
Getting Started with Health IT Implementation

Atif Zafar, MD

Clinical Professor of Medicine

Indiana University School of Medicine

Regenstrief Institute for Healthcare

AHRQ National Resource Center for Health Information Technology

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Session Outline

1. Introduction to Health IT
2. Framework for Change Management
3. Anticipating Implementation Problems
4. Evaluating Health Information Systems
5. Case Examples of HIT Implementation
6. Questions



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Section 1: Introduction to Health IT

- What is wrong with Healthcare today?
- What are some components of Health IT?
- How can Health IT help solve these problems?



What is wrong with Healthcare?

- Healthcare delivery is inherently fragmented
 - Multiple Providers/Services & Multiple Payers
 - More than 360,000 care delivery sites in the US
 - Inefficient or Absent communication
 - Increased Provider Specialization

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- Blumenthal, D, “The Duration of Ambulatory Visits to Physicians”, Journal of Family Practice, April 1999
 - Stafford, RS, Saglam, D et. Al., “Trends in Adult Visits to Primary Care Physicians in the United States”, Archives of Family Medicine, Vol. 8, Jan/Feb 1999



So what are the consequences? Well, patient safety suffers!

- Fragmentation leads to miscommunication and errors
 - Duplicate Testing
 - Medication Lists not reconciled properly causing medication interactions and ineffective therapy as meds are stopped pre-maturely
 - Poor documentation, illegible handwriting and other mis-communication causing errors
 - Increased healthcare utilization and increased cost of care
 - Reduced timeliness of care
 - Inappropriate or Unnecessary Care
 - And many other problems



What is wrong with Healthcare?

- Problems with the data storage:
 - These communication problems arise partly because the data is stored in many ways and in many locations:
 - On Paper
 - Within inaccessible “silos” behind the firewalls of institutions
 - As tacit knowledge in someone’s mind
 - What *is* communicated is often *incomplete, inaccurate (wrong or out of date) or unclear (illegible, nonsensical)*
 - Clinical decisions based on invalid or out-of-date information can have disastrous consequences
 - In many outpatient encounters, between 0.12 and 5.2 questions per half-day go unanswered because of a lack of information about patient data, population statistics, biomedical knowledge, logistical information and social influences

Cimino JJ, et. al, “Theoretical, Empirical and Practical Approaches to Resolving the Unmet Information Needs of Clinical Information Systems Users”, *Proceedings of the Fall AMIA Annual Symposium*, 2002:170-74

J. Walker et al., "The Value of Health Care Information Exchange and Interoperability," *Health Affairs*, 19 January 2005 <http://content.healthaffairs.org/cgi/content/abstract/hlthaff.w5.10>



What is wrong with Healthcare?

- Problems of Overuse and Underuse
 - 30% of children receive excessive antibiotics for otitis
 - 20-50% of surgical procedures are not necessary
 - 50% of back pain x-rays not necessary
 - 50% of elderly patients don't get a pneumovax
- Great disparities in access to healthcare

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- The Dartmouth Atlas Project
 - <http://www.dartmouthatlas.org/>
 - The AHRQ National Healthcare Disparities Report
 - <http://www.qualitytools.ahrq.gov/disparitiesreport/browse/browse.aspx>



What is wrong with Healthcare?

- Adverse Drug Events (ADEs) are a leading cause of morbidity (and mortality) in the US
- In a meta-analysis of ADEs, 84% were classified as *preventable*
 - EX: Many of the patients studied with permanent disabilities directly resulting from ADEs received higher than usual drug dosage
- The average settlement cost in the resulting litigations was \$4.3 million!

Leap LL, Bates DW, et.al “Systems analysis of adverse drug events”,
JAMA 1995; 274:35-43

Kelly, WN. “Potential Risks and Prevention, Part 2: Drug Induced Permanent Disabilities”, *American Journal of Health System Pharmacies*, 2001; 58:1325-1329



What is wrong with Healthcare?

- Challenge to continually educate
 - “Physicians must keep track of 10000 different diseases and syndromes, 3000 medications, 1100 lab tests and 40000 articles in the biomedical literature”
 - *Harvard Business Review (July 2002)*
 - It takes 17 years for *known best-practices* to be actually applied in clinical care
-

Lenfant, C, “Clinical Research to Clinical Practice – Lost in Translation”, *N Engl J Med*, 2003; 349: 868-74

Berwick, DM, “Disseminating Innovations in Healthcare”, *JAMA* 2003; 289:1969-75



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What is wrong with Healthcare?

- Some references on medical errors:
 - “To Err is Human” – IOM report
 - <http://books.nap.edu/books/0309068371/html/>
 - AHRQ National Patient Safety Conference
 - <http://healthit.ahrq.gov/conf2005/>
 - JCAHO Taxonomy of Medical Errors
 - <http://www.jcaho.org/news+room/press+kits/who/taxonomy.pdf>
 - Crossing the Quality Chasm: A New Health System for the 21st Century
 - <http://www.iom.edu/focuson.asp?id=8089>

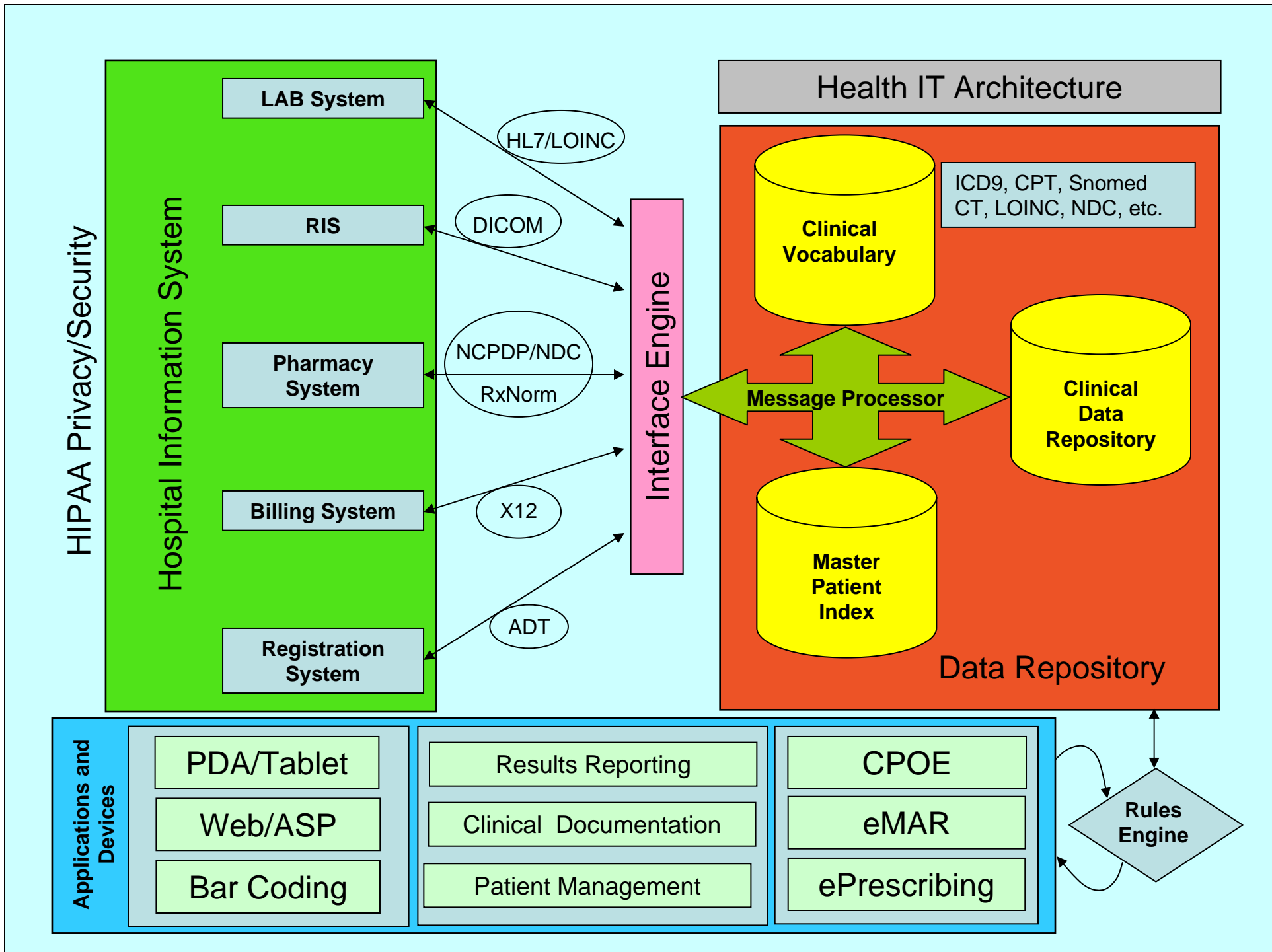


What are the components *Health IT*?

- Health IT is *very complex* with many cultural, technical, financial and logistical components
- This complexity can be simplified using the following framework:

- Application Level:
 - CPOE, CDS, ePrescribing, eMAR, Results Reporting, Electronic Documentation, Interface Engines ...
- Communication Level:
 - Messaging Standards
 - HL7, ADT, NCPDP, X12, DICOM, UB92, HCFA, ASTM, EDIFACT, etc.
 - Coding Standards
 - LOINC, ICD-9, CPT, NDC, RxNorm, Snomed CT, etc.
- Process Level:
 - HIE, MPI, HIPAA Security/Privacy ...
- Device Level:
 - Tablet PCs, ASP models, PDAs, Bar Coding, ...





How can Health IT help?

- IT solutions can provide you with needed data *in the exam room*:
 - Latest lab and test results
 - Medication Lists
 - List of appointments
 - Clinic notes and consult recommendations
- IT solutions can help with *clinical decision support*:
 - Medication conflicts
 - Research results and evidence based guidelines
 - Clinical knowledge – differential diagnoses etc.
- IT solutions can help with prevention and patient education
 - Preventive services order sets
 - Patient handouts and pamphlets



How can Health IT help?

- IT solutions can help with the documentation process
 - Macros and Templates for rapid documentation activities
 - Through advanced data entry methods – speech and handwriting recognition
 - Entrance by exception – enter data only if changed
 - Automated clinical pathways – decision support
 - Trend tracking
- IT solutions can help you communicate better – with colleagues, specialists and *patients* and coordinate care delivery
 - Using telemedicine if in remote/rural sites
 - Communicate with home health nurses, nursing homes etc.
 - Using email and other communication channels besides paper
 - Help bridge the health disparities gap



How can Health IT help?

- IT solutions can help manage busy workflows
 - Keep track of patients as they come to a clinic (Greaseboard function)
 - Help you communicate with the front-office staff more efficiently
 - Order pneumovax/flu shots, tests (EKGs), meds **from the exam room** so the nurse is ready to give the shot or do the test when the patient walks out!
- IT Solutions can help improve Patient Satisfaction
 - Improved patient compliance
 - Easy to read and understand written instructions
 - Better medication side effect tracking
 - Improved access to and more “personalized” care for the patient and caregivers
 - Patient centered care for high-risk patients – i.e. better monitoring



How can Health IT help?

- IT solutions can help care for patients long distance
 - Telemedicine tools can help a primary care provider communicate with a specialist long-distance *with the patient in the room*
 - Examples include:
 - Teleradiology, Telecardiology, Teledermatology etc
- IT solutions can help reduce the cost of care
 - Help you select cost-effective interventions (lab tests, medications etc.)
 - Help you bill more effectively and *more completely*
 - Help protect you from costly lawsuits by documenting better
 - Better time-management of healthcare personnel



Some categories of problems a shared repository can help solve

- Outpatient docs do not know what happened in the hospital to one of their patients
 - Medication Lists
 - Lab and test results
 - Diagnoses and Problems
 - Discharge Summary
- The ER does not know the history of a patient being seen by a primary care provider
 - Clinic Notes
 - Medication Lists
 - Diagnoses and Problems



Some categories of problems a shared repository can help solve

- A specialist does not know what tests were done on a referred patient
 - Referral Question – i.e. *why were they referred?*
 - Lab and test results
 - Radiology and Nuclear Medicine data
 - Medication Lists
 - Diagnoses
- A primary care provider does not know what a specialist did
 - Specialty care clinic notes
 - Follow-up recommendations



Some categories of problems a shared repository can help solve

- Other questions regarding usage:
 - Was the patient seen in other clinics or in other ERs recently and for what and what was done?
 - Patients move around a lot (esp. here in Indiana)
 - Which pharmacies are filling the prescriptions?
 - What appointments does the patient have that are upcoming or which appointments were missed?
- Prevention and Surveillance
 - Immunization and Disease Outbreaks
- Home Health Care



But beware of the process change!

- IT solutions will almost always be distracting and be abandoned unless specific attention is paid to re-engineering workflows or integrating IT solutions into existing workflows!
- Many, many real-world examples of this
 - One institution spent \$20M implementing an EMR. 2-3 months later it had to be shut off because people complained so bitterly!
- Implementing new technical systems often surfaces existing organizational and/or people issues



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Sharing Data Helps Save Lives

- The root cause for healthcare fragmentation usually reduces to poor communication among providers
- Sharing clinical data among providers helps save lives but is complex and costly to implement
 - <http://www.cio.com/archive/030105/healthcare.html>
- However it can have a major impact in terms of future return on investment and patient safety
 - <http://content.healthaffairs.org/cgi/content/abstract/hlthaff.w5.10>



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Section 2: Framework for Change Management

- A General Approach to Change Management
- Workflow and Process Redesign



Change Management is Culture Change

- The hardest part about any HIT implementation process is the culture change. The technology is the easy part
 - 80/20 rule - 80% culture change, 20% technology
- Approaching HIT implementation involves a concerted effort at many different levels:
 - Organizational
 - Technical
 - Process
 - Educational
 - Financial
 - Legal
 - Political

Lorenzi, Nancy, "Strategies for Creating Successful Local Health Information Infrastructure Initiatives", Vanderbilt University, December 16, 2003



A Framework for Change Management

- Organizational
 - Establish management, clinical and technical leadership groups and a process to monitor the people, process and technology
- Technical
 - Understand information flows, establish the data standards and data models and pilot test it all with real users in real settings
- Process
 - Clearly define the objectives, roles/responsibilities (esp. who is in charge and name people to head up specific change management objectives in order to create a sense of ownership)
 - Establish clear communication channels between these parties
 - Establish efficient processes for coordination
 - Create a process for dealing with mid-course changes and requests
- Educational
 - Establish a clear educational plan for all parties involved



A Framework for Change Management

- Financial
 - Need to obtain financial support early on
 - Continuously monitor financial resource use
 - Have contingency plans and address sustainability issues
- Legal
 - Establish clear standard operating procedures, formal agreements and policies early on
- Political
 - Assess the “climate” for change to see where the “pockets of resistance” may be and address them early
 - Identify ALL possible stakeholders (very granular)
 - Establish a climate of trust with the stakeholders
 - Involve all people to some degree early on so people don’t feel they are just “along for the ride”



Workflow Redesign

- Davies Award given to successful national implementers of HIT
- Many common themes emerged from their successes:
 - Almost all approached change management incrementally (each increment overcame a *specific barrier to care*)
 - All winners had to re-engineer some workflow process – “don’t automate a manual process that occurs commonly but does not work”!
 - Customer Service, Customer Service!
 - Frequent, sustained, end-user orientations and feedback with *demonstrated* responsiveness to feedback!
 - Weekly Regenstrief Pizza Meetings
 - Kaiser physician focus groups
 - Northwestern weekly feedback with “supplements”
 - System developers were also the salespeople, troubleshooters, coaches and colleagues!
 - Plans in place for system evaluation and monitoring
 - Systems were viewed as *tools* to enable care process improvement and were not an end to themselves



Tools for Workflow Redesign

- Many systematic ways to look at workflow

- Business Process Management

- Use of computers to analyze, change or augment workflows

- Root Cause Analysis

- Retrospective systematic evaluation of the cause of an error or negative outcome

- Healthcare Failure Mode and Effect Analysis

- Prospective look at *current* practices and how they may lead to an error

- Continuous Quality Improvement

- FOCUS then Plan/Do/Check/Act

- Six Sigma & Lean

- Statistical Methods

- Many software tools that use these methods are available. Some commercial, others open-source

- A Google search will easily yield many whitepapers and solutions.



First Aid for Anticipating Problems: “Project Management 101”

- **Business & System Analysis step:**

- How will the organization change from the business point of view?
- What steps will be enabled and which ones eliminated?
- Determine how employees will function differently due to the project or phase.
- Describe any proposed user interfaces for electronic systems.
- Determine technical requirements for new automated systems and changes to existing automated systems

- **Project Plan step:**

- For the project, break the project into sub-projects, or phases.
- For a phase, break the phase into tasks in order to develop or implement the phase.

- **Implementation step:**

- Develop or make changes to automated systems based upon information from the Business and System Analysis step.
- Change the way employees function in the organization, or implement or change automated systems in the organization

- **Evaluation step:**

- For the project as a whole during the overall project design, or for a phase, evaluate the projected value or actual success of the project or phase.
- Determine whether to continue, change course, or terminate the project or phase; should you re-do previous phases and re-do plans for future phases?

<http://www.uprforum.com/Chapter2.htm>



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Section 3: Anticipating Implementation Problems

- Culture and Workflow Change
- Technology Issues
 - Security
 - Standards (data communication)
 - Repository Design
 - Applications
 - Performance Issues
 - Procurement Issues
- Cost and Sustainability

HIT Framework



Culture and Workflow Change

- Problem: HIT in most cases will initially *impede* workflows which makes user acceptance harder. Some may resist use altogether so don't worry about these (hopefully) few individuals initially.
 - New systems to learn
 - CPOE has the greatest impact on workflow
 - New “vocabulary” to learn
 - Need to map *your* way of expressing something into that which the system can understand. There are many ways of expressing the same thing but the end-result may be quite different!
 - EX: nurse who worked with a group of docs knew which kind of echo test each one wanted and could correctly enter it into a CPOE system. When the docs tried to do this themselves they were lost and ordered the wrong test.
 - New workflows to learn
 - Need to “cosign” verbal orders electronically, etc.
 - Need for trust to develop in the “back-end” processes - i.e. what happens to the “order” once it is entered? How does it get done? Who is responsible and when and how can you see a result?



Culture and Workflow Change

- Problem: Some types of process questions that commonly arise:
 - How do I enter an order for _____ into the system?
 - What happens when I order a script online? Where does it print? Who gets it?
 - How will I be notified that my order was completed?
 - Patient had blood drawn and sent to a lab
 - Script was printed and given to the patient
 - A consult or test appointment was scheduled
 - Who do I go to if I have a question entering orders or data in the system?
 - How does this particular screen work?
 - Etc.

- So you need to have a lot of “support” services in place when you go live with certain types of health IT implementations.



Culture and Workflow Change

(Remember: Culture change = Advertising+Support)

- Solution: *Do not underestimate* the training required in order to address culture change. In most cases you will need full-time support staff for this. You may have to spend up to 20% of your IT budget on training alone.
 - Need for Upfront, Ongoing and Retraining
 - Use of “surrogate” trainers - the Cleveland Clinic CPOE example.
 - EX: Train those that work the closest with the individuals who are resistant and use these “surrogates” to monitor, train and support these resistant providers. Need to first find out who these people are so do a workflow observation.
 - “Catch-on” features - advertise them well and to everyone!
 - Ensure that the “vocabulary” is as close to that of a user as possible so that a seamless transition occurs between the paper and electronic worlds.
 - Make sure to pilot test and troubleshoot the system before going live and go live in stages (by care units, staff types, institutions etc.)
 - Make sure you can anticipate user questions, understand the full closed-loop system, train the support people first and have contingency plans ready in case of disaster and continuously benchmark the system (use/acceptance, %orders etc.)
- The culture change can take years to develop so don't rush it - work more closely with the enthusiasts and early adopters (20%) and let them blaze the trail for the others to follow, i.e. **START SMALL!**



Technology: Security

- Problem: Lack of trust in data security is a huge barrier to adoption of HIT systems.
 - Many providers still worry about what will happen if the system goes down or is hacked? Do you need paper backups? Redundant servers (\$\$\$)?
 - Vendors advertise that they are “HIPAA compliant” but don’t let that fool you. A lot of burden for HIPAA compliance is actually on your shoulders and the vendor can do nothing about that.
 - Vendors are responsible for making sure *their application* is HIPAA compliant (uses login/passwords, has automatic signouts, uses secure messaging (https, SSL, etc.) and is backed up.
 - But they have no control over *your network architecture!*
 - Your institutional policies and procedures need to be HIPAA compliant, and in most cases they will be
 - For small practices this could be a problem. May need to invest in security tools and personnel.



Technology: Security

- HIPAA Security calls for 3 areas of protection:
 - Administrative Safeguards
 - Develop administrative security process, provide training, provide authorizations, document violations and have a disaster recovery plan
 - Physical Safeguards
 - Facility access control, workstation level security (automatic logoff, screen guards etc.), dispose of devices and media appropriately
 - Technical Safeguards
 - Data access and audit controls, provision of emergency access, data encryption/decryption and verification



Technology: Security

■ Caveats:

- Firewalls (hardware or software) are *overrated*.
 - They prevent most known ways of hacking but new ways are found every day.
 - Need competent people watching the firewall most of the time in order for this to work properly.
 - CISCO Systems estimates this can cost upwards of \$20K/month!
- Beware of software that “open up ports on your system” without you knowing that it is happening!
 - Providers like to install all kinds of health related software on their systems that can potentially open up the system for hackers!
- Wireless networks are inherently insecure. Don’t install them unless absolutely necessary and then consult a security advisor to ensure it is safe. Some common sense, easy to use ways to do this well exist.



Technology: Security

- Solution: Understand your network security architecture
 - Do you have security personnel?
 - Do you use secure communications channels?
 - SSL Certificates
 - https (128-bit encryption)
 - VPNs (Virtual Private Networks) - quite safe
 - Peer-to-Peer connections (safest)
 - Do you have a firewall, virus protection and intrusion detection capabilities and competent people to oversee them?
 - Educate the users well! This takes a lot of time, effort *and patience* for the docs to “accept” the security equation.

- Solution: For small practices an ASP model may be more attractive



Technology: Security

- Solution: Use common-sense measures to prevent problems
 - Logoff when you leave a terminal
 - Use good “password hygiene”:
 - Use number/letter combinations
 - Change your password often
 - Do not reuse a password
 - Don’t give your passwords out to others
 - Don’t have passwords written down.
 - Use easy to remember passwords.
 - Be sure you understand your institution’s policies and procedures, including the reporting chain of command, disaster plans etc.
 - Use security hardware: RSA keys/tokens, biometrics (quirky)



Technology: Security

- Solution: Be aware of what is happening nationally:
 - ONCHIT has an effort underway in terms of security
 - Looking at federal and state laws and helping to formulate better business practices and security solutions in up to 40 states
 - Stark Laws are prohibitive in many states and some legislation to relax these laws will be coming



Technology: Standards

- Problem: The key thing to remember about standards is that they are not standard!
 - Many “acceptable” ways of representing data within HL7 messages - some “mischievous”
 - EX: Putting lab results in the “message” section of an HL7 stream
 - Putting the result data and units together in one field instead of in separate fields
 - Different institutions may use different “versions” which may need to be accounted for (i.e. v2.4 vs. v2.5 of HL7).
 - Interface Engines will typically *not* pick up these errors - need human intervention which is costly
 - Regenstrief has 2-3 FTEs dedicated to address mapping problems alone!
 - A change in reporting units by one lab (from mg/dl to mg/L) resulted in 20,000 exceptions being generated! Someone had to manually look at all of these results and check what was wrong!
 - May need face-to-face contact to address some problems.
 - There are no standards for certain types of data:
 - Problem Lists
 - Allergy information
 - etc.



Technology: Standards

- Solution: Don't underestimate the effort needed for conformance testing.
 - Will need at least 1-2 FTEs to make sure that standards are working.
 - For the small practice EHRs make sure that your vendor has done the conformance testing and is able to report out the most common problems
 - Use HL7 Lint (a freeware application available from Regenstrief)
 - <http://www.regenstrief.org/loinc/download/>
 - Picks up misplaced *unit* fields but is being extended to support other types of errors
 - Be firm with the entities supplying data into your system - make sure they comply with the correct formulations of standards and that they report any aberrations to you in a timely manner - you really need open and frequent communication for this to work



Technology: Standards

- Solution: Keep abreast of what is happening nationally:
 - The ONCHIT Standards Harmonization Effort
 - HHS has sought to contract with non-for-profit collaborative to look at the feasibility and effectiveness of a process for widespread EHR interoperability
 - <http://www.hhs.gov/healthit/documents/RFPfactsheet.pdf>
 - The new final rule for Foundation Standards for ePrescribing under Medicare
 - <http://www.ehealthinitiative.org/initiatives/policy/administration.msp>

http://www.himss.org/Content/Files/HIMSSPulseonPP/pulseonpp_20050616.html



Technology: Repository Design

- Problem: Representing clinical data in a coded manner in a database is not a trivial task. There are many ways to do the same thing and many standards for representing clinical data
 - Ex: ICD9, CPT, Snomed CT, LOINC, NDC, etc.
 - You need to be aware of the different ways people say the same thing and build your repository to accommodate those ways to expressing information
 - This makes sure that a provider does not inadvertently order the wrong test or the wrong medication
- Problem: Getting data out of the system is also a big problem in many systems. You need to make sure you can get data out easily - its usually required for many purposes such as benchmarking, research, administrative reporting etc.



Technology: Repository Design

- Solution: You need a master synonym dictionary for clinical terms. Many vendors do this for you already but you need to be able to customize it to your settings. Work with your providers to define these additional terms.
- Solution: As you look towards planning your system deployment and testing/benchmarking it, you should think of adding *instrumentation metrics* right into your system from the start.
 - For example, have built-in fields for indicators such as:
 - # orders completed online
 - Averages for clinical endpoints such as Hgb A1c, Blood pressure, etc.
 - Demographics etc.
 - Work with your vendor at the outset to define and enable automatic data capture within these areas because you will undoubtedly need them later.



Technology: Applications

- Problem: The user interface is a critical element of the EHR. However, many systems have suboptimal user interfaces and actually *introduce* the opportunity to make errors
 - EX: In one vendor’s system, the patient selection screen and the order entry screen are *independent* and not tied together. This means that you can go to the order entry screen *without* first selecting a patient and the order will go into the file of the *last selected patient*. This can introduce all kinds of errors that you may not even hear about until its too late.
 - EX: In another system, the back-end processes after CPOE are not electronic. So a false sense of security is instilled in the user that an order entered into a system will actually get completed. There is no feedback to the user ascertaining the *status* of the order, so the patient comes back 3 months later and nothing has been done.
- Problem: “Alert Fatigue” is a big problem with EHR’s today
 - Too many alerts, many of which may or may not be relevant



Technology: Applications

- Solution: It's a good idea to define use cases and have a requirements analysis phase for your EHR. This ensures that vendors stick to the guidelines as you implement your systems.
 - Make sure you think through the full sequence of events of what happens to orders and other data entered into an electronic system. Make sure you work out all of the possible contingencies ahead of time and have a backup plan in case things do not function correctly.
 - Make sure to involve the users in the interface design stage or if the interface is fixed then user education is of paramount importance.
 - Go out and do site visits of institutions where your vendors' system is up and running. This is critical to understanding the runtime problems.



Technology: Applications

- Solution: There is no easy answer to the problem of alert fatigue.
 - You need to have a balance between too many alerts and missing critical alerts. This often comes with experience and fine tuning of the product in your environment.
 - You need to have the flexibility in your system to turn on and off the alerts very easily and without vendor intervention.
 - Timeliness of an alert is the best indicator of use. Popping up irrelevant alerts at the wrong time will ensure they are ignored.
 - Use of order sets may actually end up costing more, despite improving compliance with guidelines. A better approach may be to present the “recommended tests or medications” but make the clinician order them individually instead of as part of an order set.



Technology: Applications

- Solution: Some Common Sense Approaches to Alert Fatigue
 - Display the *indications and price* of a test or medication at the time it is ordered. This is a quick way to help change ordering behavior without overwhelming the user.
 - It is useful when ordering a medication to list suggested orders for follow-up labs, with the ability to order these labs quickly from the same screen.
 - Same thing applies to when a diagnosis is made and a problem documented.
 - Force the clinicians to comply with critical alerts in order to move any further with use of the system. For example, all in the Regenstrief system, all input is prohibited unless a decision about a critical alert is made - it takes 1-2 seconds to do this and makes all the difference.



Technology: Performance

- Problem: System performance is a big factor in acceptance. A slow system will never be acceptable.
- Solution: Pilot testing will help iron out some of the performance issues:
 - Database performance
 - Remember that with some database back-ends unless the configuration is done correctly they will be very slow for very quirky and technical reasons, despite having fast servers and wide network bandwidths
 - Problems result from the use of inefficient caches, need to look-up a result every time instead of caching frequently used results, etc.
 - To give you some perspective on this, the Oracle database needs to be fine tuned depending on what application is running on it. Some examples of this can be found here:
 - http://www-rohan.sdsu.edu/doc/oracle/server803/A54638_01/evalchar.htm
 - Avoid a transaction based database configuration - ensure it is patient based or encounter based in order to optimize performance.



Technology: Performance

- Solution: Pilot testing will help iron out some of the performance issues:
 - Network Performance
 - Firewalls are notoriously slow and sometimes network IP packets are broken down in front of the firewall and reconstituted on the other end (a la Star Trek transporter paradigm).
 - Needless to say this can be very slow and can be turned off for intranet devices but you need to explicitly configure the firewall that way.



Technology: Procurement

▪ Vendor Selection:

- This is a big part of any EHR Implementation process
- Take your time doing this - do it right, or else ...
 - \$20M system put in at a famous institution, few months later was shut off.
- A good place to start is the AAFP website:
 - <http://www.aafp.org/fpm/20050200/55howt.html>
 - Defines 12 common-sense steps with some tools you can use right away
 - Includes an RFP process and site visits
 - Provides checklists and tools for you, including vendor rating forms
- Others have similar tools (eg: http://www.communityclinics.org/files/797_file_DTM_6.pdf)
- Make sure you are able to compare different vendors side by side using the *same* metrics - this can be tricky as vendors don't often report the same performance metrics.
- Also make sure that you don't just listen to a vendors' demo but develop your own use cases and ask the vendor to demo how their product will work given your demo cases!



Technology: Procurement

- Solution: Beware of the national standards for EHRs
 - CCHIT is working on an EHR “certification process”
 - This will include the following areas:
 - Incorporation of Common Use Cases
 - Development of Detailed Methodology and Performance Criteria
 - Certification Application Process
 - Test Execution
 - Certification Results
 - Certification Maintenance/Re-certification
 - <http://www.cchit.org/files/Certification%20Process%20Narrative.pdf>



Cost and Sustainability

- Problem: Cost and Sustainability are perhaps the biggest questions to EHR deployment. The data that is there about cost is conflicting.
 - In a study by Wang et al ROI was not established until year 4
 - <http://www.brighamandwomens.org/gms/News/WangEMRCostBenefit.pdf>
 - Another study observed almost a \$1M savings in year 1
 - <http://www.himss.org/content/files/ambulatorydocs/TheEconomicEffectofImplementingEMROutpatient.pdf>
 - The Center for Information Technology Leadership (Partners Healthcare Boston) estimates that the national healthcare savings from CPOE in the ambulatory environment could be as high as \$44 billion!
 - <http://www.citl.org/research/ACPOE.htm>
 - <http://www.rand.org/publications/RB/RB9136/>



Cost and Sustainability

- Case Studies:
 - In some places the cost is being partly absorbed by payers.
 - In Indiana, the IHIE is working on a sustainable model by delivering data for 20c on the dollar to the docs as compared to labs and other data generating institutions. So these entities use our data aggregation and data delivery services instead of sending data themselves.
- Bottom line is that cost is an exceedingly complicated metric to resolve and will likely vary considerably from place to place.
- An unremitting pressure to show value in multiple domains is a better approach than cost estimation alone.



Section 4: Measuring Success or Failure

- Why Evaluate?
- “Evaluation on a shoestring”
- General Methodologies for Evaluation

- Great Evaluation Paper Search Engine:
 - <http://evaldb.uit.ac.uk>



Why Evaluate?

- For many reasons:
 - To get support from your own stakeholders
 - Providers, payers, administration, patients
 - Local government
 - Your community (through the media)
 - To show the federal government (for some, they are your sponsors) that you are making a difference and that your voice counts in policy issues
 - To share lessons learned with others doing the same thing across the country
 - For future funding and sustainability issues



Evaluation on a “shoestring”

- You don't necessarily need to do a randomized controlled trial for every implementation.
- What matters more is *your story* and *how you are moving your field forward*
- So evaluate:
 - What is important to you
 - What you can *afford* to evaluate
 - What makes your story compelling
 - What makes you move the field forward



Evaluation on a “shoestring”

- Try to fill in the following table before you decide which measures to consider:

	Cost/Resource efficient	Moderate Cost and Resource Use	Very Costly and Resource intensive
Very Important	First	Second	
Moderately Important	Third	Fourth	
Somewhat Important	Fifth		



Evaluation on a “shoestring”

- Instrument your implementations
- Hire “inexpensive” research assistants to do time-motion studies
- Be considerate of “expensive” provider time. Try to ask quick questions when they are in their element rather than taking them out of their workflow.
- Use anecdotes and stories as qualitative data as supplements to focus groups



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General Methodologies

- Not everyone can do an RCT
- Before-After observation studies are very popular in medical informatics
- Use simpler statistics (t-tests, chi-square statistics) to benchmark quick indicators
- Other methods (glm, logistic regressions) may be expensive but worthwhile for overall effect analysis *if you have the budget and the expertise to do this.*



Section 5: Case Examples

- Regenstrief
- Vanderbilt
- Cleveland Clinic



Regenstrief

■ Process:

- Patient call-ins into the clinic were being triaged *both* by clinic nurses and by triage operators (essentially nursing personnel assigned to triage duty for the day)
- The information was noted on a piece of paper and handed to the doctor
- The doctor had to look up the relevant patient information from the chart or the computer
- They acted on the information by:
 - Calling Patients
 - Ordering Tests
 - Ordering Consults
 - Ordering/Changing Medications
 - Looking up results



Regenstrief

- Process Inefficiencies:

- Duplicate call-ins from the same patient if the doctor did not address the problem in a timely manner
- Multiple telephone numbers and processes by which to access the call-in triage system (good for the patient but a distraction for clinic nurses not on triage duty)
- Time-consuming work for the doctor who had to consult both the chart and then logon and check test results etc. on the computer
- Sometimes the pieces of paper were lost so no record of what was done was available



Regenstrief

- Intervention:

- Use of computer based TO-DO lists to capture the patient call-in information
- An email is sent to the nurse automatically upon completion of the task and removal of the item from the TO-DO list

- Workflow Change:

- Nurses enter patient call-in data into the computer instead of writing on a piece of paper
- Physicians are notified of the action items as soon as they logon and can attend to them quickly with a prompt (renewing meds, ordering labs, ordering consults, checking test results, looking up patient telephone numbers)



Regenstrief

■ Outcome:

- Physicians able to act on the patient call-in information 53% *faster* than with the previous workflow
- Nurses automatically notified upon task completion and electronic documentation secured automatically about the transaction
- Duplicate call-ins automatically detected if 2 of the TO-DO items match within a given period – usually within 1 week as default



Vanderbilt

- Here is an example of aspects from the “paper world” to consider when implementing HIT.
- Process:
 - Nurses put faxed echo results (and other tests) in a basket for docs to see as they came into the clinic
 - An EMR was implemented and reports of echo tests were then stored in the database for users to access – faxing of results were discontinued.
 - Since the docs were not informed of the availability of results (faxing stopped), they suddenly stopped getting echo results and wondered what had happened.
 - Solution – “New Results” implemented in EMR.



Vanderbilt

- An example of “fragmented healthcare” and HIT.
 - Different groups that need to be coordinated within healthcare often exist as separate “black boxes.”

- Process – Poor reimbursement for electrocardiograms:
 - Heart station places stack of billing forms for pickup by “billing and coding people.”
 - Forms often returned for rework.
 - No one knew what happened to the forms after they left the heart station.
 - A complex, manual process involving 2 independent sets of duplicate paper-electronic transcription followed.
 - Solution – an electronic billing module to bypass error-prone steps and provide useful and timely feedback on issues related to billing.



Cleveland Clinic

- Many “lessons learned”
 - Implemented CPOE in a group of affiliated urban hospitals
 - Resident physicians are a great resource for pilot testing EMR implementations - they are in the front lines - use them if you can
 - When “selling” CPOE to providers, make sure they have a contact person assigned to them who can help them learn the ropes and troubleshoot if necessary and this contact person is accessible 24/7
 - Alert fatigue a huge issue they are tackling with
 - Workflow change must be incremental - if you ask people to do too much at once they will be lost and errors will result. Implement the system in one unit at a time and then move on
 - You often discover system and policy issues when you embark on implementing health IT - things you never thought existed!
 - Interface design is a critical element. Be sure it is appropriate and easy to understand. Don't overwhelm with too much information on-screen at once.



Section 7: Questions

Thank you.

For more about AHRQ's health IT programs:
<http://healthit.ahrq.gov>

Atif Zafar, MD
azafar@iupui.edu

**The Agency for Healthcare Research and Quality and
AHRQ's National Resource Center for Health IT**



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