How LIS tweaks can enhance efficiency, patient safety

Kevin B. O'Reilly

Access LIS interactive guide

November 2014—So, you have a great idea that will improve laboratory workflow and reduce errors? Chances are the change will depend on automation of some sort, and will involve the LIS. But upgrades to laboratory information systems may not come fast enough, and the middleware may not be available to accomplish what you need. Then the question becomes how to customize the LIS to achieve your aims.

That is what the six-member pathology informatics team at the University of Pittsburgh Medical Center Health System has had to do—work on their own, with middleware providers, and with their LIS vendor to meet the demands of their laboratory colleagues.

Dr. Pantanowitz

"That's the philosophy we have. Our users ask, and we aim to deliver," Liron Pantanowitz, MD, tells CAP TODAY. An associate professor of pathology at the University of Pittsburgh School of Medicine, Dr. Pantanowitz also directs cytopathology at UPMC Shadyside, heads UPMC's pathology informatics fellowship program, and is associate director of Pitt's Pathology Informatics Division.

Dr. Pantanowitz and his colleague Anil V. Parwani, MD, PhD, detailed several innovative UPMC projects in a CAP '14 session, "Customizing the Laboratory Information System to Improve Patient Safety and Workflow in the Pathology Laboratory." These include using the LIS to drive improvements in anatomic pathology quality control, synoptic reporting, and specimen tracking, while exploring the promises—and challenges—of digital pathology and next-generation sequencing.

Drs. Pantanowitz and Parwani together serve as editor-in-chief of the *Journal of Pathology Informatics*. The journal is published by the Association for Pathology Informatics, which cosponsored the CAP '14 session.

Dr. Parwani, who specializes in anatomic pathology informatics, says AP has for too long lagged behind clinical pathology when it comes to automation.

"If you look at the clinical pathology lab, it's about 20 years ahead of the AP lab in a lot of ways," he said at the CAP '14 session in September. "In many cases, we don't have barcoding. And how many AP labs have standardized and structured reports? These are some of the things that are the key players in this transformation to automation."

Dr. Parwani, professor of pathology and a genitourinary pathologist, expands on the point in an interview with CAP TODAY.

"Every time I look at what's in AP and then walk into the CP lab, I think, 'Wow, if we had that in the AP lab it would be great.'"

The view that anatomic pathology is more qualitative than the highly quantitative nature of clinical pathology has contributed to AP's lagging on LIS-driven automation, Dr. Pantanowitz says.

"We are at least a decade behind CP when it comes to automation," he says. "We in AP are moving toward being more quantitative, with more accurate grading, more image analysis. All of that is being built into the LIS, especially as we are getting higher volumes of cases and are being asked to do more quantitative work."

One of the customizations the UPMC team worked on with its vendor, Cerner, has enabled review of AP reports before sign-out. UPMC had many ways to spot errors in pathology reports, but detection came after the case was signed out. These included comparing frozen section diagnoses with final diagnoses, amended reports, intra- and extradepartmental consultations, tumor boards, clinician requested reviews, and autopsies.

"There is a lot of good retrospective QA after the fact, but then it's obviously too late," Dr. Pantanowitz said. "You may spot an error at a tumor board, but it may be too late because the patient already had surgery or received chemotherapy."

Cerner enabled a functionality in its CoPathPlus product that would randomly select eight percent of cases for secondary review by another pathologist. At the sign-out stage, a message will pop up that reads, "This specimen has been selected for QC." The case is sent to a quality control work list. "Then you have another pathologist review the case entirely and the report," Dr. Pantanowitz said. The reviewing pathologist can note different levels of disagreement, ranging from minor to major.

"That major disagreement basically means, come and talk with me about this case," Dr. Pantanowitz said. "It could be that you missed that a flow cytometry was pending on a case. And we want to avoid such a case being called negative, when the flow comes back later as positive."

Using this tool, "we can prevent an error before it actually happens," Dr. Pantanowitz said. The LIS customization, implemented in 2009, enabled an 8.4 percent rate of secondary, pre-sign-out case review, more than double the 3.7 percent rate before the functionality was implemented. Dr. Pantanowitz presented data from more than a year of use of the functionality at UPMC. Random review of 3,165 cases before sign-out prevented 73 errors, he said.

And the turnaround time for surgical pathology cases selected for review was 2.08 days, compared with 2.17 days for cases not subjected to the quality control process. That time difference was not statistically significant, but the pre-sign-out QA process was a major improvement on the 62 days it typically took to review cases under UPMC's retrospective audit system. Results from Pitt's work in this area were published in the *Journal of Pathology Informatics* (Kamat S, et al. 2011;2:42).

"The number of amended reports went down by 30 percent," Dr. Pantanowitz added. "The major errors go way down just by making a simple change in the LIS. And we actually changed the culture among our pathologists. The culture now is that it's good to share your cases. They share more and more cases, independent of the QC. Basically, by improving a small functionality in the LIS, we replaced this manual thing and it involves hardly any clerical work. It's hands free. It's not affecting the workflow, it didn't affect turnaround time, but it did improve patient safety."

UPMC has also taken advantage of the LIS in synoptic reporting. In his portion of the CAP '14 talk, Dr. Parwani said the traditional, narrative pathology report is to the structured, template-based synoptic report as a messy clothes closet is to an organized closet.

"In the messy closet, things are hard to find," Dr. Parwani said. "In the neat closet, you can find the things you need easily. If I have a pathology report that looks like [the neat closet], it's easier to put information in there and take information out of there. You can store things in a standardized way. And you make sure all that information is stored in the report in the LIS, and you can search for it."

Dr. Parwani

Cerner's CoPathPlus offers synoptic worksheets, Dr. Parwani said. These offer simple user interaction and provide choices in how data are stored and how reports are formatted, he added. When the CAP comes out with updates to its reporting templates, the LIS can accommodate them.

"Once you have this data and you fill out these synoptic reports, you can collect data on QA, on usage, and you have the ability to take this data and send it to external systems," he said. "For example, we send our prostate cancer resection cases to tissue banks, or to outcome-based systems, to cancer registries, and to research databases. This has a lot of power built into it."

While UPMC pathologists are expected to complete the synoptic elements of the report, the narrative is not yet banished entirely.

"Lots of pathologists didn't want to give up the free text part of the report. They still wanted to express their view in the way they felt was the most appropriate," Dr. Parwani said. "So, rather than fighting that battle, we decided to create a section in the report called the case synopsis. . . . So we still preserve the free text part of the report."

Pathology residents are evaluated on their synoptic reports, he added. "Paper works well, but with the LIS you can monitor this and track it."

"Compared with input errors for free text, we see a reduction in those types of errors with the synoptic reporting tool," Dr. Parwani said. "One of the biggest things we've seen is that . . . TNM staging is more accurate as a result. We've seen a lot of benefits with this standardization."

The UPMC team also customized the way reports appear in the electronic health record using what it calls a comprehensive theranostic summary. This quick look is the first thing that an oncologist, for example, will see, and it displays the results of molecular, IHC, FISH, and other tests in one place.

"We always got complaints from the physicians that the report was too long and took 15 pages to get to the TNM staging," Dr. Parwani said. The comprehensive theranostics summary addresses that concern.

"We are working on these changes in the LIS to enhance communication," Dr. Parwani added. "We want to have a way to note benign, malignant, etc., and have that be the first thing that appears in the report going out. That way, you're going to ensure that reports are more efficiently done and enhance patient safety."

The UPMC team also is working on a special code that would be used to electronically alert clinicians about AP critical values, such as new or unexpected findings of cancer.

When it came time to bring in barcoding for AP, starting in 2008, the UPMC team wanted to build something within the lab information system.

"We didn't want to create many different systems. We wanted to use the power of the LIS to do barcoding," Dr. Parwani said. "We wanted to adopt a system to be used by all 20 hospitals [in the UPMC system], across all the [AP] labs. We wanted to build something scalable, and something flexible enough to accommodate the different types of workflow at the small labs as well as the large, central labs."

"If done correctly, a barcoded asset management tracking system can drive your workflow. It can help detect bottlenecks in the system," he added. "We wanted to get to the point where the workflow is being driven by the

LIS capturing all these measurable data outcomes. The biggest goal was to minimize errors."

A similar barcoding project at the Henry Ford Hospital cut case misidentifications by 62 percent, slashed common histologic slide misidentification defects by about 95 percent, and improved throughput at the histology microtomy station by 125 percent (Zarbo RJ, et al. *Am J Clin Pathol.* 2009;131:468–477).

"When we first started doing this with our first pilot barcoding system, we started to see similar numbers," Dr. Parwani said. "More importantly, we saw changes in the culture. We saw histotechnologists who at first didn't want to adopt barcoding. But after the first week, they loved it and didn't want to give it up."

Under the system implemented at UPMC, several manual steps that posed risk for human error were automated. These include the labeling of requisitions and the patient identification double-check, the labeling of blocks and cassettes, status updating, calling up the case in the LIS, and creating slide labels.

"Now we can get up-to-the-minute information about the cases," Dr. Parwani said. "I have an email sent to me showing that today I will be getting 200 blocks, and so many of them are immunos, etc. This data has been captured in the LIS in real time."

"We can get status monitors now. Managers can walk into the lab and see the number of cases coming out with near real-time tracking. It's like a manufacturing plant," Dr. Parwani added. "You can see how many are in the stainers, and how many techs are working on it. We have read-out capability at the block level. If we have errors, it's an easier way to investigate them."

In the six months before implementing the system at UPMC Shadyside's histology lab, there was a monthly average of 2.17 mislabeled slides, and 13 total labeling errors. Both of those numbers went to zero in the six months after implementation. Errors were not eliminated at UPMC Presbyterian's histology lab, but they also fell dramatically—by 67 percent.

To accomplish this, it was necessary to get software updates to the LIS. UPMC is in the enviable position, due to its size and pathology informatics expertise, of having a close working relationship with Cerner.

"We partner with our vendor, not just in the work environment but more at a strategic level," Dr. Pantanowitz tells CAP TODAY. "It's an ongoing, continuous conversation with them. And what I mean by that is we continue to tell them where we think we would like to be headed, and what ideas we have in mind for the future. And we continue listening to their conversation, and what's on their road map, and what they have going on."

Dr. Parwani says UPMC's relationship with Cerner "is really a collaborative partnership."

The UPMC informatics team also has sought to integrate two cutting-edge technologies—digital pathology and next-generation sequencing—into its laboratory information system. The real benefit of digital pathology is to be able to share the images for consultations and other uses, Dr. Pantanowitz said.

"There's no value in taking a stack of slides and just digitizing them, especially if your histology lab is right across the room," he noted. UPMC uses its whole-slide images as part of resident training, for teaching conferences, tumor boards, proficiency testing, and image analysis and research. UPMC also receives whole-slide image consults via telepathology.

Many of the images, such as gross pathology pictures, are acquired directly into the LIS. There are benefits to storing the images in the LIS as well as outside of it, Dr. Pantanowitz said. Restricting them to the LIS gives the pathology department more control over them, but also makes it more difficult for others to access them.

The UPMC team made changes to the LIS image database so that gross images could be shared with the radiology system and easily accessed for tumor board meetings and similar uses. This is done by "wrapping" them in the Digital Imaging and Communications in Medicine, or DICOM, standard used for radiology images.

“The pathology images are now viewable in the EHR side by side with the radiology images,” Dr. Pantanowitz said. “We can still maintain all the images in our LIS, but we can now share them more easily through this central pathology image repository that is accessible to clinicians.”

He sees an eventual move toward a “slideless lab” in which histotechnologists would take on the role of performing QA checks on the images to ensure they are adequately readable by pathologists.

As for next-generation sequencing, “the elephant in the room” is how to store all the data generated by the testing process, Dr. Pantanowitz said. And that elephant is bound to get bigger.

“I don’t know about your lab, but I’m being asked to do next-gen sequencing on everything,” he said. “If you’re not doing NGS now, it will be coming your way soon.”

To give a sense of the big-data problems caused by NGS, Dr. Pantanowitz noted that exome-targeted sequences could yield a million genetic variants that range in size from 10 to 100 gigabytes. So, 100 samples would require one terabyte of storage space. That is a lot, but manageable under conventional IT capabilities. For next-gen sequencing, one data file could generate 500 gigabytes depending on which system is used. One hundred samples would require 50 terabytes of storage space.

“And that’s not including backup,” Dr. Pantanowitz said. “Informatics now is the biggest bottleneck to this process, besides reimbursement.”

The UPMC lab invested a lot of money in servers to accommodate next-generation sequencing. Other challenges posed by NGS include workflow tracking, data transfer time, data accuracy, data standards, data security, and HIPAA-compliant IT. Notably, cloud storage is not an option due to lack of compliance with HIPAA. There is one NGS software solution developed at Washington University in St. Louis called Clinical Genomicist Workstation, Dr. Pantanowitz said. Otherwise, labs exploring NGS will likely be looking to middleware for help in managing the process from start to end.

Dr. Pantanowitz acknowledged that most labs lack UPMC’s advantages with regard to its testing and development collaboration with an LIS vendor.

“We’re not here to frustrate you that you can’t do this with your LIS,” he said. “We just wanted to show that you can customize it in many ways. You can go back to your IT folks and say, ‘We want this,’ and get it done.”

“If your vendor won’t allow you to do so, you can explore what middleware you can get to do that for you. But the key here is that whatever you tackle or take on—whether it’s barcoding or digital imaging in your lab—you need to make sure whatever you’re doing is integrated with your LIS. Otherwise, you’re just going to make complicated processes and make people unhappy.”
[hr]

Kevin B. O’Reilly is CAP TODAY *senior editor.*