



Digital pathology implementation: Key lessons for success and a new method of interactive imaging designed for integration

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The growing healthcare needs in North America have created a number of challenges for modern pathology practices such as limited capacity for slide storage, reduced access to specialist expertise, and increased workload and budget constraints. In order for healthcare providers to address these issues, workflow efficiency and labour distribution must be improved across the industry. Digital pathology is a powerful tool that helps achieve these objectives by allowing for significant cost savings and improved quality of care. ViewsIQ has worked closely with institutions across North America to learn the keys to successfully implementing digital pathology. This paper shares these key insights and how ViewsIQ's Panoptiq™ imaging system was designed for integration.



Pathology Challenges in the Face of Rising Healthcare Needs

Despite the rapid recent progress in medical technology, pathology still relies largely upon traditional equipment and methods of practice. Modern pathology faces an assortment of challenges that increase the need for more efficient workflows that incorporate recent technological advances. These challenges include limited slide storage capacities, the shortage of medical expertise in remote areas, and increased workloads owing to budget cuts and an aging baby boomer population.¹⁻³

Limited capacity for slide storage – Hospitals are nearing capacity of their slide storage facilities, and many lack concrete plans or financial support for facility expansion. In addition, storage facilities are frequently challenging to navigate, making slide retrieval difficult.

Reduced access to specialist expertise – Hospitals are limited by pathologist expertise in both rural/remote and urban areas. In rural and remote areas, patients may not have access to the necessary specialists, requiring transportation of patients or samples to urban centres. Even within urban areas, factors such as laboratory consolidation and increased implementation of Ambulatory Surgery Centers are resulting in fewer on-site specialists. In fact, there is expected to be a 20% decline of full-time pathology expertise from 2015 to 2030, requiring collaborative efforts to meet demands.^{1,3}

Increased workload and budget constraints – The workload on the healthcare system is increasing, owing partly to a large proportion of the population reaching retirement age. At the same time, levels of reimbursement are decreasing and many institutions are being forced to reduce their costs. Consequently, healthcare networks are under pressure to operate more efficiently while maintaining their standards of patient care.³

These issues are already having a significant impact on healthcare in North America, prompting the industry to consider how new tools and technologies can be used to improve existing practices.

Benefits of Digital Pathology

Digital imaging directly addresses the challenges of modern pathology by eliminating slide storage limitations, facilitating remote access to specialist expertise and enabling more efficient hospital workflows. The recent exponential advances in computing technology and internet infrastructure have made it both possible and practical to implement digital pathology in healthcare networks.

One of the many strengths of digital pathology is the potential for improved operational efficiency. As seen in a study done by Ho *et al.*, a cost saving of \$12.4 million from digital pathology usage at a healthcare institution in Western Pennsylvania was projected due to improved pathology productivity and consolidated histology operations.⁴ Other significant contributions of digital pathology include the removal of barriers associated with digital mediums. For example, glass slides are traditionally prepared in bulk and then

transported to the designated parties, which can be costly and time-consuming. Digital systems circumvent these problems by allowing slide images to be immediately distributed via internet or local area network (LAN) connections. These types of advantages enable the institutions to improve operational efficiency, allow for collaborative expertise, and archive comprehensive digital records that are easy to navigate and review.

Operational efficiency and cost-savings – Digital pathology systems allow slide images to be rapidly distributed to consulting pathologists or other parties. This eliminates costs associated with intra- and inter-facility travel and the physical shipping of glass slides. Also, individuals can log in and review digital samples without needing to leave their stations or facilities. Eventually, digital imaging may replace physical slide storage as a more cost- and space-efficient record-keeping system.⁴

Improved access to pathology expertise – Collaborative consultations are often required both within facilities and between metropolitan and rural regions. Modern networking software and infrastructure now allow labs to conduct telepathology via real-time web streaming or file transfers on local networks or the internet. For institutions that lack in-house specialty expertise, this type of consultation is crucial for providing accurate diagnoses and optimal treatment plans.⁵

Comprehensive digital records – Many modern digital imaging systems feature direct annotations onto the slide image. This streamlines all the relevant case information visually, allowing for more intuitive case reviews. Unlike physical archives, digital records will not suffer physical deteriorations, fading stains, or other natural degradations. Also, these digital records are often coupled with other analysis tools as additional workflow aids.

However, in order to achieve all of the benefits of a digital pathology system, it is critical to assess which technology is the best fit for all relevant stakeholders.

Key for Successful Implementation

The key for successfully implementing a digital pathology system is to address the needs and concerns of stakeholders. In the hospital setting, the main stakeholders include the pathologists, administration, and IT. Each group has their own set of requirements for the adoption of a new technology.

Pathologists are the primary users of new imaging technologies, and it is therefore critical that the imaging system is intuitive and flexible enough to meet their particular needs. Often, the primary user is concerned that the new system will disrupt their current workflow. Therefore new technology must bring about an evolution, not a revolution, to their workflow. In order to be implemented successfully, the imaging system of choice must enhance existing workflow with minimal disruption or required revalidation.



Secondly, pathologists are concerned that the chosen digital pathology system should align with the goals of their affiliate groups. For example, if the group's aim is to establish a high-throughput imaging initiative, then a multi-slide imaging system may be required. However, if the goal is to improve immediacy and collaborative feedback in intra- or inter-facility telepathology, then the digital pathology system should have a more real-time and interactive design.

For the Administration Departments, their main objectives are to improve patient care and return on investment (ROI). They are concerned about whether the initial capital investment and change of practice required for a given digital pathology system will be a justifiable disruption to their institution. To address administrative needs, the ROI and operational benefits of the new system must be clear. It is up to both the vendor and the internal champion to create a proposal that outlines the benefits and success metrics for implementation of new digital pathology systems.

IT is a frequently overlooked part of technology integration. It is imperative that all stakeholders consult and gain IT buy-in with respect to storage feasibility, format compatibilities, network capabilities and fit within the organization's current infrastructure. The vendor must have flexible, scalable capability for integrating with an organization's IT infrastructure to ensure successful implementation over the long term.

Panoptiq™: Designed for Successful Integration

Once the requirements of key stakeholders have been established, it is important to decide what type of digital pathology system is most suitable. ViewsIQ has worked closely with pathologists and medical professionals in North America to create Panoptiq™, an imaging system designed to enhance pathology workflows with minimal disruption to current practices.

Panoptiq™ is an interactive digital imaging system for the dynamic, real-time creation of panoramic microscope images. Panoptiq™ integrates with a pathologist's existing microscope, allowing the user to retain control of image creation and seamlessly stitch together multiple fields of view while scanning the sample using the microscope stage. The field of view under the microscope is transmitted to a high-performance computer via an industrial-grade CCD camera and processed using the Panoptiq™ software. Operated via the same microscope stage controls pathologists are familiar with, the software's live view becomes a digital representation of the microscope.

While the user scans the slide, the Panoptiq™ software dynamically stitches the images together in real-time to create a panoramic region-of-interest scan. Using the companion Z-module, Z-stacks can also be captured and embedded into the scan as the observer finds a three-dimensional region of interest, closely replicating the act of scrolling through the focus on a microscope. This additional plane of capture is conventionally limited or not available in modern whole

slide imaging (WSI) technologies, frequently creating frustrations when observing samples with thick regions of interest.⁶ Via web-conferencing software, the entire real-time imaging process can be streamed to another user who can begin the slide review as soon as the imaging begins. This real-time and interactive method is especially suitable for highly time-sensitive procedures such as FNA analysis or frozen section consultation.

The Panoptiq™ system was carefully designed to meet the needs of all stakeholders in a pathology setting. To minimize the disruption to a pathologist's workflow, Panoptiq™ faithfully replicates the microscope and ergonomically presents it onto a monitor. Unlike WSI systems, which automatically scan entire slides by stitching images together in a pre-defined pattern, Panoptiq™ allows the user to capture only the regions of interest and stitch a panoramic image together in real time. Panoptiq™ also comes with the full suite of annotation capabilities, allowing the user to add notes directly to the image.

Panoptiq's™ region-of-interest approach is also designed to reduce image size for more straightforward IT integration. One of the IT barriers for digital pathology is limited data storage capacities. Even with recent advances in digital storage infrastructures, enterprise-level usage of WSI can quickly deplete server capacities owing to gigabyte-range file sizes. Being able to image only the relevant regions-of-interest with Panoptiq™ allows users to capture crucial information at only a fraction of the file size without compromising image quality.

The Panoptiq™ system is intended to help achieve an evolution of the pathologist's workflow by satisfying the needs of the key stakeholders. While no technology adoption can be entirely free of workflow disruption, Panoptiq™ allows institutions to retain much of their existing microscope infrastructure while achieving all of the benefits of digital pathology.

Additional Considerations

In addition to the issues discussed above, digital pathology implementation requires considerations such as accountability, data security, electronic medical records (EMR), laboratory information systems (LIS), and regulatory guidelines. All hospitals need to have a system of accountability that keeps a record of staff activities, and this requirement needs to be applied to any new digital pathology system being implemented. In the internet age, where data breach frequents the news, it is also important for institutions and vendors to work together to ensure that reliable security measures are in place. It is common for different institutions to use different EMR or LIS systems, and it is important for both the stakeholders and vendors to take flexible integration into consideration. Finally, it is important to understand the legal boundaries with regards to clinical applications for digital pathology. Ultimately, whether it is through the utilization of Panoptiq™ or other digital pathology systems, having full visibility to the various concerns and addressing them is the key to successfully implementing digital pathology systems.



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About ViewsIQ

ViewsIQ is an imaging software company that develops microscopy imaging solutions for academic institutions, hospitals, and research laboratories. It is our vision to propel the medical industry forward towards a future of true digital interactivity. With the company's recent innovation, Panoptiq™, we aim to share this vision towards modernizing educational and clinical practices for medical and scientific professionals around the world.

