Beyond the Industrial Age: Moving to an Information Age Model for Healthcare

“The Potential of Medical Science – The Practice of Medicine: How to Close the Gap”

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Overview:

1. The Current System Is Failing
   – Information lapses contribute to failure; IT underpins success

2. Healthcare is “Decentralizing”
   – Exacerbates information discontinuity & failure

3. Finding, Evaluating, and Using the most Relevant Information Becomes the New Challenge
   – VA EHR Example 1

4. New Knowledge Can be a Systematic By-Product of Healthcare Delivery
   – VA EHR Example 2

5. Information Engines Support Personalized Healthcare
   – The information age potential of science realized
1) From the Industrial to the Information Age: Some Planning Assumptions for Desired Attributes

- **Safety – is Fundamental**
  - Goal: Avoid Getting It Wrong

- **Effectiveness – To Close to Chasm**
  - Expect effectiveness in maintaining & improving health, managing disease & distress
  - Goal: Getting It Right . . . Consistently

- **Efficiency:**
  - Goal: Reduce waste; Use resources for maximal benefit

- **Compassionate (Patient-Centered, Coordinated) Care**
  - Patient (or lay caregiver) is locus of control
  - Seamless across environments
  - Seamless across health & disease(s)
  - Anticipates needs, rather than just reacting to them

- **Goal: Safe, Effective, Efficient & Compassionate Care**
  - Litmus Test: Without the need for an advocate
1) How Badly Are We Failing?
Safety & Quality in Healthcare & Aviation

- Airline Safety: > 99.999999
- Airline Baggage Handling: > 99.9999
- B-Blocker p MI: 70 – 99%
- Immunization: 55 – 94%

Frequency of Failures Occurring
1) Why is Information Technology a Central Issue?

- System Failures:
  - 12% of physician orders are not executed as written*
  - 20% of laboratory tests are requested because previous studies are not accessible.*
  - 1 in 6.5 hospitalizations complicated by drug error**
    - 1 in 20 outpatient prescriptions**
  - 1 in 7 hospitalizations occur because previous records not available*

- Safety Gap
- Quality (Effectiveness) Gap
- Compassion Gap
- Value Gap:
  - Health care inflation
    - Inferior outcomes per dollar
      - 31% Waste Estimated (Woolhandler, O’Neil, et al)
    - Un-insurance / Under-insurance
  - Patients / Payors (Govt) / Providers increasingly concerned
    - Compromising Global Competitiveness

* PITAC (President’s Information Technology Advisory Committee, 2004)
** Bates & Leape, multiple references
2) Information Must Link Decentralized Care . . .
2) Ultimate Decentralization:
The “Point of Service” is the Patient

“A company has demonstrated a cellphone in Japan that incorporates a glucometer into the phone. The device uses blood testing strip, and insulin and glucose levels can be viewed right on the phone. Readings are uploaded to an online database for retrieval later. No word on when this phone might be available in the US.”
3) VA’s Electronic Health Record Underpinned Improvement

5.85 Sigma Performance
Helped hold per prescription costs virtually constant for 5 years (~2½% / year)

Bush calls for electronic medical records

President: 'We're kind of still in the buggy era'

Baltimore, Maryland (AP) -- When it comes to patients' health records, the United States hasn't left the "buggy era," President Bush said Tuesday at a veterans hospital.

"On the research side, we're the best," Bush told about 120 guests, including veterans, health care professionals, doctors from Johns Hopkins Hospital and the staff from the Veterans Affairs Medical Center in Baltimore. "We're coming up with more innovative ways to save lives. ... On the providers side, we're kind of still in the buggy era."

The president has set a goal of assuring that most Americans have electronic health records within the next

Cost - $90 / pt / yr
From Evidence to Practice…

Reduce Quality Chasm

Possess Knowledge

Operationalize Knowledge

Patient Need Met

Patient With Need

Possess Knowledge

Operationalize Knowledge

Reduce Quality Chasm

Patient Need Met

Possess Knowledge

Operationalize Knowledge

Reduce Quality Chasm

Patient Need Met

Possess Knowledge

Operationalize Knowledge

Reduce Quality Chasm

Patient Need Met

Possess Knowledge

Operationalize Knowledge

Reduce Quality Chasm

Patient Need Met
3) Operationalizing Knowledge through the EHR - Pneumonia Vaccination Rate Improvement in VA

- BRFSS 90th
- BRFSS

Percent Vaccinated

FY 95 FY 96 FY 97 FY 98 FY 99 FY 00 FY 01* FY 02 FY 03 FY 04 FY 05

- VHA
- Healthy People 2000
- Iowa 99*
- NHIS

• Iowa: Petersen, Med Care 1999;37:502-9. >65/ch dz
• HHS: National Health Interview Survey, >64
Clinical Reminders for Decision-Support

Contemporary Expression of Practice Guidelines

- Time & Context Sensitive
- Reduce Negative Variation
- Create Standard Data
- Acquire health data beyond care delivered in VA

Links Reminder With the Action

With Documentation
Pneumonia: Acute Inpatient

Despite doubling patient population, halved hospitalizations for pneumonia!

9,500 fewer bed days

8,000 fewer discharges
Increased Rates of Pneumococcal Vaccination have saved over 6,000 lives, just among Veterans with Emphysema!

Extrapolated from K Nichols et al
3) QUALITY: RAND Study - Asch, McGlynn et al
Annals of Internal Medicine 2004;141:938-945

"VHA scored significantly higher... on 294 quality metrics"
Overall, VHA patients receive better care than patients in other settings.

Comparison of Quality of Care for Patients in the Veterans Health Administration and Patients in a National Sample

Steven M. Asch, MD, MPH; Elizabeth A. McGlynn, PhD; Mary M. Hogan, PhD; Rodney A. Hayward, MD; Paul Shikelle, MD, MPH; Lisa Rubenstein, MD; Joan Keesey, BA; John Adams, PhD; and Eve A. Kerr, MD, MPH

Background: The Veterans Health Administration (VHA) has introduced an integrated electronic medical record, performance measurement, and other system changes directed at improving care. Recent comparisons with other delivery systems have been limited to a small set of indicators.

Objective: To compare the quality of VHA care with that of care in a national sample by using a comprehensive quality-of-care measure.

Design: Cross-sectional comparison.

Setting: 12 VHA health care systems and 12 communities.

Patients: 596 VHA patients and 597 patients identified through random-digit dialing. All were men.

Measurements: Between 1997 and 2000, quality was measured by using a chart-based quality index that was adjusted for clustering, age, number of visits, and medical conditions.

Results: Patients from the VHA scored significantly higher for adjusted overall quality (67% vs. 51%), chronic disease care (72% vs. 58%), difference in percentage points (0.1 to 17 percentage points), but not for acute care. The VHA advantage was most prominent for diabetes and other medical and surgical conditions, whereas differences were minor for acute care.

Creating a Culture of Quality: The Remarkable Transformation of the Department of Veterans Affairs Health Care System

For decades, fairly or unfairly, the Department of Veterans Affairs (VA) health care system had a suboptimal image of the quality of care it provided and in the evaluation of that care. About 10 years ago, the VA leadership, in response to evidence of a quality gap (most notably mortality), embarked on an ambitious and unprecedented effort to transform care, improve the culture within the VA, and raise its performance in line with the best in the country. The VA has made considerable progress in improving the quality of care it delivers, measured in a variety of ways. Although mortality and other outcomes have improved, the VA is still widely believed to have a culture of care that is bureaucratic, disorganized, and too hierarchical. Yet the VA has also made major strides in improving care, in large part because of the leadership's commitment to improving the VA culture.
3) **COST-EFFECTIVENESS:**

Ten Year Cumulative Percent Change in Costs

- **VHA Cost per Patient**—Total Medical Care Obligations (including MAMOE) per Total Unique Patients (including non Veterans)
- **Average Medicare Payment per Enrollee**—Medicare Program Benefits per Enrollee ([www.cms.hhs.gov/researchers/pubs/datacompendium](http://www.cms.hhs.gov/researchers/pubs/datacompendium))
- **Medical Consumer Price Index**—Bureau of Labor Statistics (household “out of pocket” medical expenses including insurance and co-payments)

### Table: Ten Year Cumulative Percent Change in Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>VHA Cost Per Patient</th>
<th>Avg. Medicare Payment/Enrollee</th>
<th>Medical CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>-0.3%</td>
<td>6.4%</td>
<td>3.3%</td>
</tr>
<tr>
<td>1996</td>
<td>0.8%</td>
<td>14.9%</td>
<td>5.9%</td>
</tr>
<tr>
<td>1997</td>
<td>-6.2%</td>
<td>14.9%</td>
<td>9.8%</td>
</tr>
<tr>
<td>1998</td>
<td>-8.6%</td>
<td>12.8%</td>
<td>13.5%</td>
</tr>
<tr>
<td>1999</td>
<td>-6.5%</td>
<td>14.9%</td>
<td>18.4%</td>
</tr>
<tr>
<td>2000</td>
<td>-7.3%</td>
<td>25.5%</td>
<td>23.7%</td>
</tr>
<tr>
<td>2001</td>
<td>-9.1%</td>
<td>31.9%</td>
<td>29.5%</td>
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<tr>
<td>2002</td>
<td>-4.6%</td>
<td>40.4%</td>
<td>34.7%</td>
</tr>
<tr>
<td>2003</td>
<td>0.8%</td>
<td>44.7%</td>
<td>39.4%</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Supporting CARE COORDINATION

Care Coordinator Becomes Aware that the Patient Is Beginning to “Get Into Trouble,”

Proactively, The Patient Is Called To Come Into Clinic . . .

Or Visited at Home!

Before S/He “Crashes”

<table>
<thead>
<tr>
<th>Date</th>
<th>Weight</th>
<th>Breathing</th>
<th>Swelling</th>
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<tr>
<td>April 22, 2004</td>
<td>154</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>April 25, 2004</td>
<td>156</td>
<td>OK</td>
<td>Mild</td>
</tr>
<tr>
<td>April 26, 2004</td>
<td>160</td>
<td>Fair</td>
<td>Moderate</td>
</tr>
<tr>
<td>April 27, 2004</td>
<td>155</td>
<td>OK</td>
<td>OK</td>
</tr>
</tbody>
</table>

Add New Record
50,000 New Orleans VA Patients did not lose their medical records, even when they lost their City
- Their Electronic Health Records followed them around the USA!
- VA Mobile Clinics served Veterans & Community
How VA Hospitals Became The Best
No longer a nation’s shame, veteran care is acing competitors
By DOUGLAS WALLER

Most private hospitals can only dream of the futuristic medicine Dr. Divya Shroff practices today. Outside an elderly patient's room, the attending physician gathers her residents around a wireless laptop propped on a mobile cart. Shroff accesses the patient's entire medical history—a stack of paper in most private hospitals. And instead of trekking to the radiology lab to view the latest X-ray, she brings it up on her computer screen. While Shroff is visiting the patient, a resident types in a request for pain medication, then punches the SEND button. Seconds later, the printer in the hospital pharmacy spits out the order. The druggist stuffs a plastic bag of pills into what looks like a tiny space capsule, then shoots it up to the ward in a vacuum tube. By the time Shroff wheels away her computer, a nurse walks up with the drugs.

Life in a big-name institution like the Mayo Clinic? Not hardly. Shroff, 31, a specialist in internal medicine, works at the Veterans Affairs hospital in Washington, where the vets who come for the cutting-edge treatment are mostly poor.
4) New Knowledge as a Transparent By-Product of Care From TRIP to TPIR & TPIP...
4) Creating Discovery From Care . . .

- Vast Data Repositories as By-Product of Care
  - Ubiquitous Health Data Input
  - Large Data Sets (VA, Kaiser, NHS, HCA) or Interoperable Health Information

- Current Process: Hypothesis and Data-Mining

- Cue from other Industries (Machine Learning)
  - NSA
  - Google Searches → Profile
    - e.g. ≤3 searches → Male, 35-45, blue suits, Japanese car

- Future State: Hypothesis Generation?
  - Task: Evaluate Biological Plausibility / Clinical Relevance

- Need Work in Novel Research Methods
  - Quasi-Experimental & Adaptive Designs
Discovery: Seasonal Variation in Blood Pressure of Hypertensive Patients Returning to < 140 / < 90

Latest BP in the last 6 months (n=10,000 patients)

Courtesy of Dr. Ross Fletcher, Washington, DC VAMC
Unadjusted Mortality, Frequency and Mean Glucose in VA ICU’s

% Hospital mortality

0.82%  29.7%  39.5%  14.1%  15.91%  Freq

< 70  70-110  111-149  150-179  >180

Mean Glucose mg/dl

Average Mortality

N=221,035
## Adjusted Odds Ratios for Mortality (2002-05) in VA ICU’s

Mean Glucose is Independently Associated with Increased Mortality

<table>
<thead>
<tr>
<th>Mean Glucose (mg/dl)</th>
<th>Entire cohort</th>
<th>No DM</th>
<th>+ DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>111-145</td>
<td>1.3 (1.2-1.3)</td>
<td>1.3 (1.2-1.4)</td>
<td>1.1 (1.0-1.3)</td>
</tr>
<tr>
<td>146-199</td>
<td>1.7 (1.6-1.8)</td>
<td>1.9 (1.8-2.0)</td>
<td>1.4 (1.2-1.6)</td>
</tr>
<tr>
<td>200-300</td>
<td>2.0 (1.9-2.1)</td>
<td>2.7 (2.4-2.9)</td>
<td>1.8 (1.5-2.0)</td>
</tr>
<tr>
<td>&gt; 300</td>
<td>2.6 (2.3-2.9)</td>
<td>3.8 (3.1-4.6)</td>
<td>2.4 (2.0-2.9)</td>
</tr>
</tbody>
</table>
5) Getting to Genomics, Proteomics & Personalized Health Care: Some Examples. . .

- Pharmacogenomics
  - “Blockbuster” BP Drugs
  - Pediatric Leukemia
  - Alcohol Addiction
    - Naltrexone sensitive vs. insensitive patients

- Multifactorial Pattern Recognition
  - Hormone Replacement Therapy
  - Clinical Trials & Data Insensitivity
    - Not just surveillance for “bad” outcomes
      - Novel CTX agent & B6
  - Biomarker Patterns and Personalized Care
    - Colon CA met to Liver and Breast CA
From Industrial Age to an Information Age Model . . .

- **Industrial Age:**
  - Care is centralized; the hospital is prominent
    - Provider-Centric
      - Patient expects to negotiate system
  - Knowledge vested in provider (almost) exclusively
    - Memory: Try to Know Everything
  - Knowledge development done mostly by researchers
  - Mass Production
    - Productivity is best evidence applied consistently
      - Population Guideline
  - Productivity is best evidence applied consistently
    - Population Guideline

- **Information Age:**
  - Care is decentralized; the point of service is the patient
    - Patient-Centric
      - System responsiveness to patient expectations
  - Knowledge accessible to professionals & patients
    - Skill: Know how to find information on anything & evaluate information quality
  - Knowledge development increasingly a by-product of care
  - Mass Customization
    - Productivity is best evidence applied uniquely
      - Personalized Health Care