Health Informatics:
An exciting path for internists and more than just health IT

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UW Medicine

Professor of Medicine
Adjunct Professor, Departments of Medicine, Health Services and Medical Education & Biomedical Informatics
University of Washington

Chair, AMIA Board of Directors

ACLGIM
December 2017

My background

Current roles

- Medical Director, Information Technology Services, UW Medicine
- Medicine inpatient attending 1-2 weeks a year
- General Internal Medicine Center ½ day per week

Training

- Medicine residency
- Fellowship in Medical Information Science

Experience in clinical computing (as ~CMIO)

- Group Health Cooperative 7 years
- VA Puget Sound Healthcare System 4 years
- UW Medicine 17 years
Topics

1. What is health informatics?
2. Natural alignment with General Internal Medicine
3. Challenges, present and future
4. Excitement

Definition of biomedical informatics

Biomedical informatics is the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving, and decision making, motivated by efforts to improve human health.
Harvard Community Health Plan

[Barnett et al, Medical Care, 1978]

REMINDERS SENT

% without documented Rx in 10d


Blois’ funnel

Bayes’ theorem

<table>
<thead>
<tr>
<th>Disease present?</th>
<th>yes</th>
<th>no</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test positive?</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>no</td>
<td>c</td>
<td>d</td>
</tr>
</tbody>
</table>

Positive predictive value = \( \frac{a}{a + b} \)

A quantitative method for calculating post-test probability using the pretest probability and the sensitivity and specificity of the test. [Owens and Sox in Shortliffe and Perreault. Medical Informatics]
Clinical Informatics Core Content examples

- Markov processes
- Decision analysis
- Bayes theorem
- Ontologies
- Messaging and content standards
- Managerial accounting
- Information retrieval
- Leadership theories
- Conflict management
- System decommissioning
- Social influence theories
- Object oriented programming
- SQL outer join
- Encryption
- Boyce Codd Normal Form
- Lewin’s Change Theory

What Is Medical Informatics?
(attributed to Homer Warner)

Technology 10%
Medicine 10%
Sociology 80%
The practice of medicine is many things. Essentially, it is an encounter on a one-to-one basis between the physician and the patient. It is an exercise in management and administration, complex enough to challenge the highest intellectual and creative abilities. But it is also, inherently, a process of information handling and a natural challenge for today’s computer technology.
How can clinical computing best help in patient care?

Careful attention to mundane and tedious detail can be more important than brilliance in the day-to-day care of patients...the kind of work that humans neither relish nor reliably perform.

Clement McDonald, 1988

Morris Collen Award recipients
American College of Medical Informatics

2017 - Carol Friedman, PhD, FACMI
2016 - David W. Bates, MD, MSc, FACMI
2015 - Jan H. van Bemmel, PhD, FACMI
2014 - Charles Safran, MD, FACMI
2013 - Peter Szolovits, PhD, FACMI
2012 - Nancy M. Lorenzi, PhD, MS, MA, FACMI
2011 - William Tierney, MD
2010 - Don E. Detmer, MD, MA
2009 - Betsy L. Humphreys, MLS
2008 - Robert A. Greenes, MD
2007 - William Stead, MD
2006 - Edward H. Shortliffe, MD, PhD
2005 - Reed M. Gardner, PhD
2004 - Clement J. McDonald, MD
2003 - W. Edward Hammond, PhD
2002 - Marion J. Ball, EdD
2001 - Howard L. Bleich, MD and Warner V. Slack, MD
2000 - Jean-Raoul Scherrer, MD
1999 - Joshua Lederberg, PhD
1998 - Robert S. Ledley, DDS
1997 - Donald A. B. Lindberg, MD
1996 - G. Octo Barnett, MD
1995 - Not Presented
1994 - Homer Warner, MD, PhD
1993 - Morris Collen, MD
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3. Challenges, present and future
4. Excitement
Can Electronic Clinical Documentation Help Prevent Diagnostic Errors?

Gordon D. Schiff, M.D., and David W. Bates, M.D.

The United States is about to invest nearly $50 billion in health information technology (HIT) in an attempt to push the country to a tipping point with electronic health records (EHRs) to enhance clinicians’ knowledge and reduce the rate of medication errors. Although electronic clinical documentation promises numerous benefits, shifting to electronic systems could substantially improve clinicians’ knowledge about the patient. The problem of having too much information is now surpassing that of having too little, and it will become increasingly difficult to review all the patient information that is currently available to them.

Despite the sentiments and claims of many physicians, who argue that electronic documentation is time-consuming and can degrade diagnostic thinking—by distracting physicians from the patient, encouraging independent data gathering and assessment, and perpetuating errors—weir and settlements.

There are numerous ways in which EHRs can diminish diagnostic errors (see table). The first lies in filtering, organizing, and providing access to information. Making accurate diagnoses has
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Estimated growth in healthcare data

Exabytes

<table>
<thead>
<tr>
<th>Year</th>
<th>Exabytes</th>
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<tbody>
<tr>
<td>2013</td>
<td>153</td>
</tr>
<tr>
<td>2020</td>
<td>2,314</td>
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</tbody>
</table>

IMPRESSION:
Multiple left rib fractures and left clavicular fracture.
Moderate left pneumothorax. The left lung is partially collapsed.
Right sacral fracture and left pelvic ring disruption with associated small extraperitoneal hematoma. Please refer to dedicated CT pelvis for details. There is mild hydronephrosis of the right kidney, which may be secondary to a 4-mm renal calculus at the level of the distal ureter. Delayed abdominal radiograph is recommended.

Small amount of fluid surrounding the gallbladder, and nonspecific finding of uncertain clinical significance.

Right adrenal cyst. Recommend nonemergent pelvic ultrasound for further evaluation to exclude cystic ovarian neoplasm.

High-density fluid is present posterior and adjacent to the inferior aspect of the descending colon. This is contiguous with the pelvic retroperitoneal hematoma, and given the absence of abnormalities of the colon most likely represents extension of the retroperitoneal hematoma, which is not increased in size since the prior study.

Use hardware you already own
Sound to meaning

“45 year old female with pulmonary sarcoidosis…”

Parent/Child (Relationship Type)
Sarcoidosis (disorder) {31541009, SNOMED-CT}

Natural language processing
A subfield of artificial intelligence and computational linguistics. It studies the problems of automated generation and understanding of natural human languages

Needles in the chart haystack
Semantic Concept Expansion – Example for “rash”

### Search for “rash”

<table>
<thead>
<tr>
<th>Concept</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>“rash”</td>
<td>“rash” (“rashes,” etc.)</td>
</tr>
</tbody>
</table>

### Clinical Concept

<table>
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<th>Matches</th>
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<tr>
<td>“rash”</td>
<td>eruption of skin</td>
<td>“skin eruption” “rash” “exanthem”</td>
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</table>

### Related Concepts

<table>
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<tr>
<th>Search for</th>
<th>Concept</th>
<th>Related Concepts</th>
<th>Matches</th>
</tr>
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<td>“skin eruption” “rash” “exanthem”</td>
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</tr>
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<td></td>
<td></td>
<td>comedone</td>
<td>“comedone” “blackhead”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wheal</td>
<td>“wheal” “weal” “hives” “urticarial rash”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pityriasis</td>
<td>“pityriasis”</td>
</tr>
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</table>

Knowledge Representation

[Diagram showing entities, symptom, schema ontology, domain annotation ontology, modifier ontology, worsening cough instances, and allowable modifiers]

Slide courtesy of Wendy Chapman
Knowledge Representation

Extraction of problem list

- Carcinoma of prostate [254900004]
- Dissection of aorta [308546005]
- Disseminated intravascular coagulation [67406007]
- Atrial fibrillation [49436004]
- Biventricular congestive heart failure [92506005]

Problem list derived using nCode
Comparison of provider and nCode to consensus of coding experts (HIM)
After calibration

PROGRESS NOTE  HOSPITAL DAY 2

CHIEF CONCERN
xx-year-old woman with a history of end-stage renal disease on peritoneal dialysis here with bacterial peritonitis

INTERVAL HISTORY
The patient feels relatively well this morning, though not back to normal. She notes that her blood pressure has been slightly low, however she denies lightheadedness. She has been up to the bathroom and back but has not walk further than this due to fatigue. She notes discomfort and irritation around the right thigh blister. This popped today and serous fluid onto her bed. She relates that her peritoneal dialysis fluid has cleared up compared with yesterday. She denies nausea or vomiting. She denies dyspnea, fever, or chills. She did have a PD cycle last night, and had antibiotic bath for a time as well.

PHYSICAL EXAM
Vital signs temperature 37 pulse 62 blood pressure 99/53 respiratory 14 oxygen saturation 96% on room air

General thin woman in no apparent distress. Heart has regular rate and rhythm with no murmurs galleps rubs. Lungs are clear on anterior examination. Abdomen is soft and nontender today. Peritoneal dialysis catheter in place. She has trace lower extremity edema. She has no rash on exposed skin.

LABS

ASSESSMENT AND PLAN
Patient is a 64-year-old woman with end-stage renal disease on peritoneal dialysis, here with resolving sepsis from peritonitis.

Coagulase-negative peritonitis Staph  Hemodynamics are improving on antibiotics. Have discontinued IV antibiotics in favor of intraperitoneal, coordinated by the nephrology team. Blood pressure in the 90s systolically today off of stress dose steroids. We'll monitor closely overnight tonight. We'll check vancomycin trough.

Hypoxemia. This is resolved, and was likely due to septic physiology.

End-stage renal disease on PD. I appreciate nephrology consultations help. Continue peritoneal dialysis cycles per their recommendations.

Chronic hepatitis B. Continue entecavir.

SYMPTOMS

Feels relatively well
Not back to normal
Has been up to the backroom
Fatigue prevented further walking
Right thigh discomfort and blister
Blisters popped
Serous fluid drained
Peritoneal dialysis fluid clearer than yesterday
Blood pressure slightly low
Declines lightheadedness

EXAM

T 37 P 62 BP 99/53 RR 14 O2sat 96% RA
Thin
No apparent distress
Heart regular rate and rhythm
No heart murmur
No heart gallop
No cardiac rub
Lungs clear to anterior exam
Abdomen soft, no tender
Peritoneal dialysis catheter in place
Trace leg edema
No skin rash on exposed skin

LABS

Clinician believes these are the most relevant labs:

WBC 12.8
Hematocrit 26
Platelets 173,000
Vancomycin trough orders and pending

ASSESSMENT

Sepsis due to peritonitis is resolving
Due to coagulase-native Staph
Hemodynamics are improving on antibiotics
Stopped IV antibiotics
Antibiotics given intraperitoneal route
BP in 90s while off stress dose steroids.
Hyoxemia resolved.
Cause of hyoxemia was sepsis

PLAN

Monitor blood pressure
Continue antibiotics via intraperitoneal route
Monitor vancomycin trough level
Continue enecavir for hepatitis B
General renal diet
Subcutaneous heparin (to prevent VTE)
She is full code
Continued nephrology consultation

She has a peripheral IV
She has a peritoneal dialysis catheter
Will EHRs Become “Platforms?”

- Modern EHRs as platform: EHR responsible for:
  - User and patient management
  - Core transactional services (orders, documentation, PAMI, etc.)
  - Workflow
  - Legal record

- Use “Apps and extensions” to complete functionality
  - App extensions that plug in to the clinical workflow
  - No single vendor can supply every needed function
  - Tap the innovation of nob-EHR developers (and informatics)

- “App Store” model is now well-understood
  - Many vendors have proprietary APIs for extensions
  - Emergence of robust app market may require standards-based APIs?
Inviting Patients to Read Their Doctors’ Notes: Patients and Doctors Look Ahead

Patient and Physician Surveys

James D. Ralston, MD, MPH; Stephen E. Ross, MD; and Tom Delbanco, MD

Objective: To explore attitudes toward potential benefits or harms if PCPs offered patients ready access to visit notes.

Methods: Doctors’ and patients’ attitudes toward and expectations of open visit notes, their ideas about the potential benefits and risks, and demographic characteristics.

Results: 112 of 114 participating PCPs (96%), 45 of 60 participating patients (75%) completed surveys. Overall, 60% to 61% of participating PCPs across the 3 sites and 73% to 75% of patients thought open visit notes were a good idea, compared with 57% to 39% of nonparticipating PCPs. Similarly, participating PCPs and patients generally agreed with statements about potential benefits of open visit notes, whereas nonparticipating PCPs were less likely to agree. Among participating PCPs, 74% to 82% anticipated improved communication and patient education, in contrast to 45% to 47% of non-participating PCPs. More than one-half of participating PCPs (53% to 56%) and most participating PCPs (84% to 92%) expected that open visit notes would result in greater knowledge among patients; for lower patients (57% to 76%). Thirty-six percent to 70% of participating PCPs and 56% to 84% of nonparticipating PCPs anticipated more patient queries (5% to 10%) anticipated increased electronic access age, education, and participation was limited to patients using such portals. Response rates were higher among participating PCPs than nonparticipating PCPs; many participating PCPs had small patient panels.

Conclusion: Access to electronic medical records and participation was limited to patients using such portals. High response rates were higher among participating PCPs than nonparticipating PCPs; many participating PCPs had small patient panels.

Patients had unprecedented online access to their medical records. More than 6 million Americans can now read their doctors’ notes via patient portals, and continued rapid growth is likely. Sharing notes with patients may yield important health benefits, including increased patient empowerment and improved medication adherence. Seeing written information, including notes, helps patients feel more tangible to patients, and can foster caring, but caring written words might help overcome denial, de-stigmatize a condition, or even motivate behavior change.

Information technologies offer new ways to engage patients in their care. Providers who have adopted electronic medical records are beginning to use secure Internet portals to offer patients online access to test results, medication lists, and other parts of their records (1–4). However, few portals offer access to notes generated in outpatient encounters, even though outpatient studies focusing on chronic illnesses suggest that such access may help patients and have little net effect on provider workflow (5–8).

To gain further insight into such a shift in care, we designed and conducted OpenNotes, a research and demonstration project involving primary care physicians (PCPs) and their adult patients in urban and suburban Boston, rural Pennsylvania, and inner-city Seattle (9). We asked PCPs whether they would volunteer for 1 year, starting in summer 2010, to send their patients electronic invitations to read their outpatient visit notes online and to assess these notes from the next scheduled encounter. We expected that PCPs would be wary of such a change in care, particularly those who had few and those who spend many. We hypothesized that patients about open visit notes, that lower patients would be particularly likely to want to share their notes; we surveyed eligible doctors to start the voluntary program.

Your Patient Is Now Reading Your Note: Opportunities, Problems, and Prospects

Patients have unprecedented online access to their medical records. More than 6 million Americans can now read their doctors’ notes via patient portals, and continued rapid growth is likely. Sharing notes with patients may yield important health benefits, including increased patient empowerment and improved medication adherence.

Inviting patients to read their doctors’ notes is a simple idea for better health. Why it Works.

Patients become more actively involved in their care.

Get Started.

Check our toolkit.

Find Participating Sites.

What is OpenNotes?

Sharing clinicians’ notes with patients—a simple idea for better health.

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Summary

1. Health informatics pursues the effective uses of data, information, and knowledge for problem solving, and decision making, motivated by efforts to improve human health.

2. Because of the importance of information management in general internal medicine, there is a natural alignment with informatics.

3. Challenges include usability of current EHRs and information growth outstripping our capacity to use it.

4. Maturing science and technologies portend improved use of information in a way that better fits our role as physicians.

Questions?

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