Biomedical IT and Informatics: Where’s the Revolution?

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Disclosures

• I am not an informatician.
• I dabble.
• I am an early adopter.
• I am a consumer of biomedical informatics.
Agenda

- The revolution in IT and informatics.
- The stagnation in therapeutics development, healthcare, community health.
- Counter-revolutionary forces.
- Key ingredients for revolution.
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The IT and Informatics Revolution

• Dramatic change in the way we live.

• Costs have declined drastically.
Calculations Per Second Per $1000
Cost of a Website

• Web development costs have decreased dramatically

• Improvements in infrastructure through Web standards and software platforms.
  – iPhone apps

• Enables individuals without training to launch a site.
  – Explosion of blogs
Cost of Information

$1395

$0
Cost of Information

8-18 year olds in the US spend one quarter of their media time using multiple media.

24% of 12-18 year olds use another media most of the time while watching TV.
Industries Revolutionized

- Banking
- Communications
- Media
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The Biomedical Arena

• Information intensive at all levels

• Trends in:
  – Therapeutics development
  – Healthcare delivery
  – Community health engagement
New Medical Treatments

Cost per New Drug

Cost of Healthcare

Growth of healthcare costs compared to CPI

- Health spending in 2005 was 18.8 times 1970 levels.
- National health expenditure per capita.
- Consumer prices as measured by CPI were five times 1970 levels.

Per person spending:
- 1990: $7,100
- 2005: $12,000

SOURCE: Wells Fargo Insurance Services

TOM KERR/THE WORLD-HERALD
Life expectancy
The average number of years a newborn is expected to live with current mortality patterns remaining the same. More info »

United States
78
2007

Clinical and Translational Science Institute / CTSI
Bringing better health to more people more quickly!
An Office Visit

Mechanic et al. 344 (3): 198
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Counter-Revolutionary Forces

• Therapeutics development
  – Barriers to pooling data (eg competition)
  – Lack of investment on shared problems (eg, biomarker development, clinical trial design)
  – The complexity of the problem: Does failure of drug x tell us anything about the development of drug y?
Counter-Revolutionary Forces

• Healthcare
  – Physicians are stodgy
  – Grave concerns about privacy and confidentiality
  – Diversity of settings and practices
  – Complexity of the information
  – Financial incentives not aligned
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Key Ingredients for Revolution

- Opportunities
- Role Knowledge
- Funding
- Timing
Opportunities: Development Pipeline

• We asked a group of pharma/biotech industry executives what was the most important contribution academics could make.

• Answer: “Identify failures earlier.”
Opportunities: Clinical Research

- Active surveillance of real-world usage
- Safety trials

- Inclusion of special populations
- Adaptive trials
- Enhanced signal detection processes

- Appropriate usage
- Phase IIIb and IV trials
- Enhanced adverse-events reports
- Proactive epidemiology
- Periodic risk/benefit analyses

Knowledge of drug safety profile

Stage 1 (pre-launch R&D)
Stage 2 (phased launch)
Stage 3 (active on-market learning)

First full marketing approval
Phased launch
Enhanced drug safety model
Traditional drug safety model

Time
Opportunities in the Clinic
Displays a list of files and subdirectories in a directory.

DIR [drive:][path][filename] [/P] [/W] [/A[:attrs]] [/O[:sortord]]
   [/S] [/B] [/L] [/C[H]]

[drive:][path][filename] Specifies drive, directory, and/or files to list.
/P Pauses after each screenful of information.
/W Uses wide list format.
/A Displays files with specified attributes.
  attrs  D Directories  R Read-only files  H Hidden files
           S System files  A Files ready to archive - Prefix meaning "not"
/O List by files in sorted order.
  sortord  W By name (alphabetic)  S By size (smallest first)
           E By extension (alphabetic)  D By date & time (earliest first)
           G Group directories first  - Prefix to reverse order
           C By compression ratio (smallest first)
/S Displays files in specified directory and all subdirectories.
/B Uses bare format (no heading information or summary).
/L Uses lowercase.
/C[H] Displays file compression ratio; /CH uses host allocation unit size.

Switches may be preset in the DIRCMD environment variable. Override
preset switches by prefixing any switch with -- (hyphen)--for example, /-W.

C: \_
Mac OS X Leopard
Opportunities in the Clinic

**HISTORY:** Include significant positives and negatives from history of present illness, past medical history, review of system(s), social history and family history.

48 year old female chest pain. Began 1.5 hrs. ago, pain is burning in character, no radiation, slight SOB, SLN and diaphoresis. Pain resolved after 20 mins. No treatment. No pain now. Has had several similar episodes over past 2-3 mos. Usually after a heavy meal or exertion with some relief with antacids.

Has Hx of elevated cholesterol but no follow-up or treatment.


No Hx HTN, DM but has not seen MD x 2 yrs.

**PHYSICAL EXAMINATION:** Indicate only pertinent positive and negative findings related to patient’s chief complaint.

No obvious distress, minimizing symptoms, anxious to leave.

BP of 160/80 rtt.

Chest - no tenderness, clear BS bilaterally without wheezes, rhonchi or rales.

Heart - apical impulse not displaced, regular rhythm, no M or rubs.

Abdomen - nondistended, BS+, no masses or organomegaly, tenderness in epigastrium on rebound.

**DIFFERENTIAL DIAGNOSES:** In order of likelihood (with 1 being the most likely), list up to 5 potential or possible diagnoses for this patient’s presentation (in many cases, fewer than 5 diagnoses are likely).

1. Esophageal reflux disease
2. Peptic ulcer disease
3. Coronary artery disease
4. Cholecystitis
5. Musculoskeletal chest pain

**DIAGNOSTIC WORKUP:** List immediate plans (up to 5) for further diagnostic workup.

1. Stool for OB
2. EKG
3. CXR
4. Upper GI endoscopy
5.
Physical Examination

128/52
66
18
97%

General: NAD
Eyes: anicteric
Cardiovascular: RRR
Respiratory: CTA
GI / Abdomen: soft; NTND
Heme / Lymph / Immuno: no / /e

Neurological:
Mental Status: alert and oriented to person, place, time, month, no day, date, year; repetition and naming intact Cranial Nerves: vftoc, 7RRL, EOMI w/o nystagmus, facial sensation/strength intact, t/p midline
Motor: normal tone/bulk; no pronator drift, nl FTM/FTs bilat
UE (R/L): delt: 5/5 bi: 5/5 tri: 5/5 WE: 5/5 FE: 5/5 FF: 5/5 IO: 5/5
Reflexes (R/L): biceps 2+/2+, triceps 2+/2+, brachioradialis 2+/2+, patellars 1+/1+, AJs 0/0; plantars flexor bilat
Coordination: intact FTN/HTS
Gait: normal, narrow based

Sensation: intact light touch, vibration, temp bilaterally; no hemisensory neglect

Swallow Evaluation: Patient awake, responsive, able to cough on demand, Patient is able to handle own oral secretions, Patient has clear voice; not wet, hoarse, slurred, Patient is able to tolerate 90 degree position
Opportunities in the Clinic

• Notes that convey information quickly and clearly.
  – Focus on changes, abnormalities, issues requiring follow-up.

• Integration of guideline recommendations, drug information, etc.
Opportunities in the Clinic

Results: 1 to 20 of 152074

1. [Dissections of cranio cervical arteries in the paediatric age: a pathology that is emerging or under-diagnosed?]
   PMID: 20217643 [PubMed - in process]
   Related articles

   Jain AK, Dutta A.
   PMID: 20217457 [PubMed - as supplied by publisher]
   Related articles

3. Reactive grip force control in persons with cerebellar stroke: effects on ipsilateral and contralateral hand.
   Anens E, Kristensen B, Häger-Ross C.
   Exp Brain Res. 2010 Mar;201(9):1085-95.
   PMID: 20217999 [PubMed - as supplied by publisher]
   Related articles

4. Association between the Thr325Ile polymorphism of the thrombin-activatable fibrinolysis inhibitor and stroke in the Ludwigshafen Risk and Cardiovascular Health Study.
   Kozian DH, Lorenz M, März W, Cousin E, Mace S, Deleuze JF.
   PMID: 20216089 [PubMed - as supplied by publisher]
   Related articles

5. A national survey of the management of atrial fibrillation with antithrombotic drugs in Italian primary care.
   Related articles

Also try:
- stroke rehabilitation
- stroke prevention
- therapy stroke
- post stroke
- stroke risk

Titles with your search terms:
- Thrombolysis with atepase 3 to 4.5 hours after acute ischemic stroke [N Engl J Med. 2008]
- Effects of aspirin plus extended-release dipyridamole versus clopid [Lancet Neurol. 2008]
Opportunities in the Clinic

• Improving quality of care
  – Continuous quality improvement, Google style
  – Next generation clinical trials?
    • The QUISP trial: Use of standardized discharge orders
    • Next Gen: toggling physician choice lists?
Opportunities: Community

• Revolution in community building
  – Wikipedia
  – Facebook
  – Twitter

• Interest in health is apparent in media

• Need to develop tools to improve health
  – Through cell phones, Internet, monitoring devices, etc.
Know Your Role

Role of Academia?

Free Love
Know Your Role

• Free love model
  – The wonders of “open source”

• Setting common standards

• Engine for innovation, with commercialization elsewhere.
  – Know how to identify “failures” early.
Funding

• Government support limited
  – Vast majority of NIH funding is disease focused.
  – Informatics investments best rationalized across diseases.

• ARRA funding likely a blip

• CTSA consortium should help

• Need to lobby for a home at NIH
Funding: Industry Partnerships
Timing is Crucial

• Too soon:
  – Too expensive:
    • Human genome project cost $2,700,000,000
    • Now would cost $50,000
  – No traction: iPad was tried 17 years ago

• Too late:
  – Too expensive: opportunities lost
  – Wrong direction
Too Late

- Colemak keyboard: 40% less effort
Timing is Crucial: Case Study

• “Profiles” system
  – Need: research networking
  – Approach: build it.
  – Drawbacks:
    • Existing social networking tools work extremely well and are evolving.
    • They include tools for communications and data sharing

• Would it be better to build an “app” for an existing social-networking platform?
Where’s The Revolution?

• Organization will be critical
• Define the strategy
  – What should happen now?
  – What do we do vs. wait for industry?
  – How do we fund it?
  – Do we have the forces?
  – Who are our partners?
• Many conspirators in this room
Biomedical Research Funding

Ronald in Bangkok