

The Forensic Laboratory Workforce Calculator*

Data-Driven Support for Optimal Forensic Laboratory Staffing

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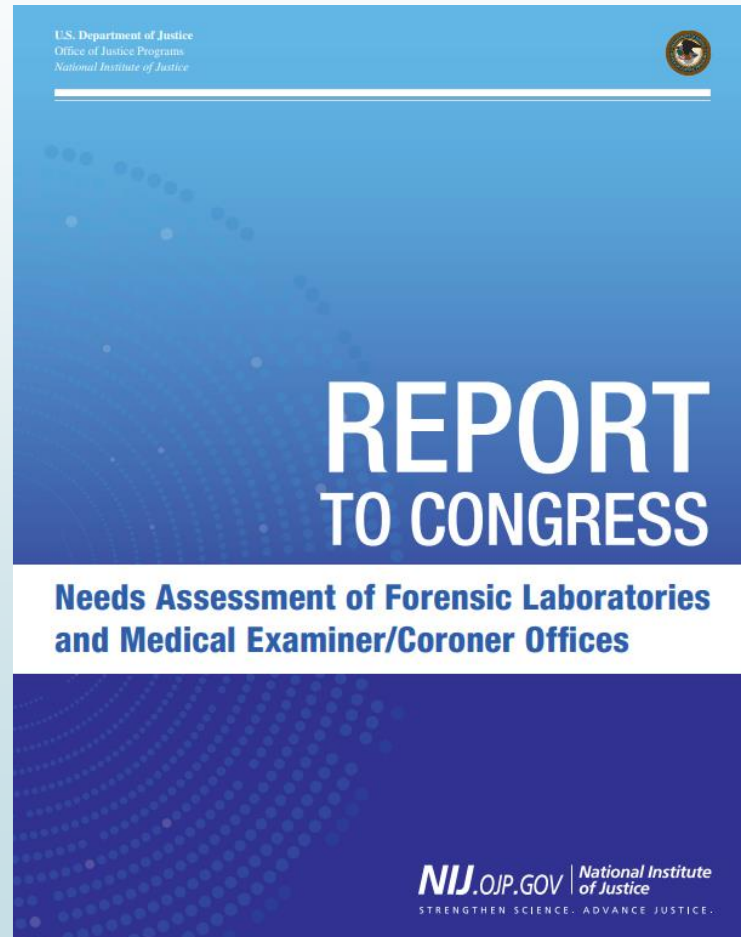
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Needs Assessment of Forensic Laboratories and Medical Examiner/Coroner Offices



Forensic Technology Center of Excellence

WORKFORCE CALCULATOR PROJECT

OVERVIEW

The workforce calculator project follows a two-year timeline to produce a workforce calculator to be housed on the FTCoE website. The calculator permits a laboratory to identify the personnel required to support a given level of casework within each area of identification and the associated investment in capital equipment to support that level of activity. The intent of the first year is to produce an initial working tool (Beta Calculator), based upon a decade of performance of the most efficient laboratories from Project FORESIGHT. The second year of analysis permits enough time to develop a more sustainable and more detailed economic analysis as a long-term planning tool.

THE BETA WORKFORCE CALCULATOR

The beta workforce calculator is a proof of concept, developed from a selection of high performing laboratories from project FORESIGHT. All sample laboratories met a standard of 90% laboratory-wide efficiency using the ASCLD Maximus award criteria^[1]. Econometric models estimate the relationship between the full-time equivalent (FTE) workforce and achievement of the 90% efficiency standard for laboratory analysis. The econometric analysis examined laboratory performance in light of the type of jurisdiction (state, metro, or regional), size population served, and state crime rates (violent and property).

Laboratories are encouraged to test the calculator and report findings to principal investigator Paul Speaker (paul.speaker@mail.wvu.edu). Laboratory insights will be incorporated into the more detailed econometric analysis in the second year of the project.

Download the Beta Workforce Calculator by clicking the button below.

DOWNLOAD FILE

THE UPDATED WORKFORCE CALCULATOR

The second year of analysis permits enough time to develop a more sustainable and more detailed economic analysis as a long-term tool. Feedback from the beta calculator will be incorporated into the second year testing with additional output breaking down the expected FTE into analytical, support, and administrative positions for optimal performance. Corresponding annual capital expenditures to maintain the support of the workforce will also be developed.

REMINDER TO ALL WORKFORCE CALCULATOR USERS

Cases per FTE is not linear, so a linear comparison should not yield the same results. The calculator is a non-linear econometric model that uses population or $\ln(\text{population})$, dummy variables for jurisdiction type, crime rates (property and violent), and interaction variables between all of these

^[1] Identification of the highest performing laboratories over the past decade followed the ASCLD Maximus criteria. At the 2016 ASCLD Symposium, fifteen forensic laboratories were recognized with the Maximus Award for a weighted performance across areas of investigation that demonstrated casework processed per dollar budgeted above the sixth percentile across all laboratories. A similar analysis was conducted for each past FORESIGHT collection year to identify the annual high performers.

Data Sources

- ▶ Project FORESIGHT
 - ▶ Over 200 forensic crime laboratories
 - ▶ FY2006-FY2019
 - ▶ Casework, expenditures, & personnel allocation
- ▶ U.S. Census population data
- ▶ FBI ucr data
 - ▶ Statewide levels
 - ▶ Violent
 - ▶ Property

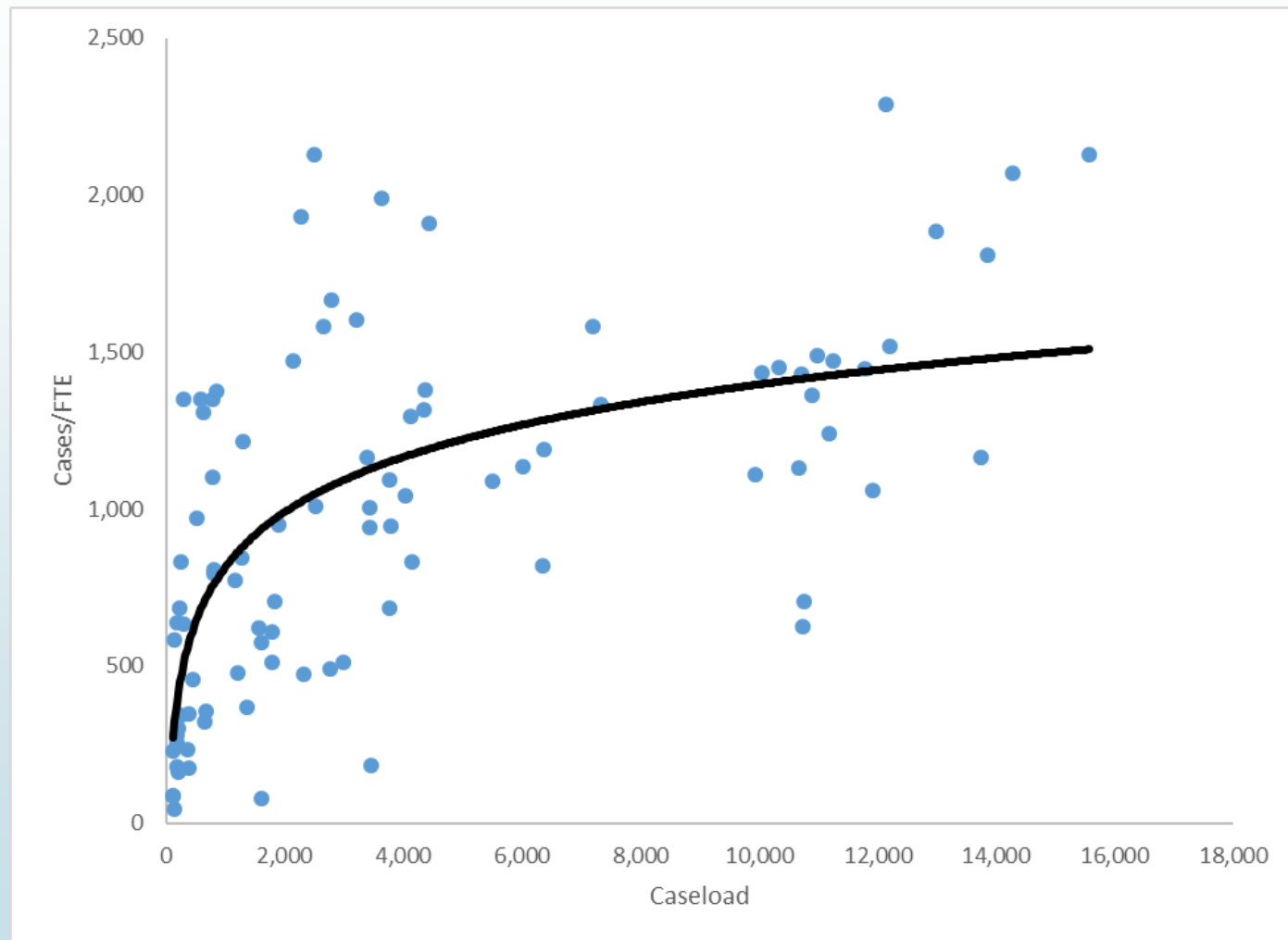
Project FORESIGHT & LabRAT

Investigation area	Cases	FTE
Blood Alcohol		
Crime Scene Investigation		
Digital evidence		
DNA Casework		
DNA Database (including CODIS)		
Document Examination (including handwriting)		
Drugs - Controlled Substances		
Evidence Screening & Processing		
Explosives		
Fingerprints		
Fingerprints Database (including IAFIS)		
Fire analysis		
Firearms and Ballistics		
Firearms Database (including NIBIN)		
Forensic Pathology		
Gun Shot Residue (GSR)		
Marks and Impressions		
Serology/Biology		
Toxicology ante mortem (excluding BAC)		
Toxicology post mortem (excluding BAC)		
Trace Evidence (includes Hairs & Fibers, Paint & Glass)		
Administration and Support		
Other Specialties (describe below)		
TOTAL		0.00

Project FORESIGHT & LabRAT

Investigation area	Personnel Expenditures: Salary, Benefits, Overtime, and Temporary	Capital Expenditures current year; Service of instruments, Equipment Leasing	Chemicals, reagents, consumables, gases	Other Expenditures (all other charges & expenditures not included in the prior columns)	Total Expenditures
Total Laboratory Expenditures	\$0				\$0
Blood Alcohol					
Crime Scene Investigation					
Digital evidence					
DNA Casework					
DNA Database (including CODIS)					
Document Examination (including handwriting)					
Drugs - Controlled Substances					
Evidence Screening & Processing					
Explosives					
Fingerprints					
Fingerprints Database (including IAFIS)					
Fire analysis					
Firearms and Ballistics					
Firearms Database (including NIBIN)					
Forensic Pathology					
Gun Shot Residue (GSR)					
Marks and Impressions					
Serology/Biology					
Toxicology ante mortem (excluding BAC)					
Toxicology post mortem (excluding BAC)					
Trace Evidence (includes Hairs & Fibers, Paint & Glass)					
Administration and Support					
Other Specialties (describe below)					

Project FORESIGHT Output



Maximus Award Criteria

- ▶ The American Society of Crime Laboratory Directors (ASCLD)
 - ▶ Above 90% efficiency
 - ▶ Weighted average across areas of investigation
- ▶ Begun in 2018
- ▶ Criteria applied back to FY2006
- ▶ Collect data from investigation area high performers

Estimation

- ▶ Estimated the non-linear regression suggested by the data for the relationship between productivity and caseload.
 - ▶ Quadratic (inverted U-shape)
 - ▶ Logarithmic
 - ▶ Double logarithmic
- ▶ A series of other independent variables and cross-effects included
 - ▶ Type jurisdiction (state, regional, metropolitan)
 - ▶ Population served
 - ▶ Crime rates (state level property & state level violent)
- ▶ Associated minimum annual capital expenditure

Estimation

Area	Jurisdiction	Dependent Variable	Intercept	LN(Case)	State	State Pop	crviolent	crnon-violent	POP	State x crv	State x crn
Blood Alcohol	State	Case/FTE	-965.47329	254.032563							
Blood Alcohol	Metro & Met	Case/FTE	-908.56645	251.615515							
Blood Alcohol	Regional	Case/FTE	-908.24662	249.60079							
Blood Alcohol		Case/FTE	-908.24662	249.60079							
CSI	All	LN(Case/FTE)	2.85720621	0.4263563	-0.1264997	1.6235E-08	-0.0030064	-0.0001733	-6.344E-08		
DIG	All	LN(Case/FTE)	1.36457283	0.46822136			-0.0019223	0.00027836	-4.558E-08		
DNA Casework	All	LN(Case/FTE)	2.70799871	0.26371984	-0.0399547	-3.815E-09	-0.0016383	0.00035073	-3.74E-09	0.00224209	-0.0005128
DNA Database	All	LN(Case/FTE)	-0.8872451	0.66891879	3.66503544	1.0386E-07	0.00304778	0.00046404	-1.5E-07	-0.0035594	-0.0008501
Document Examination	All	LN(Case/FTE)	-1.4463495	0.71062656			-0.0016731	0.00138686	7.3569E-08		
Drugs - Controlled Substances	All	LN(Case/FTE)	3.02532823	0.30794904	0.76214436	-3.319E-09	-0.0019319	0.00067098	-3.483E-08	0.00319964	-0.000888
Evidence Screening & Processing	All	LN(Case/FTE)	1.98965438	0.36616189			0.00546536	-0.0008313	1.2254E-07		
Explosives	All	LN(Case/FTE)	0.33940231	0.6586642	0.92502199	3.7454E-08	0.00252499	-0.0004828			
Fingerprints	All	LN(Case/FTE)	2.99625728	0.5282671			-0.003774	0.00014892	-2.457E-07		
Fire analysis	All	LN(Case/FTE)	1.2549367	0.67564248							
Firearms and Ballistics	All	LN(Case/FTE)	2.56065457	0.57721461	-1.1335643	1.2488E-09	-0.0038147	6.3828E-05	-6.345E-08	0.00280155	1.8799E-05
Forensic Pathology	All	LN(Case/FTE)	2.54094474	0.23133609							
Gun Shot Residue (GSR)	All	LN(Case/FTE)	2.56106674	0.50847657	-0.814787	-1.533E-08	0.00101965	-0.0002022	9.2968E-08		
Marks and Impressions	All	LN(Case/FTE)	2.30495549	0.35399905							
Serology/Biology	All	LN(Case/FTE)	2.59382951	0.37882369	-0.5509642				5.5778E-08		
Toxicology ante mortem	All	LN(Case/FTE)	3.02397787	0.44373687			0.00208669	-0.0005845	-4.298E-08		
Toxicology post mortem	All	LN(Case/FTE)	6.65894068	-0.0373791	-1.5212702	-1.193E-08	0.00428245	-0.0009356	-8.305E-08	-0.0123493	0.00266751
Trace Evidence	All	LN(Case/FTE)	3.15546022	0.29432727			-0.0001967	-0.000317	-4.114E-08		
			Intercept	LN(Case)			crviolent	crnon-violent	POP		
			5.17800068	0.06435171			-0.0009675	0.00011581	-1.08E-08		

The Workforce Calculator

Answer each of the following to estimate your workforce needs. Use the up and down arrows to select jurisdiction type and state crime rates (note that the worksheet "Crime Rates by State" has recent data for your state). Enter the population questions in numeric format only. Additional worksheets contain recent crime rate and population detail for city and counties. For the anticipated caseload in each area of investigation, enter the number of cases for one year (leave blank if you are not supporting a particular area of investigation).

Jurisdiction: state, metro, or regional

State crime rates: State crime rate violent State crime rate property

Populations: State population Jurisdiction population Population Largest City in Jurisdiction

Area of Investigation	Caseload	Current FTE	Optimal Total FTE	Operational Staff FTE	Administration & Support FTE	Additional Staffing Needed
Blood/Breath Alcohol			0.00	0.00	0.00	0.00
Crime Scene Investigation			0.00	0.00	0.00	0.00
Digital Evidence			0.00	0.00	0.00	0.00
DNA Casework			0.00	0.00	0.00	0.00
DNA Database			0.00	0.00	0.00	0.00
Document Examination			0.00	0.00	0.00	0.00
Drugs--Controlled Substances			0.00	0.00	0.00	0.00
Evidence Handling/Processing			0.00	0.00	0.00	0.00
Explosives			0.00	0.00	0.00	0.00
Fingerprint Identification			0.00	0.00	0.00	0.00
Fire Analysis			0.00	0.00	0.00	0.00
Firearms & Ballistics			0.00	0.00	0.00	0.00
Forensic Pathology			0.00	0.00	0.00	0.00
Gun Shot Residue			0.00	0.00	0.00	0.00
Marks & Impressions			0.00	0.00	0.00	0.00
Serology/Biology			0.00	0.00	0.00	0.00
Toxicology ante mortem			0.00	0.00	0.00	0.00
Toxicology post mortem			0.00	0.00	0.00	0.00
Trace Evidence			0.00	0.00	0.00	0.00
Administrative						
TOTAL Laboratory Personnel		0.00	0.00	0.00	0.00	0.00

Minimum Annual Capital Budget* to Sustain Efficiency (2019 dollars)

The Workforce Calculator

Answer each of the following to estimate your workforce needs. Use the up and down arrows to select jurisdiction type and state crime rates (note that the worksheet "Crime Rates by State" has recent data for your state). Enter the population questions in numeric format only. Additional worksheets contain recent crime rate and population detail for city and counties. For the anticipated caseload in each area of investigation, enter the number of cases for one year (leave blank if you are not supporting a particular area of investigation).

Jurisdiction: state, metro, or regional 1

State crime rates

State crime rate violent 2 State crime rate property 3

Populations

State population Jurisdiction population Population Largest City in Jurisdiction

Area of Investigation	Caseload	Current FTE	Optimal Total FTE	Operational Staff FTE	Administration & Support FTE	Additional Staffing Needed
Blood/Breath Alcohol			0.00	0.00	0.00	0.00
Crime Scene Investigation			0.00	0.00	0.00	0.00
Digital Evidence			0.00	0.00	0.00	0.00
DNA Casework			0.00	0.00	0.00	0.00
DNA Database			0.00	0.00	0.00	0.00
Document Examination			0.00	0.00	0.00	0.00
Drugs--Controlled Substances			0.00	0.00	0.00	0.00
Evidence Handling/Processing			0.00	0.00	0.00	0.00
Explosives			0.00	0.00	0.00	0.00
Fingerprint Identification			0.00	0.00	0.00	0.00
Fire Analysis			0.00	0.00	0.00	0.00
Firearms & Ballistics			0.00	0.00	0.00	0.00
Forensic Pathology			0.00	0.00	0.00	0.00
Gun Shot Residue			0.00	0.00	0.00	0.00
Marks & Impressions			0.00	0.00	0.00	0.00
Serology/Biology			0.00	0.00	0.00	0.00
Toxicology ante mortem			0.00	0.00	0.00	0.00
Toxicology post mortem			0.00	0.00	0.00	0.00
Trace Evidence			0.00	0.00	0.00	0.00
Administrative						
TOTAL Laboratory Personnel		0.00	0.00	0.00	0.00	0.00

Minimum Annual Capital Budget* to Sustain Efficiency (2019 dollars) 7

The Workforce Calculator Output

Answer each of the following to estimate your workforce needs. Use the up and down arrows to select jurisdiction type and state crime rates (note that the worksheet "Crime Rates by State" has recent data for your state). Enter the population questions in numeric format only. Additional worksheets contain recent crime rate and population detail for city and counties. For the anticipated caseload in each area of investigation, enter the number of cases for one year (leave blank if you are not supporting a particular area of investigation).

Jurisdiction: state, metro, or regional

State crime rates: State crime rate violent State crime rate property

Populations: State population Jurisdiction population Population Largest City in Jurisdiction

Area of Investigation	Caseload	Current FTE	Optimal Total FTE	Operational Staff FTE	Administration & Support FTE	Additional Staffing Needed
Blood/Breath Alcohol	3,500	3.25	3.06	2.40	0.66	-0.19
Crime Scene Investigation			0.00	0.00	0.00	0.00
Digital Evidence			0.00	0.00	0.00	0.00
DNA Casework	5,000	19.50	24.94	20.68	4.25	5.44
DNA Database			0.00	0.00	0.00	0.00
Document Examination			0.00	0.00	0.00	0.00
Drugs--Controlled Substances	4,000	5.50	5.13	4.07	1.06	-0.37
Evidence Handling/Processing			0.00	0.00	0.00	0.00
Explosives			0.00	0.00	0.00	0.00
Fingerprint Identification	2,500	4.75	5.05	4.09	0.96	0.30
Fire Analysis			0.00	0.00	0.00	0.00
Firearms & Ballistics			0.00	0.00	0.00	0.00
Forensic Pathology			0.00	0.00	0.00	0.00
Gun Shot Residue			0.00	0.00	0.00	0.00
Marks & Impressions			0.00	0.00	0.00	0.00
Serology/Biology	1,500	6.00	6.85	5.51	1.34	0.85
Toxicology ante mortem	3,000	7.50	9.66	7.70	1.96	2.16
Toxicology post mortem	2,500	8.49	12.17	9.16	3.02	3.68
Trace Evidence	100	2.25	2.78	2.30	0.48	0.53
Administrative						
TOTAL Laboratory Personnel		57.24	69.63	55.90	13.73	12.39

Minimum Annual Capital Budget* to Sustain Efficiency (2019 dollars)

Concluding Comments

- ▶ All laboratories are encouraged to visit the Forensic Technology Center of Excellence site and try the Workforce Calculator.
- ▶ The calculator is free to use.
- ▶ After trying the calculator, laboratories are encouraged to provide feedback to FTCoE or Project FORESIGHT, including comparison of their current staffing to the output of the workforce calculator.
- ▶ Additionally, all laboratories are encouraged to participate in Project FORESIGHT.
- ▶ As of this writing, participation in Project FORESIGHT continues to be free of charge to participating laboratories.

For more information:

- ▶ FTCoE <https://forensiccoe.org/workforce-calculator-project/>
- ▶ YouTube: <https://youtu.be/s1UNdO4AjJo>
- ▶ Project FORESIGHT <https://business.wvu.edu/research-outreach/forensic-business-studies/foresight>

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