Using IT to Improve Quality: Past Results and Future Potential

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Goals
• Major gaps between evidence, practice
  • Costs high
  • Problems with errors
• Computerized decision support
  • Current Partners system
  • Errors
  • Costs
  • Guidelines
• Next 5 years at Partners IS
• Conclusions

Leadership and IT
Leadership is the capacity to hold a shared vision of that we wish to create.
– Peter Senge
The best way to predict the future is to invent it.
– Peter Drucker

Old Paradigm
• Authorities are infallible
• Heuristics work well
  • If in doubt, do it
• Clinical judgement and the “art of medicine” get you to the right answers
• Community standards are correct

New Paradigm
• Authorities vary substantially
• Heuristics don’t work
• Clinical judgement is insufficient
• Huge variation by community
Therefore
• Need to begin to practice evidence-based medicine

The IOM Report
• Report targets hospital errors: Mistakes killing thousands every year 11/30/99
  • Medical errors kill 44,000-98,000 people per year
  • “More people die from medical errors each year than from suicides, highway accidents, breast cancer, or AIDS”
• “These stunningly high rates of medical errors - resulting in deaths, permanent disability, and unnecessary suffering - are simply unacceptable in a system that promises to first ‘do no harm.’”
  William Richardson
Reengineering Medicine: The Role of IS

- Could be changed by providing external aids
- Linking medical knowledge and patient-specific data
- Identifying options
- Without such tools, experts
  - Make errors
  - Overlook available knowledge
  - Don't sufficiently account for uniqueness
- Patients could participate in decision-making


Development and Implementation of POE

- Physician involvement and leadership
- Decision to automate existing systems as is
- Constant focus on speed
- Strong support from hospital administration
- Willingness to be flexible, modify system

Event monitor architecture

- Applications (new data) → Patient database
- Inference engine (decisions) → Annun-ciators
- Rule editor → Knowledge base
- Coverage List

- Page, email, write to file, [real time message]

Physician Coverage List

- Functions
  - Identifies first and second-call physicians
  - Manages physician rotation
  - Handles evening coverage and signing out
  - Facilitates delivery of computer-generated messages
  - Computer-page interface allows automated paging

Pharmacy Computer System Field Test of Unsafe Orders

<table>
<thead>
<tr>
<th>Medication</th>
<th>Unsafe Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cephradine oral suspension IV</td>
<td>61%</td>
</tr>
<tr>
<td>Vinoristine 3 mg IV x 1 dose</td>
<td>62%</td>
</tr>
<tr>
<td>(2-year-old)</td>
<td></td>
</tr>
<tr>
<td>Colchicine 10 mg IV for one dose (adult)</td>
<td>66%</td>
</tr>
<tr>
<td>Cisplatin 204 mg IV x 1 dose</td>
<td>63%</td>
</tr>
</tbody>
</table>

Source: ISMP Medication Safety Alert! Feb 10, 1999

Handwriting example
Medication Error Frequency and Potential for Harm

In 10,070 Orders
530 Medication Errors 1.4 per admission
35 Potential ADEs
5 Preventable ADEs

• 1 in 100 medication errors results in an ADE
• 7 in 100 represent potential ADEs

ADE Prevention Study: Key Results

• 6.5 ADEs/100 admissions
• 28% preventable
• 3 potential ADEs for every preventable ADE
• 62% of errors at ordering and transcription stages
• Systems analysis
  • No individual responsible for repeated errors
  • Systems should be designed to:
    • Make errors less likely
    • Catch those that do occur

JAMA 1995;274:29-43

Costs of ADEs

• ADEs are expensive
  • $2461 per ADE, $4555 per preventable ADE
• Annual BWH costs:
  • $5.8 million for all ADEs
  • $2.8 million for preventable ADEs
• These figures exclude costs of:
  • Injuries to patients
  • Malpractice costs
  • Costs of admissions due to ADEs
• Justifies investment in prevention efforts

JAMA 1997;277:307-311

Improving the Quality of Drug Ordering with Order Entry

• Streamline, structure process
• Doses from menus
• Decreased transcription
• Complete orders required
• Give information at the time needed
• Show relevant laboratories
• Guidelines
• Guided dose algorithms
• Perform checks in background
  Drug-allergy Dose ceiling Drug-lab
  Drug-drug Drug-patient

Chemotherapy Order: Patient Characteristics

Allergy to Medication
High Chemotherapy Dose Warning

High Chemotherapy Dose: Requires Attending Approval

Serious Medication Error Rates Before and After OE

Impact of BWH Inpatient Provider Order Entry

"Panic" Laboratory Study

Reducing Drug Costs with Order Entry
Effect of Changing Default Dosing Frequency for Ceftriaxone

![Graph showing the effect of changing default dosing frequency for Ceftriaxone.]

Selected Laboratory Interventions

- Charge display RCT
  - No statistically significant effect
  - BUT $1.7 million lower lab charges in intervention group
- Redundant labs
  - 67% reminders followed
  - Annual charge savings $31,000, vs. estimate of $376,000
  - Only 44% tests performed had computer order
- But $1.7 million lower lab charges in intervention group
- Substantial improvement possible if loop closed with laboratory "back end"

Other Laboratory Evaluations

- Antiepileptic drug levels
  - Only 28% of BWH inpatient levels appropriate
- RCT of structured ordering showed improvement
- Digoxin levels
  - Only 16% of BWH inpatient levels appropriate
  - Potential charge savings $386,000
- PSA levels
  - 19% inappropriate (age, frequency issues)
- Thyroid studies
  - Initial testing TSH alone in only 73% of patients

Guidelines: Vancomycin RCT

- Initiation, renewals both targeted
- Vancomycin use was reduced by intervention
  - Bigger effect on renewals than on initiation
  - Magnitude of overall decreases
    - Vancomycin-days/prescriber 37% lower
    - Duration of therapy 17% lower
  - Much of use likely still inappropriate
  - Further decreases possible by targeting specific indications

Guideline for Expensive Agent

Low Yield Critique
Alternate Exam

Chest Radiographs and Structured Ordering

Percent Acceptable

<table>
<thead>
<tr>
<th></th>
<th>History</th>
<th>Assess/R/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>78%</td>
<td>35%</td>
</tr>
<tr>
<td>After</td>
<td>99%</td>
<td>99%</td>
</tr>
</tbody>
</table>

Impact of Computer OE on Physician Time

- Order writing took twice as long on computer
  - Medical HOs 44 min/day, recovered half
  - Surgical HOs 73 min/day, no recovery
- Daily and one-time orders accounted for most of change, increasing 3-fold
- Sets of orders took half the time they did before order entry
- Interventions
  - Introduction of "Write 1"
  - Reorganization of screens to facilitate access to OE

Order Entry and Critical Paths

- Critical paths specify what should happen for a specific day
  - Essentially sequences of order sets
  - In place for 25 diagnoses
- Have decreased LOS, costs, improved satisfaction
- Require physicians to select dx at admission
  - Allows prompting about path
  - Increases likelihood path will be selected

Results of Critical Path Evaluation

- 82% of admission diagnoses coded
- Half the diagnoses have an order set
  - Physicians select 40% of time when offered
- Substantial variation by diagnosis
  - Total knee 77%
  - Pregnancy 54%
  - Deep venous thrombosis 14%

HO Satisfaction with OE

- Overall satisfaction with OE
- OE improves productivity
- OE improves patient care
- OE reduces errors

1 = never, 7 = always

Surgery

Medicine
Rough Cost-Benefit for POE

- Costs:
  - Development $1,000,000
  - Hardware $400,000
  - Maintenance $500,000/year

- Benefits:
  - Overall $5-10 million/year charges
  - Main savings relate to efficiencies re drugs, ADE prevention, and tests
  - Many other interventions coming on line all the time

Current BWH Quality Measurement Strategy

- Measure as much as possible using IS
- Collect limited number of measures across institution
- Have each department specify additional measures covering following domains:
  - Efficiency
  - Critical variances
  - Sentinel events

Trajectories that Will Shape the Next Five Years

- Healthcare context
  - Movement of care to outpatient/non-acute settings
  - Managing inpatient capacity
  - Growing dominance of the treatment of the chronically ill in the healthcare cost discussion
  - Gradual movement to provider payment based on quality
  - Increased patient service and participation expectations

- Technology context
  - Growing presence of mobile technologies
  - Improved (but not great) interoperability between systems
  - Progressive improvement in the Internet infrastructure

Trajectories that Will Shape the Next Five Years

- Management context
  - Increased information systems sophistication on the part of organizational leadership
  - Heightened emphasis on defining and managing information systems “value”

- “Agenda” context
  - Leapfrog
  - Jackson Hole
  - eHealth Initiative
  - Series of IOM reports
  - HIPAA
  - NHII

Key Clinical IS Over the Next Five Years

- Provider order entry
- Computerized medical record
- Knowledge repositories and management
- Physician-to-physician consultation
- Patient-provider communication/monitoring
- Care analysis
- Integration of clinical systems
The Kaiser Experience

- KP-Online supports:
  - Ask a question
  - Review guidelines and consumer information
  - Review benefits

- Piloted with 100,000 members
- Resulting in:
  - 11% fewer office visits
  - 14% treated their illness at home
  - 46% fewer calls to nurses
  - 42% improved perception of Kaiser
  - 59% reported understanding their disease better

Comparison of Site Scores on Five Quality Domains

Percent of Patients Seen at Another Partners Hospital

MGH 29%
BWH 34%
NWH 46%
FH 79%
SRH 87%

Scale of the Partners Clinical Information Systems

- 56,000 user accounts
- 2,300,000 patients in the Partners MPI
- 350,000,000 results in the Clinical Data Repository and growing at a rate of 100,000 transactions per day
- 80,000,000 images archived
- 26,000 inpatient orders are written on an average day, across Partners, using CPOE
- 1,800 physician users (58 practices) of the Computerized Medical Record

The Computerized Medical Record as a Foundation for Outpatient Care Process Improvement
What Do Providers Want From IS?

- Speed
- Ability to access information from multiple sites
- Different views of same information
- Ability to aggregate across patients
- Better information about performance
- Decision support that anticipates needs and doesn’t waste time

What Can IS Do To Help?

- Can improve communication between:
  - Providers
  - Payors/providers
  - Patients/providers
- Can decrease costs, improve quality, by
  - Pointing out redundancies
  - Suggesting alternatives
  - Identifying errors of omission
  - Emphasizing important abnormalities
  - Making guidelines accessible
- Make routine quality measurement possible

What Is Future of Systems?

- Can give providers “better cockpit”
- Will help narrow gaps
  - Between evidence and practice
  - Between revenues and expenses
- Ordering is the key process
  - Communication can also be vastly improved
    - Especially at transition points
  - Even simple decision support has enormous leverage
- Quality measurement will be increasingly important