

A Telepathology Business Model That Actually Works

Effective Telepathology

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- No direct or indirect personal financial relationship with the above or other imaging system vendors

Objectives

- Define telepathology with examples as to how it may be applied
- Describe the state of telepathology and its relationship to digital imaging technology
- Define cost effectiveness as applied to biomedicine and implications for telepathology
- Describe the impact of implementation choices on cost effectiveness
- Present a model for effective implementation of telepathology with example

What is telepathology?

Philosophical Underpinnings of an
Effective Business Model



Telepathology is...

- Pathologic diagnosis, review, or consultation made from a site remote to the patient
 - Typically think of “telemicroscopy”
 - Scope is broader: clinical and anatomic pathology
- Pathology education and clinical conferences carried out at a distance

Telepathology

Broad view

- Administrative conferences or organizational meetings
- Image enhanced pathology
 - Particularly electronic or web based reporting to distant providers
- Feeding the EMR?
 - We don't typically think of the central lab serving a region with electronic (or paper) results as telepathology
 - Given today's practice model for pathology and lab medicine service what isn't "tele" pathology?

Telepathology

Specified view

- Telemicroscopy
- Remote provision of anatomic pathology services
 - Diagnosis
 - Consultation
 - Education
 - Quality assurance
- Integration of images into diagnostic report for remote viewing by electronic means

Telepath vs. Digital Imaging

- Telepathology is based on digital imaging technology
- Concept of Networked digital imaging as first step toward telepathology
- Digital imaging with network connectivity naturally leads to remote provision of anatomic pathology services
 - Telepathology
- Telepathology activities are ultimately connected back to digital imaging processes

Driving Forces within Pathology and Laboratory Medicine

- Image orientated specialty
- Trend toward centralization of the specialty
- Critical role in patient, health provider, and student education
- Current cost and requirements for distributed photo documentation, archiving, retrieval
- Research/Diagnostic laboratories will increasingly use digital imaging technology

Technical Driving Forces

- Low cost, high power computing
 - disk space
 - network
 - processing
- Revolutionary changes in cost and quality of digital photography (imaging)
 - digital photography equals traditional photography
 - Virtual microscopy is approaching light microscope in quality
 - unique advantages

Technical Driving Forces

➤ Analytic processing

- File storage and retrieval
 - Not glass
- Image analysis
- Content based image retrieval
- Only beginning to be actualized
 - I believe this will rapidly follow effective whole slide imaging and will integrate with molecular characterization for tissue based diagnosis
 - Will radiology get there first?

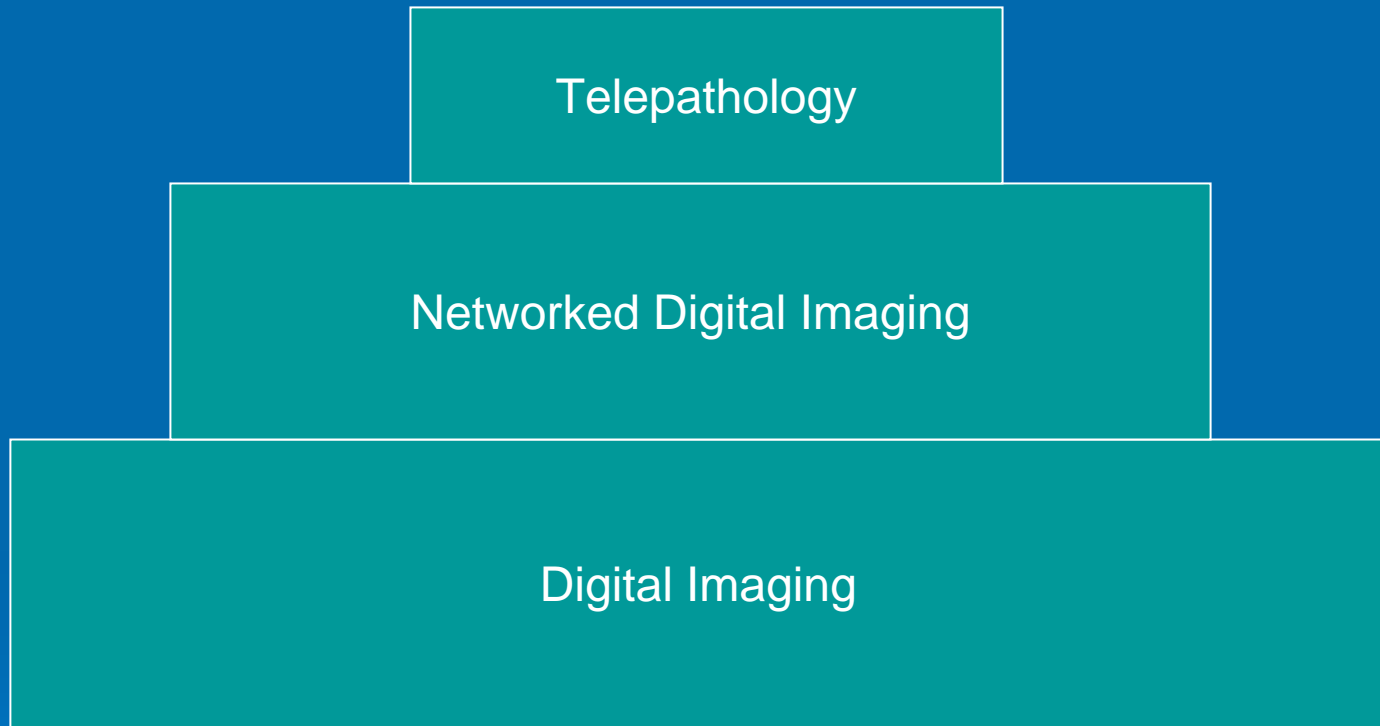
Digital imaging is core to pathology service activities

Telepathology and Digital imaging are NOT adjunct to, but rather, a replacement for prior methods and processes!

Continuum of Activities

- Digital Imaging → Telepathology
- We have segregated our thinking about digital imaging as:
 - digital imaging or telepathology?
 - For effective business implementation think:
 - digital imaging AND telepathology
 - You can do digital imaging without telepathology, but you can not do telepathology without digital imaging
- One is a tool, the other is a business need

Digital Imaging Pyramid



Key Problems Addressed by Telepathology

- Distance independent diagnosis
 - Time independence (asynchronous)
 - Manpower shortages in underserved areas
 - Wide spread geography
- Access to expert consultation on difficult cases
- Provider, student, patient education over distance

Technical Overview



Methods of Accomplishing Telepathology

- Store and forward: asynchronous
- Live dynamic: synchronous
- Robotic telemicroscopy: both
- Virtual microscopy: both

Store and Forward

- Static imaging
- Email or website based
- Extensively used
- Issues
 - Sampling error
 - Labor intensive as applied
- Least expensive

Live Dynamic

- Distant live video feed from a microscope with video camera
- One of the oldest technologies used for telemedicine
 - Satellite → Internet
- Significant decrease in price
- Synchronous
- Bandwidth intensive for high quality

Robotic Telemicroscopy

- Remote control of a microscope + live dynamic
- Synchronous or asynchronous
- Bandwidth similar to live dynamic
- Has integrated store and forward type technology useful for documentation
- User experience becomes nearly equivalent to microscopy

Virtual Microscopy

- Whole slide imaging
- Storage, retrieval advantages
- Large bandwidth and storage requirements
- Image analysis opportunities
 - Obvious integration with molecular technology
 - Multi-spectral analysis
 - Digital staining
- Expensive, large storage requirements, data intensive for processing
 - Like megabyte files used to be :)

Impact of Virtual Microscope on Telepathology

(Whole slide digitization)

- With whole slide digitization there is a convergence of processes supporting:
 - pathology digital imaging
 - telemedicine applications
 - Additional efficiencies and opportunities
 - Education
- This will change how pathology is practiced!

In Search of the Holy Grail

- When the effectiveness of digital imaging surpasses microscopy for tissue based diagnosis
 - I believe we are in a time where this is more than imagination
 - This will continue change the paradigm as to what is telepathology as pathology service at this level will be increasingly centralized

What is Effective?



What is (cost) effective?

- Better outcome than previous technology
- Efficient
 - Save effort and time
- Improved quality
- Solves a problem
- Saves money
- It's enjoyable...

...to boldly go where no one has gone before...

Issues with defining effectiveness

- What about new technology?
- How is convenience part of effectiveness?
- User acceptance is critical: utilization
- What level of cost overwhelms effectiveness?

Cost Effectiveness Analysis

- Technique for selecting among competing technologies
 - Developed by military in the 1960's, applied to healthcare in the late 1970's
 - Method to compare clinical strategies compared to current practice
 - “price of additional outcome”
 - “value judgment-what you think is a good price for additional outcome, others may not.”

CE Ratio

(cost new strategy) – (cost of current)

(effect new strategy) – (effect current)




Caveats on Cost Effectiveness

- Typically used to compare clinical strategies or technology that cost more, but have improved clinical outcome
 - Life is precious
 - Expected to cost more
- Application to pathology service may be less palatable
- CE ratios of \$10,000 per life year are considered excellent investments in technology

CE Ratio Telepathology

(cost telepathology) – (cost of current practice)

(effectiveness telepathology) – (effectiveness current practice)



CE Ratio Telepathology

$$\frac{(\$50,000) - (\$0)}{\text{5 year}} = \$10,000/5 \text{ year}$$

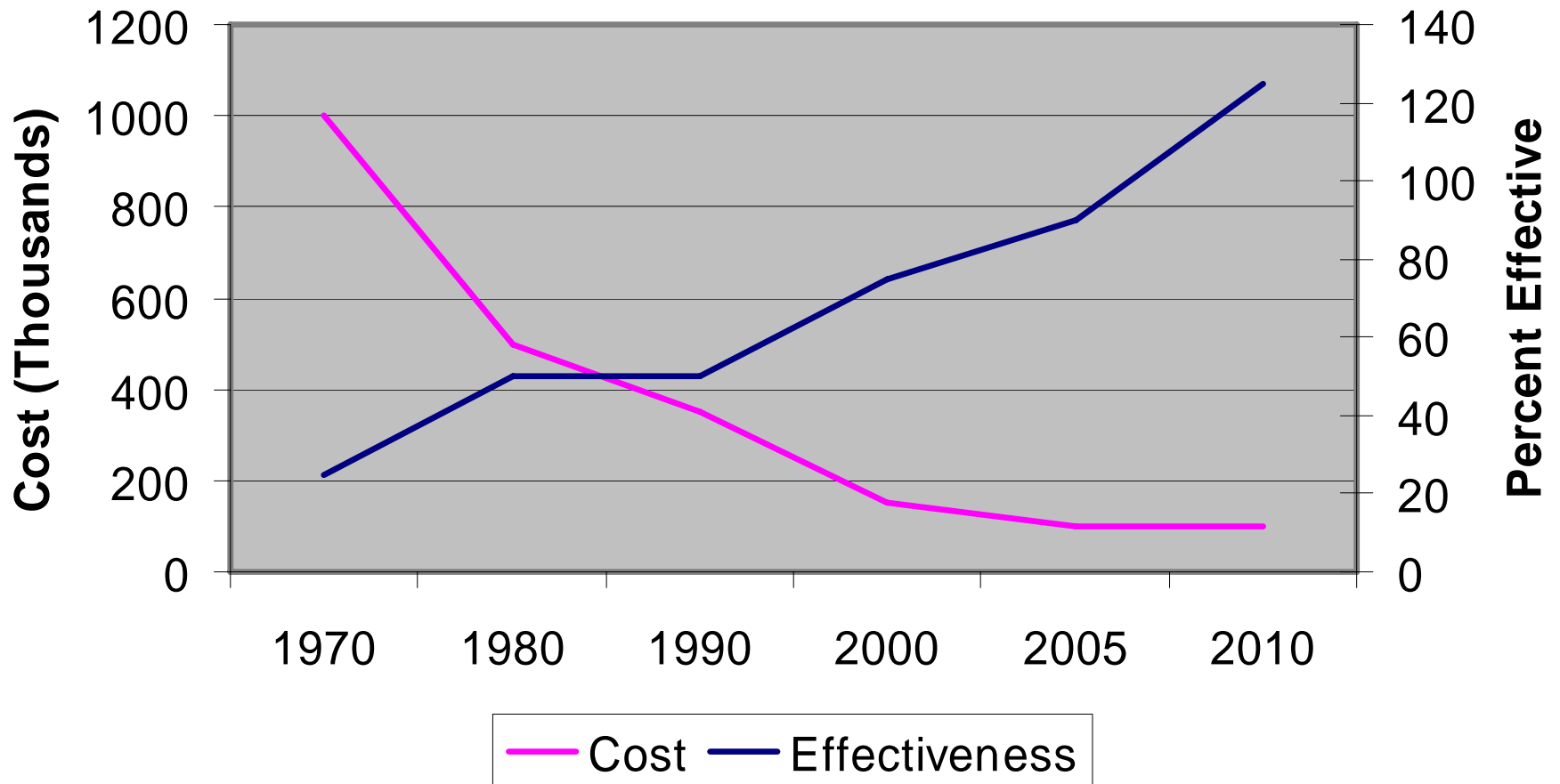
$$(1) - (0) = 1$$

What if telepathology is valued to be more effective?

What if telepathology changes the practice model?

Cost Effectiveness of Telepathology Over Time

Cost and Effectiveness Over Time



Effectiveness versus Implementation

- Highly effective technology can be implemented in such a way as to limit success
- Users can choose not to use new technology
 - The challenge of change
- Implementation is key to success for effective telepathology!
- Utilization is the dirty little secret of telemedicine in general
 - There's been a lot of priming
- Implement to meet your business needs

An Effective Telepathology Model



Effective Telepathology Implementation

1. Know your business

- Understand the true costs of your current practices that will be supported through telepathology

2. Understand current costs of pathology imaging related activities that may be considered telepathology

3. Understand your need for telepathology

- What specifically are you going to use it for?
- How often
 - The dirty little utilization secret
- Broad or specified view of telepathology?
- Utilization is key!

Effective Telepathology Implementation

4. Choose the most effective “imaging platform” to meet your needs
 - **Marry telepathology to other pathology imaging initiatives**
 - More bang for the buck the better (IMO)
 - This may be multiple systems and will involve middleware!
5. Implement effectively
 - Know your pathologists
 - Create a common platform across devices
 - Implement for efficiency
 - bar codes
 - LIS Integration if image enhanced reporting is required
 - New support and training challenges

Method	Application				
	1'DX	2' DX	QA Review	Confer -ences	Ed.
Static Imaging (Lowest cost)	++	+	+	+++	+++
Live Dynamic	+	++	++	++	+++
Robotic Microscopy	+++	+++	++	+	++
Virtual Microscopy (Highest cost)	++++	++++	++++	++++	++++

+ Least Effective

++++ Most Effective

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Example

➤ Our Business

- Academic medical center with four hospitals, 26 free standing medical centers
- Wide geographic dispersion
- Education, service, research
- Lots of interest, but late adopters

➤ Current Costs of Imaging related activities

- Much time and effort spent on conference preparation
- Significant expenditure on film based imaging
- Time and inconvenience of travel between sites
 - Wait time and winter!

Henry Ford Health System

Example

➤ Need for telepathology

- intra-institutional
 - Support clinical and teaching conferences
 - Night and evening frozen section support
 - Consultative support for other practices
 - Triage and photo documentation of gross specimens
 - Image enhanced reporting
 - Requisition imaging for paperless access

Henry Ford Health System Example

➤ System selection

- Digital scanning for requisition imaging
 - Scantron Corporation
- 7 gross workstations
 - Canon G6 consumer grade cameras
- Two Digital Imaging workstations
 - Olympus DP70, 35mm slide scanners, flatbed scanners
- Trestle MedMicroscopy solution
 - Robotic microscope for primary/consultative diagnosis
 - Static imaging for documentation
 - Live Dynamic Gross Specimen Imager for real time review of gross
- Image management software
 - ThumbsPlus Professional, Cerious Software
- Image file server, MS-SQL server
- Mysis CoPath Plus

Henry Ford Health System

Example

➤ Workflow

- Static imaging
 - Scan lab tag with Scantron
 - reads bar code on tag
 - Automatically creates case folder named by accession number
 - Image of tag
 - Users acquire images using common twain interface to all devices via ThumbsPlus
 - Images retrieved and displayed remotely with ThumbsPlus
 - Key wording, image creation data
 - Image editing and annotation
 - Image processing

Henry Ford Health System

Example

➤ Workflow

- Dynamic Systems
 - MedMicroscopy Imaging
 - Gross system
 - Robotic Microscope
 - Web client access, secured via VPN for extranet access
 - Static images placed in case folder for documentation
 - Used to triage cases remotely, communicate with surgeons, primary diagnosis on frozen sections

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Example

➤ Utilization

- Static imaging
 - Daily use
 - Thousands of images
 - Clinical conferences, requisition distribution
 - Just beginning image enhanced reporting
 - Image repository accessed via ThumbsPlus for case image selection
- MedMicroscopy
 - Night and weekend use 350 cases, no discordance
 - Daytime use
 - Triage, communication with surgeons
- Systems are being used and have become integral to our practice model
 - Technology has not been a barrier
 - User acceptance is increasing particularly with static imaging applications

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Example

➤ Costs

- Static imaging
 - \$20,000
- ThumbsPlus
 - \$3,500
- MedMicroscopy
 - \$70,000
- Scantron
 - \$30,000
- Total \$125,000
 - 2nd year, expect 3-5 year life span for most components
 - No recurring costs
 - Rivals cost of prior photo documentation at 3 years
 - Cost effective without considering efficiency, convenience etc.

Conclusions

- Telepathology is effective
- Costs for telepathology are decreasing
- Implementation is key to effective solution
 - Efficiency
- Utilization improves when effective technologies are well implemented
 - benefits are tangible even to the naysayer
 - User adoption curves
- Match technology to your need
- Consult the literature

References

- PubMed: 300 primary papers with telepathology as subject heading
 - 8 addressed cost effectiveness in some capacity
 - Most addressed store and forward or live dynamic systems
- 1 major assessment of telemedicine
- I Will post a selected bibliography with lecture online

References

- “Crossing the chasm” Geoffrey Moore
- “Leading change” Kotter
- PLCO British Columbia Telepathology Forum
 - Presentations by Drs. Mike Becich and Ulysses Balis

http://www.plco.ca/publications/Dr_Ulysses_Balis_Presentation.pdf

http://www.plco.ca/publications/Dr_Michael_Becich_Presentation.pdf

- CAP Today Survey on digital imaging

http://www.cap.org/apps/docs/cap_today/feature_stories/0505digital.html

- Survey Detail

http://labsoftnews.typepad.com/file_uploads/CAP_today_digital_imaging.pdf