



IN-BRIEF

Leveraging Laboratory Information Management Systems (LIMS) to Maintain Continuity of Operations: Lessons from the COVID-19 Pandemic



“With more staff working from home, we needed to take advantage of LIMS functionalities previously underutilized.”

—Peter Stout, President & CEO,
Houston Forensic Science Center

Introduction

In response to 2020's COVID-19 pandemic, forensic crime laboratories have changed their business operations to ensure responsiveness to their customers' needs while protecting staff welfare and data security. This balance has challenged laboratory management to address the following questions:

- 1) How do we make necessary in-person laboratory work safer for staff?
- 2) How do we enable staff to work on casework remotely and securely?
- 3) How do we serve our customers efficiently during a global pandemic or a similar type of short or long-term critical incident?

As one of the primary software systems used by crime laboratories, Laboratory Information Management Systems (LIMS), a program that collects, creates, and stores all data related to forensic examinations, is a critical tool to leverage in response to COVID-19-induced realities. This report considers using LIMS features to help a laboratory adjust to operating in a pandemic based on the experiences of managers and leadership of five crime laboratories around the United States, including three federal crime laboratories (DEA, ICE-HSI, USSS), one state laboratory (Arizona), and one city laboratory (Houston).

As forensic laboratories adjust to new pandemic policies and procedures with the help of a LIMS, they may also see lasting improvement in future operational efficiencies and build solutions that add flexibility to ensure continuity of operations to respond and recover from critical incidents.

Objectives

- Understand how forensic crime laboratories have adjusted operations in response to the COVID-19 pandemic
- Identify capabilities of commercially available LIMS and other technologies that can support the shift to remote working

For more information about LIMS products, features, and implementation considerations, consult the FTCOE's [Landscape Study on Laboratory Information Management Systems for Forensic Crime Laboratories \(August 2020\)](#).



Crime laboratories are adjusting to the impacts of the COVID-19 pandemic.

Laboratory leadership has been faced with the challenge of maintaining business continuity—which requires on-site operations—while ensuring that employees can do their jobs safely. In addition to implementing stringent personal protective equipment (PPE) and testing policies, many laboratories have assigned staff to varied working schedules to maintain 50% staff on-site capacity, often in established “cohorts” to limit in-person interactions. This adjustment has increased the need for further laboratory digitization. To enable continuity of operations, laboratories enacted work-from-home policies when possible. The impacts of implementing these new measures include the following:

Increased need for resources to prevent and address COVID-19 outbreaks. Despite the precautions that laboratories can take, such as social distancing practices and appropriate PPE, outbreaks may happen. Coworkers exposed to a sick individual must quarantine for a set amount of time, and the laboratory must undergo deep cleaning, which leads to downtime. Preventing COVID-19 outbreaks takes significant resources. Some facilities, such as laboratories located in hot spot areas, are requiring employees to undergo surveillance testing prior to accessing facilities regularly. These testing measures have been a significant unexpected expense to crime laboratories and impact the laboratory’s ability to afford additional resources for daily operations.

Shifting schedule needs and casework. COVID-19 has required staff to be more flexible with their schedule. For example, some laboratories may shift to early/late shift schedules, which may be difficult for some individuals to accommodate. Laboratories have seen shifts in casework, not only in the number of cases (interviewees mentioned a pattern of low case numbers fluctuating to very high between March and December 2020) but in the types of cases encountered. For example, the frequency of cases including evidential breath alcohol tests may have decreased because of less frequent use in the field. Some laboratories have reported reductions in seized drug analyses but increases in cases involving postmortem toxicological analyses. Laboratories may face challenges in ensuring that the various forensic discipline services are appropriately staffed in light of shifting trends.

To address challenges with staff scheduling in some laboratories, an analysts schedule has shifted to working a few days in the lab and a few days at home. Interviewees indicated that after the schedule adjustment, staff have found that instruments are more readily available for running assays. Many analysts have found this gives them more ability to presort their work, analyze evidence concurrently on more instruments, and use time at home to complete reports. Although laboratory staff have a shorter window of time to run their experiments, interviewees indicated that this shift has compelled staff to be more efficient using their time in the laboratory. Some staff members have appreciated improved ability to focus without typical workplace distractions and have been more efficient in their analyses and reports.

Communication bottlenecks. Analysts must push every analysis report through a quality review process before it is delivered to the requesting agency and other clients. Staff dispersal has disrupted traditional report creation, review, and approval processes, as well as dissemination of the information to requesting agencies and other stakeholders. Staff may find communication and collaboration between lab members more difficult and time-consuming when they cannot be in the same room and may require more time for these review processes.

To address communication bottlenecks, agencies are implementing a partial or full transition from paper to electronic records. Laboratories have reacted by increasing communication avenues via electronic methods, such as automated request systems offered through many commercially available LIMS systems. These systems automatically send reports to the next reviewer, which helps staff manage necessary quality control measures by providing staff with timely alerts when a case is ready for review. Network- or cloud-based systems such as Microsoft SharePoint or Qualtrax can help staff work collaboratively and access critical information from a home setting.



LIMS may enable continuity of crime laboratory operations.

Business continuity during these times is influenced not only by effective laboratory leadership but by use of technology to overcome challenges. Although laboratories rely on a number of tools to operate, LIMS play a key role in storing and communicating essential information about daily processes. LIMS database management systems that collect, create, and store data related to forensic examinations enable forensic laboratories to manage evidence and resources efficiently and can be scaled to meet the demands of federal, state, county, and municipal laboratories.

Laboratories using up-to-date commercially available (or COTS – “commercial off-the-shelf”) and internally developed (“homegrown”) LIMS can leverage their capabilities, and those of supporting tools such as virtual desktop infrastructure (VDI), to help them work effectively despite workflow, resource, and communication challenges. Laboratories should keep in mind the following considerations for addressing pandemic-related operations challenges:

Consider your options for accessing LIMS data remotely, from outside of the laboratory.

Although staff may have limited access to the laboratory, they must have reliable and secure access to the LIMS system outside the facility. Updating and accessing case information via LIMS helps keep the entire staff current and avoids security concerns of transmitting and securing data outside the application. Labs interviewed for this report used two different types of applications to access LIMS data remotely:

- 1) Cloud- or web-based LIMS applications: A cloud- or web-based application can be accessed through a web browser and can be accessed from a multitude of devices, including computers, tablets, and smartphones. This approach provides end users the flexibility to access data from a laboratory-issued or -approved personal device.
- 2) Remote access via client-based applications: In contrast to cloud- or web-based access, a client-based application requires the LIMS program be installed locally on a device; this means that a user can only access the LIMS system from a single device and would require additional customized application for each platform (e.g., iOS, Android). Laboratories may need to change existing protocols to allow staff to take on-site devices home or may need to purchase additional “portable” equipment (e.g., tablets and laptops).

In cases where agencies use a client-based application, remote access to LIMS requires additional technology, such as a virtual private network (VPN) or VDI. This technology helps off-site staff securely access locally stored network data. Network access via a client-based application can be complicated by inadequacy of the security protocols, lack of two-factor authentication, and non-encrypted telecommunication. Given security concerns inherent with housing data in a cloud environment housed by a third-party vendor, most labs are reluctant to use cloud-based storage options and prefer to use a client-based application in conjunction with data stored on local servers. For more information on cloud and client-based options, consult the FTCOE’s [Landscape Study on Laboratory Information Management Systems for Forensic Crime Laboratories \(August 2020\)](#).

Plan for information technology (IT) investment to maintain consistent remote functionality.

An adequate IT support infrastructure is key to a successful transition to remote working, and managers must keep this IT environment in mind when implementing remote working protocols. During interviews, laboratory administrators often commented on the value of their in-house IT teams. The conventional wisdom is that in-house teams, rather than vendor-based support, are better suited to successfully troubleshoot problems and bypass security issues in assisting lab team members remotely.

Leverage electronic communication methods.

Though current commercially available LIMS systems offer an electronic review process, many labs still rely on paper for some review, approval, and reporting. With the move to digital working, labs are now using LIMS to adjust to new processes not only to approve the documents but to create them as well. Laboratories should consider leveraging LIMS features that make communication processes more effective within and outside the lab.



Forensic Technology Center of Excellence

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Switching to electronic-based reporting and peer review has led previously paper-based laboratories to implement standard procedures for document composition and review. This shift has necessitated the development of a standard reporting template appropriate for each discipline, which has resulted in faster review times for quality control. Reviewers can check for completeness of information against the template, and the location of information in the reports are standardized. After the review process, many LIMS can transfer interim or final reports directly to the requesting agency and other stakeholders via portals or email transfer, eliminating the need for printing and mailing the information.

Leadership should plan to invest in solutions to leverage LIMS to build and maintain lab efficiency. For example, testing and addressing network slowdowns caused by high traffic and shifting security protocols to allow IT staff to take remote control of an employee's desktop may improve outcomes. Many labs are currently investing in teleconferencing and team collaboration software to easily allow multiple employees to collaborate through audio, video, and screen sharing, so that staff in the lab and those working remotely can be coordinated.

Enable staff to execute and benefit from new LIMS-based protocols.

As with any new protocol, laboratory management should ensure that staff are properly trained on using these electronic features. To help facilitate this process, some laboratories have invested in training modules built for specific use cases by their LIMS solution providers.

Set up LIMS using Application Programming Interfaces (APIs) to create “one stop shop” access to tools and data.

Many commercially available LIMS products enable interfacing with third-party software (via APIs) to bring information from systems such as quality management software and digital image comparison software, so that a LIMS may act as a “one stop shop” to access a variety of analysis tools and directly input information into the LIMS. LIMS can also directly interface with laboratory equipment so that data from these instruments upload directly into the LIMS. This is especially helpful when analysts are conducting experiments with long analysis times; rather than waiting in the laboratory, the analyst can leave and have results pushed directly to the LIMS remotely. Uploading data directly also helps reduce transcription errors, which are a considerable source of quality incidents. By interfacing these tools into the LIMS, the laboratory enhances the ability of its staff to work with near-full functionality from a remote setting.

Conclusion

COVID-19 has challenged forensic laboratories to drastically change the way they operate. Laboratories have accommodated restrictions by adjusting their policies and procedures to maintain staff on-site capacity, addressing IT challenges, and creating new standard operating procedures. Employing advanced LIMS features has enabled laboratories to digitize key processes and allow remote access to information critical to efficient operation outside of the facility. These changes were not easy because staff had to adapt to new requirements for accessing data and for reviewing and approving reports. However, the implementation of these features has benefited labs because workflows are now more standardized and streamlined. The result of these efforts will provide lasting improvements in efficiency.

“Within probably less than a month after COVID, the blood alcohol unit starting using our LIMS to perform their data review. Since staff are remote, information could no longer be printed. All documents had to be reviewed electronically. We changed policies and procedures using LIMS functionalities that were not used prior to COVID that allow us to document our review and approval steps. No more sticky notes on case files.”

In addition to forensic crime laboratories, other forensic stakeholders have used teleconferencing technology to maintain operations. Some accrediting bodies have changed to digital assessments, requiring a walkthrough of the laboratory via camera.



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