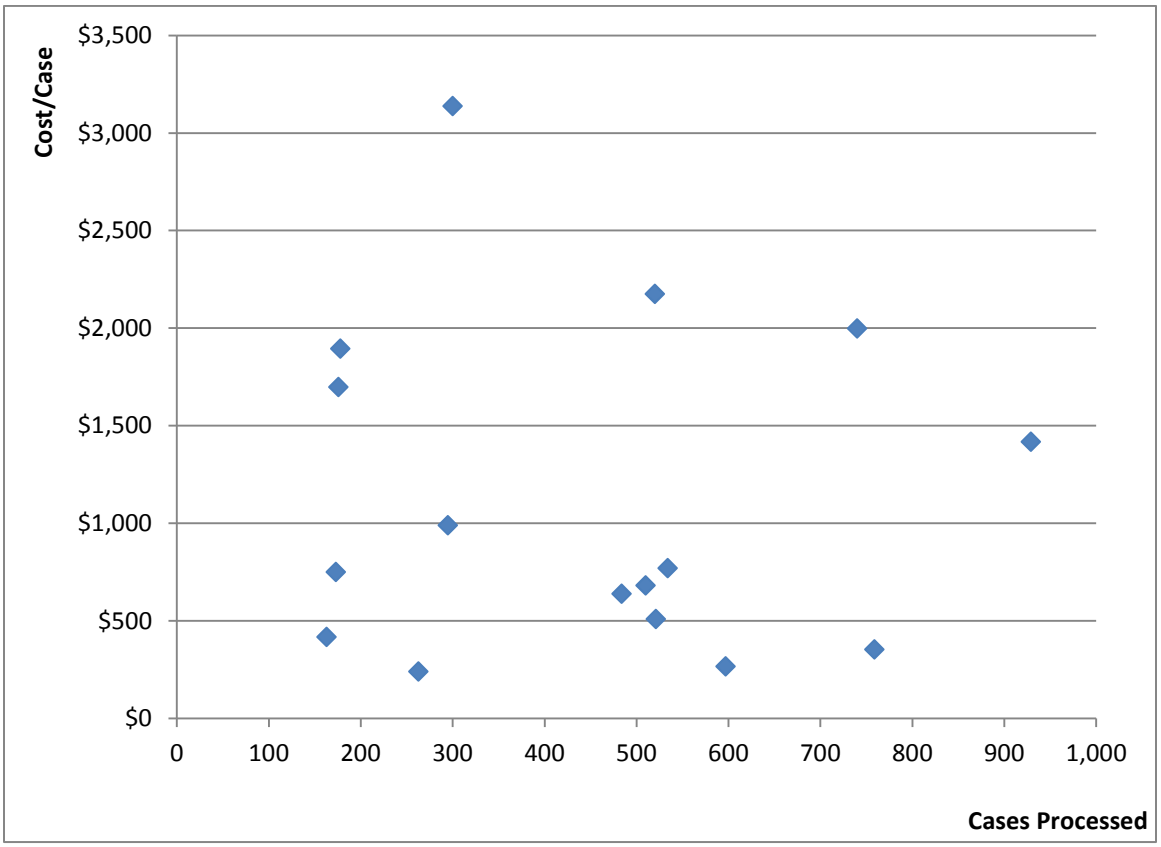
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Drugs – Controlled Substances Analysis



Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

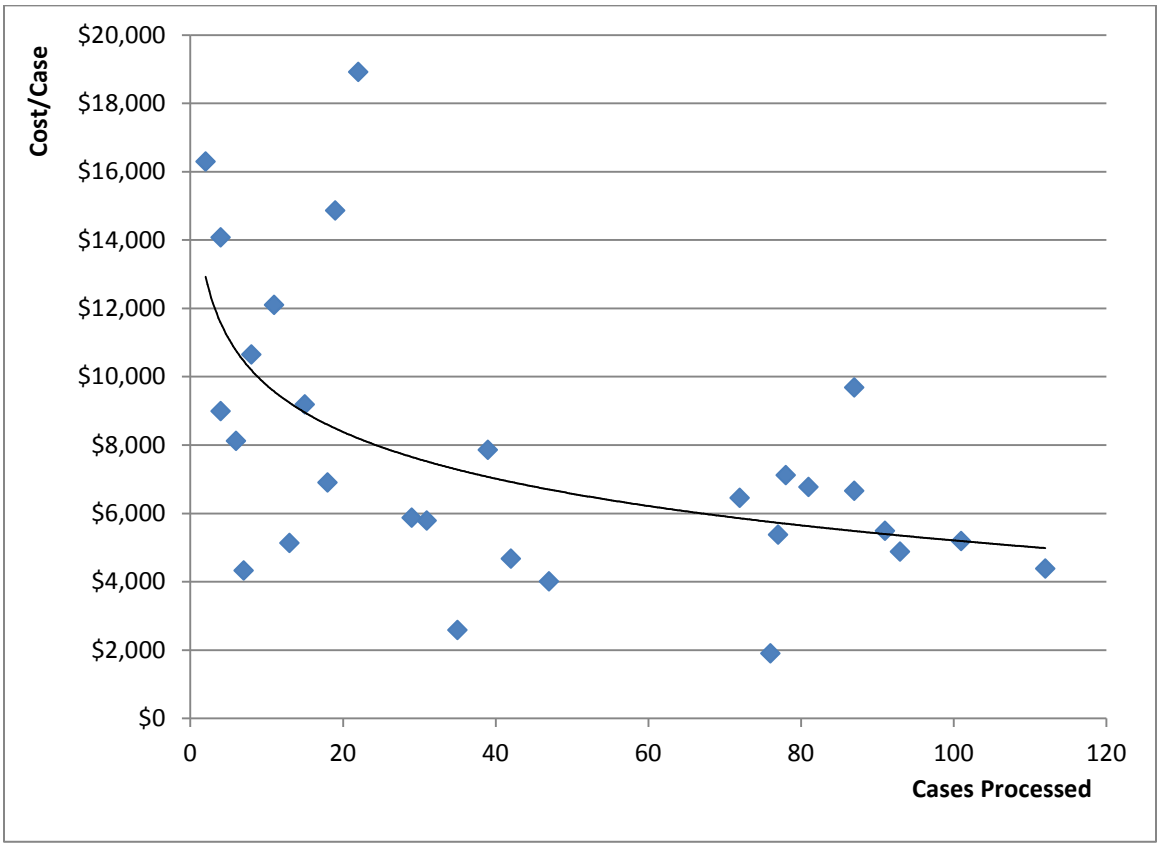
Evidence Screening & Processing



Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Sample size is too small to estimate the average total cost curve.

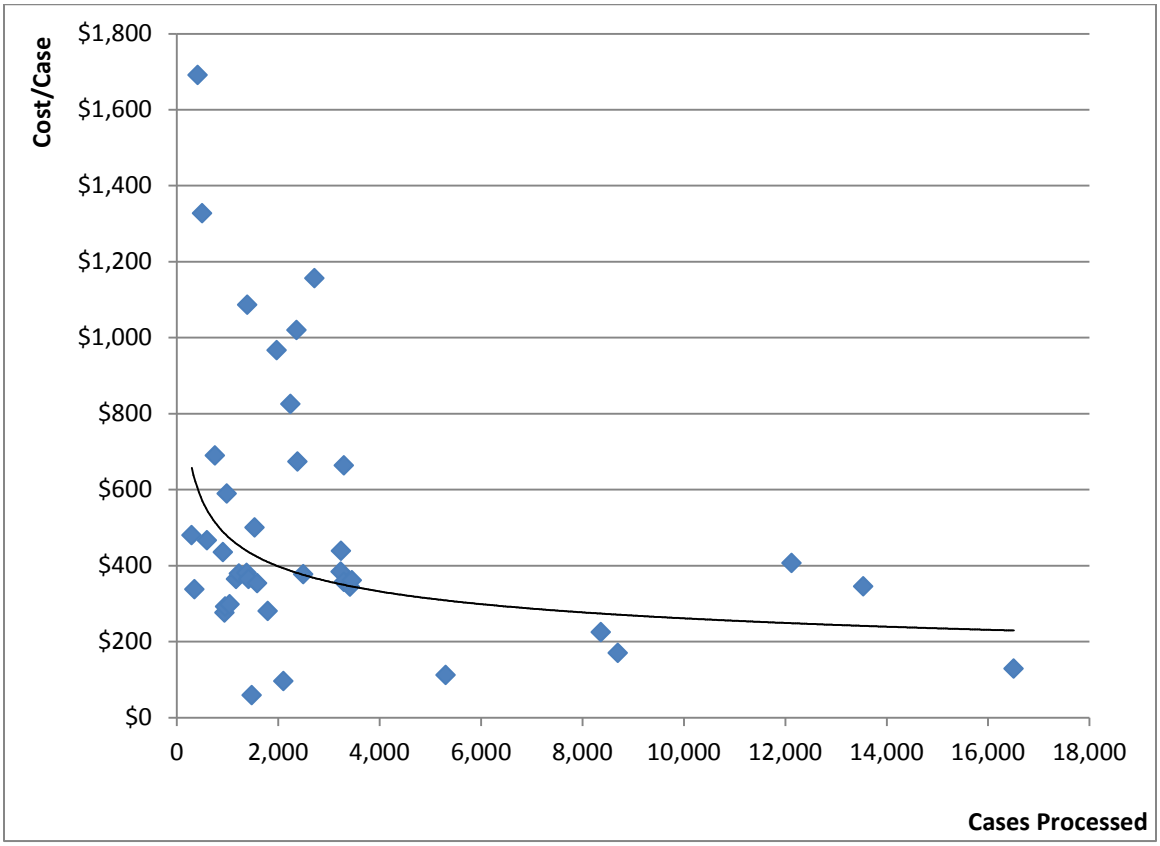
Explosives Analysis



*excludes National Laboratories with Homeland Security responsibility

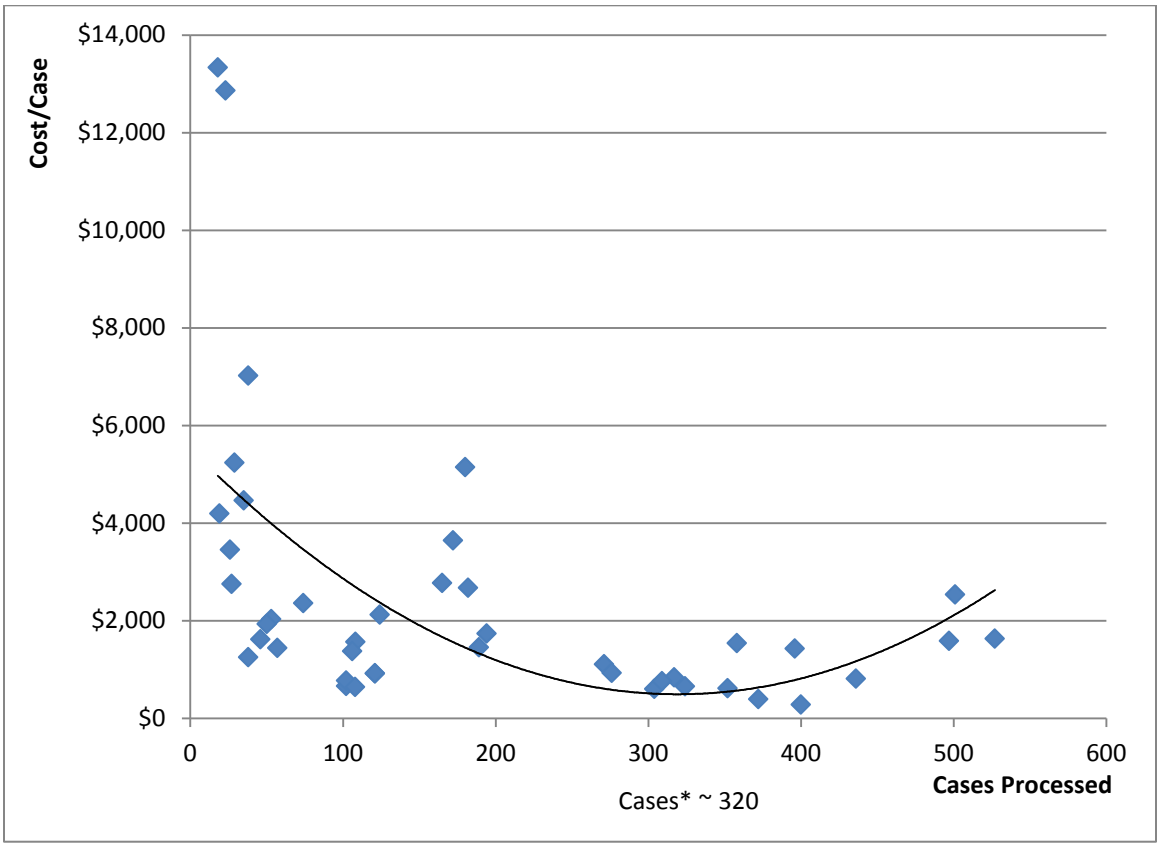
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Fingerprint Identification



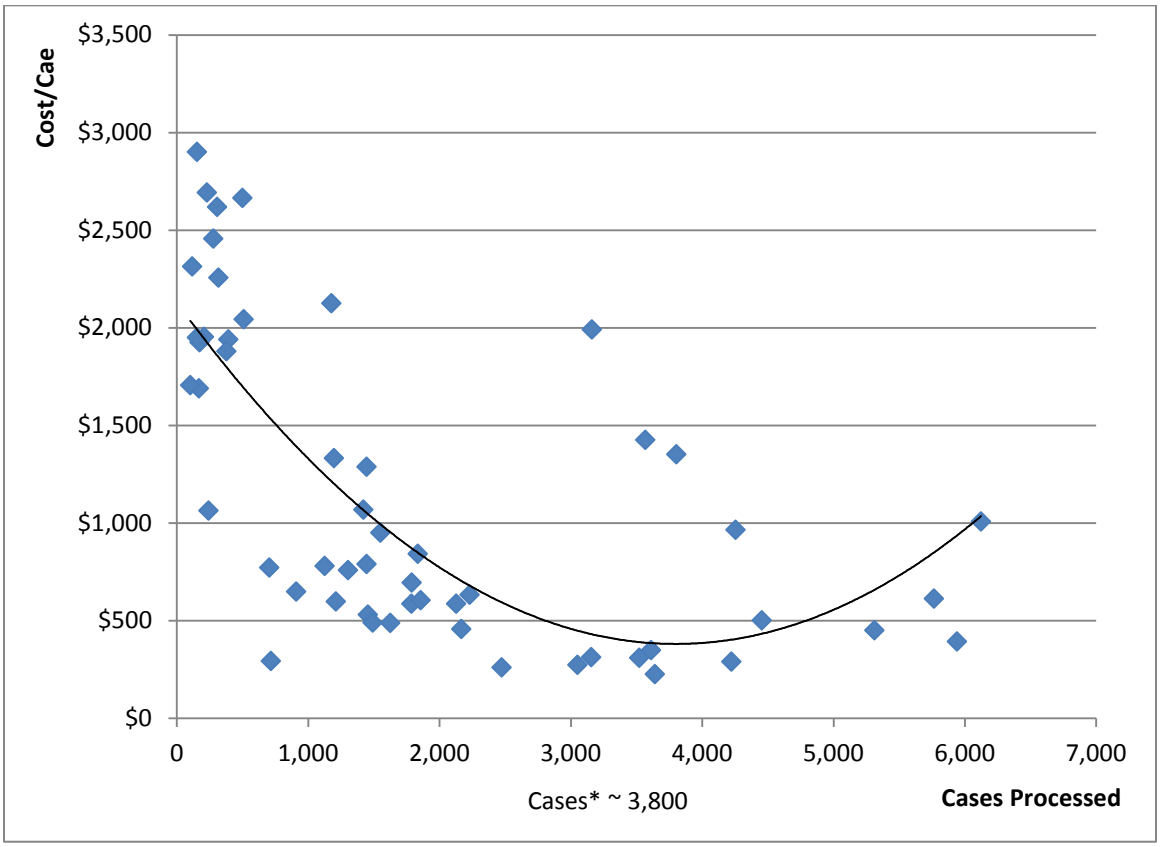
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Fire Analysis



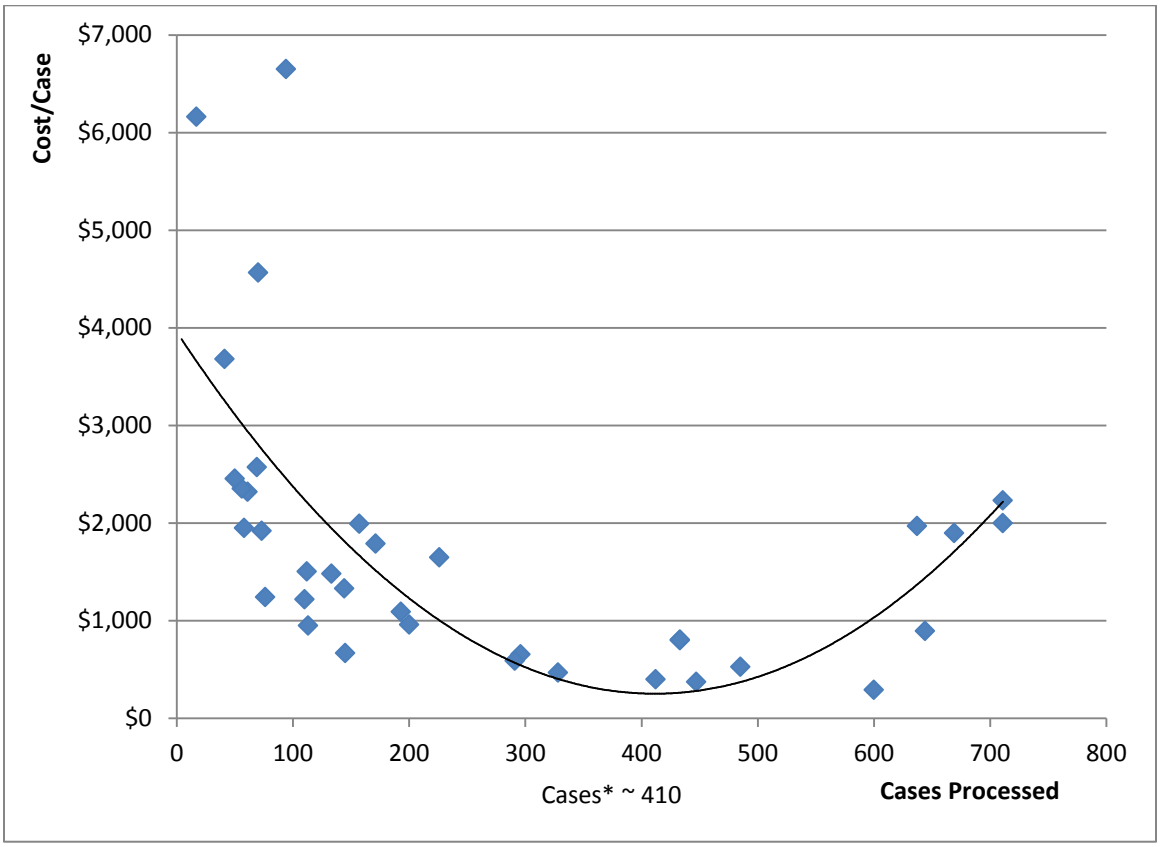
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Firearms & Ballistics Analysis



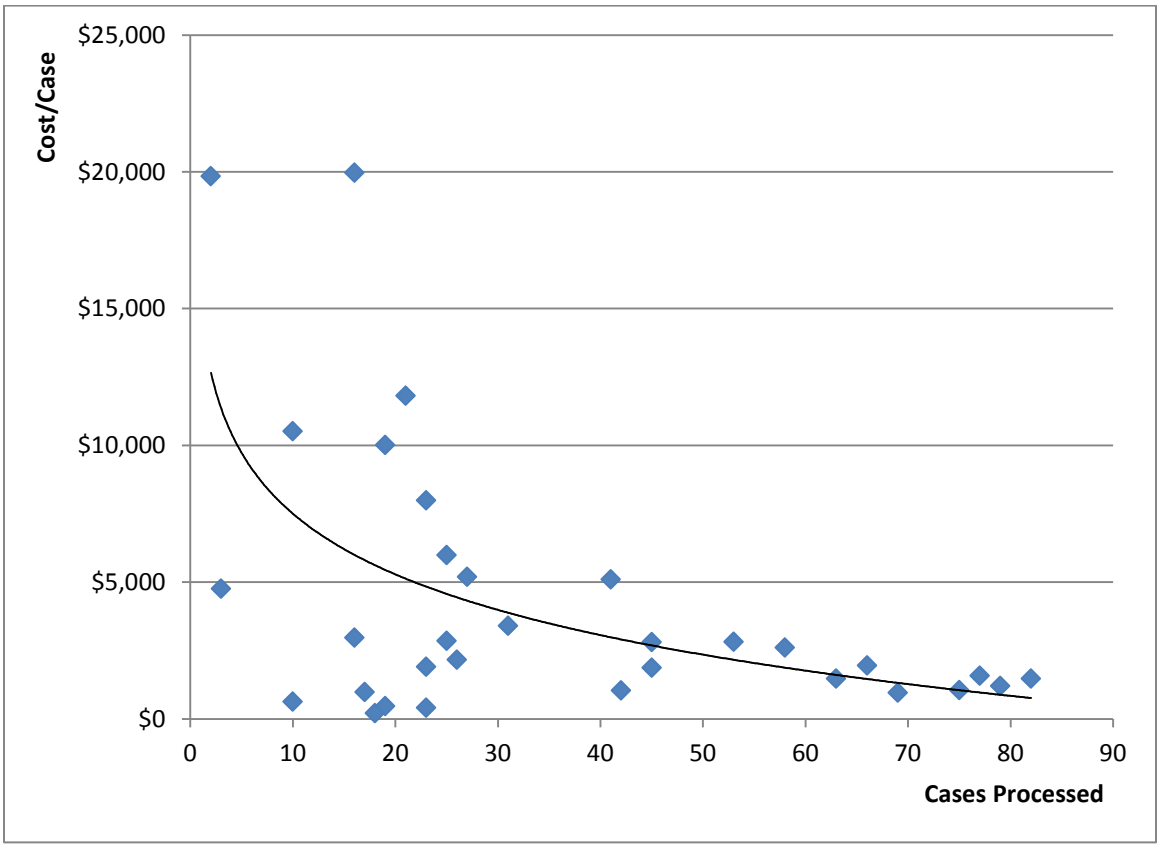
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Gun Shot Residue Analysis



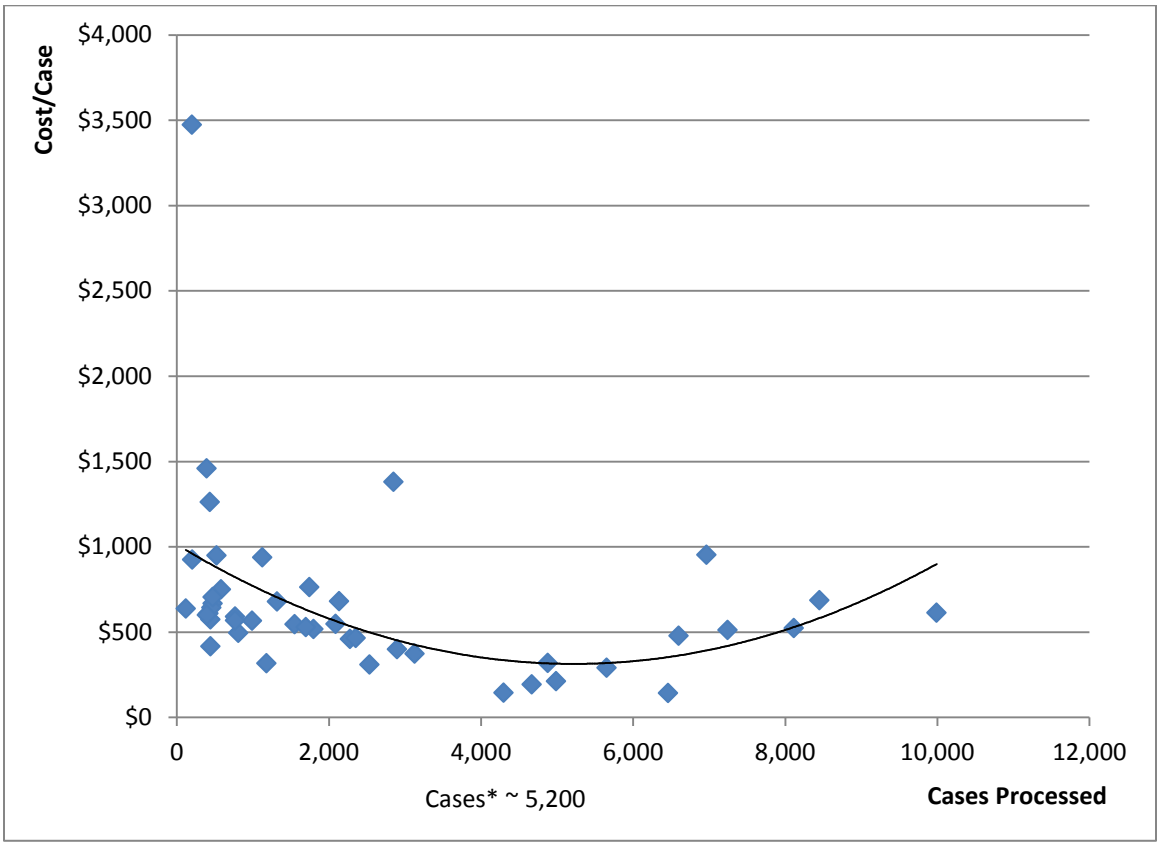
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Marks & Impressions Analysis



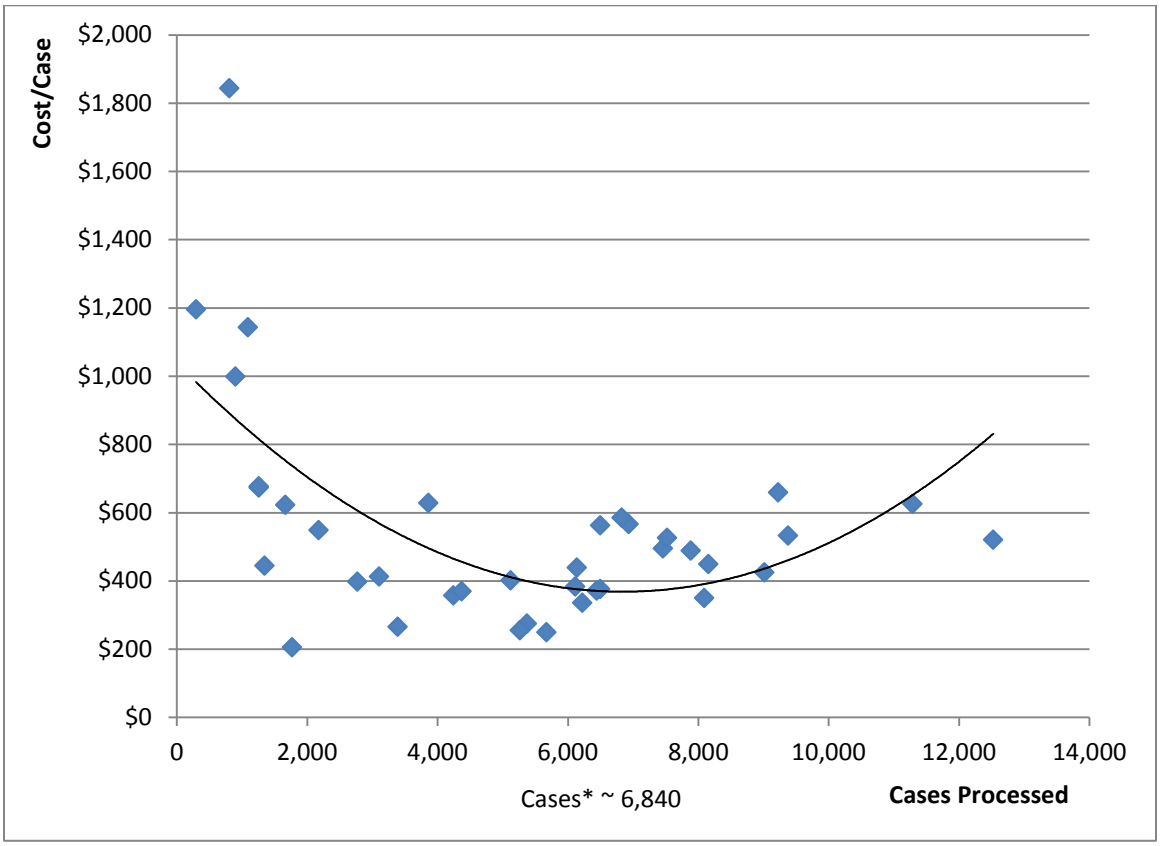
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Serology/Biology Analysis



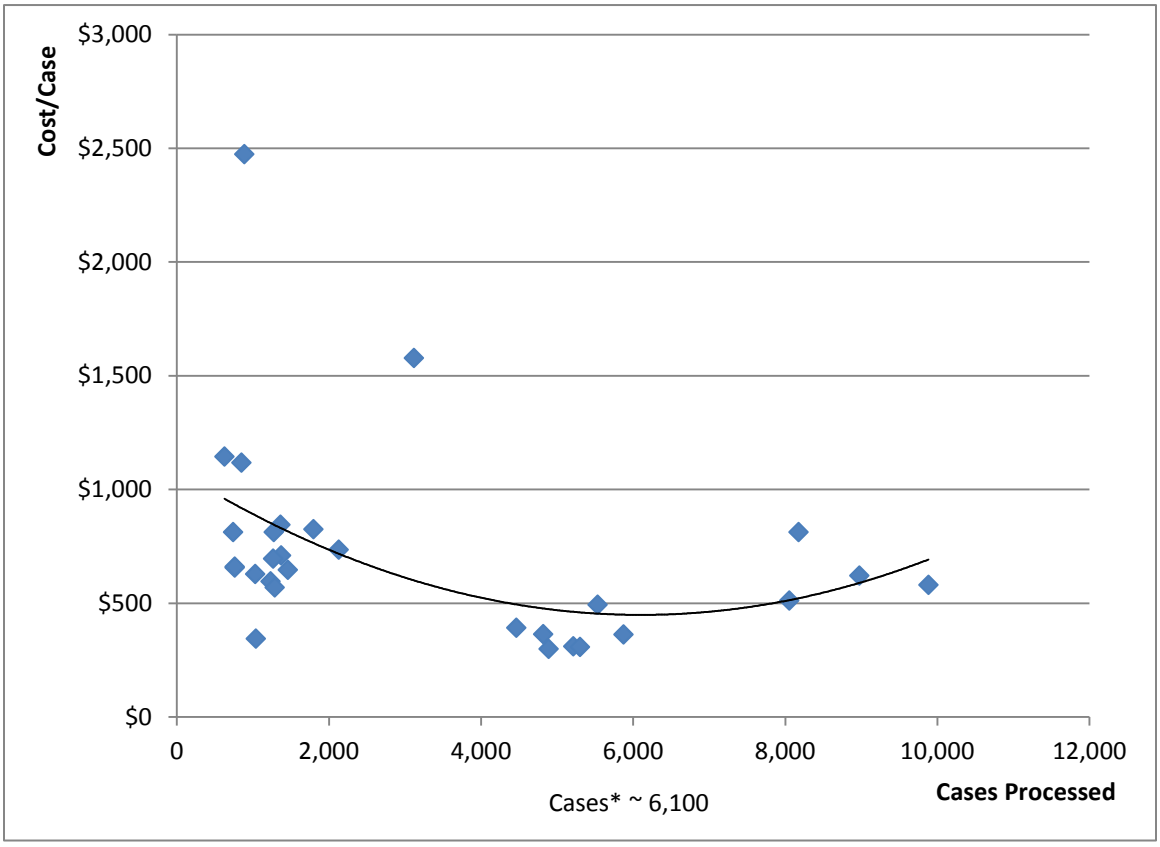
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Toxicology ante mortem



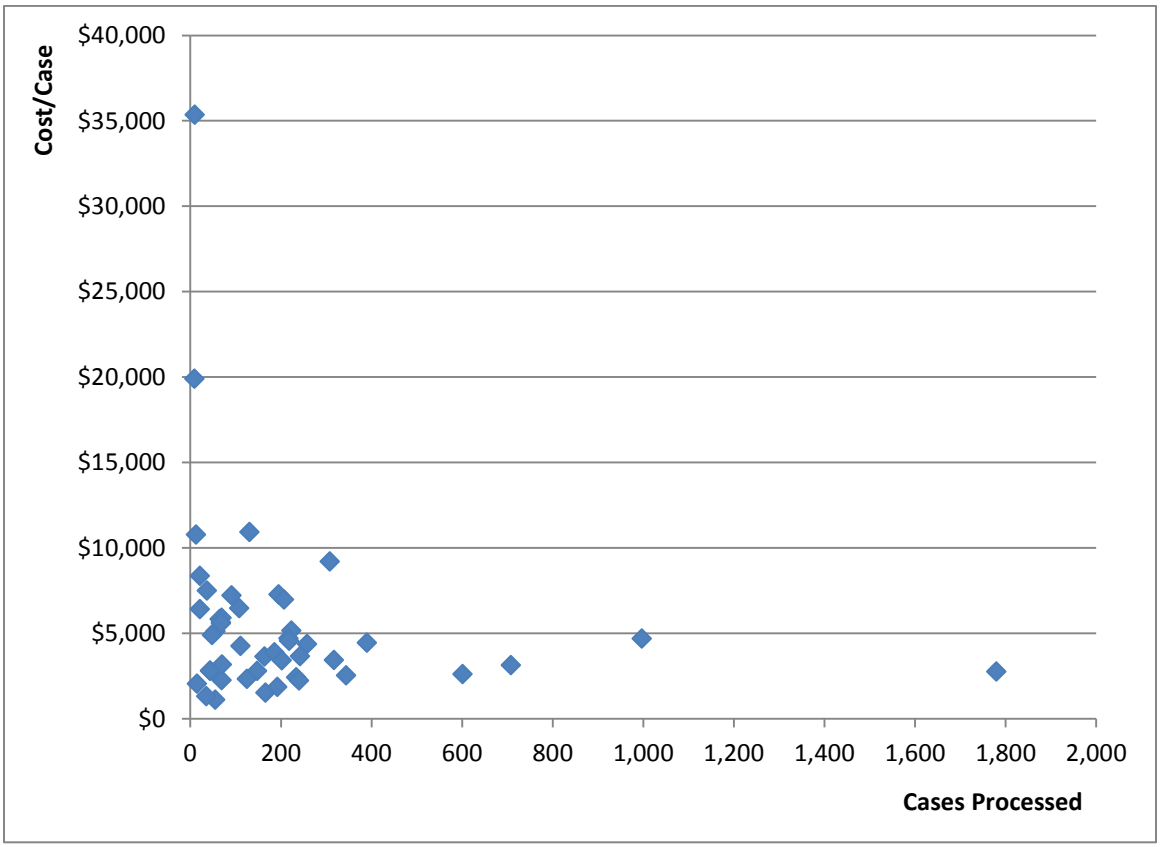
Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Toxicology post mortem



Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

Trace Evidence



Foresight Project 2010-2011, West Virginia University, Morgantown, WV, USA.

FORESIGHT Benchmark Data 2010-2011

Consider the benchmarks for each of the key performance indicators. Two measures of central tendency, mean and median, are reported because of outliers in several of the investigative areas. Most meaningful comparisons might best be made with respect to median as a representation of "typical" laboratory performance.

Cost per Case

	Summary Statistics		
Investigative Area	**Mean**	**Median**	**Std. Dev.**
Blood Alcohol	$255	$124	$389
Digital Evidence (computer, audio, video)	$10,851	$2,789	$15,225
DNA Casework	$2,255	$2,186	$637
DNA Database	$283	$75	$650
Document Examination (including handwriting)	$2,756	$2,281	$1,658
Drugs - Controlled Substances	$274	$240	$162
Explosives	$9,117	$6,550	$9,445
Fingerprint Identification	$528	$435	$295
Fire analysis	$2,465	$1,567	$2,795
Firearms and Ballistics	$1,150	$816	$785
Gun Shot Residue (GSR)	$2,105	$1,648	$1,795
Marks & Impressions	$5,010	$2,612	$5,570
Serology/Biology	$663	$568	$516
Toxicology ante mortem (excluding BAC)	$663	$489	$806
Toxicology post mortem (excluding BAC)	$875	$652	$946
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	$5,528	$4,412	$5,442

$$\frac{Cost}{Case} = \frac{Average\ Compensation}{Labor\ Productivity\ x\ Labor\ Expense\ Ratio}$$

From the decomposition expression for the Cost/Case, an increase in the numerator component, Average Compensation, 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.

Average Compensation

	Summary Statistics		
Investigative Area	**Mean**	**Median**	**Std. Dev.**
Blood Alcohol	$83,387	$82,466	$24,377
Digital Evidence (computer, audio, video)	$79,340	$83,228	$35,356
DNA Casework	$98,599	$99,458	$26,906
DNA Database	$70,973	$72,459	$20,150
Document Examination (including handwriting)	$105,781	$87,647	$67,063
Drugs - Controlled Substances	$89,736	$91,200	$22,173
Explosives	$110,236	$105,043	$37,450
Fingerprint Identification	$88,473	$87,109	$21,924
Fire analysis	$101,031	$88,630	$61,314
Firearms and Ballistics	$104,297	$100,894	$34,502
Gun Shot Residue (GSR)	$105,494	$99,337	$52,918
Marks & Impressions	$104,341	$91,925	$66,357
Serology/Biology	$84,490	$78,331	$36,585
Toxicology ante mortem (excluding BAC)	$91,916	$94,724	$24,399
Toxicology post mortem (excluding BAC)	$91,955	$87,983	$21,855
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	$100,553	$99,789	$41,657

The Average Compensation measure includes all forms of compensation including normal salaries, employer benefits expenses, overtime, and expenditures for temporary employees.

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 the typical employee is able to process more cases per year, then the effect will be a decrease in the average cost as fixed expenditures are average over a higher volume of cases processed. 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 two tables contain the LabRAT summary statistics for each of these ratio measures, labor productivity, and the percentage of the budget devoted to labor expenditures.

Cases per FTE

	Summary Statistics		
Investigative Area	**Mean**	**Median**	**Std. Dev.**
Blood Alcohol	1,000.22	825.34	754.56
Digital Evidence (computer, audio, video)	240.71	39.50	616.57
DNA Casework	77.85	73.42	32.74
DNA Database	2,136.75	2,068.76	1,611.18
Document Examination (including handwriting)	60.67	57.18	34.98
Drugs - Controlled Substances	545.99	473.30	272.98
Explosives	24.66	22.56	13.61
Fingerprint Identification	268.69	234.40	150.90
Fire analysis	93.01	85.19	58.23
Firearms and Ballistics	169.48	149.91	110.76
Gun Shot Residue (GSR)	111.73	88.97	87.63
Marks & Impressions	89.61	27.94	163.46
Serology/Biology	229.37	182.22	227.06
Toxicology ante mortem (excluding BAC)	288.98	271.61	163.92
Toxicology post mortem (excluding BAC)	229.20	228.20	100.58
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	37.11	31.00	19.75

This measure is simply the number of Cases completed for each FTE employee retained by the laboratory. It gives an indication of the level of productivity within the average laboratory in the global group by investigative area.

The next 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.

This measure will be shown below to have a specific connection and analytical breakdown of the entire laboratory cost structure. Below, the cost structure is detailed with a breakdown of expenses in capital, labor, consumables, and other costs. So, 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

	Summary Statistics		
Investigative Area	**Mean**	**Median**	**Std. Dev.**
Blood Alcohol	71.81%	74.28%	9.75%
Digital Evidence (computer, audio, video)	62.00%	75.55%	28.68%
DNA Casework	62.20%	60.82%	12.51%
DNA Database	46.76%	38.97%	15.12%
Document Examination (including handwriting)	78.08%	82.47%	11.14%
Drugs - Controlled Substances	74.73%	76.04%	9.95%
Explosives	72.88%	75.03%	16.98%
Fingerprint Identification	81.05%	84.03%	10.58%
Fire analysis	76.02%	75.32%	11.80%
Firearms and Ballistics	80.69%	83.08%	9.51%
Gun Shot Residue (GSR)	76.94%	79.33%	11.00%
Marks & Impressions	79.26%	81.70%	12.14%
Serology/Biology	77.04%	80.06%	11.99%
Toxicology ante mortem (excluding BAC)	66.85%	64.39%	11.34%
Toxicology post mortem (excluding BAC)	67.23%	64.17%	12.85%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	71.55%	72.11%	13.39%

Capital Expense as a proportion of Total Expense

	Summary Statistics		
Investigative Area	**Mean**	**Median**	**Std. Dev.**
Blood Alcohol	3.79%	2.55%	4.79%
Digital Evidence (computer, audio, video)	11.73%	5.01%	17.29%
DNA Casework	8.04%	7.31%	5.66%
DNA Database	2.97%	3.09%	2.74%
Document Examination (including handwriting)	2.85%	2.13%	5.04%
Drugs - Controlled Substances	4.19%	2.57%	5.70%
Explosives	5.79%	2.59%	9.36%
Fingerprint Identification	3.18%	1.82%	4.24%
Fire analysis	4.20%	2.76%	8.75%
Firearms and Ballistics	5.09%	2.99%	6.33%
Gun Shot Residue (GSR)	5.45%	2.90%	9.15%
Marks & Impressions	2.41%	1.29%	2.54%
Serology/Biology	4.54%	3.32%	5.78%
Toxicology ante mortem (excluding BAC)	6.27%	4.85%	6.26%
Toxicology post mortem (excluding BAC)	5.05%	2.55%	6.71%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	8.28%	3.21%	13.36%

Consumables Expense as a proportion of Total Expense

Summary Statistics

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	6.98%	7.01%	2.84%
Digital Evidence (computer, audio, video)	1.51%	1.49%	1.47%
DNA Casework	12.49%	11.03%	7.28%
DNA Database	32.38%	33.84%	18.98%
Document Examination (including handwriting)	3.04%	2.84%	2.57%
Drugs - Controlled Substances	5.15%	4.89%	2.77%
Explosives	4.66%	4.47%	2.35%
Fingerprint Identification	4.02%	2.77%	5.12%
Fire analysis	3.61%	3.02%	2.47%
Firearms and Ballistics	2.61%	2.41%	2.01%
Gun Shot Residue (GSR)	2.73%	2.67%	1.47%
Marks & Impressions	4.67%	2.77%	5.00%
Serology/Biology	7.39%	5.72%	9.40%
Toxicology ante mortem (excluding BAC)	8.55%	7.71%	4.84%
Toxicology post mortem (excluding BAC)	7.13%	6.28%	4.24%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	3.46%	2.83%	3.32%

Other Expenses as a proportion of Total Expense

Summary Statistics

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	17.42%	15.85%	8.49%
Digital Evidence (computer, audio, video)	12.27%	13.76%	7.79%
DNA Casework	17.27%	15.98%	8.25%
DNA Database	17.90%	17.42%	9.69%
Document Examination (including handwriting)	16.03%	12.67%	9.65%
Drugs - Controlled Substances	15.93%	14.76%	9.05%
Explosives	16.68%	10.25%	14.48%
Fingerprint Identification	11.74%	9.70%	7.23%
Fire analysis	16.18%	15.56%	10.10%
Firearms and Ballistics	11.62%	9.34%	7.39%
Gun Shot Residue (GSR)	14.89%	15.18%	7.80%
Marks & Impressions	13.66%	12.95%	9.45%
Serology/Biology	11.03%	10.93%	6.38%
Toxicology ante mortem (excluding BAC)	18.33%	18.88%	8.87%
Toxicology post mortem (excluding BAC)	20.59%	22.02%	11.12%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	16.71%	16.25%	7.03%