

Digital Pathology Tools and the COVID-19 Pandemic: Insights and Practices from an Academic Institution



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BACKGROUND

Whole Slide Imaging Technology

- Whole slide imaging (WSI) technology has undergone significant advances in the last 20 years.
- WSI scanners produce digital replicas of glass slides that can be viewed remotely with similar functionality to a physical microscope.
- The images produced by WSI scanners are of diagnostic quality with spatial resolution that allows for the identification and recognition of key histological features (ex: nucleoli, viral inclusions, etc.).
- The viewer software that accompanies WSI scanners allows slides to be annotated and collaboration tools are available to facilitate digital sign-out, teaching, consultation, research, and quality assurance activities.

SARS-CoV-2 (COVID-19)

- COVID-19 constitutes the most significant global health crisis of our time.
- Public health measures to reduce virus transmission include social distancing, additional cleaning procedures, daily health screening, mask initiatives, selective quarantine and contact tracing.
- The pandemic has served as a catalyst for the adoption and expansion of digital pathology tools.

Prior to the pandemic, we had successfully deployed WSI and other digital pathology tools for daily sign-out, education, and research at our institution. As such, we were well positioned to adapt to the changes in practice imposed by the pandemic.

METHODS

We conducted a survey of our pathologists and trainees to gather information about their pre- and post-COVID-19 use of digital pathology tools. Results of the survey were analyzed and representatives from each subspecialty commented on unique aspects of their workflow.

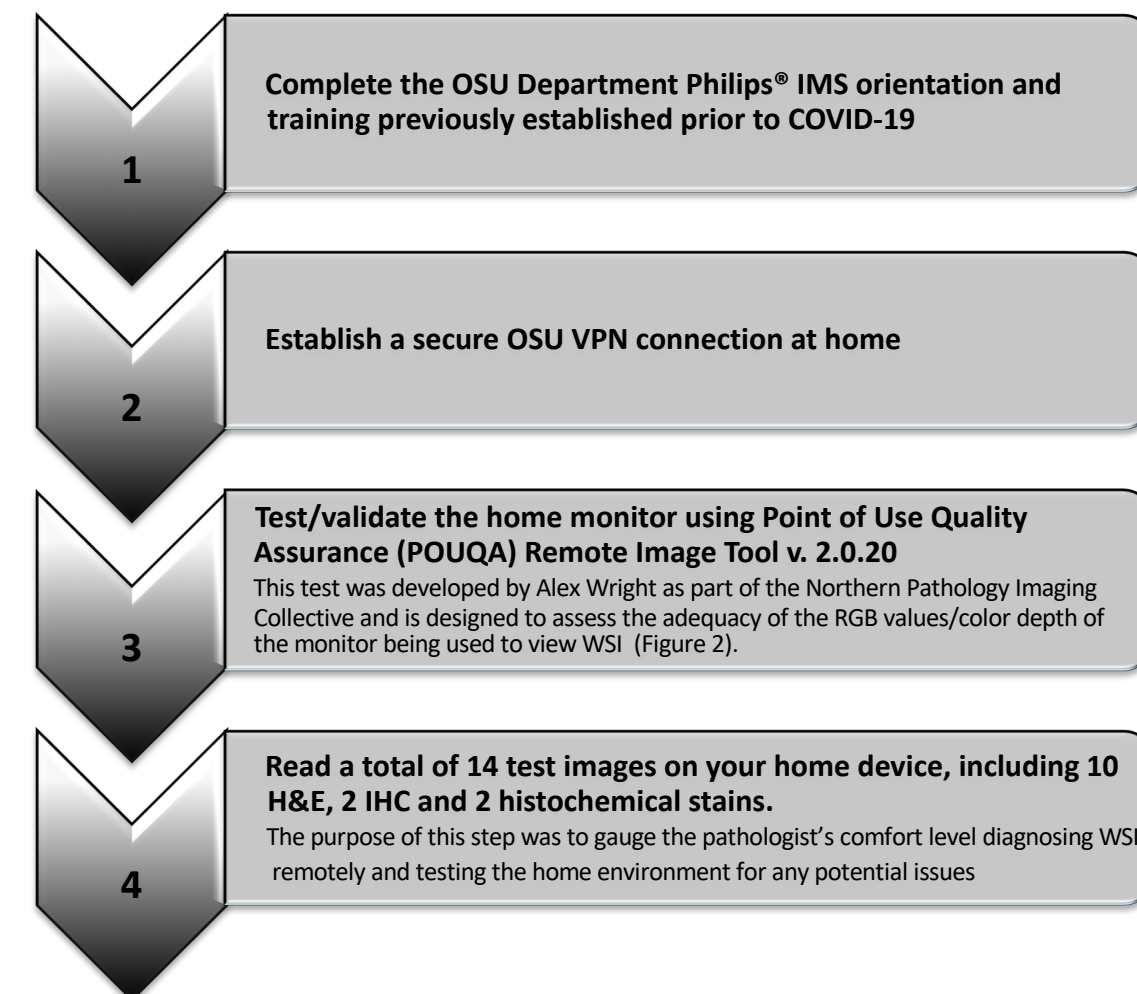


Figure 1. Validation procedure for pathologists performing remote (off-site) primary sign-out

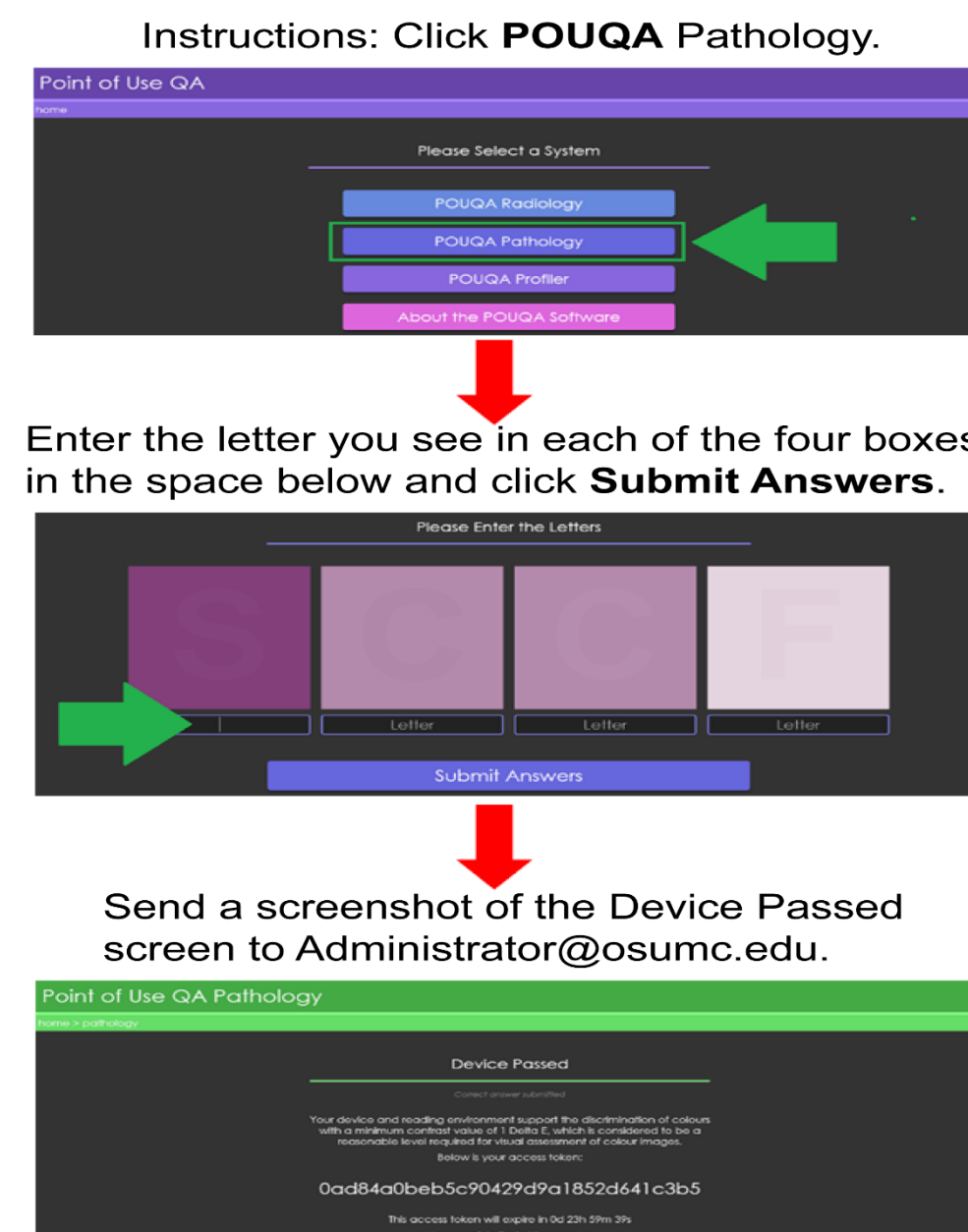


Figure 2. Test utilized for validation of home monitor – Point of Use Quality Assurance (POUQA)

SELECTED REFERENCES

- Niazi MKK, Parwani AV, Gurcan MN. Digital pathology and artificial intelligence. *Lancet Oncol.* 2019;20(5):e253-e261.
- Guo H, Birsa J, Farahani N, et al. Digital pathology and anatomic pathology laboratory information system integration to support digital pathology sign-out. *J Pathol Inform.* 2016;7:23.
- Hartman DJ, Pantanowitz L, McHugh JS, Piccoli AL, Oleary MJ, Lauro GR. Enterprise Implementation of Digital Pathology: Feasibility, Challenges, and Opportunities. *Journal of Digital Imaging.* 2017;30(5):555-560.
- Browning L, Colling R, Rakha E, et al. Digital pathology and artificial intelligence will be key to supporting clinical and academic cellular pathology through COVID-19 and future crises: the PathLAKE consortium perspective. *J Clin Pathol.* 2020.



Figure 3. A) Digital sign-out between the attending and trainee using the Philips® IMS collaboration function and video conferencing. B) Example of the display and annotation abilities of the Philips® IMS.

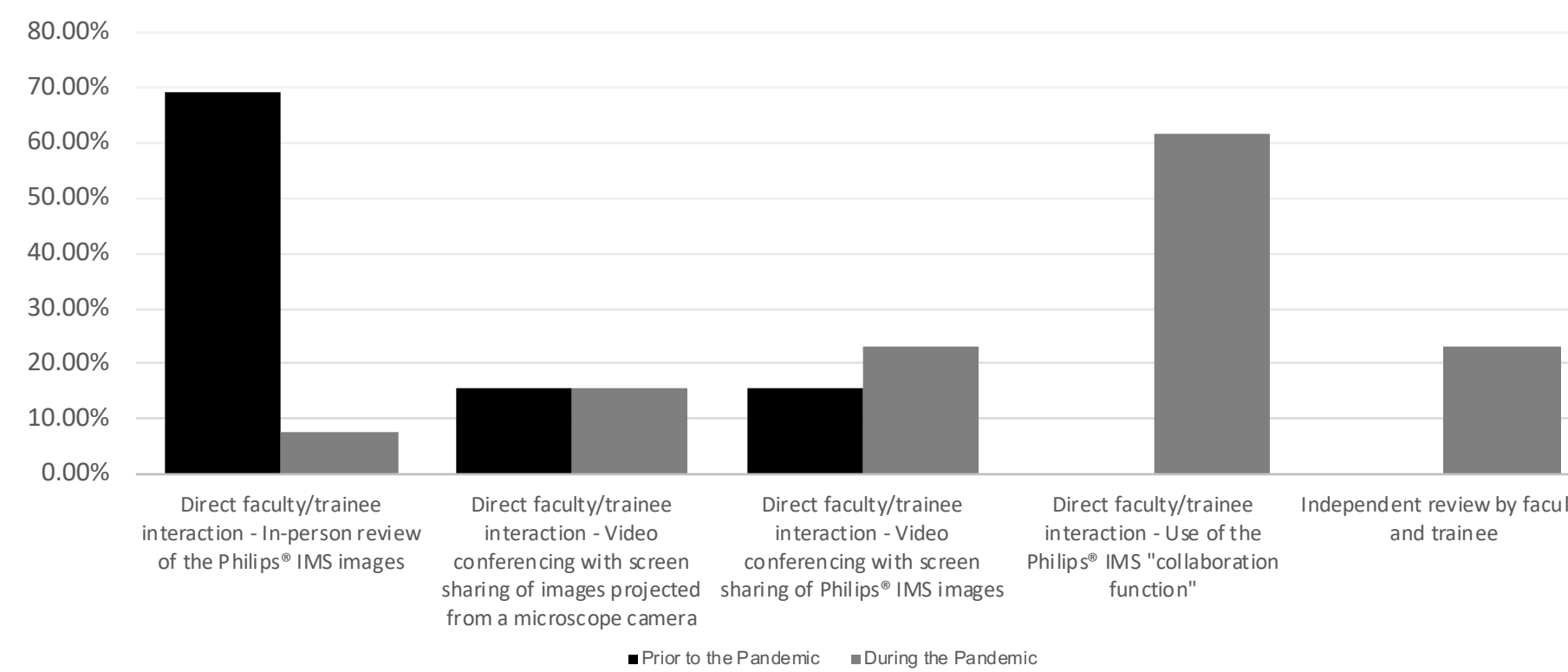


Figure 4. Primary (most common) digital pathology method used for trainee/attending faculty interactions prior to and during the COVID-19 pandemic.

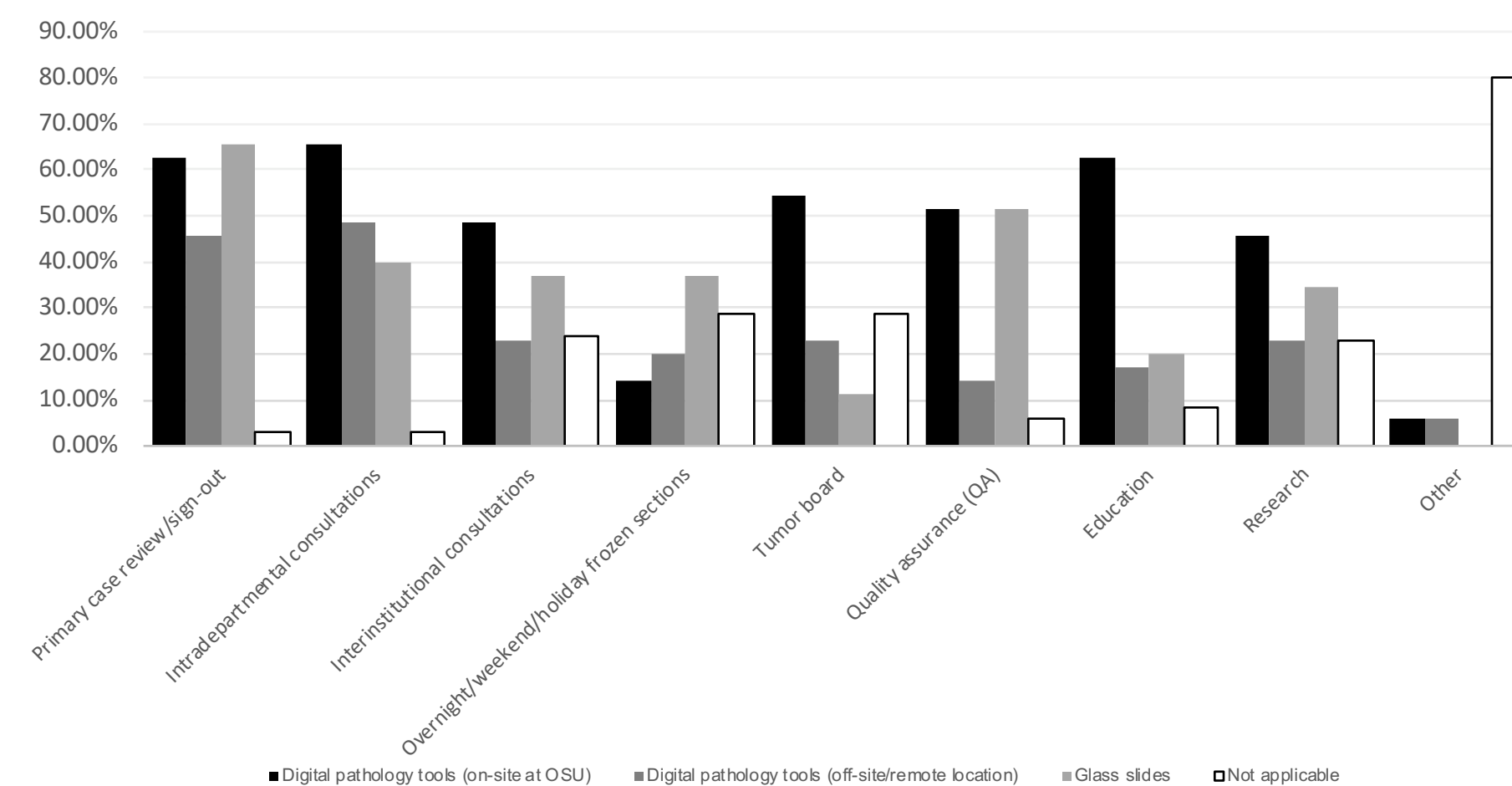


Figure 5. Methodologies used as part of the daily workflow during the COVID-19 pandemic (attending faculty responses).

THE OSU EXPERIENCE AND FACULTY/TRAINEE REFLECTIONS

Advantages of a digital workflow

- Increased flexibility regarding staffing
- Reduction of in-person/face-to-face interactions and the number of individuals handling case material
- Improved efficiency
 - Digital images are available prior to the receipt of physical glass slides
 - IMS tools are available to improve precision (i.e. measurement tool) and communication (i.e. annotations)
 - Ability to incorporate computational analysis of digital images
 - Rapid retrieval and review of prior case material
 - Images are always available for review (the physical slides could be in a faculty member's office, pulled for research, or sent out; but the images are still available for view)
- Improved office ergonomics

Challenges encountered in a digital workflow

- Internet connectivity issues from remote locations
- Potential need to purchase new hardware for home use
- Some special stains and histologic findings may be difficult to interpret in a digital format
 - Some microorganisms (i.e. *H. pylori*, AFB, some fungi)
 - Some special stains (i.e. Congo Red)
 - Some histologic findings: Material either identified or confirmed by polarization, borderline nuclear features (i.e. some nuclear features of papillary thyroid carcinoma), identification of mitotic figures, etc.
- Suboptimal slide scanning
 - In our laboratory, approximately 2.57% of slides fail to properly scan and need to be physically reviewed
- Decreased personal interaction among staff, trainees, and attending faculty