Who Controls Images?
Informatics Challenges in Creating an Integrated Solution with Molecular Imaging Data & Digitized Pathology Images?

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Summary of Topics for This Lecture

- Goal of this lecture is to discuss who controls medical images in hospitals but with relevance for the total scope of healthcare
- Will first provide some of basic definitions that will be used later in lecture; then present history of IT management/control in hospitals
- Next, will present the argument that direct & total control of IT by radiology, pathology, lab medicine (RPLM) personnel is essential
- Given that hospital politics involves allocation of resources, will next discuss strategies for retaining & justifying RPLM control of its own IT
- Will conclude by presenting future scenario for RPLM control of diagnostic cloud/network including computerized decision-making

My Background Working in Pathology Informatics and Hospital IT

- From 1982 until 2006, I was the director of pathology informatics at the University of Michigan Health System
- For five years, I was director of all ancillary info. systems including LIS, reporting to health system CIO & path. chairman
- Systems under my supervision include pathology, radiology, pharmacy, radiation oncology, and several smaller hospital units
- As a hospital IT director, I participated in decision-making relating to all aspects of computing in this large health system
- In so doing, I gained a better understanding of the role and pressures on the IT directors and CIO and what motivates them

What Is Meant by Control of Images; Stewardship as Alternative Term

- Control is obviously a loaded word; I use it in this lecture to make a strong point about strategies RPLM need to pursue
- Term stewardship may be preferable; stewards act as the agents of patient to protect/conserve/effectively utilize data
- Stewardship of patient data should be assigned to those healthcare professionals best able to function in this capacity
- Need to emphasize the existing law in most states: healthcare data belongs to patients & not to hospitals or to physicians
- Need to understand basic conflicts that inevitably arise in IT: integration vs. functionality, centralization vs. decentralization

Possibility that LISs, RISs, & PACS Will Be Supported by a "Diagnostic Information System"

- Although title of this lecture makes reference to images, merely another form of information like text/numbers; handled similarly
- Radiologists have advantage in their skills in image management; PACS will ultimately evolve into enterprise-wide image server
- Pathologists have advantage of managing large data sets, quality control programs, & complex reporting options from multiple labs
- LISs, RIS, and PACS will merge into diagnostic information system (DIS); at that time, image/data dichotomy will soon disappear
- Not clear yet whether impetus for a DIS will initially emerge from vendors or will arise among specialists seeking integrated system

Tension Between Integration and Functionality for Hospital-Based Apps

- Goal of RPLM departmental personnel will always be to increase the work output and functionality of their respective departments
  - Functionality defined here as efficiency and effectiveness of work output: doing things rights and doing the right things
- Central IT personnel also seek better functionality of their unit but defined in different way and different context from clinical depts.
  - Reduce number of vendors, simplify hardware footprint, efficiently manage multiple servers at the lowest cost
  - Dealing with far larger scale and scope; they are thus forced to standardize & simplify all of the systems under their control
  - Because central IT personnel report to the CIO who reports to the CEO, strategic goals will emphasize both financial & clinical

Tension Between IT Centralization and Decentralization in Hospitals

- IT centralization/decentralization debate boils down to debate about trade-offs between info. system functionality & cost
- Central IT will not knowingly sabotage dept. functionality with their IT strategies; result of law of unintended consequences
- Central IT personnel make the incorrect assumption that there is no functionality loss by hardware/software standardization
- Major problem of central IT is that they don't know what they don't know; innocently damage ancillaries with high-level plans
- A standardization strategy is probably necessary if all servers are maintained by the central IT group; otherwise chaos results

Basics Regarding Hospital Politics and Information Technology Control

- Politics in hospital & healthcare settings revolves around competition for resources with big egos in thrown into mix
- Role of hospital exec's: manage budgets and optimize the use of resources; know little about medical science & technology
- Executives do understand the power of information control; hospital central IT group & CIO are their agents for this control
- Hospital CIOs and central IT control the EMRs; difficult for them to control LISs, RIS, PACSs because lack necessary expertise
- They try to exercise some control over ancillaries by central hosting of applications and salary control over dept. personnel

Support for Radiology Capital Projects and PACS by Hospital Executives

- Large percentage of the operating surplus for non-profit hospitals attributable to RPLM; clinical activities not generally profitable
- Medical imaging generates high profit margins; hosp. executives enthusiastic about capital investments in new imaging systems
- Also enthusiastic about RIS/PACS deployments; reduce costs & provide access to images, promoting greater utilization of services
- Control over PACS often ceded to radiology personnel without fight; central IT lacks image management experience & expertise
- Image management growing in importance; movement toward enterprise-wide image server for studies in cardiology, GI, etc.

Early IT Strategy by Hospital Executives: Control Financial and PM Systems

- For about 15 years (circa 1975-1990), hospital executives focused on financial (PA) & patient management (PM) systems
- IBM assured them that clinical apps, as they evolved, could easily be maintained on single “mainframe” hospital system
- Hospital mainframe managers reported to the CFOs; chief information officers (CIO) not yet part of the executive suite
- Selection & management of LISs, and later RISs, left to the departments; generated hardcopy reports in pre-network era
- Capital and operating costs of LISs and RISs baked into the departmental budgets; some central review of vendor selection

Era of the Hospital EMR Began in the 1990s Under Control of Central IT

- Hospital EMRs emerged in the 1990s like Meditech, TDS, SMS, Cerner; offered support/documentation for clinical processes
- Control of EMRs ceded without a fight to the central IT groups; RPLM busy deploying LISs/RISs; clinicians had no interest in area
- Model subsequently adopted that ancillaries would report their results through the EMR; clinicians wanted one-stop-shopping
- This worked for a short period of time but not working now; technology & science caused explosion of knowledge in RPLM
- EMRs being dumbed down to increase likelihood of successful deployments; unable to wedge RPLM reports in shrinking “box”

The Problem of a Constrained EMR and Expanding LIS, RIS, and PACS

- The capabilities of EMRs are being constrained because model of all clinical information flowing through it is unattainable
- EMR vendors and hospital personnel throttle down the goals of an EMR deployment to make them practical and avoid failure
- Meanwhile, RPLM exploding with innovation & need to publish increasing complex images, data, & interpretations to clinicians
- This complex RPLM information can only be reported out through the EMRs by sending top-level dx's & conclusions
- Ultimate solution will be to allow clinicians to sign-on directly to LISs, RISs, PACS or click-through to them via the web/EMR

Why Substantial Failure Rate in Hospitals Associated with EMR Deployments?

- History of high failure rate, substantial project delays, & dissatisfaction with hospital EMR deployments across country
- Reasons for failures varied: complex tasks being automated, antiquated software, MDs bridle at imposed system rigidities
- High cost of systems reflect prolonged sales cycle, demands for customization, prolonged installations, few choices in market
- Epic EMRs have high success rate because company does not allow customization; write contracts with more vendor control
- Billions of new federal $$$$ flowing into automated records; will largely be wasted money because of this EMR failure rate

Criticality of Direct And Total Control Of Ancillary Systems By RPLM

- State-of-the-art information technology is the foundation layer for optimum performance in RPLM; they simply can't run without IT
- New developments in molecular dx, digital pathology, & new radiology imaging modalities increasingly demand new IT initiatives
- Management & innovation for LIS/RIS/PACs requires managers and operators *inside* these departments who understand data & images
- Accountability for system performance & enhancements made much easier with departmental personnel responsible for system
- Three-party developmental relationships (vendor, central IT, dept. personnel) too complex for vendors; will turn to other hospitals

The Wisdom of Outsourcing Your Most Mission Critical Tools

- Would a radiologist cede all management and control over all of his various imaging devices to some external organization?
- Would a lab director cede all management and control of his automated analyzers to some external organization?
- Would a pathologist cede all management and control of his digital imaging system to some external organization?
- The answers to all of these questions will obviously be no; not necessary to discuss advantages of central IT control of RPLM IT
- The only reason why this question is even discussed at all is because of the political power wielded in hospitals by CEOs/CIOs

Hospital Exec's Conundrum: Manage IT Costs, Satisfy Clinicians, Control Information

- Hospital C-level executives faced with information control conundrum; three simultaneous goals that may conflict
  - Control budget/protect margins, satisfy clinicians with greater system functionality, & exercise control over information
- Competent executives will usually tilt toward protection of revenue stream and satisfying clinicians in lieu of control of information
- However, execs do not always understand the subtleties of IT deployments; often more influenced by CIOs than clinicians
- RMLM personnel need to argue that departmental control of LIS/RIS/ PACs better value despite "perceived" increased costs

Arguments in Favor of RPLM Control Over the LIS, RIS, and PACs

- Personnel are embedded into departments; better at troubleshooting acute IT problems & managing new features
- Better understanding of needs of clinicians because departmental personnel interact with them on daily basis when filling orders
- Less wedded to major EMR vendors whose RPLM systems are often inferior to those of smaller vendors catering to departmental needs
- Less oriented toward a standardized approach; more accustomed to managing a set of smaller specialized departmental systems
- Long history of successful deployment of LISs, RISs, & PACs; failed deployments of such systems in recent years has been very rare

Service Level Agreement (SLA) to Define Intra-Hospital IT Ownership and Responsibility

- One way to reduce tensions regarding RPLM control over diagnostic IT resources is with development of SLA developed with central IT group
- This constitutes a written contract with central IT and CIO defining loci of control & responsibility for whole array of hardware/software issues
- Frequently, will need to integrate into document the contracted-for vendor responsibilities & local contacts for acute/chronic problems
- Document becomes more complex if hospital personnel are engaged in alpha/beta developmental relationships & projects with vendors
- Detailed problem escalation; complex because need initial triage among parties to diagnose network, hardware, software problems

Understanding Federated Architecture Model for LISs, RISs, and PACS

- Federated architecture provides new solution for efficient reporting of lab/image diagnostic data through the EMR
- In essence, RPLM allocated “white space” in EMR; diagnostic data served-up to requesting clinicians only at time of need
- Using this model, RPLM formats their own data once & then passes it to EMR; no reformatting of data as now occurs in EMR
- Few EMR vendors will willingly choose to adopt this architecture; can still sell their antiquated systems to CIOs
- EMR vendors also can’t maintain EMRs price structure when systems serve mainly as conduits for lab/radiology information

Political and Technical Consequences of Going All-Digital in Radiology

- Most radiology departments have gone all-digital whereas a rare phenomenon in pathology where all mages start as analog
- This technology-driven changes have caused a de-linkage between interpreter of images & image-generation enterprise
- Same phenomenon may occur in surgical pathology but with a decade lag or more; requires adoption & capital investment
- Many advantages to all-digital approach and total image portability: patient convenience & enabled expert consultations
- We do not yet fully understand all of the changes that will ultimately occur in radiology department business models

What Hath Nighthawk Radiology Wrought for Radiologists (at Their Own Request)?

- Nighthawk and its imitators has created a global radiology network for transmitting digital images & interpretive reports
- The radiologists themselves nurtured the creation of this network so they could hand-off responsibility during off-shifts
- Major challenge for Nighthawk has been specialty certification of its physician employees so that they can function in all states
- Nighthawk now expanding its service/product line to workflow software & interpretation of imaging in other medical specialties
- Many specialty practices (e.g., urology) employ their own pathologists & transmit CT images for outside interpretation

Auctions & New Biz Models Emerging for Professional Services of Radiologists

- *Telerays* is new company that has developed a novel Web-based auction approach to providing teleradiology services
- Biz model for reporting to be awarded to the lowest bidder; designed to appeal to both hospitals and imaging centers
- Company is currently recruiting radiologists to work for company; great appeal for those who want to work from home
- European Union launching teleradiology auction based on eBay called *RBay* under *eTEN* program (trans-European e-services)
- *Virtual Radiologic* emphasizing its product as a final interpretation; no over-read by the local radiologist required

Radiologists Move from Reporting Impressions to Diagnoses

- Most radiology departments do not submit challenging cases to a set of distant “marquee” radiologists for second opinions
- This is the norm for most surgical pathology units; many academic departments have faculty who act as consultants
- Radiology department do have procedures for overreading images for patients referred to their hospitals from outside
- Different attitude about consultations stems from fact that most radiology reports provide impressions rather than concrete dx’s
- Under molecular imaging, transition to generating dx’s; more pressure to collaborate with pathologists in integrated reporting

Development of RPLM Clouds/Networks for Future Service Delivery

- The “cloud” is a term for an array of distributed servers on the web that can be rented to provide computer processing/storage
- Location of these servers is largely irrelevant as long as the cloud provides reliable service, including redundancy & rapid response
- Transition to the cloud by RPLM is inevitable; server time is cheap & the model also avoids control of resources by central IT group
- *InsiteOne* currently providing healthcare vertical cloud; major product is standards–based PACS storage for radiology depts.
- *InsiteOne* web site boasts of current storage statistics in radiology: studies archived: 31,213,528; images archived: 2,247,540,488

Radiologists and Pathologists Must Own (i.e., Control) Their Own Clouds!

- Initially, the RPLM computing cloud will provide inexpensive, expandable PACS storage for the growing archive of digital images
- RPLM cloud will evolve into a network extension of LIS/RIS/PACs for soliciting/storing consultations & creating integrated report
- Computerized decision support for RPLM images/data will then be added to the cloud with final editing & review by local specialists
- The mass of images & information in the RPLM cloud/network becomes totally indigestible for the EMR; only top level dx's passed
- Because of growing importance of the cloud/network for report integration, RPLM must wield total control over total asset

Future Scenario for Reporting Integrated Diagnostic Results Via EMR & RPLM Cloud

- As previously noted & under federated model, RPLM will be granted “white space” in EMR to populate with its own data
- Integrated reports will contain final diagnostic conclusions, relevant key images, and therapeutic recommendations
- Links provided in the final integrated diagnostic report to relevant RPLM images and data that will be stored in the cloud
- In five to ten years, many patients will seek to store their entire genome in the RPLM cloud for periodic rework and review
- Each pt genome will be scanned periodically & compared to new research; new diagnostic procedures recommended for them

Summary and Take-Home Points for This Lecture

- Information technology is foundation for all healthcare; even more critical for RPLM with evolving systems & new business models
- Integration of LISs, RISs, & PACS into “diagnostic information system” may lag/precede increased interest in specialty conversion
- Imperative that RPLM personnel control over their IT systems in hospitals; necessary to support new political & clinical agenda
- Federated architecture will provide opportunity to provide integrated dx reporting through EMR to hospital clinicians
- RPLM cloud will evolve from storage space to complex dx network for data/images & support for computerized decision support