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Laboratory Automation: Important Considerations

Up to an estimated 70% of medical decisions are based on laboratory test results.¹ Yet, while diagnostic testing is a critically important step toward improving health-care outcomes, many labs remain constrained by tight budgets and limited resources. This often makes purchasing, replacing, or even expanding a laboratory automation system feel like a daunting endeavor. But ongoing trends—including a shrinking field of qualified laboratory personnel (over 17% of lab professionals are set to retire in the next five years²) and increasing test demand driven by an aging population—have only fueled the necessity for increased adoption and use of laboratory automation.

Given these realities, lab directors must be armed with a clear vision of how to best move their laboratory's capabilities into the future with automation. Following are five key topics each laboratory must explore to ensure that an investment in automation not only pays off in the long run, but also improves their ability to positively impact patient care.

Integrating IT to maximize laboratory automation benefits

As information technology continues to open new pathways in clinical diagnostics and broaden how we measure and define success, lab directors must consider how IT can complement their investment in automation. In fact, automation and IT systems can no longer be regarded as separate laboratory solutions, but rather must be

viewed as a single entity that exists to maximize input and output across the laboratory continuum. With automation serving to centralize testing and tube throughput and IT to aggregate and display testing data quickly and accurately, the benefits of the whole clearly become more important than the sum of its parts.

That is why it is paramount to research the availability and capabilities of an IT system that can enhance an automation solution. When automation and IT functionality combine, the closed-system loop provides seamless, total process management at a magnitude far greater than can be achieved by an automation solution that lacks adequate IT support.

An example of how automation combined with IT drives efficiency gains in the laboratory can be seen at Swedish Covenant Hospital in Chicago, IL. Prior to automation, Swedish Covenant's routine turnaround time (TAT) for chemistry testing was nearly 96 min. After automation, routine TAT fell to 73 min. Then, by implementing IT solutions—including autoverification and a patient identification-check system—the hospital was able to further reduce routine TAT to approximately 51 min, a reduction of more than 45%.

Flexibility/adaptability of the lab automation system

The laboratory diagnostics field is constantly evolving, making it difficult to anticipate future testing needs. Not only can laboratories expect testing volume to rise as the baby-boomer generation ages, but testing menus also will change as new as-

says are developed. Therefore, laboratories must ensure they select an automation solution that can be configured to meet current testing needs and also be easily re-configured to handle future demands. For example, a medium-sized laboratory today may only require (and have space) to run chemistry and immunoassay tests through two systems connected to an automation track. But what happens when that same lab needs to add another immunoassay system and expand its automated line to include a hematology analyzer? If the automation platform is not flexible enough to adapt to these needs or enable the lab to keep up with growing testing demand, then not only is the ability of the lab to increase testing capacity impacted, but result turnaround times may be compromised. Therefore, it is important to consider implementing an automation solution that easily supports connection of additional instruments and has the ability to quickly extend track length as needed.

Management and efficiency of laboratory tubes

Along with increasing test volumes and menus, there will be more tubes to manage, store, and archive, which will create an inevitable surge in pre- and postanalytical work flow. Total tube management—tracking all aspects of a tube's life, from the time it arrives in the lab until it is archived, to help manage pre- and postanalytical processes more efficiently—is an important development in automation that laboratories should consider when selecting a solution.

Equally important is primary tube efficiency, which measures how well the solution can route tubes through the lab to maximize throughput and deliver patient test results to clinicians in a timely manner. For example, some solutions maximize use of the primary tube, minimizing the need to aliquot (or split) samples. Others require samples to be split prior to analysis, often

resulting in additional costs, blood volumes, consumables, and waste.

A work flow assessment conducted by an automation-solutions vendor is an excellent way to help laboratories understand their current tube-routing processes and realize where additional efficiencies could be gained. A typical assessment consists of the vendor identifying where current bottlenecks exist in the system and providing recommendations for how to overcome these challenges.

Sustainability of specimen management

Since automation eliminates the variability inherent in a work flow that partially or fully relies on manual specimen handling, an obvious benefit of these solutions is that they provide laboratories the ability to establish sustainable processes for managing specimens.

Perhaps a less-understood aspect of sustainability is how automation solutions can support a laboratory's overall "green" initiatives, whether those initiatives are specific to the laboratory or associated with a larger affiliated health-care system. As demonstrated in the following example, choosing an automation system can help deliver broad, multilayered sustainability gains and provide a major advantage to any laboratory.

In 2007, responding to market pressures to increase productivity and deliver faster testing results, the Laboratório Dr. Joaquim Chaves in Portugal began to explore installing a new automation system. While automation indeed helped them achieve these goals—the average time it took the laboratory to deliver results was reduced by 59%, from 5 days to less than 2 days—they discovered an additional benefit. The number of blood tubes collected from each patient was cut in half, enabling the lab to slash material costs, decrease water use, and pro-

duce less waste. As a result, overall lab costs were reduced by 30%. And, with the new system in place, the lab generates 30 tons less material waste each year. In fact, solid-waste volume was cut by 61% and liquid waste by 74%³.

Impact of laboratory automation system on staff

Adding or upgrading a laboratory automation system obviously impacts how laboratory staff perform their jobs, and it may also provide opportunities for technologists to enhance their knowledge base and skill sets. As existing responsibilities are reconfigured due to automated work flows, lab directors must reevaluate where to reposition team members to maximize their value to the laboratory, promote continued professional development, and ensure that the laboratory remains compliant.

To help prepare for this postimplementation shift in staff responsibilities, laboratory directors must pinpoint several key tasks within the laboratory that require more consistent staff involvement, particularly those that center around patient safety and efficacy. With automation reducing the need for manual intervention in specimen handling, it can free up staff to take on these other, often more critical roles.

Not only does automation help lab managers fill in these responsibility gaps, but it also can lead to greater job satisfaction among technologists, who often find themselves able to more fully use their formal training and education within the new scope of their jobs. When they no longer need to perform important, yet mundane, manual tasks such as specimen handling, technologists in newly automated laboratories often transition to roles overseeing establishment of clinical test performance parameters, directing quality control and quality assurance programs, or, in some cases, transferring their skills to another laboratory diagnos-

tics discipline, such as the growing and exciting field of molecular diagnostics.

Conclusion

The evolving health-care market is changing the delivery of care and impacting how laboratories, clinicians, and hospitals supply these services. For medical laboratories, this means relying more on those technologies that enable them to do more with less, and to do so with the highest possible quality. Laboratory directors should have a clear vision of what they need and want automation to achieve prior to implementing a solution. With this roadmap to preplanning and analysis, laboratories can be confident that they are choosing an automation solution (and complementary IT system) that will prepare their lab for today, tomorrow, and well into the future.

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