Forensic Technology
CENTER OF EXCELLENCE
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Moving Knowledge from Research to Impact

SUCCESS STORY

National Institute of Justice and West Virginia University
Revolutionizing Laboratory Efficiency Assessments Through Project FORESIGHT

> "Iron sharpens iron. Project FORESIGHT is built on collaboration among peers, and enhanced with academic and economic support—it provides actionable and realistic data to assess how well a lab is performing."
>
> —*Bruce Houlihan, Director, Orange County Crime Laboratory*

Overview of the Issue

Crime laboratories are expected to provide consistent and high-quality services across multiple domains to criminal justice stakeholders, even though these laboratories may have limited resources and constrained budgets. Operational practices can influence the laboratory's ability to provide these services efficiently. However, assessing the efficiency of these practices requires the ability to both track performance metrics over time and compare metrics with similar laboratories, which may be resource intensive. Crime laboratories worldwide require universal metrics and frameworks to help them identify benchmark data and standard reporting tools to help them measure, monitor, and manage operational practices and stakeholder demands. Common industry standards, terminology, and measurement practices are needed to enhance management's ability to diagnose and address performance issues and assess the effectiveness of improvement measures. The ability to assess these key metrics such as laboratory costs, workloads, staffing needs, and returns on investments is also critical for decision-makers, such as lab management, policymakers, and budget formulators.

The Solution

Dr. Paul Speaker, PhD, a finance professor from West Virginia University, recognized the potential to identify and address crime laboratory inefficiencies. In 2009 and with support from the National Institute of Justice (NIJ), Dr. Speaker helped launch Project FORESIGHT, which enables laboratories to measure internal work processes and compare their work processes with those at similar crime laboratories nationwide (Award Nos. 2008-DN-BX-K223, 2010-D1-BX-K016).

Project FORESIGHT is a business-oriented self-evaluation that provides laboratory managers with actionable insights into the performance of their laboratory. These metrics are broken down by investigative area and are based on analysis of a rich set of multiyear data from a growing number of U.S. laboratories.

Standardized Terminology and Metrics

Building off the European QUADRUPOL project—a study that analyzed the performance of four crime laboratories in the European Union—Project FORESIGHT began with the creation of a universal language to enable discussions about crime laboratory operations [1]. The preliminary effort included defining terminology and normalizing metrics across the industry. This was a broad task and included developing metrics across seven key performance areas:

► Relative volume and activity

► Cost

► Personnel productivity

► Analytic process

► Risk/quality

► Turnaround time

► Backlog

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The Project FORESIGHT team identified key metrics related to a laboratory's performance. These include areas like relative volume and activity, including the number of cases, items processed, samples, tests, and reports per 100,000 population served.

To assess the cost of laboratory services, the cost per case, item, sample, test, and report are individually measured. The measure of cost accounts for all financial expenses (e.g., capital, employee wages and benefits, chemicals, quality assurance and accreditation, and utilities).

Building on the basic cost metrics, five personnel productivity metrics are calculated: number of cases, items, samples, tests, and reports completed per each full-time equivalent employee. If an average laboratory employee processes more cases per year, then the cost per case will drop.

Measures of the analytic process serve as a proxy for the level of analytical technology used (i.e., capital-intensive vs. labor intensive processes). These metrics include the proportion of total expenditures allocated to personnel, capital, consumables, and other expenses.

Risk/quality is operationalized via testing intensity, or the depth of analysis prior to issuing a report. Testing intensity is assessed at the case, item, and sample levels of analysis, including the number of items, samples, and reports per case; the number of samples, tests, and reports per item; and the number of tests and reports per sample.
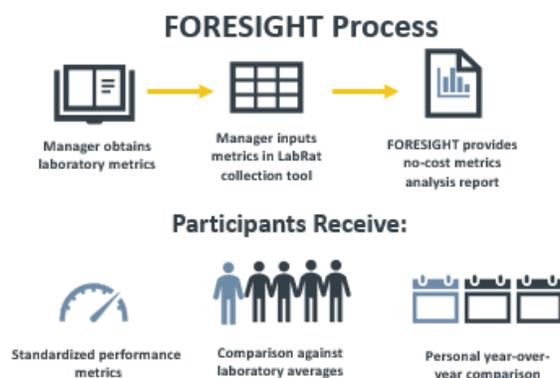
In addition to the above metrics covering quality and cost efficiencies, turnaround time—or the time it takes for a laboratory to issue a report—is of particular interest to the justice system. Project FORESIGHT recognizes two turnaround time measures: time from the last evidence submission in a case until issuance of a report and time from the first evidence submission in a case until issuance of a report.

The final metric included in Project FORESIGHT is backlog, or the proportion of open cases at the end of the fiscal year that have been open for at least 30 days.

Data Collection Tool and Customizable Reports

Using the established language, voluntary Project FORESIGHT participants annually input data into a software tool called the Laboratory Reporting and Analysis Tool

(LabRAT). The inputs cover three broad performance-indicating categories (casework, budgets, and personnel). Because crime laboratories perform a range of services across multiple scientific disciplines and employ staff with different expertise, it is essential to assess performance in distinct domains. To account for this diversity, LabRAT collects and reports the standard metrics separately for each of 19 investigative areas (blood alcohol, crime scene investigation, digital evidence, DNA casework, DNA database, documentation examination, drugs, evidence screening and processing, explosives, fingerprints, fire analysis, firearms and ballistics, forensic pathology, gunshot residue, marks and impressions, serology/biology, ante mortem toxicology, post mortem toxicology, and trace evidence). This allows laboratories to precisely diagnose where efficiencies may be gained by comparison with "efficient frontiers," an assessment of efficiency and cost effectiveness, for each investigative area. LabRAT generates a report that details each laboratory's operations and efficiencies and compares this information to other anonymized Project FORESIGHT participants. The comparison can be customized to focus on similar laboratories in terms of size and case load. The free report, tailored and confidential to each participant, describes a laboratory's performance comparatively and over time.

FORESIGHT Process

Manager obtains laboratory metrics → Manager inputs metrics in LabRat collection tool → FORESIGHT provides no-cost metrics analysis report

Participants Receive:

Standardized performance metrics | Comparison against laboratory averages | Personal year-over-year comparison

Key Benefits

Laboratory Benefits

Project FORESIGHT provides laboratories with data-driven insights to guide decision making for improved management operations. The project

► Provides individualized annual reports at no-cost, with detailed metrics about productivity, risk management (i.e., sampling, testing, and reporting intensity), analytical process, and economic market forces

- ► Offers yearly annual summary reports that provide high-level trends around the "efficient frontier" for different disciplines [2]

- ► Synthesizes operational inefficiency insights from existing laboratory data

- ► Generates reports that can be leveraged to justify funding requests, identify required levels of personnel, and determine resource allocations

- ► Pinpoints opportunities for improvement in budget, personnel, and/or laboratory management

- ► Enables repetitive, annual self-assessments to identify trends and quantify the effects of changes over time

Community Benefits

Data collected through participation in Project FORESIGHT benefits the greater forensic laboratory community by:

- ► Providing a means for laboratories to identify and compare with similar labs across the country

- ► Identifying and facilitating the adoption of best practices among laboratories

- ► Enabling systematic reform in decision making and accountability

- ► Enabling analyses to assess the impact and financial burden of caseload increases. For example, recent analyses supported by the NIJ through the Forensic Technology Center of Excellence (FTCoE) on the opioid crisis and backlogs of untested sexual assault kits (SAKs) Dr. Speaker recently published papers in *Forensic Science International: Synergy* discussing the costs and benefits of reallocating resources to address the SAK backlog [3] and the impact of the opioid crisis [4].

NIJ-Supported Research

The NIJ led the effort to improve crime laboratory operations by supporting the development of Project FORESIGHT through grants from 2009 through 2015. NIJ recognized that studying the forensic science industry through the lenses of business and economics could provide evidence-based metrics to support efficiency improvements in crime laboratories.

Bringing Research to Practice

Project FORESIGHT has grown to more than 139 participating laboratories in 2019, including local, regional, state, and national laboratories. Project FORESIGHT

participation is available at no cost to laboratories. Registration is available via West Virginia University's John Chambers College of Business and Economics.

Dr. Speaker and his colleagues have published more than 30 papers that detail best practices for using, understanding, and implementing data from Project FORESIGHT; additionally, they have delivered countless presentations and webinars about these topics. In 2018, the American Society of Crime Laboratory Directors (ASCLD) established the Maximus Award, which is now presented at their annual meetings to recognize Project FORESIGHT laboratories that operate at or above 90% efficiency.

Growing participation has enabled the meta-analysis of data that calculate jurisdiction-specific return on investment. To ensure the validity and anonymity of the data gathered as part of the project, the FORESIGHT team created a separate entity—Forensic Science Management Consultants, LLC—to handle the data. Return on investment across laboratory activities can help prioritize limited funds through the direct comparison of associated societal benefits. He also participated in the NIJ/FTCoE's 2019 National Opioid and Emerging Drug Threats Policy and Practice Forum [5]. Furthermore, Speaker discussed the role of Project FORESIGHT in understanding SAK backlogs [6] and helping understand the financial burden of the opioid crisis [7] on crime laboratories in the FTCoE's *Just Science* podcast series.

Project FORESIGHT contributed to the Department of Justice Needs Assessment of Forensic Laboratories by providing a comprehensive analysis of FORESIGHT data to develop national estimates of laboratory workloads, expenditures, and staffing needs and identify overall funding levels needed to reach and maintain an optimal balance of workloads, capital investments, and personnel [8]. Based on this effort, Project FORESIGHT worked with the NIJ's FTCoE to develop a workforce calculator tool that will help a laboratory determine the appropriate number of personnel and pieces of equipment needed to support a certain level of discipline-specific casework [9].

Learn more from the two following early adopter Project FORESIGHT participants:

1. Orange County Crime Laboratory
2. Denver Police Department, Forensics and Evidence Division

Moving Knowledge from Research to Impact

Project FORESIGHT provides the Orange County Crime Laboratory with objective, practitioner-driven metrics to set stakeholder and staff expectations.

Bruce Houlihan is the Director of the Orange County Crime Laboratory (OC Crime Lab).

The OC Crime Lab serves all public agencies in Orange County, including the collection and evaluation of crime scene evidence and forensic analysis for all law enforcement and fire protection agencies. The OC Crime Lab is a full-service crime laboratory with over 160 staff members, and it serves over 3 million residents in the county. The OC Crime Laboratory has been a participant in Project FORESIGHT since the project's inception, and Mr. Houlihan participated in the original group that helped define the terms and structure of data required by Project FORESIGHT. Within the original Project FORESIGHT team, Houlihan contributed to the models helping determine national norms by developing baseline commonalities and standardized definitions for terms like "case," "test," and "item." Houlihan notes that the tool has been consistently improved through higher participation and increasing years of data, which provide a means to make informed decisions that make financial and practical sense. Project FORESIGHT enables Houlihan and his team to do the following:

> "FORESIGHT provides us the data to respond to challenges and redirect the conversation to understanding what causes performance issues."
> —*Bruce Houlihan, Director, Orange County Crime Laboratory*

Inform strategy for lab services. Project FORESIGHT can dial down into metrics for specific forensic disciplines, which enables laboratory directors to objectively assess the practicality of supporting certain capabilities in the laboratory. For example, Houlihan used Project FORESIGHT data to help build the business case that keeping DNA analysis capabilities in-house was worth the investment given the low cost per sample the laboratory maintains. Conversely, these data were valuable for appraising complex (but more expensive) disciplines like trace evidence analysis, where resource use and allocations are important. Gunshot residue was also evaluated on cost versus value to the legal community basis.

Help community stakeholders establish reasonable expectations for the laboratory. The benchmarking ability also helped demonstrate that many of the OC Crime Lab's disciplines were among those of the most efficient operating laboratories in the country. The laboratory has communicated these data with stakeholders, including requesting law enforcement agencies and legislators on key metrics such as turnaround time based on their caseloads and personnel, which helps them to better understand reasonable expectations for laboratory performance and better anticipate time and resources needed to support the laboratory.

Realistically manage team performance. Project FORESIGHT data also help the laboratory understand realistic expectations of employee workloads to prevent burnout and identify where team members may need additional staffing to best support the workload of the laboratory. Thus, supporting workforce resiliency.

Houlihan noted that a flexible laboratory information management system (LIMS) plays a large role in quickly pulling valuable inputs for the tool. Orange County has developed their own LIMS, which is built on industry standard SQL relational databases, with high-performance natively compiled front-end applications and websites for the user interfaces and presentation. The agility of the LIMS has enabled them to easily find accurate information, decreasing the amount of time needed for compiling relevant data.

Impact of Project FORESIGHT

► Provides standardized, practitioner-driven metrics needed to assess laboratory performance and efficiency.

► Provides objective data that can be shared with stakeholders to demonstrate the appropriateness of resource allocation.

► Shapes conversations with staff about realistic caseload expectations by comparing metrics with similar laboratories.

Lessons Learned

► There are different tiers of Project FORESIGHT involvement such that a lab can report a subset of the metrics (e.g., cases) and get a rough model. However, the more metrics a lab inputs, the more useful the outputs will be.

► Collecting the data needed to populate LabRAT is easier with a flexible LIMS.

Project FORESIGHT provides Denver's crime laboratory with the metrics needed to support the efficient allocation of resources.

Bonnie Mountain is a Deputy Director for the Forensics and Evidence Division (FED) of the Denver Police Department (DPD).

The DPD FED provides forensic and crime scene services to the City and County of Denver, supporting the Police Department, District Attorney's Office, Sheriff's Department, Fire Department, and Office of the Medical Examiner. As a full-service crime laboratory with nearly 70 staff, the Division provides services in multiple disciplines and is composed of eight units: quality assurance, crime scene, firearms, forensic biology and DNA, forensic chemistry and trace evidence, forensic imaging, latent print, and computer forensics. The DPD uses Project FORESIGHT data to do the following:

Identify key benchmark differences and diagnose efficiency issues. Laboratories look to their peers to benchmark and understand how to improve their performance. Institutions vary widely in caseloads, number of personnel, services available, jurisdictional level, and other key metrics. Project FORESIGHT is a robust data source that enables laboratories to quickly benchmark their performance with a more accurate view. We can check on specific trends, such as case turnaround time, case backlogs, or cost per sample. In the event our metrics deviate from benchmarked data, we can examine the reasons and determine areas for improvement. Laboratories may even take the further step of reaching out to peer laboratories and understanding what measures they may have taken to improve their performance.

> "FORESIGHT is helpful acting as a 'measuring stick' for us to compare to. It's a consolidated package of information about forensic laboratories across the U.S. We can quickly identify our areas of improvement."
> —*Bonnie Mountain, Deputy Director of Forensics and Evidence Division, Denver Police Department*

Justify the need for additional resources in grant funding and budgets. The DPD uses FORESIGHT data to clearly show the relationship between resources and outputs for grant and budget purposes. The data help inform decision makers of specific and concrete benefits for funding and clearly demonstrate needs based on benchmarking data. Project FORESIGHT data have helped us justify resources such as additional personnel and equipment from funding sources. Because this tool helps paint a realistic picture of current capabilities, limitations, and how resources may improve operations, Project FORESIGHT helps to ensure that the Division does not overcommit to what we can accomplish with grant funding.

Impact of Project FORESIGHT

► Provides laboratory leadership with objective measures to justify additional resources and support grant applications and other funding requests.

► Provides data to estimate the number of additional cases or samples that could be processed with additional resources keeping expectations realistic and preventing overcommitting our resources.

► Allows the director to assess whether a new trend is anomalous and may require action.

► Comprehensive analysis of FORESIGHT data provides national estimates for laboratory workloads, expenditures, staffing, and funding levels.

Lessons Learned

► Understanding the key qualities of a laboratory operation (such as personnel and caseload) can provide a more realistic picture of its performance. This improves the ability to identify and compare our operations with others that are similar.

Ongoing Enhancement and the Future

The Project FORESIGHT team is working to facilitate data entry and streamlining with participating crime laboratory systems. The team is working with ASCLD to create financial intelligence software called FORESIGHT 20/20. Currently, the LabRAT tool requires manual data entry processes, which prevents some laboratories from joining Project FORESIGHT. Most often, data related to case work and data related to personnel and expenditures are stored on separate computer systems. Thus, participants must manually extract data from multiple sources; this time-consuming work requires dedicated funds and personnel. Project FORESIGHT and ASCLD are working with vendors to integrate the FORESIGHT 20/20 software into four major LIMSs to streamline data collection and implementation and increase laboratory participation in Project FORESIGHT, and labs are currently piloting this software.

Project FORESIGHT's goal is to achieve 100% participation from U.S. crime laboratories to ensure that the data reflect diverse operational environments and capture a complete picture of the forensic community. To engage the crime lab community and encourage participation, ASCLD hosted a Project FORESIGHT strategy session at the Utah Department of Public Safety Crime Laboratory in March 2019, which discussed how the data are used and could be used more effectively.

To participate in Project FORESIGHT, request information from their website or contact Dr. Speaker at the email address on this page.

Resources

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