

Standardizing pipette calibration in a large laboratory organization results in economic and quality gains

By Paula Pou

Large laboratory organizations with many departments find it difficult to allocate responsibility effectively for quality control. While a centralized, top-down approach can simplify regulatory compliance, distributing responsibility for calibration to individual departments has distinct advantages.

ARUP Laboratories in Salt Lake City, UT, a national clinical and anatomic-pathology reference laboratory, recently decentralized pipette quality control (QC) across its departments with great success. Working closely with a provider of liquid-handling quality-assurance technology, the lab implemented a standardized process for over 1,500 pipettes used in 71 departments. A pipette calibration system (PCS) and its associated pipette-tracking software were used to facilitate this process. ARUP also formed a pipette users group, drawing representatives from participating departments to ensure that standardized protocols were continually implemented with input from the entire organization.

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By putting into practice rigorous quality standards through this initiative, ARUP realized significant economic benefits. This outcome was achieved by reducing the number of tests that had to be rerun due to known or perceived pipetting error, thus minimizing wasted time and materials.

ARUP's need for quality

Based in the University of Utah Research Park in Salt Lake City, ARUP offers more than 2,000 clinical tests and test combinations, ranging from routine screening tests to highly esoteric molecular and genetic assays. As with any medical laboratory, pipetting is a critical component of the organization's operations. Regular pipette calibration has always been an important part of ARUP's QC system. Because many of the tests are extremely sensitive and results often determine patient diagnoses and treatment regimens, accurate and precise pipetting, especially when working with low volumes, is crucial for the success of the laboratory.

The drive to decentralize calibration

ARUP was an early adopter of the PCS for calibrations in its reagent-production lab. As the organization grew, the reagent lab assumed responsibility for calibrating many of the pipettes used organization-wide. The reagent lab, however, often confronted a backlog of pipettes and experienced challenges in handling uneven workflow.



To facilitate and oversee its decentralized approach, ARUP created a pipette users group, bringing together QC staff from across the organization. The group spans all levels of the organization: lab technologists, quality specialists, and group managers.

"Since most departments specified quarterly calibration intervals, calibration requests would peak and overload the lab at the end of each quarter," says Jeff Howard, ARUP quality specialist.

Another difficulty with this centralized approach was that — although the actual calibration was performed by the reagent lab — each individual department was responsible for the cleaning, maintenance, and calibration frequency of its pipettes as well as setting tolerance limits associated with different pipette types.

As ARUP expanded and its pipette population grew, more challenges arose. There were discrepancies in the calibration procedures among different labs. Different tolerances, data requirements, naming conventions, and standard operating procedures (SOPs) often would be associated with the same pipette model. Users of a pipette could set their own preferences, potentially leading to the same pipette being entered into the data-tracking system two or three times. This duplication led to inefficiencies and hampered ARUP's ability to garner useful data from the pipette tracking system. To remedy these issues, ARUP decided to decentralize the pipette calibration function and install multiple PCS instruments throughout its facility, which allowed each functional department to assume responsibility for the calibration and maintenance of their own pipettes.

"Pipetting technology was critical in facilitating this changeover," adds Howard. "It has enabled us to standardize pipette quality procedures across our entire organization."

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Users group standardizes pipette-calibration protocols

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The users group began by standardizing calibration methodology, frequency, and tolerance limits. For example, a particular pipette with a range of 20 μ L to 200 μ L could have different calibration procedures associated with it based on the department in which it was used. Now, following users-group standards, the policy is set: The pipette is calibrated quarterly at three volumes (20 μ L, 100 μ L, 200 μ L) with defined tolerance limits for accuracy and precision.

The group also helped standardize how the data-tracking system was used. Pipette-tracking software is designed to manage QC of an entire population of pipettes. It schedules calibrations, automates data collection during calibrations, and produces all documentation for regulatory compliance. The software also enforces the calibration methodology and tracks who is responsible for calibrating specific pipettes.

By standardizing calibration methodologies and procedures for each pipette, the group eliminated duplications and redundancies, reducing the data in the system by two-thirds. The group also standardized how the system was used so that each pipette now has a defined nomenclature, specific serial number, and specified SOPs

The users group streamlined the entire quality process, making management of calibration data more efficient. Howard notes, "By implementing standardized policies across the board, we were really able to speed up the entire system, making it more effective and productive over the long term."

Next step: standardize pipetting-technique training

One advantage of assigning calibration responsibility to the departments that actually use the pipettes was that it made ARUP more aware of the need to train users in proper pipetting technique. Since the PCS provides immediate feedback on pipetting performance, ARUP could observe errors in accuracy and precision based on variability in technique. The organization decided to create a training program to ensure that all pipette users were proficient in pipetting.

To streamline this training process, the users group is designing an online tutorial in pipetting technique that will be mandatory for all technical staff. The tutorial combines information from the organization's pipette vendor's quality-management certification seminar, in which ARUP recently participated, and ARUP's own internal SOPs.

The online tutorial is merely the first step in ARUP's training initiative. The organization also plans to implement a wet-lab training class that will merge elements of the vendor's training program and the best practices currently in use at ARUP. All incoming technical staff will be required to learn about and practice proper technique and receive hands-on experience using the PCS. The PCS is uniquely suited for training staff because a trainee can perform a 10-data-point calibration, complete with documentation, in less than three minutes. This quick feedback allows trainees to see the positive impact of minimal changes in technique.

"Even for technical staff who do not use pipettes daily, merely having them go through this training significantly raises awareness about the relationship between pipetting technique and quality," says Zachary Wilkey, quality specialist at ARUP. "That fits with the overall goal of the users group: to standardize our quality procedures throughout the organization and make quality a priority."

The benefits of quality

Rigorous quality procedures is the economic benefit associated with a high degree of accuracy and precision in liquid-delivery operations. "The users group's emphasis on standardizing quality not only ensures data integrity, it also saves us money over the long term," says Howard.

If pipettes are properly calibrated and operators are well trained in proper technique, there are fewer run failures over time. This minimizes material waste — such as expensive solvents and reagents — and also saves time and labor allocated to re-running tests.

"Quality is a goal in its own right," says Howard, "but there is also a strong business case for maintaining high standards. The pipette users group is executing that mission at ARUP." □

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