The Value of Healthcare Information Technology in Clinical Practice

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Overview

• Motivation for Healthcare Information Technology (“HIT”)
• The Value Proposition for Electronic Records (“EHR”) & HIT
• US Activities Driving HIT Adoption
• Making EHR Work in Practice: Partners Healthcare
• Q&A
Healthcare Delivery Challenges

- Medical error, patient safety, quality and cost issues
  - 1 in 4 prescriptions taken by a patient are not known to the treating physician
  - 1 in 5 lab and x-ray tests ordered because originals cannot be found
  - Patient data unavailable in 81% of cases in one clinic, with an average of 4 missing items per case.
  - 18% of medical errors are estimated to be due to inadequate availability of patient information.
  - 40% of outpatient prescriptions unnecessary
  - Patients receive only 54.9% of recommended care
- A fractured and ‘unwired’ healthcare system
  - Medicare beneficiaries see 1.3 – 13.8 unique providers annually, on average 6.4 different providers/yr
  - 90% of the >30B healthcare transactions in the US every year are conducted via mail, fax, or phone

2006 HIT Adoption Study

- 36 surveys identified and reviewed
- Clinical context:
  - Half assessed outpatient EHR only
  - 25% assessed both inpatient and outpatient
  - 25% focused on inpatient EHR only
- 17 surveys had adequate information for quality scoring
Outpatient EHR Use

- Five surveys high quality
  - “EHR” adoption rate: 17% - 27%
    - NAMCS 2005 survey: 24%
    - Audet 2004: 27% use at least occasionally
    - CSHC 2001: 25% use at least one function
  - Use of EHR with key functionalities
    - 10% of ambulatory physicians

Figure 1: EHR Adoption Among U.S. Physicians and Health Centers (2005-2006)

Note: Physicians percentages are based on preliminary data from the 2005 National Ambulatory Care Survey (N=1,281 eligible physicians; 66.2 percent response rate), CHC percentages are based on preliminary data from the 2006 Survey of Health Center Use of Electronic Health Information (N=723 health center CEOs or Executive Directors; 79.5 percent response rate)
The “CPR Adoption Gap”:
The United States vs Others

Figure 2: Percent of physicians using electronic medical records and percent of physicians using electronic medical record system by practice size: United States, 2005

NOTES: Both trends are significant (p<0.05). EMR is electronic medical record. General EMR is positive response to single question on full or partial EMR use. EMR system is a positive response to four minimal features: computerized orders for prescriptions, computerized orders for tests, test results and physician notes. Includes nonfederal, office-based physicians who see patients in an office setting. Excludes radiologists, anesthesiologists and pathologists.

SOURCE: National Ambulatory Medical Care Survey.
Dilbert Wisdom…

The Value Proposition for EHR & HIT

• Headlines:
  — ROI of Partners Longitudinal Medical Record
    • $31K Savings per provider
  — Value of ACPOE suggest
    • $28K savings per provider
    • $44B savings potential nationally
  — Value of Healthcare Information Exchange
    • $78B year nationally
Breakdown of Benefit Areas for Base Case: $31,300

- Decrease error queue: 8%
- Chart pull savings: 10%
- Transcription savings: 8%
- Formulary suggestions: 25%
- Drug Suggestions: 9%
- ADE prevention: 19%
- Radiology Suggestions: 5%
- Lab Suggestions: 8%
- Increased billing capture: 8%
- Increased billing capture: 8%

The Value of Ambulatory CPOE

- Summarized costs and benefits across clinical, financial, and organizational factors
- ACPOE Taxonomy:
  - Basic: passive references, no pt data, no EDI
  - Intermediate: some order and Rx patient-specific CDSS, limited pt data, no EDI
  - Advanced: adv. order and Rx patient-specific CDSS, full patient data, with EDI
- Full-time ambulatory provider
  - panel of 2,000, 3875 annual visits, capitation rate 11.6%
  - Total Rx, Lab, Radiology expenditures (almost $1.2M):
    - Rx: $650K
    - Lab: $166K
    - Radiology: $355K
Clinical Impact of ACPOE

- Per “average” provider, Advanced ACPOE systems would prevent...
  - 9 ADE/yr
  - 6 ADE visit/yr
  - 4 ADE admission/5yr
  - 3 life-threatening ADE/5yr

Per “Average” Provider Annual Cost Saving Projections

<table>
<thead>
<tr>
<th></th>
<th>Basic Rx</th>
<th>Basic Rx-Dx</th>
<th>Int Rx</th>
<th>Int Rx-Dx</th>
<th>Adv Rx-Dx</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADE Reductions</td>
<td>$2.2K</td>
<td>$2.5K</td>
<td>$12.3K</td>
<td>$16.6K</td>
<td>$28K</td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5 Yr Net Cost-Benefit for 25 Providers

Advanced Systems Produce Superior Returns

- For example, Advanced ACPOE costs nearly 4x as much as Basic, but…
  - Generates over 12x more financial returns
  - Produces nearly 10x greater reduction in number of ADEs
  - Provides IT infrastructure for core clinical computing – the outpatient EMR – which produces additional benefits
  - Pays for itself within first two years
US Healthcare System Will Benefit

- National adoption of Advanced ACPOE systems would prevent…
  - 2 million ADE/yr
  - 190,000 ADE admission/yr
  - 130,000 life-threatening ADE/yr
- Nationwide implementation of advanced ACPOE could:
  - Save the US $44 billion annually
Value of HIEI: Key Findings

- Standardized, encoded, electronic healthcare information exchange would:
  - Save the US healthcare system $337B over a 10-year implementation period
  - Save $78B in each year thereafter
  - Total provider net benefit from all connections is $34B
- Net benefits to other stakeholders:
  - Payers $22B
  - Laboratories $13B
  - Radiology centers $8B
  - Pharmacies $1B
  - Public Health $0.1B

- Dramatically reduce the administrative burden associated with manual data exchange
- Decrease unnecessary utilization of duplicative laboratory and radiology tests

HIEI Definition

- Provider-centric encounter-based model of clinical information exchange
  - Clinical and administrative transactions and data exchange
    - Between providers and other providers
    - Between providers and labs, pharmacies, payers, radiology centers, and public health departments
Flow of Healthcare Information

Clinical Encounter

Diagnosis
Treatment

Claims and Billing

Public Health

Prescription
Order
Results

Pharmacy

Lab

Imaging Center

Disease Reports, Vital Statistics

Local Public Health Dept.

Other Provider

HIEI Taxonomy

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-electronic data</td>
<td>No PC/information technology</td>
</tr>
<tr>
<td>2</td>
<td>Machine-transportable data</td>
<td>Fax/Email</td>
</tr>
<tr>
<td>3</td>
<td>Machine-organizable data</td>
<td>Structured messages, non-standard content/data</td>
</tr>
<tr>
<td>4</td>
<td>Machine-interpretable data</td>
<td>Structured messages, standardized content/data</td>
</tr>
</tbody>
</table>
HIEI National Net Cost-Benefit

<table>
<thead>
<tr>
<th>Level</th>
<th>Net Return over 10-year Implementation</th>
<th>Annual Net Return after Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2</td>
<td>$141B</td>
<td>$22B</td>
</tr>
<tr>
<td>Level 3</td>
<td>-$34B</td>
<td>$24B</td>
</tr>
<tr>
<td>Level 4</td>
<td>$337B</td>
<td>$78B</td>
</tr>
</tbody>
</table>

Value of HIE standards is the difference between Level 3 & 4

10-Year Cumulative Net Return by HIEI Level

![10-Year Cumulative Net Return by HIEI Level](image)
US Would Benefit from Healthcare Information Exchange

- Nationwide implementation of standardized healthcare information exchange would:
  - Save $337B over 10 years
  - Save the US $78B annually at steady state
  - Cumulative breakeven during year five of implementation
- There is a business case for standardized healthcare information exchange and interoperability

Forces Influencing HIT adoption in the USA

- Pay-for-performance
- Certification Commission for Healthcare Information Technology
- Healthcare Information Technology Standards Panel
- American Health Information Community – Breakthrough Workgroups
- NHIN Demonstration projects
- RHIO Projects
- Consumerism – Healthcare Savings Accounts, PHRs
Partners HealthCare – NHII *in situ*

- Founded in 1994
  - Brigham and Women’s Hospital
  - Massachusetts General Hospital
- Now includes:
  - Community Physician Network
  - 2 Rehab Hospitals
  - 4 Community Hospitals
  - Affiliated cancer hospital – Dana Farber
- Common Clinical IT supported by Partners Information Systems

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**Partners Geography**

- Go Red Sox!
Overview of Partners IS: Scale of the Integration Effort

- 55,000 devices attached to the Partners network
- 45,000 users accounts
- 110 locations on the network
- 750 servers
- 800 applications
- 540 active projects
- 1,100 employees based in 19 locations

Partners HealthCare: Scale of the Integration Effort

- 580,000,000 results in the CDR
  — growing at a rate of 100,000 transactions/d
  — 800 GB allocated
- 25 million specimens on file
- 8 million Radiology reports
  — 75,000,000 images archived
- 2+ million Pathology reports
- 1+ million Operative notes
- 1+ million Discharge summaries
- 2+ million Microbiology Specimens
Partners IT Statistics, ca. Q4 2004

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of patients</td>
<td>3,300,000</td>
</tr>
<tr>
<td>Physician users of CPOE</td>
<td>2,700</td>
</tr>
<tr>
<td>Patient users of the patient-provider portal</td>
<td>20,000</td>
</tr>
<tr>
<td>Orders entered daily through inpatient CPOE</td>
<td>26,000</td>
</tr>
<tr>
<td>Telemedicine consultations annually</td>
<td>2,600</td>
</tr>
<tr>
<td>Notes in LMR</td>
<td>9,937,947</td>
</tr>
<tr>
<td>Medications</td>
<td>2,661,475</td>
</tr>
<tr>
<td>Prescriptions printed (new and refills)</td>
<td>4,195,900</td>
</tr>
<tr>
<td>Prescriptions faxed</td>
<td>580,781</td>
</tr>
<tr>
<td>Health Maintenance items</td>
<td>2,267,706</td>
</tr>
<tr>
<td>Immunizations</td>
<td>3,669,665</td>
</tr>
<tr>
<td>Vital Signs</td>
<td>6,094,474</td>
</tr>
<tr>
<td>Patient Sessions</td>
<td>51,392,709</td>
</tr>
<tr>
<td>Web Sessions</td>
<td>18,951,058</td>
</tr>
<tr>
<td>Patient Visits including phone call encounters</td>
<td>11,960,444</td>
</tr>
<tr>
<td>Appointments: Avg./day</td>
<td>~ 17,000</td>
</tr>
<tr>
<td>New Notes: Avg./day</td>
<td>~ 15,000</td>
</tr>
<tr>
<td>Edits to Notes: Avg./day</td>
<td>~ 10,000</td>
</tr>
<tr>
<td>Patient Sessions: Avg./day</td>
<td>~ 220,000</td>
</tr>
<tr>
<td>Web Sessions: Avg./day</td>
<td>~ 65,000</td>
</tr>
<tr>
<td>(Average patient sessions per web session = 3)</td>
<td></td>
</tr>
<tr>
<td>Web pages generated: Average per day</td>
<td>~ 300,000</td>
</tr>
</tbody>
</table>

What Are the Signature Initiatives?

The Signature Initiatives are five System-wide projects with one common goal:

To deliver better care to patients.

- Care that is:
  - Safer
  - Better coordinated
  - More reliable in delivering proven interventions
- Systems that support providers in “doing the right thing.”
What Are the Signature Initiatives?

1. Investing in quality and utilization infrastructure
   - Information systems
   - Other resources

2. Enhancing patient safety by reducing medication errors system-wide
3. Enhancing uniform high quality by measuring performance to benchmark for select inpatient and outpatient conditions
4. Expanding disease management programs by supporting activities for certain patients with chronic illnesses
5. Improving cost effectiveness through managing utilization trends and analysis of variance
No one should have to decipher your doctor's handwriting to give you the right prescription.

Almost 90 percent of doctors' computer-based patient care notes also are provided by computer, but one-third of all doctors still handwrite their notes. This trend may lead to mistakes, especially when the notes must be interpreted by computer programs.

The handwritten notes often are difficult for computers to interpret, leading to errors in patient care. In one study, computer programs were unable to accurately interpret handwritten notes more than 50 percent of the time.

These programs use artificial intelligence to recognize handwriting, but the accuracy can vary widely depending on the style and legibility of the handwriting.

To improve this process, many hospitals are implementing handwriting recognition software. These programs use advanced algorithms to convert handwritten notes into digital text, making it easier for doctors to communicate effectively with patients.

For more information, go to [www.bostoninnovators.com](http://www.bostoninnovators.com).

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Sometimes our sickest patients prefer to get coached at home.

Hospice patients or those with chronic conditions such as diabetes or heart disease are often more comfortable taking care of their health at home. However, the task can be overwhelming, especially for those new to managing these diseases. Patients want to maintain their health at home, which keeps them from having to leave their homes.

In response, Partners, Brigham and Women's and Mass General have launched new telemedicine programs. These programs are designed to help patients manage their health at home, providing them with the support they need to live independently.

The programs use technology to connect patients with their doctors, nurses, and other health care providers. Patients can access these resources 24/7, allowing them to receive care when they need it most.

For more information, go to [www.partners.org/ medicine](http://www.partners.org/medicine).

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A physician

A physician

A physician

A physician
Informatics Innovators

Vanderbilt Medical Center  Massachusetts General Hospital  Brigham & Women’s Hospital

Kaiser Permanente  Stanford Hospital

...a recent systematic review in *Annals of Internal Medicine* found that 25% of all studies took place at the above institutions.
Automatic Alerts in the Clinical Workflow

KnowledgeLink
Results Management and Patient Communication

Checking results, writing letters

Tickler

Paragraphs, letter templates

Add turbo letter
CAD Quality Dashboard – Summary Page

Quality Dashboards: Coronary Artery Disease

<table>
<thead>
<tr>
<th>Measure</th>
<th>My Value (%)</th>
<th>Clinic Average (%)</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid Management: % of patient with LDL &lt; 100</td>
<td>66% (22)</td>
<td>60% (1747)</td>
<td>&gt; 62%</td>
</tr>
<tr>
<td>Anti-platelet Management: % of patients on anti-platelet agent</td>
<td>98% (29)</td>
<td>92% (2277)</td>
<td></td>
</tr>
<tr>
<td>Blood Pressure Management: % of patients with BP at or below goal</td>
<td>74% (22)</td>
<td>54% (1710)</td>
<td>&gt; 65%</td>
</tr>
<tr>
<td>Smoking Status Documentation: % of patients with smoking status documented</td>
<td>97% (30)</td>
<td>75% (1072)</td>
<td></td>
</tr>
<tr>
<td>BMI Documentation: % of patients with BMI documented</td>
<td>66% (19)</td>
<td>54% (1011)</td>
<td></td>
</tr>
<tr>
<td>Beta-blocker Management: % of patients on beta-blocker</td>
<td>89% (26)</td>
<td>74% (2035)</td>
<td>&gt; 65%</td>
</tr>
<tr>
<td>ACE Inhibitor/ARB Management: % of patients on ACE inhibitor/angiotensin receptor blocker</td>
<td>73% (20)</td>
<td>57% (1043)</td>
<td></td>
</tr>
<tr>
<td>Zero Defect Cases: % of patients with zero deficiencies</td>
<td>0% (0)</td>
<td>3% (13)</td>
<td></td>
</tr>
</tbody>
</table>

Total # of CAD Patients: 32
SmartView: Intelligent Data Review (template driven)

SmartNote: Free text and Coded Clinical Documentation (template and rule driven)

SmartOrders: One-click disease specific order recommend-actions and workflow support
• Prescription
• Appointment
• Referral (practice selected)
• Medications
• Allergies (from LMR)
• Illnesses & Conditions
• Drugs
• Medical Tests
• Self Help (from Healthwise)

• Staff
• Directions
• Insurance
• Contact info (practice)

• Mail (secure)
• Notification
• Request Defaults
• Pharmacy
• Contact info
• Registration info

• Mail (secure)

Patient Gateway

• A “tethered” secure patient portal
  — Abstracted chart info: Meds/Allergies/Schedule
  — Coming soon: Lab results pilot
  • Secure web messaging to the primary care practice, with notifications
  • Health reference information (Healthwise) and practice information
  • Portal preferences and personal profile

BWH Physician Group - Internal Medicine
PATIENT GATEWAY

Welcome

Dear [Patient Name],

You have [number of messages] new messages.

You have no future appointments.

You have [number of tasks] tasks to complete in the Prepare for Care study.

The Brigham and Women’s Hospital monthly Health E-Newsletter contains valuable health information and our current research findings. Subscribe.

Please visit Brigham and Women’s Hospital online.

The Women’s Health Center at Brigham and Women’s Hospital provides comprehensive primary care to adult patients. From routine checkups to complex
Increasing Enterprise Integration: Partners Advanced Informatics Infrastructure

Increasing the level of enterprise integration is supported by core IT services that can be integrated with and/or accessed by site-based applications.

This approach leverages:
- A common technology infrastructure;
- Common data, terminology and rules (especially those associated with allergies, problems and medications);
- Shared clinical services and applications; and
- Customized views and capabilities for specific user types.

Overview of a Service-Oriented Architecture

- Web-Based Portals
  - Physicians, Nurses, Researchers, Administrators
- Applications
  - Order Entry, Clinical Documentation, Order Processing
- Services
  - Clinical Decision Support, Error Scheduling, Notification, CCRP access
- Knowledge & Data
  - Data Repositories, Controlled Medical Terminologies, Catalogues, Dictionaries and EMPI
- Infrastructure
  - Data Center, User Devices, Networks, Security

These IT services integrate and communicate with the site-based and enterprise applications via a service-oriented architecture made up of layered components.
Discrete vs. Shared Data, Knowledge, Logic

Many Partners’ applications utilize discrete data, logic and knowledge or rules; most are not integrated across sites – creating islands of information and supporting varying levels of functionality.

The Future: Shared Data, Knowledge, and Logic

Future clinical applications will take advantage of shared repositories of enterprise data, knowledge, and logic, in a services-oriented architecture.
Welcome to the KM portal

Compare Content Across Organizations

Keyword search

Site Search

Compare Content

Compare Across Organizations

Keyword search

Site Search

Compare Across Organizations

Keyword search

Site Search

Compare Across Organizations

Keyword search

Site Search

Compare Across Organizations

Keyword search

Site Search

Compare Across Organizations

Keyword search

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Keyword search

Site Search

Compare Across Organizations

Keyword search

Site Search
Multi-Clinician Collaboration on a 300 x 5 Decision Table

From Clinic to IDN to RHIO to NHII
"I conclude that though the individual physician is not perfectible, the system of care is, and that the computer will play a major part in the perfection of future care systems."

Clem McDonald, MD
NEJM 295:1355, 1976

Thank you!
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