Swedish Hospital

A Model of Workflow Optimization and Staff Utilization for a Multidisciplinary Lab

Hospital laboratory capitalizes on innovations in automation, IT, and consolidated diagnostic platforms to simplify operations

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Case Study

SIEMENS Healthineers

Swedish Hospital at a Glance

- 312-bed hospital
- 12,500 admissions/year
- 50,400 ER visits/year
- 285,780 outpatient visits/year
- 14,745 surgical procedures/year
- 1.4 million lab tests/year
- 1100 lab samples/day
- 65 FTE laboratory staff
  - 37% trained medical technologists
  - 63% nontechnical personnel

Doing Less and Accomplishing More

A multicultural population of more than 2.7 million people speaking 40 different languages on the northwest side of Chicago depended on Swedish Hospital for its Level 2 trauma center, general and open-heart surgeries, two birthing units, in- and outpatient oncology care, mental health services, hospice care, and community outreach programs. Yet the independent, mid-sized community hospital was feeling the same operational stresses that were affecting so many other laboratories in the United States at the turn of the 21st century, making the pressure to adapt or perish very substantial. “I had to figure out how I was going to handle all the work with the staff I had,” said Susan Dawson, laboratory administrative director.

Facing rising healthcare costs and a technologist shortage that continues today, the multidisciplinary laboratory turned to innovation and in 2002 began a steady course of investment to simplify operations, improve workflows, and better utilize medically trained and nontechnical staff. Today, its paperless process features computerized physician order entry, positive patient identification during collection, automated check-in, and immediate processing in a continuous flow laboratory where only 2% of testing is batched.

Positive Outcomes

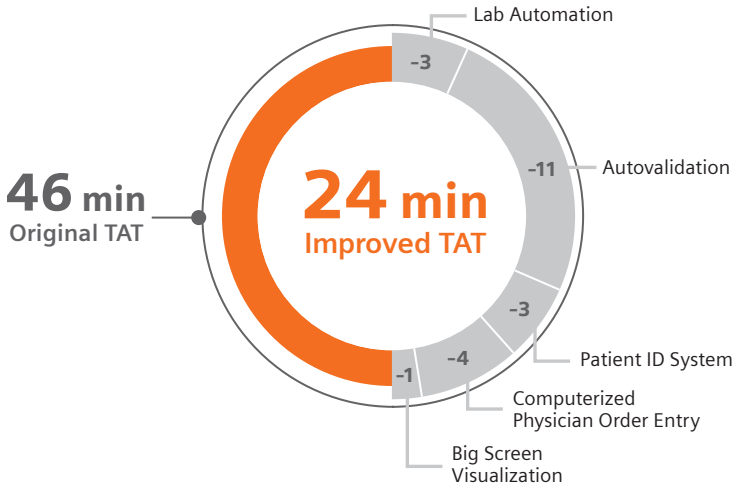
- Rated in top 10% by CAP against peers for service turnaround times
- Rated in top 10% by CAP against peers for specimen acceptability
- Rated in top 10% by HCAHPS against peers in cost-effectiveness
- Stroke certification
- Chest pain certification

Combining total lab automation (TLA) with several stand-alone analyzers and powered by advanced data management, turnaround time (TAT) from sample receipt to results being released can take as little as 24 minutes for select* chemistry, immunoassay, hemostasis, and hematology testing for Emergency Department patients. CAP has consistently ranked the lab among the top 10% for cost-effectiveness, turnaround times (TAT), and specimen acceptability in peer comparisons from 2000 to 2020.

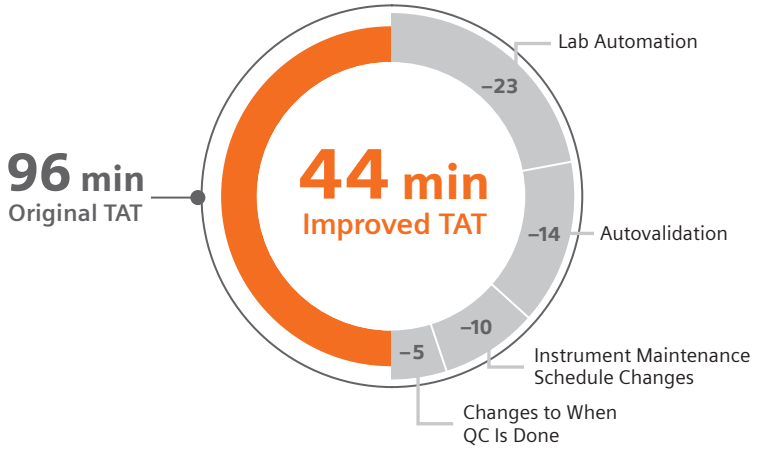
This case study examines how Atellica® Solution, Aptio® Automation, and Atellica Data Manager have helped to simplify operations and enable Swedish Hospital to transform into a model laboratory for workflow optimization and staff satisfaction. A powerful combination of diagnostic innovation, advanced data-management practices, and total laboratory automation—refined over more than decade—enables the lab to do less but accomplish more.

**Data excludes some longer infectious-disease tests such as hepatitis.*

Turnaround Time (TAT) Improvement for Emergency Department Results



TAT Improvement for Routine Morning Chemistry Samples



Swedish Hospital has introduced a variety of workflow improvements since 2002 resulting in significant improvements in TAT.

The Biggest Innovation: Automation

"We introduced our biggest innovation in 2002 by bringing Siemens automation into a mid-sized hospital," continued Dawson. "Because of our size, we were told we couldn't do it, but we did it anyway. It worked out extremely well, and we've grown from there."

In 2002, Swedish Hospital brought a first-generation automation solution into the core lab to automate chemistry and immunoassay testing, while urinalysis, hematology, and hemostasis analysis continued to be performed on stand-alone analyzers in the 2700 square-foot area. The five connected analyzers met the early volume requirements of a mid-sized hospital lab while providing the necessary operational redundancy during quality control and maintenance routines.

The immediate efficiency gains from the automation track resulted in an average 10-minute TAT improvement for chemistry and immunoassay testing. Moreover, it created excess capacity that was steadily offset by new volume coming from several hospitals that soon closed in the area.

After 14 years, the lab decided to leverage the full benefits of total lab automation (TLA) and replaced its track

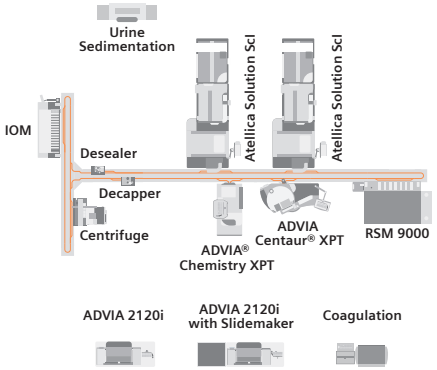


Figure 1.

with Aptio Automation, featuring both pre- and post-analytical processing modules (see Figure 1).

One-touch automated sample management and testing—from centrifugation and cap removal to sealing, storage, and disposal—reduced labor-intensive, error-prone manual work in the lab. The lab also used data-driven rules to immediately drive repeat, reflex, and dilution testing for the connected analyzers on the Aptio Automation track without the need for reactive manual intervention by lab staff. However, the increased capacity and improved TAT associated with automation had much more serious implications for Dawson's staff.

The Greatest Impact: Autovalidation

"Bringing in automation meant that we were handling more specimens and more results—and seeing results come faster," continued Dawson. "We had to be able to handle all those results in an efficient way. Our ability to perform autovalidation with Atellica Data Manager has by far had the greatest impact on what our lab is able to do." Almost immediately, average TAT was reduced by another 10 minutes.

All patient results generated in the lab are reviewed in the Atellica Data Manager software based on predetermined criteria established by Dawson and her team. These autoverification rules ensure that all results are evaluated according to accepted industry standards and lab protocols. A result that violates any rule, whether it is related to acceptable ranges, a percentage or absolute delta check value, quality control issues, and/or instrument flags, is automatically highlighted and held for manual review.

Samples may also be automatically reflexed for additional testing. Autovalidation ensures that results are evaluated consistently across technologists, shifts, instruments, etc., for instruments both on and off the Aptio Automation track.

"We use Atellica Data Manager to separate the normal results from the abnormal results, so autovalidation enables us to get our normal results out a little quicker." That's important considering that approximately 85% of results—more than 9500 individual test results/day—at Swedish Hospital are autovalidated. But that isn't what Dawson considers the biggest benefit. "Autovalidation has become a true stress reliever for the techs. Not having to worry that we are going to miss an abnormal result is a huge advantage. Bringing the results that need attention to the forefront is just a better use of my techs' time."

"Performing validation in the middleware is so much more valuable than at the LIS," Dawson also explained. "It's more powerful because there are more options for what we can do." When reviewing chemistry results, for example, the lab staff may rerun a test with a dilution and view both results side by side to determine which result to upload.

The Review and Edit screen consolidates important information so it is easy to see which results are held, understand why, and prompt action.

The Next Level of Efficiency: Atellica Solution

Two Atellica Solution systems connected to Aptio Automation provide the technological innovation needed to move the lab into the future. The integrated system combines flexible configurations of independently operating chemistry and immunoassay modules on a single platform that features unique STAT handling capabilities. The high throughput of Atellica Solution has enabled Swedish Hospital to expand its chemistry and immunoassay testing capacity by 15% (vs. legacy instrumentation) and uses only two of the available automation touchpoints. The game-changing diagnostic platform has enabled Swedish Hospital to achieve new levels of efficiency for both doctors and staff.

"Atellica Solution is able to produce immunoassay results much faster than the legacy systems that were connected to our track," said Dawson. TAT decreased 16% for cardiac markers and 25% for HCG testing. Emergency Department and ICU doctors took special notice of improved service levels when a procalcitonin assay, considered essential to the hospital's ability to combat sepsis, was moved to the Atellica Solution menu from a stand-alone instrument in the lab.

Atellica Solution is saving time for lab staff as well. "Automated QC has been especially invaluable in infectious-disease testing," noted Dawson, "where as many as eight or nine different controls may need to be tested two to three times per day." QC is onboard and runs with no staff intervention.

Atellica Solution also automatically performs a daily maintenance routine, which saves time and reduces stress for the two technicians who staff the night shift. When one module is offline for maintenance, the staff needs only to redirect samples to the other system on the automation track. "Just the fact that the techs don't have to worry about it, it just gets done automatically, is a huge time savings," says Dawson.

The high-volume Atellica Solution platforms meet overall chemistry and immunoassay demand but occupy only two automation touchpoints in the space-constrained lab. Consequently, Dawson has decommissioned the lower-volume legacy instruments that were connected to the track and has future plans to connect coagulation to leverage the pre- and post-analytical benefits of total lab automation.

"Innovation from Siemens Healthineers has helped our laboratory, especially with Atellica Solution, by helping us to do less and accomplish more."

Susan Dawson
Lab Director, Swedish Hospital, USA

The Secret to Quality: Standardized Processes

The open, multidisciplinary design of Atellica Data Manager enables Swedish Hospital to support chemistry, immunoassay, hemostasis, and hematology test and result management for instruments both on and off the Aptio Automation track. "Standardization is really important in our lab," Dawson continues. "Atellica Data Manager makes processes consistent across disciplines and shifts. All the results are handled the same way. If you have consistency, you end up with high quality."

"Decision support systems and algorithms built into the Atellica Data Manager software have helped us to handle HIV, hepatitis, and hematology testing," explains Dawson. The software's powerful rules have enabled the lab to integrate infectious-disease testing algorithms, ISLH hematology guidelines, critical review criteria, and next steps into the manual review process. Well-designed Review and Edit screens make it easy for techs to see exactly why a result has been held, what specific rule has been violated, and what action to take. Delta checks, automatically performed by the system, can be easily viewed in real time from a single screen. Such capabilities give Dawson the flexibility to move techs to different, less-familiar areas during evening and night shifts and have been a valuable teaching tool for new techs, particularly in the area of hematology.

"When data management was performed at the LIS, it was not possible to implement complex rules for hematology reviews, nor could technologists choose to accept or reject automated differentials," commented Dawson. With Atellica Data Manager, hematology reviews are no longer a multistep process where technologists need to consult different systems or click through screen after screen for key data needed to support informed clinical decisions.

In addition to bringing up distinct WBC, RBC, hemoglobin, and platelet data, it's possible to bring up cytograms and see and compare previous differentials within the software. "We've set it up so that the techs can immediately see if a slide needs to be created, or whether or not they need to do a manual differential," noted Dawson. "We actually have test reflex that says 'Manual Diff Required."

"High efficiency, great turnaround time, simplicity, and all without increasing stress on my techs. In fact, it has lowered the stress for my techs. Our techs aren't mentally or physically exhausted at the end of the day. As a manager, that's important to me."

Susan Dawson
Lab Director, Swedish Hospital, USA

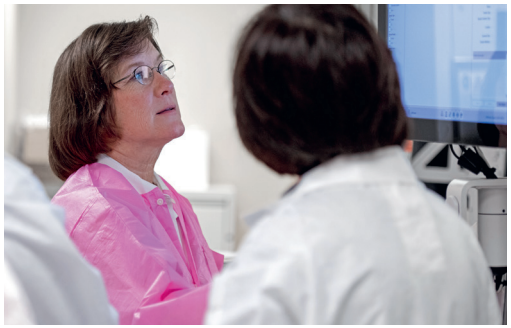
The Home screen identifies where attention is needed and provides direct-click access. It can standardize operations while also accommodating user-specific needs in a multidisciplinary lab.

The Key to Success: A Focused and Engaged Staff

A powerful combination of diagnostic innovation, advanced data management, and TLA has enabled Swedish Hospital to do less but accomplish more. The lab staff saves valuable time with the automated QC and maintenance routines of Atellica Solution and pre- and post-analytical processing performed on the Aptio Automation track. Likewise, the high-throughput, STAT prioritization, and one-touch testing capabilities of these solutions eliminate work for the staff and improve capacity and TAT for the healthcare providers served. Algorithm-driven testing and result verification rules also automate some activities. While the overall reduction in workload has been significant, what is more impressive is the increased focus, engagement, and motivation of the laboratory staff.

"My techs are thrilled with the Atellica Data Manager Home screen. They can see and easily access, with one click, what they need at any given time," says Dawson. The customizable Home screen makes it easy to manage multidisciplinary testing within a single system. While the main dashboard and overall software design are user-friendly, the Counters feature, which automatically tracks how many samples meet predefined search criteria in real time, is especially important in ensuring smooth operations and high staff morale in the lab.

The staff was closely involved in creating tailored counters, including alerts, that enable them to prioritize work according to individual responsibilities and the patient population.



"Atellica Data Manager custom counters have enabled us to separate STAT specimens from the Emergency Department. Our technicians focus on those before they worry about routine specimens. We've been able to separate hematology and coag from chemistry and IA results." Dawson believes the participatory nature of this approach has strengthened her team's ownership of the tool and their commitment to meeting key performance targets.

Easier management of QC testing is another key improvement appreciated by the staff. Alerting capabilities on the Home screen make it easy to identify, investigate, and address QC issues. "Results need to be in control at all times," stresses Dawson. "Atellica Data Manager brings all the QC failures right up to the front Home screen, and that makes a huge difference because techs can easily access the information and then drill down if they need to. One click takes them to a list of tests that have QC issues. Another click will take them right to the very problem."

More Than a Partnership: A Relationship Built on Trust

As Dawson looks to the future, she also notes the importance of the past. "We've been partnering with Siemens Healthineers for over 20 years, and it's more than a partnership: It's a relationship. We are able to communicate openly. They listen to us, assess our needs, and if they have something that can meet our needs, they present it in such a way that it makes sense to us." The partnership has already enabled Swedish Hospital to do less but accomplish more through a powerful combination of diagnostic innovation, advanced data management, and total lab automation. "I don't know what the future will bring, but I'm confident that Siemens Healthineers will provide not only the innovation, but also the partnership, needed to face it," Dawson concludes.

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Lab Director, Swedish Hospital, USA

At Siemens Healthineers, we pioneer breakthroughs in healthcare. For everyone. Everywhere. By constantly bringing breakthrough innovations to market, we enable healthcare professionals to deliver high-quality care, leading to the best possible outcome for patients.

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The outcomes achieved by the Siemens Healthineers customer described here were achieved in the customer's unique setting. Since there is no typical hospital or laboratory, and many variables exist (e.g., hospital or laboratory size, case mix, level of IT adoption), there can be no guarantee that others will achieve the same results.

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