ADVANCED INSTRUMENTS

Application Note

Tackling Staff Shortages by Optimizing the Testing Workflow

Well-functioning medical laboratories are a vital component of health systems all over the world.[1] Overall, they provide essential and objective information for the prevention, diagnosis and treatment of almost every health issue. Among other information, test results may indicate whether a patient is having a heart attack, needs surgery, or chemotherapy; the results may also reveal whether the patient needs a medication adjustment or is healthy enough to return home from a hospital stay.[2] In Germany, for example, two-thirds of all diagnoses are made or confirmed by laboratory testing.[3] Therefore, a constructive and well-structured collaboration between physicians and laboratory medical professionals is at the core of the clinical decision-making process.

A Looming Crisis: Workforce Shortage in Clinical Laboratories

As the global population ages, experienced medical lab technicians and technologists are retiring without being replaced by younger professionals; these colliding issues have led to a critical lack of lab workers with the experience to meet leading medical matters. Considering that it takes 5–10 years for a medical lab tech to become fully competent in hands-on practical processes and problem-solving, it has become evident that a serious shortage of laboratory technicians will emerge in the near future.[4] Research carried out by the Gatsby Foundation has indicated that, by 2030, the UK will require a further 700,000 lab techs to support the economy.[5] Further, a 2019 report by the DKI (Deutsches Krankenhausinstitut—The Hospital Institute of Germany) showed that by 2030, there will be a gap of nearly 13,000 full-time laboratory professionals in Germany's hospital system alone.[6]

The simultaneous increased demand for clinical lab tests, sharpened by the Covid-19 pandemic and driven by population growth, aging societies and a constantly increasing number of patients, are all factors aggravating this situation. Hence, without a significant increase in the number of laboratory techs entering the job market, the

consequences may be alarming: very long wait times for patients to receive urgent results from body fluid testing, and, at the same time, increasing pressure on the understaffed laboratories to improve their capabilities. In fact, a 2020 survey of laboratory employees in Germany, Austria, Great Britain, Italy and France conducted by Starlab International showed that 30% of the respondents view the shortage of specialist staff as their greatest challenge.[7]

A 2021 study of 65 laboratories in Germany, Austria and Switzerland further confirmed these findings: One-third to two-thirds of the surveyed laboratories are facing staff shortages, a situation that is more pronounced for highly-skilled staff.[8]

State-of-the-Art Technologies: Easing the Staffing Burden by Optimizing Processes

Under these circumstances, diagnostic laboratories are facing a dilemma. On one side, they are under increasing pressure to improve diagnostic accuracy, process higher numbers of samples faster and more predictably, and offer more tests. On the other side, they need to reduce costs, and they have fewer staff.[9] This is where automated analytical instruments come into play: They can support clinical laboratories in keeping up with testing demands while improving turnaround time, quality of results, ease of use and safety when handling patient samples. In fact, modern technologies, process optimization and automation reduce the length and number of manual procedures that staff must perform, which helps to compensate for staff shortages. At the same time, automated technologies offer laboratories standardization and consistency; the results have better accuracy, lower error rates and lower costs, while allowing more time for the highest-certified staff to perform complex tasks. Ultimately, these technologies increase patient care and safety.[10]

How to Enhance Efficiency in Your Lab: A Case Study

The most significant advantages of an automated osmometer:

1. Decreasing turnaround times
2. Increasing accuracy while minimizing impact of staff experience levels
3. Reducing tech-time at the instrument
4. Avoiding sample mix-ups
5. Automating result transmission

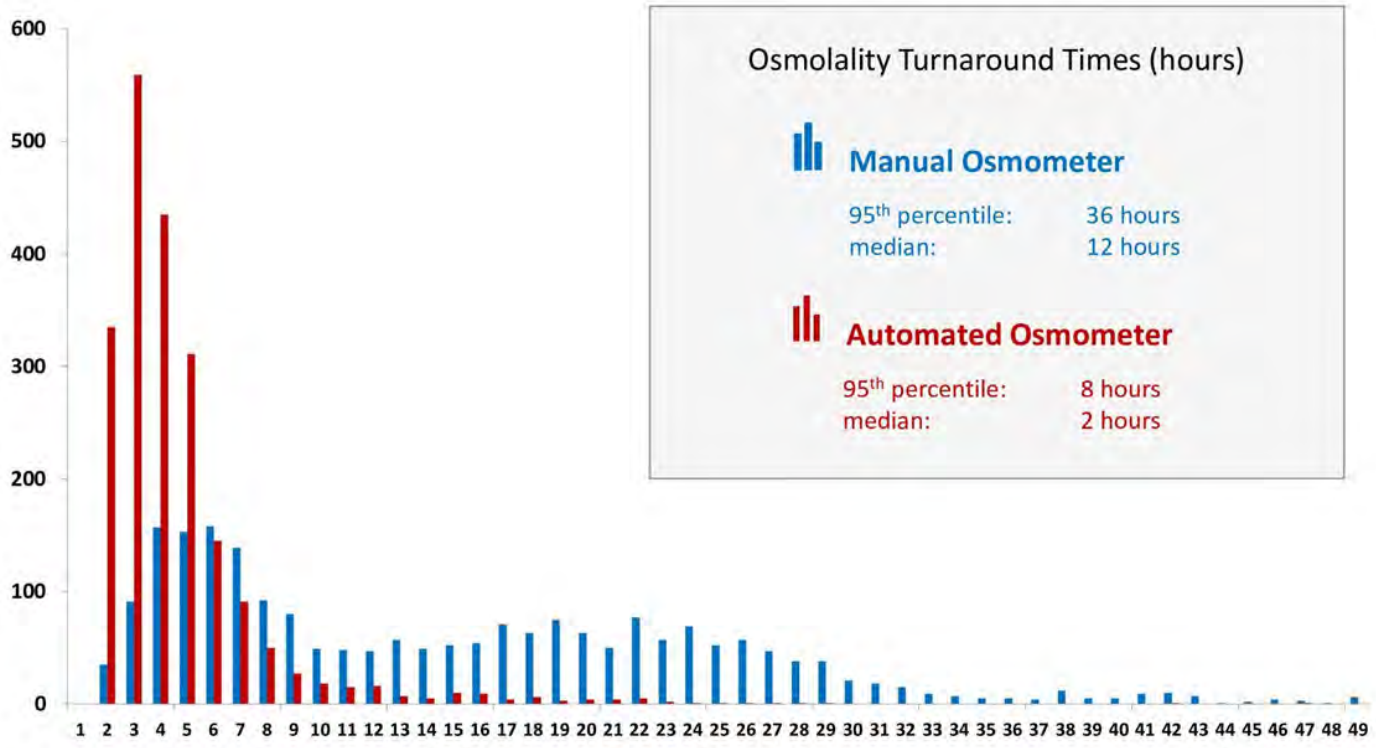
Among the tests routinely carried out in clinical laboratories, osmolality plays an essential role because it allows physicians to make quick and accurate diagnoses for a wide range of disorders. Therefore, using highly efficient and automated instruments for osmolality testing would allow laboratories to optimize their analytical workflow and provide the full range of accurate information physicians need without delays.

A case study conducted at the Department of Pathology—Laboratory Medicine at the University Hospital Southampton, UK, between 2016 and 2018 shows the impact of replacing a single sample manual osmometer with an automated osmometer in a large clinical lab. The University Hospital's lab processes approximately 3,500 samples per day (15–20 osmolalities) as well as supports a large teaching hospital and two clinical commissioning groups (CCGs). In 2017, the lab was encountering increasing difficulty in reporting results in a timely manner due to a 54% increase of workload over the prior four years. Therefore, they started investigating the potential benefits of using an automated freezing point osmometer, instead of a manual one, in terms of turnaround time, accuracy, sample mix-ups and transcription errors.

Turnaround Times

Turnaround times are a crucial parameter, especially in the management of patients admitted to emergency departments and intensive care units, when a fast therapy onset can save lives. In these cases, it is important to quickly identify the cause of a disorder—for example, hyponatraemia—as the cause directly dictates the treatment modalities, which can be completely different depending on the underlying pathological processes.

Using a manual instrument requires a trained member of laboratory staff sitting in front of the instrument and analyzing one sample at a time. This process is very time consuming and does not lend itself to urgent analysis. At the lab in Southampton, an audit in July 2016 showed that only 45% of manually performed osmolality tests were completed within the target time of 12 hours. "The 12 hours target is historical and is based more on what is achievable than what is clinically appropriate," explains Richard Allan, Operations Manager at the University Hospital Southampton. "A clinically appropriate turnaround time would be four hours for routine samples and one hour for urgent samples. An automated osmometer would allow us to reach this target, improving the turnaround time for osmometry and allowing for faster diagnosis and patient management." Indeed, the department's introduction of an automated osmometer in 2018 dramatically improved turnaround times to a median of 2 hours per test, allowing the lab to respond to health care challenges in a timely manner.



Accuracy

The need for patient safety through consistent diagnostic performance has increasingly grown during the last two decades, with studies showing that laboratory staffing levels and experience have a direct impact on error rates, mortality and patient outcomes.[11,12] Present and future workforce shortages and an increased workload already put lab staff under great pressure, and it has a negative impact on productivity and accuracy.

In addition, the present lack of experienced lab techs has resulted in an increased number of less experienced staff performing analyses. Potential consequences include rushed processes, the inability to prioritize when results must be delivered quickly

to physicians, as well as higher error rates. This lack of experience can also be a reason for inaccurate measurements. At the same time, an increasing number of sophisticated technologies and techniques require specialized knowledge and a broader skill set to perform tests and interpret results. If techs are not adequately trained, they often lack the required knowledge to understand the principles of osmometry and to check the final results. Moreover, many manual and repetitive steps in a nonautomated analytical workflow can have a negative impact on the concentration of the staff and, therefore, can increase error rates. Especially with tests that require a high level of accuracy and precision such as osmolality, suboptimal testing quality can ultimately compromise patient care.

Automation can help minimize the impact of varying levels of staff experience as well as increase accuracy. As shown in the case study at Southampton Hospital, the introduction of an automated osmometer with an automatic aspiration of samples from the primary patient tube led to an increased accuracy. The improved accuracy was reflected by an improvement in standard deviation index (SDI) scores for external quality assessment (EQA) samples. The SDI is an index of total errors and includes components of both inaccuracy and imprecision.

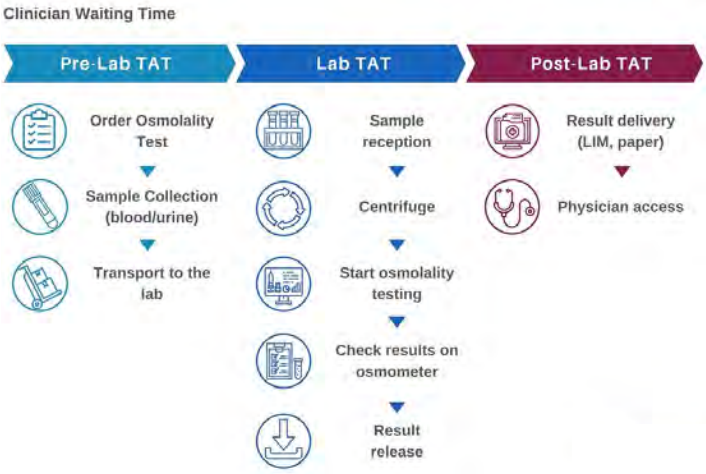
Sample Mix-Ups and Transcription Errors

In clinical labs, every step of sample preparation that can be automated is effective in mitigating the risk of human error, given that more than 60% of laboratory errors occur in the preanalytical phase.[13] Hence, optimized and simplified processes can contribute to promote the quality of laboratory services. Moreover, simple operation patterns can also increase tech confidence and boost productivity. User-friendly features such as onboard barcode readers, which can automatically scan sample IDs, reduce the risk of typing errors and facilitate sample traceability. For example, the identification of barcoded primary samples with the integrated barcode scanner of the osmometer at the laboratory at Southampton University Hospital resulted in a decreased number of sample mix-ups. Further, an automatic transmission of the test results to the Laboratory Information Management System (LIMS) can eliminate transcription errors and minimize paperwork. At Southampton, this led to a decrease in incidents related to either sample mix ups or transcription errors.

In summary, the advantages of introducing an automated osmometer observed in the busy Southampton Hospital laboratory were:

- improved turnaround times
- increased walk-away times for lab techs
- fewer sample mix ups
- fewer transcription errors due to LIMS interface
- no user error factor

Handling More With Less: Improving Productivity By Reducing Tech-Time on the Instrument



Studies suggest that as much as 35% of hospital staff time is spent on wasteful work that adds no value to patients.[14] Reducing the number of mundane tasks through automation would therefore improve workforce productivity, increase overall laboratory efficiency and improve the quality of the results. Moreover, minimal sample handling reduces the level of biohazard risk as technicians receive less exposure to patient fluids.

Automation also means decreased time spent on an instrument and manually executing every step of the analysis. This would allow techs to concentrate on the analytical side of their work. As a result, trained employees could spend their time on more demanding tasks, increasing the appeal of their work. Performing more challenging tasks could also improve employee retention and compensate for a shrinking workforce. Overall, automation has the potential to allow clinical laboratories to support an increased workload with fewer staff while improving turnaround time, quality of results, ease of use and safety. Especially during the SARS-CoV-2 pandemic, this operational efficiency is critical for establishing a safe and efficient diagnostic process, and therefore adequately managing the patients in order to determine favorable clinical outcomes.[15]

1. https://www.euro.who.int/en/health-topics/Health-systems/laboratory-services/about-laboratory-services
2. https://blogs.scientificamerican.com/observations/a-shortage-of-skilled-medical-lab-workers-is-looming/
3. https://healthcare-in-europe.com/en/news/lab-services-don-t-cut-the-cost.html
4. https://healthcare-in-europe.com/en/news/addressing-the-critical-lack-of-skilled-lab-workers.html
5. https://www.gatsby.org.uk/education
6. https://dvta.de/sites/default/files/2019_05_Fachkr%C3%A4ftemangel%20und%20Fachkr%C3%A4ftebedarf%20in%20MTA-Berufen_final.pdf
7. https://www.starlabgroup.com/GB-en/laboratory-survey.html
8. https://link.springer.com/article/10.1007/s00508-021-01962-4
9. https://link.springer.com/article/10.1007/s00508-021-01962-4
10. https://blogs.scientificamerican.com/observations/a-shortage-of-skilled-medical-lab-workers-is-looming/
11. https://link.springer.com/article/10.1007/s00508-021-01962-4
12. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3994349/
13. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7271754/
14. https://www.cs.odu.edu/~cpi/old/cpi-s2004/statag/murphy-wastefulwork.pdf
15. https://pubmed.ncbi.nlm.nih.gov/34533005/

ADVANCED INSTRUMENTS

Two Technology Way / Norwood, Massachusetts 02062, USA

800-225-4034 | 781-320-9000 | www.aicompanies.com

MP00153 Rev 0