Digital Pathology:
*Increases Clinical and Operational Efficiency with Cost Savings*

Monday May 6, 2019 5:30-6:00 pm
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DISCLOSURE

In the past 12 months, I have not had any significant financial interest or other relationship with the manufacturers of the products or providers of the services that will be discussed in my presentation.
Background

Digital Pathology
- Vast Potential

Adoption
- Sluggish
- High Overhead

Evidence
- Few studies
- Academic

Metrics
- Sparse
- Reflective of practice
Background

Implementation of whole slide imaging in surgical pathology: A value added approach

Mike Isaacs, Jochen K. Lennerz, [...], and John D. Pfeifer

2010 WUSTL (10,257 slides)

• Time Costs
  – Scan time=8 min/slide (20x); 35 min/slide (40x)
  – Quality control=5 min (review, delete)
• Capital Costs
  – $2M (hardware and software)
• Personnel Costs
  – 650K minimum salary & benefits (at entry level)
    • 1 digital imaging technician (30% utilization)
    • 1 IT support person (30% utilization)
**Background**

Operational Savings ($)

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Total 5 - Year</th>
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<tbody>
<tr>
<td>Productivity</td>
<td>868K</td>
<td>1,936K</td>
<td>2,618K</td>
<td>3,432K</td>
<td>3,524K</td>
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<td>Quality/better medicine</td>
<td>44K</td>
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<td>1,014K</td>
<td>1,984K</td>
<td>1,984K</td>
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<td>Total Savings</td>
<td>912K</td>
<td>2,263K</td>
<td>3,632K</td>
<td>5,416K</td>
<td>5,508K</td>
<td>17,731K</td>
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- 2014 UPMC (218,744 total accessions)
- Calculations include full utilization of digital pathology including but not limited to:
  - 100% digital pathology adoption
  - Gains in productivity and laboratory consolidation
  - Reduction in cancer interpretative errors
  - Payor/provider sharings and cost savings
Proven “value added” deliverables

Products of **instantaneous availability**
Background

Memorial Sloan Kettering Cancer Center

473 Inpatient Beds
Background

Large Anatomic Pathology Laboratory

- Pathologists: ~60
- Median over 3 years (2015 to 2017)
  - Case Accessions: 161,730
  - In-house Surgical Cases: 49,623
  - Consult Cases: 29,644
Background

Subspecialty Distribution

- **Derm**: 12%
- **Breast**: 17%
- **GI**: 17%
- **GU**: 17%
- **Neuro**: 2%
- **Cytology**: 3%
- **BST**: 5%
- **Head Neck**: 5%
- **Heme**: 6%
- **Gyn**: 7%
- **Thoracic**: 9%
- **Gyn**: 7%
- **GI**: 17%
- **Breast**: 17%

Total Slides

- 2013: 0
- 2014: 200,000
- 2015: 400,000
- 2016: 600,000
- 2017: 800,000
Clinical WSI Archival

- Instant recall of old cases using AP-LIS integration
- Archives for teaching and research
- Archive outside cases returned to outside institution
Background

Implementation of Retrospective Clinical Digital Slide Scanning

Outside Reviews
• 8/2015

Surgical Resections
• 2/2017

Biopsies
• 1/2016
Background

### Slides Scanned Per Month

- **Biopsies**: 1/2016
- **Outside Reviews**: 8/2015
- **Surgical Resections**: 2/2017

**Axes:**
- **X-axis**: Months (Jan-15 to Aug-17)
- **Y-axis**: Slides (n)

**Key Observations:**
- The number of slides scanned per month has increased significantly over the years.
- Notable peaks and declines in the number of slides scanned are indicated for specific months.

**Note:** This graph provides a visual representation of the data, showing the trend and key events in the number of slides scanned per month.
Jan 2015 – Dec 2017

424,901 slides scanned
A digital pathology experience survey was distributed
Requisition forms were tabulated to identify the total number of cases, slides, and blocks requested from the slide archive over time.
Design

Frozen section glass slide requests for prior pathology material were tabulated for an off-campus surgery center starting January 2016.
Design

Our AP-LIS was queried for cases with documented review of available digital slides from prior specimens, then correlated to ordering of ancillary tests.
Design

Offsite physical pathology asset storage costs were comparatively calculated from 2015-2020 (projected)
Design

Turnaround time (TAT) was analyzed for cases with and without digital slides from prior specimens.
Digital Slide Experience Survey (71 respondents)

- Fellow, 40.8%
- Instructor, 2.8%
- Early Level, 9.9%
- Early-Mid Level, 14.1%
- Non-Junior Level, 32.4%
- Mid Level, 11.3%
- Senior Level, 21.1%

I check to see if digital slides are available before requesting glass slides

You view prior digital slides (when available) during clinical signout

Archival glass slide requisitions had a 93% decrease in requests

Intraoperative consultation requests for prior archived pathology material showed a 100% decrease with implementation of retrospective digital slide scanning.

The availability of patient’s prior digital slides help in deciding if repeat ancillary studies are needed on prospective pathology for the same patient

- **5 - Strongly Agree**: 86%
- **4 - Agree**: 10%
- **3 - Neutral**: 1%
- **2 - Disagree**: 3%
- **1 - Strongly Disagree**: 0%

Cases with documented review of available digital slides from prior specimens shows decrease in IHC ordering

Pathologists did not order confirmatory IHC studies in up to 72% of cases with documented prior available digital slides (2016-2017)

Benchmark – Cost Savings Model for Immunohistochemical (IHC) Utilization

Data based on years 2016-2017

- Mean # cases with IHC Not Ordered per year: 756
- Median # IHC slides per case: 3
- Average cost per IHC slide: $50

Anticipated savings per year: $113,400

DP has and will continue to result in ever decreasing expense for vendor services.
The availability of digital slides improved your turnaround time

- 5 - Strongly Agree: 71%
- 4 - Agree: 20%
- 3 - Neutral: 6%
- 2 - Disagree: 3%
- 1 - Strongly Disagree: 0%

Review of average TAT from 59,571 surgical cases

Benchmark – *Cost Savings Model for Better TAT*

How to model?

Not everything that counts can be counted, and not everything that can be counted counts.
Expense

~$215K / year
$1.075M over 5 years

Data center storage
Labor: slide scanning
Capital equipment to increase scanning capacity

Savings

~$274K / year
$1.37M over 5 years

Physical storage vendor services
Labor: retrieval, refiling
Patient safety
Legal
Increased pathologist efficiency
The use of digitally scanned slides improve your clinical sign-out experience

- **5 - Strongly Agree**: 55%
- **4 - Agree**: 26%
- **3 - Neutral**: 14%
- **2 - Disagree**: 4%
- **1 - Strongly Disagree**: 1%

Implementation of DP Offers Clinical and Operational Increase in Efficiency and Cost Savings

Conclusions

1. Decrease in glass slide requests
2. Decrease in ancillary workup for patients
3. Long term savings in glass slide storage costs
4. Faster turnaround time for reporting cases
5. Improved clinical sign-out experience
Moving Forward: Future Directions
Pathologists’ comfort in adoption of primary WSI sign-out

Major anticipated hurdle

• Transitioning from an analog microscope to digital workflow
You would feel comfortable providing primary diagnosis using digital pathology, with retrieval of glass slides available upon request.

You would feel comfortable providing primary diagnosis using digital pathology, without availability of glass slides

Digital Slide Equivalency and Efficiency Study

Aims:
• Replicates/simulates clinical workflow
• Comparison through actual reporting of true clinical workloads

Eight Pathologists:
• Bone/Soft tissue
• Genitourinary
• Gastrointestinal
• Breast
• Gynecological
• Dermatopathology

Material:
• 2000 glass slides
• 2000 digital slides
• 200 glass cases
• 200 digital cases

Concordance

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Median time difference:
• 19 seconds longer per WSI
• 177 seconds longer per digital case

Primary WSI sign-out - Advantages

Glass slides go directly from cover slipper to scanner to proper pathologist

WSI workflow:
• Reduces time lost to organization and tracking of materials
• Distributes automatically workload with load balancing
• Eliminates geographic barriers

WSIs:
• Accessible simultaneously in multiple locations
• Accessible immediately for archived cases
• Available instantly for cases upon scanning
• Reduces investment in optical microscopes
Opportunities still remain for improved quality and productivity

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