A/Prof. Terry J. Hannan
MBBS;FRACP;FACHI;FACMI

UNDERSTANDING e-HEALTH AND WHY WE NEED IT.

"To improve care you have to measure it. Information management is care" (Don Berwick)

ACHI The Australasian College of Health Informatics

OpenMRS

- Clinical computing 1976-2011.
- Current/Future data demands on CDM
- Technology of clinical computing
  - . Storage, interoperability and standards, forms, data capture, CPOE.
- Translocating health information technologies MMRS-AMPATH-OpenMRS.
- Effective CDS tools (MSAccess) show how HIT and CDS works.
- Meeting the needs of scalability.
- Role of the internet, WWW, m-Health to meet the demands of modern health care. [VIDEOS]

Some Definitions.

Information is not a necessary adjunct to care, it is care, and effective patient management requires effective management of patients' clinical data.

Donald M. Berwick President and CEO, Institute for Healthcare Improvement

There is no health without management, and there is no management without information.

WHO-Gonzalo Vecina Neto, head of the Brazilian National Health Regulatory Agency

Information is necessary to provide and manage health care at all levels, from individual patients to health care systems to national Ministries of Health (MOH). ***W.Tierney. Dir. Regenstrief Institute.***

So what is eHealth?

The World Health Organization (WHO) definition:

"e-Health is the combined use of electronic communication and information technology in the health sector."

Health Informaticians.

"Informaticians should understand that our first contribution is to see healthcare as a complex system, full of information flows and feedback loops, and we also should understand that our role is to help others ''see' the system, and re-conceive it in new ways."

E. Coiera. April 2009, Centre for Health Informatics, Institute of Health Innovation, University of New South Wales, Australia

Functions of Clinical Informaticians

Clinical informaticians use their knowledge of patient care combined with their understanding of informatics concepts, methods, and tools to:

- Assess information and knowledge needs of health care professionals and patients;
- Characterize, evaluate, and refine clinical processes;
- Develop, implement, and refine clinical decision support systems;
- Lead or participate in the procurement, customization, development, implementation, management, evaluation, and continuous improvement of clinical information systems.

Goals of Computerized Clinical Decision Support Systems (for EMR)

International Journal of Medical Informatics 54 (1999) 183–196 The CCC system in two teaching hospitals: a progress report. Warner V. Slack Howard L. Bleich

1. **Information**:
   captured directly at computer terminals located at the point of each transaction, not on pieces of paper.

2. **Information** captured at a terminal or automated device:
   anywhere in the hospital should be available immediately, if needed, at any other terminal.

3. The **response time** of the computer should be rapid-blink times.

4. The computer should be **reliable and accurate**.

5. **Confidentiality** should be protected.

6. The **computer programs should be friendly to the user and reinforce the user's behavior**.

7. There should be a **common registry** for all patients.

Goals of implementation.

1. **Eliminate logistic problems of paper record- clinical data timely, reliable, complete.**

2. **Reduce the work of clinical bookeeping-no more missed Dx, or forgotten preventive care.**

3. **Information 'gold' within medical records available to clinical, epidemiological, outcomes and management research.**

The Regenstrief Medical Record System. IJMI 54 (1999) 225-253

Four key functions of electronic clinical decision support systems

"Administrative”:

Supporting clinical coding and documentation, authorization of procedures, and referrals.

"Managing clinical complexity and details”:

Keeping patients on research and chemotherapy protocols
tracking orders,
referrals follow-up,
and preventive care.

"Cost control’:

Monitoring medication orders;
avoiding duplicate or unnecessary tests.

"Decision support”:

Supporting clinical diagnosis and treatment plan processes;
promoting use of best practices,
condition-specific guidelines,
population-based management.

http://www.openclinical.org/dss.html

What can technology do NOW!

The Regenstrief Medical Record System. IJMI 54 (1999)

Retrieval times-Fast (blink times)
Data and information-Comprehensive
Data storage- Long-term-lifelong
Data applications-Introspective of total database
Data storage-
- 200 million coded observations
- 3.25 million narrative reports
- 15 million prescriptions
- 212,000 ECG tracings
- More than 1.3 million patients

Access-
- 1300 medical nurses
- 1000 physicians
- 220 medical students
- Across health care institutions (16)
- Data access more than 628,000 / month

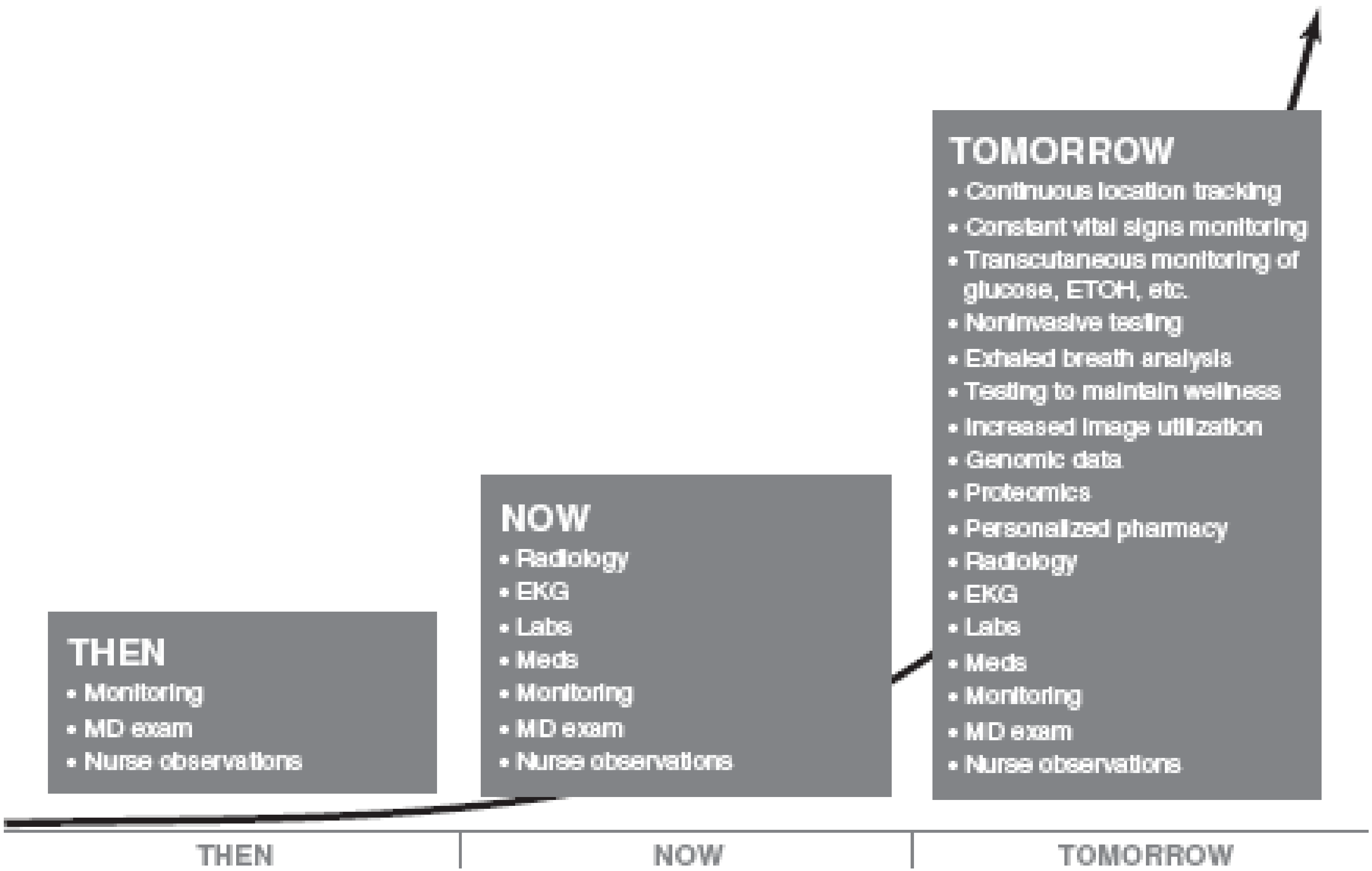
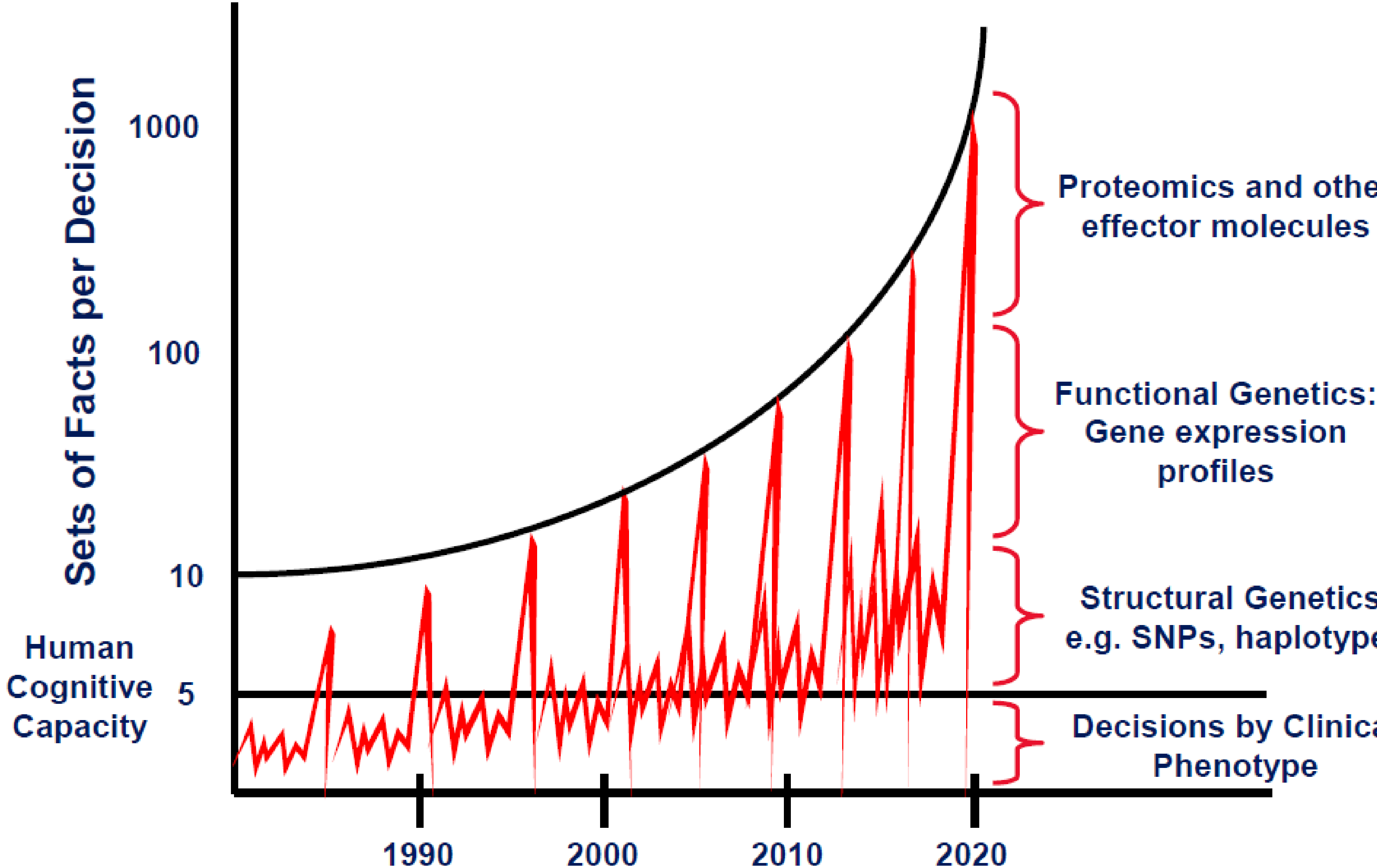


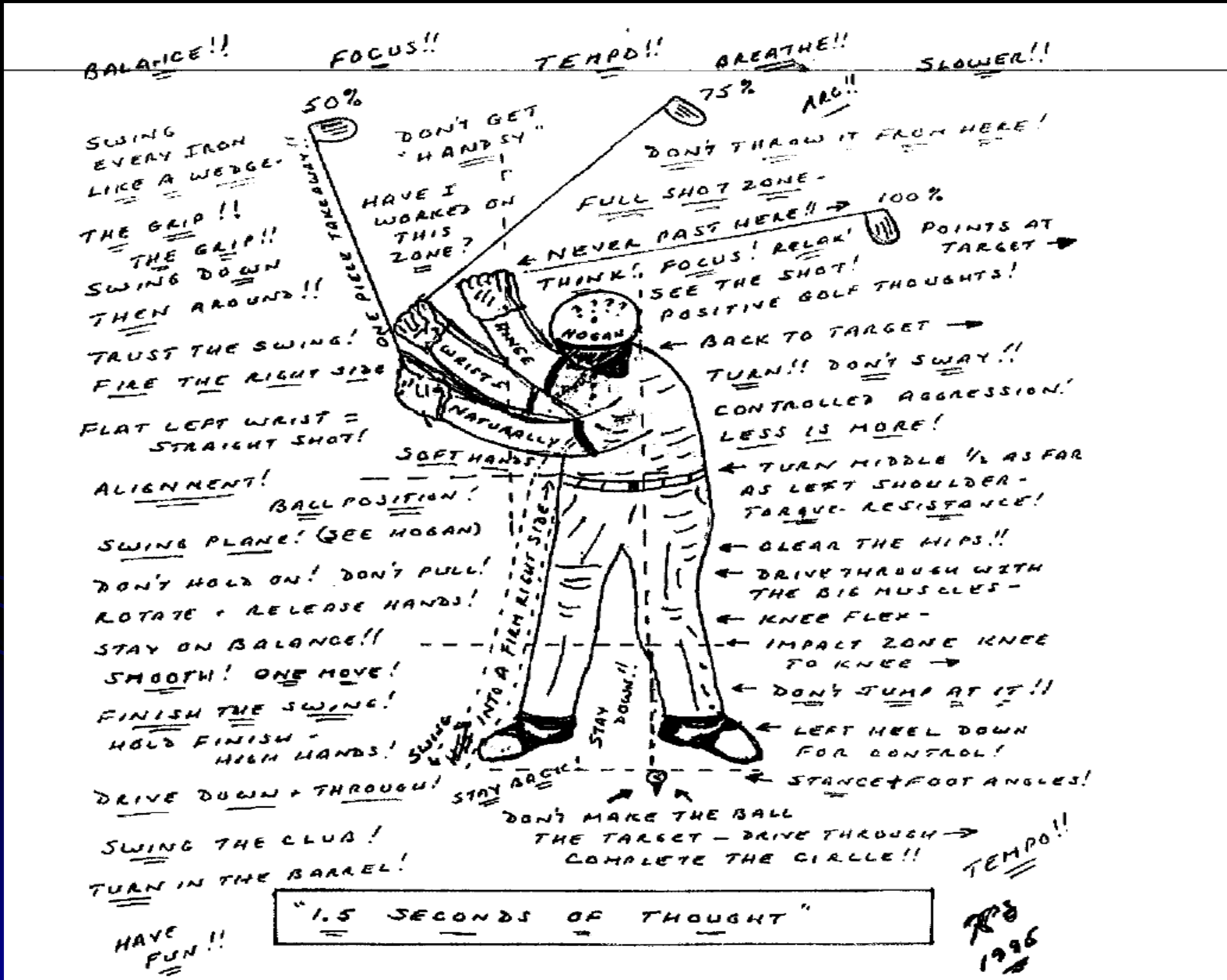
FIGURE S-4 Data advances in medicine.
SOURCE: Peter M. Neupert, 2007.

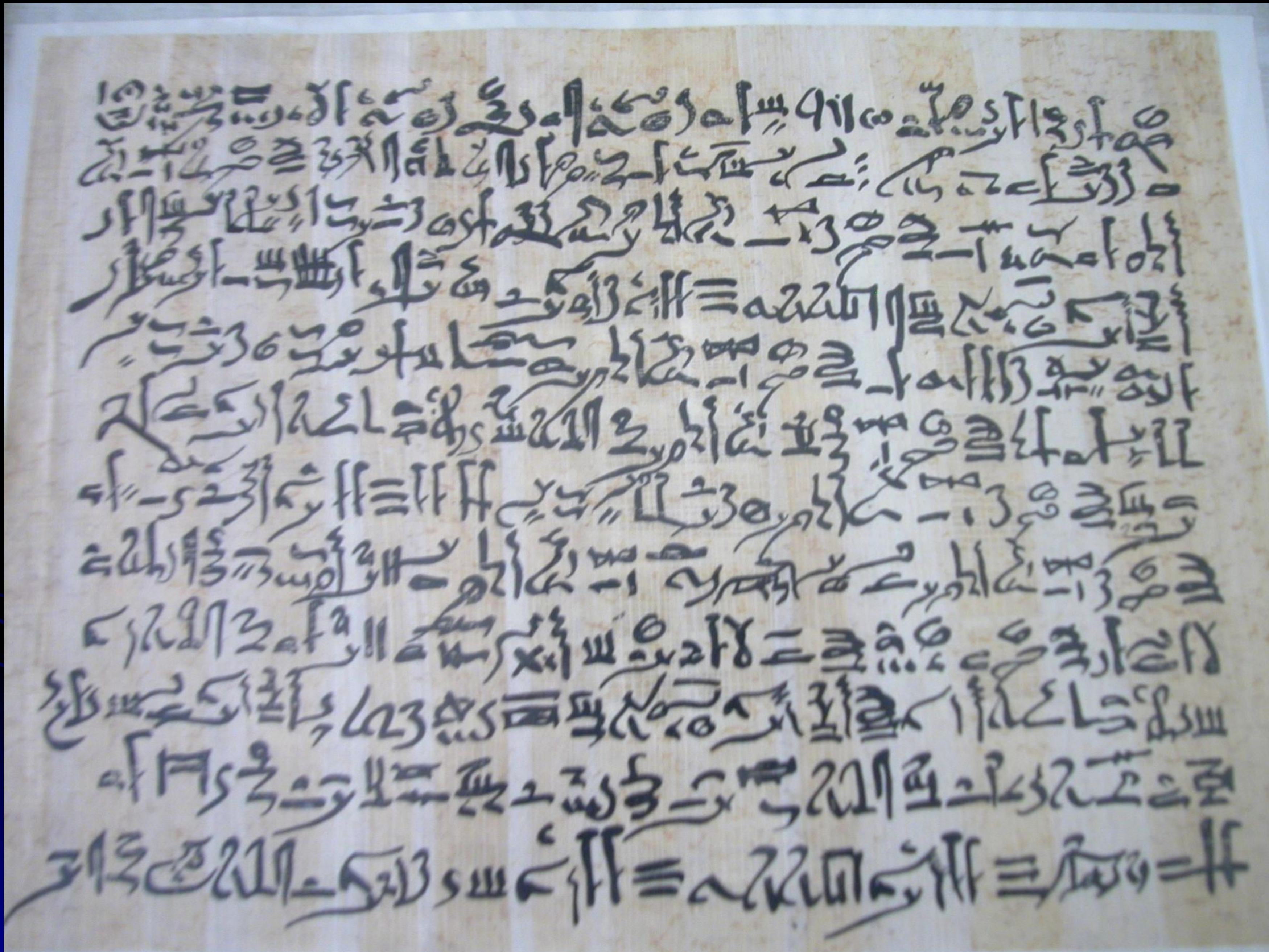
Burning Platform: Overwhelming Complexity



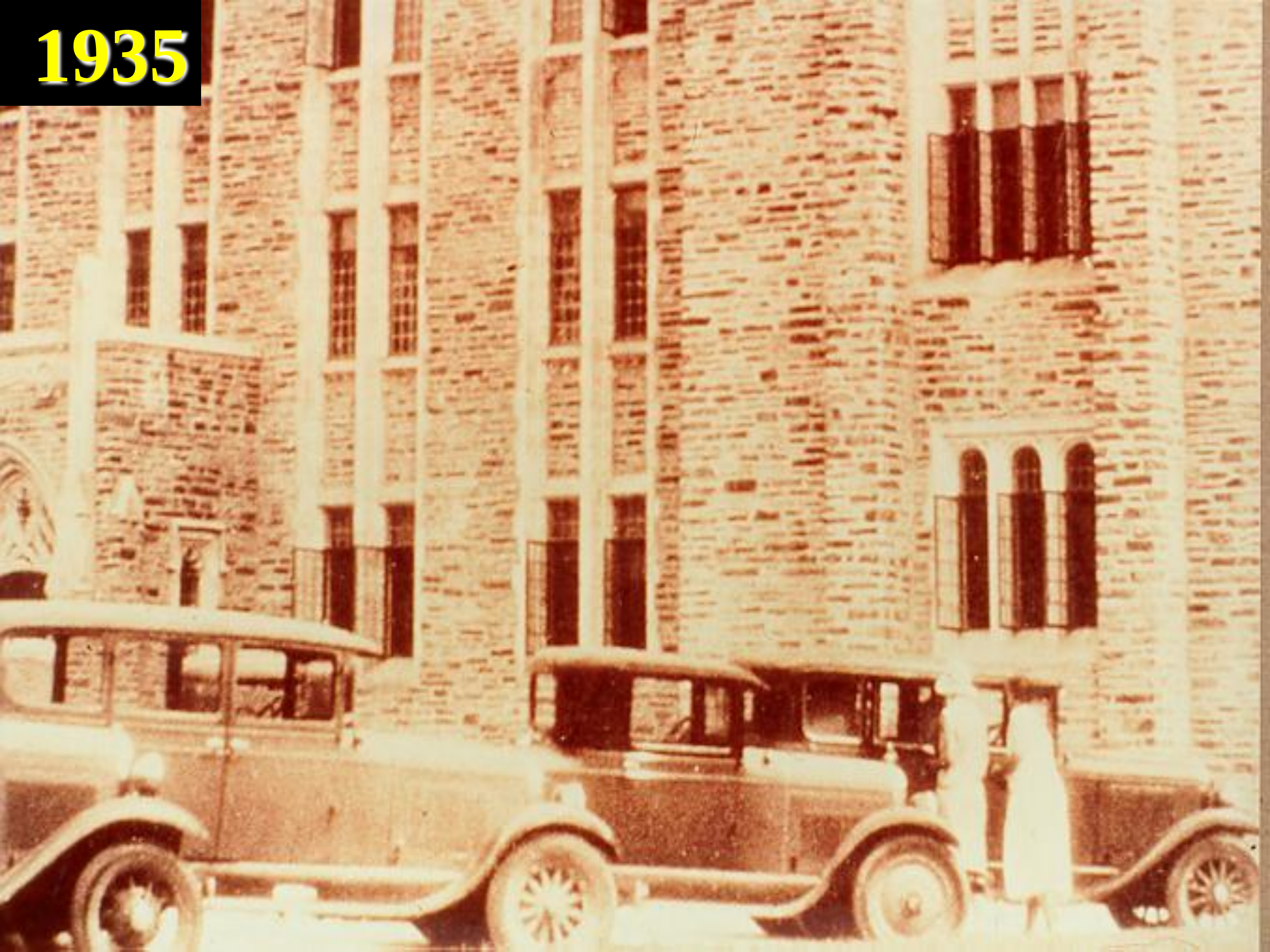
Stead WW. Beyond expert-based practice. IOM (Institute of Medicine). Evidence-based medicine and the changing nature of health care: 2007 IOM annual meeting summary,(Introduction and Overview, p. 19). Washington, DC: The National Academies Press 2008.

Other complex decision making activities and errors!





1935



2002

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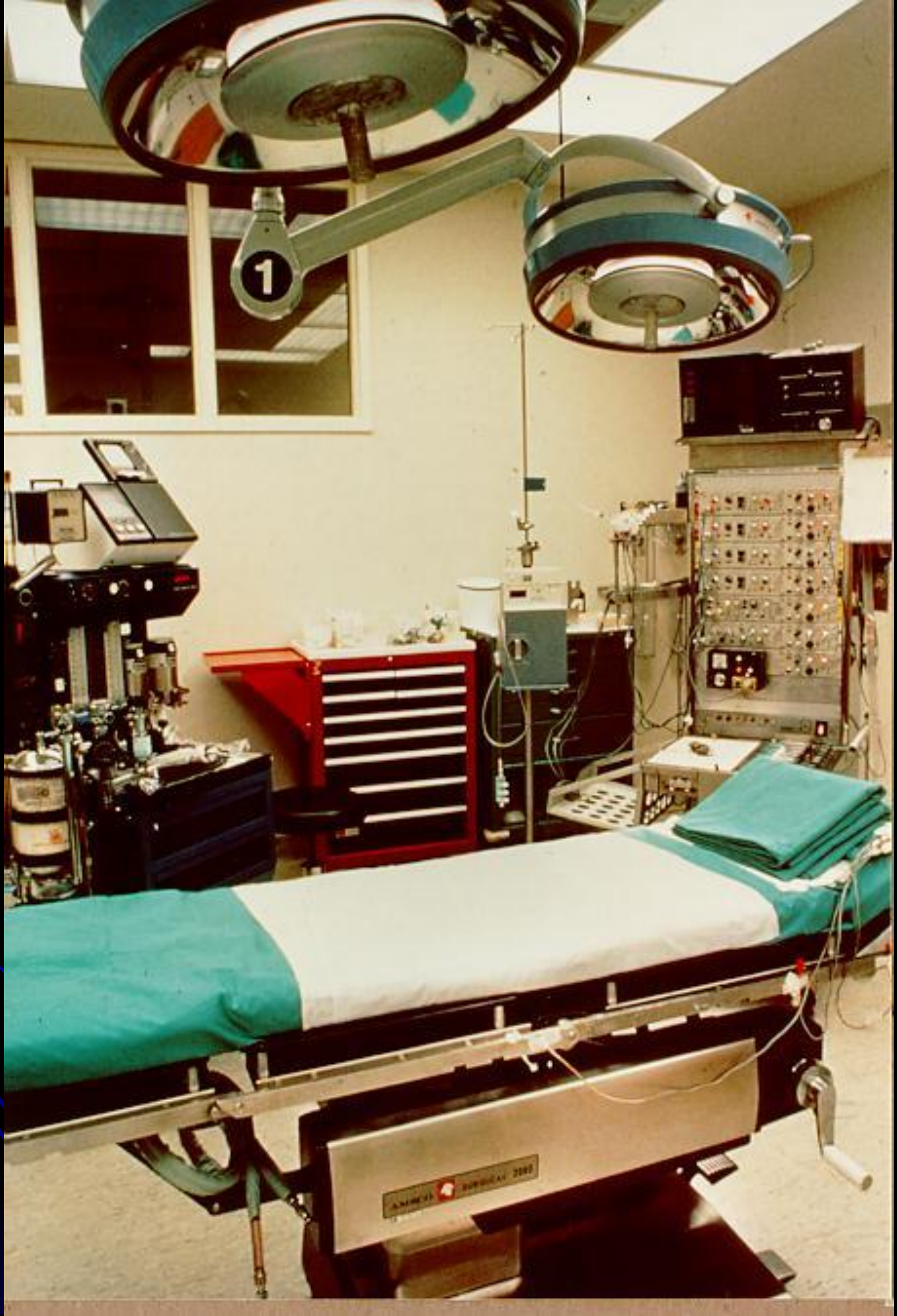


1935

2002

ADVERSE EVENTS & NEGLIGENCE IN HOSPITALISED PATIENTS.(BRENNAN TA, AND OTHERS. N Engl J Med. 1991;324:370-6)

ADVERSE EVENTS

3.7% HOSPITALISATIONS

27.6% DUE TO NEGLIGENCE

70.5% DISABILITY OF < 6MONTHS

2.6% PERMANENT DISABILITY

13.6% DEATH

"Lawyers generally believe that investigation of substandard care only **begins with the medical record;** that in many instances the **medical record even conceals substandard care**; and that substandard care is ***not reflected in, or "discoverable"*** in the medical record."

Very little change since 2000!

In 2003, the RAND Corporation - on average patients receive recommended care only 54.9% of the time.
(Leape, 2005, McGlynn et al., 2003).

Of what we do in routine medical practice, what proportion has a basis in published scientific research?

1. Williamson (1979)	***<20%***
2. OTA (1985)	***10-20%***
3. OMAR (1990)	***< 20%***
4. B. James (2007)	***20-40%***

1. Williamson et al. Medical Practice Information Demonstration Project: Final Report. Office of the Asst. Secretary of Health, DHEW, Contract #282-77-0068GS. Baltimore, MD: Policy Research Inc., 1979).
2. Institute of Medicine. Assessing Medical Technologies. Washington, D.C.: National Academy Press, 1985:5.
3. Ferguson JH. Forward. Research on the delivery of medical care using hospital firms. Proceedings of a workshop. April 30 and May 1, 1990, Bethesda, Maryland. Med Care 1991; 29(7 Suppl):JS1-2 (July).
4. B. James. Intermountain Health Care. 2007

The rest is opinion That doesn't mean it is wrong -- much of it probably works but it may not represent the best patient care

Landmark Clinical Trials

and their current rate of use

Clinical Procedure	Landmark Trial	Current Rate of Use
Flu Vaccine	1968	64% (2000)
Thrombolytic Therapy	1971	20% (2000)
Pneumococcal vaccine	1977	53% (2000)
Diabetic eye exam	1981	48.1% (2000)
Beta blockers after MI	1982	92.5% (2001)
Mammography	1982	75.5% (2001)
Cholesterol screening	1984	69.1% (1999)
Fecal occult blood test	1986	20.6% (1999)

Balas EA, Boren SA. Managing Clinical Knowledge for Health Care Improvement. Yearbook of Medical Informatics 2000.

IMPACT OF HEALTH CARE COSTS ON U.S. ECONOMY

MEDICAL COSTS RISING RAPIDLY..

Annual increase 1986-91

Medical Costs = 14.1%

- **Inflation = 3.8%**

Medical costs rising 4 times faster than inflation.

…IMPACTING BUSINESSES…

Health care spending

Percent of pretax profits

- **1965 = 8.4%**
- **1980 = 27.3%**
- **1990 = 61.1%**

….AND GOVERNMENT FINANCES..

Health care spending

Percent of total government expenditures

- **1980 = 10.7%**
- **1985 = 11.5%**
- **1988 = 12.8%**
- **1990 = 14.0%**

Increases in health expenditures per capita across different countries are actually fairly similar—averaging about 3 percent a year adjusted for overall inflation. *Taking a Walk on the Supply Side: 10 Steps to Control Health Care Costs* Karen Davis.USA DOH Mar. 2005.

Dis-proportional use of Acute care services (CKD) 5% of CKD – bed days.

Proportion of Patients, Acute Care Separations and Acute & Rehab Days in each Disease Group, 2005.

	Patients in Group	Acute Inpatient Separations in Group	Acute/Rehab Days in Group
CVD	66.2%	56.2%	52.0%
DM-CVD	17.9%	22.3%	22.9%
DM	11.4%	6.6%	6.2%
CVD-CKD	2.0%	6.2%	7.6%
CKD-CVD-DM	1.4%	6.8%	9.1%
CKD	1.0%	1.5%	1.6%
DM-CKD	0.1%	0.4%	0.5%

5% of patients
19% of days

Gap analysis: Duplicate testing common in cluster group (CKD)

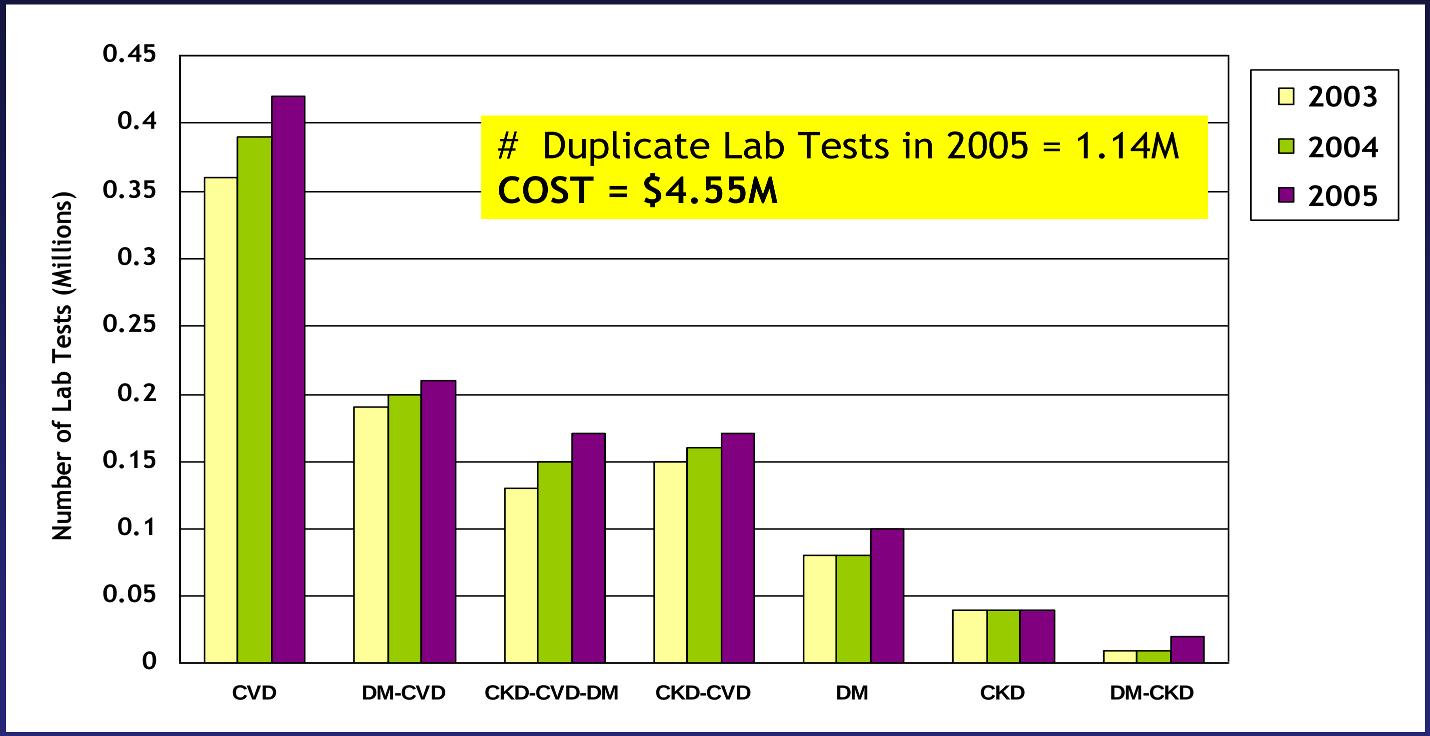
Proportion of Patients and Duplicate Lab Tests
in each Disease Group, 2005.

Disease Group	Patients in Group	Duplicate Tests in Group
CVD	66.2%	47.5%
DM-CVD	17.9%	18.2%
CKD-CVD	11.4%	10.2%
DM	2.0%	10.5%
CKD-CVD-DM	1.4%	9.4%
CKD	1.0%	3.1%
DM-CKD	0.1%	1.1%

5% of patients
25% of duplicate tests

Gap analysis: Duplicate testing ~$4.5 M (~$4.50/test)

Duplicate Lab Tests* by Group, BC, 2005.



* duplicate test defined as same test within 30 days

Duplicate lab testing-Canada 2005 for 30 Day period

Table 3. Duplicate laboratory test by type and attendant costs (within 30-day period) (source: MSP Billing Data)

Lab text	Number	Cost
Haematology profile	126 436	$1 588 392
Haemoglobin (A1C)	10 208	$145 070
Ferritin (serum)	4 670	$116 423
Creatinine (serum/plasma)	107 993	$112 502
Potassium (serum/plasma)	93 950	$97 786
Urinalysis (macroscopic)	24 808	$94 938
Sodium (serum/plasma)	83 177	$86 562
Microalbumin	4 322	$85 098
Glucose semiquantitative	22 466	$74 816
Urea (serum/plasma)	61 055	$63 837
Total duplicate tests	747 286	$2 960 085

Table 4. Hospital costs (in millions) by the group, 2003–2005

Group	% Patients (2005)	Year 2003	2004	2005
CVD	33.9%	$298	$379	$427
DM	46.2%	$122	$170	$206
DM + CVD	12.3%	$137	$184	$202
CKD + CVD + DM	1.2%	$38	$53	$62
CVD + CKD	1.5%	$40	$50	$58
CKD	12.9%	$26	$41	$44
DM + CKD	1.2%	$15	$18	$25
	Total cost	$675	$895	$1024

After Hours Resource Utilisation - 1998/99 (PRH0s-UK.)

87% Unnecessary out-of-hours tests
80% Diagnostic uncertainty
79% Medico-legal protection
66% Avoid leaving work for colleagues
71% Prevent criticism from staff (especially Consultants)
76% Lessen anxiety and reduce stress levels
71% Agreed attempts should be made to reduce unnecessary testing

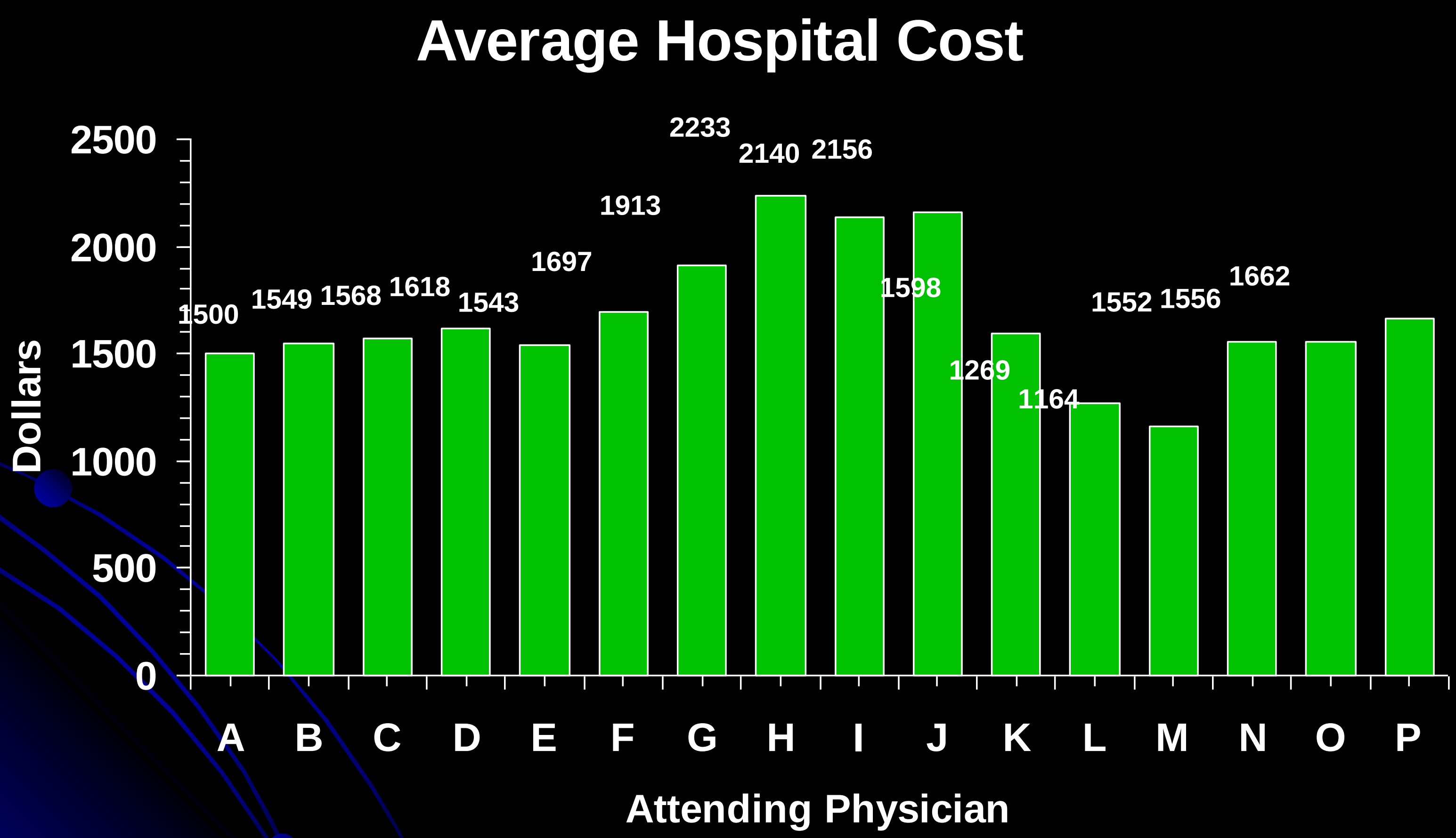
McConnell AA, Bowie P. Health Bull (Edinb). 2002 Jan;60(1):40-3.
Unnecessary out-of-hours biochemistry investigations--a subjective view of necessity.

THE VARIATION PHENOMENON

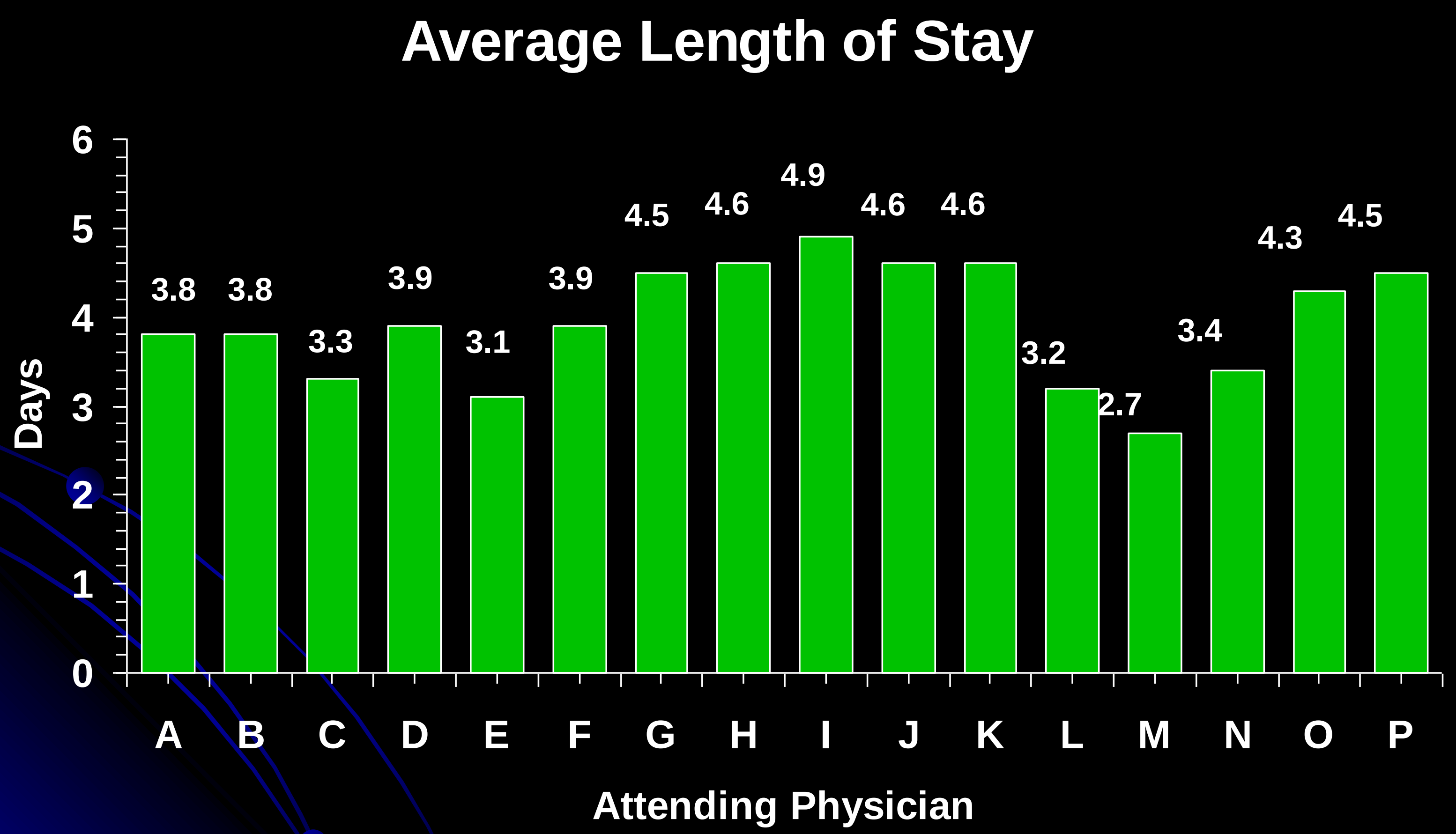
"The variation phenomenon in modern medicine -the observation of differences in the way apparently similar patients are treated from one health care setting to another."

D. Blumenthal. Editorial NEJM 331:1994;1017-8

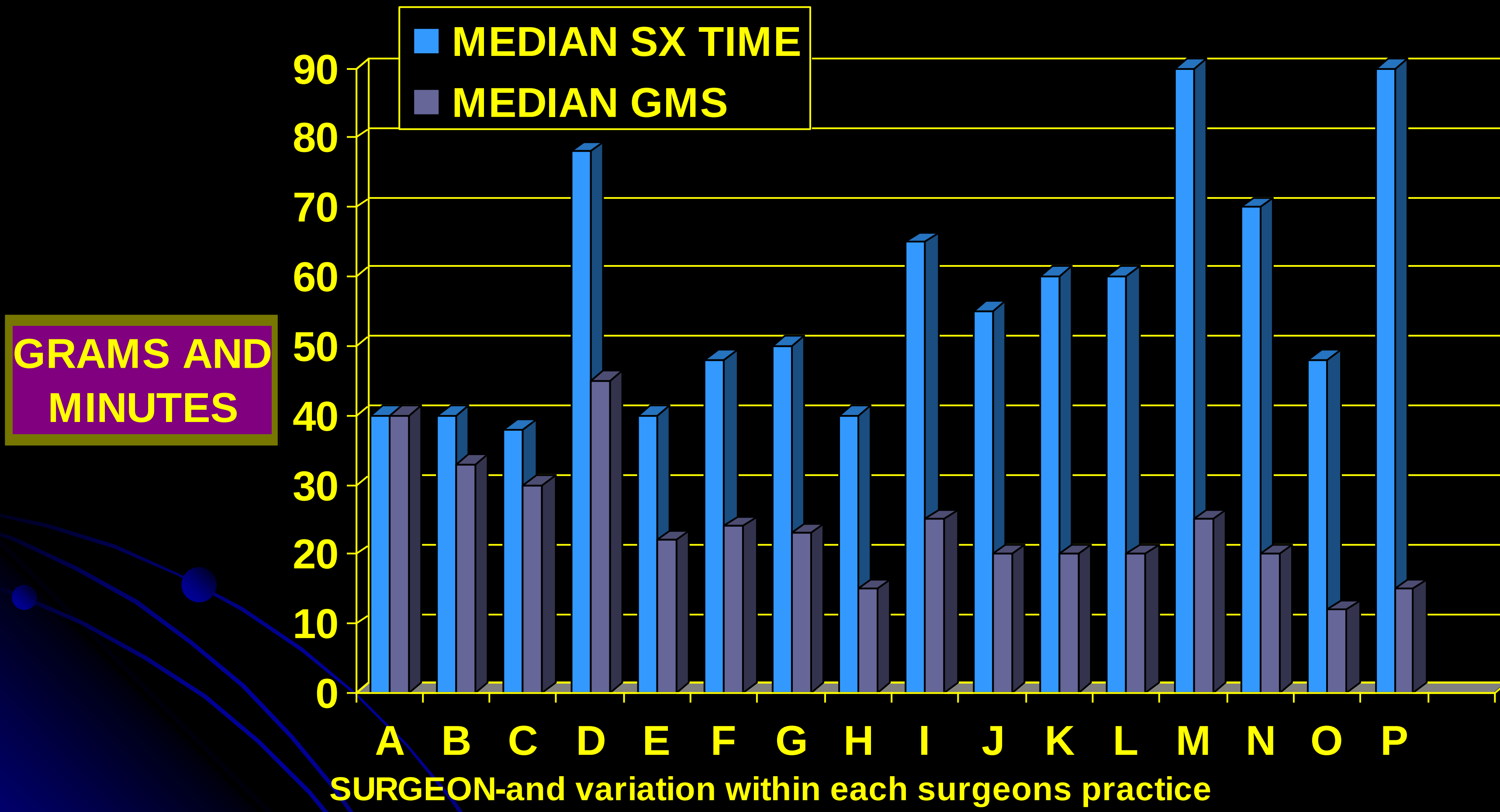
IHC TURP QUE Study-COST VARIATION



IHC TURP QUE Study-Average LOS variation



IHC TURP QUE Study-Grams excised vs. Time variation



Reasons for practice variation

♦Complexity

- **How many factors can the human mind simultaneously balance to optimize an outcome? -- Alan Morris, MD**
- **"The complexity of modern American medicine exceeds the capacity of the unaided human mind" -- David Eddy, MD**

♦Lack of valid clinical knowledge **(poor evidence)**

♦Subjective judgment / uncertainty

- Subjective evaluation is notoriously poor across groups or over time
- Enthusiam for unproven methods **-- Mark Chassin, MD**

♦Human error

-- humans are inherently fallible information processors **-- Clem MacDonald, PhD**

SMALL AREA VARIATIONS IN HEALTH CARE DELIVERY

SERVICE	REIMBURSEMENT VARIATION
XRAYS	400 %
ECG	600 %
LAB SERVICES	700%

Wennberg J. Gittelsohn A. Science;1973;182:1102-8

Variation over time-has it improved?

Per capita Medicare spending varies considerably from region to region.
The effect of greater Medicare spending on quality of care and access is not known.

•Using end-of-life care spending as an indicator of Medicare spending
•Geographic regions into five quintiles of spending and examined costs and outcomes of care for;

  •hip fracture
  •colorectal cancer
  •acute myocardial infarction.

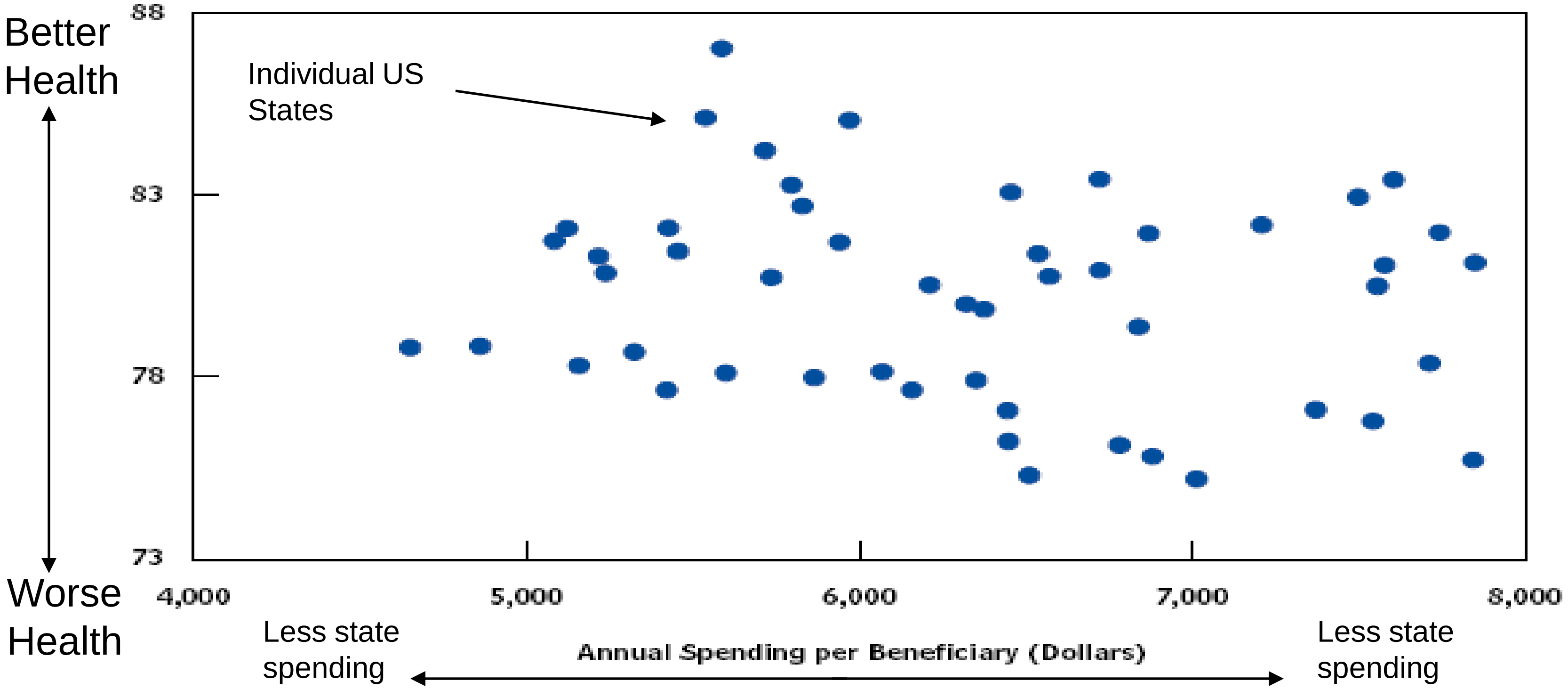
Outcomes:
Residents of high-spending regions received 60% more care but did not have better quality or outcomes of care.
Implications: Medicare beneficiaries who live in higher Medicare spending regions do not necessarily get better-quality care than those in lower-spending regions.
–The Editors

The Implications of Regional Variations in Medicare Spending. Part 1: The Content, Quality, and Accessibility of Care. Elliott S. Fisher, MD, MPH; David E. Wennberg, MD, MPH; The´ re` se A. Stukel, PhD; Daniel J. Gottlieb, MS; F.L. Lucas, PhD; and ´ Etoile L. Pinder, MS. *Ann Intern Med.* 2003;138:273-287.

Figure 3.

The Relationship Between Medicare Spending and Quality of Care, by State, 2004

(Composite measure of quality of care)



Source: Congressional Budget Office based on data from Department of Health and Human Services, Agency for Healthcare Research and Quality, *National Healthcare Quality Report, 2005* (December 2005), Data Tables Appendix, available at www.ahrq.gov/qual/nhqr05/index.html, and data from the Centers for Medicare and Medicaid Services' Continuous Medicare History Sample.

Notes: The composite measure of the quality of care, based on Medicare beneficiaries in the fee-for-service program who were hospitalized in 2004, conveys the percentage who received recommended care for myocardial infarction, heart failure, or pneumonia.

Spending figures convey average amounts by state.

GEOGRAPHIC VARIATIONS IN PHARMACY SPENDING

- ~20% Medicare spending
- Varies substantially among hospital-referral regions
  - Highest-spending region spending 60% more per beneficiary on pharmaceuticals than the lowest.
  - Variation in both drugs prescribed and number of prescriptions/month
  - Physicians in higher-spending areas - more drugs and more expensive drugs.

Medical spending varies more across hospital-referral regions than drug spending.

Geographic Variation in the Quality of Prescribing. Yuting Zhang, et.al.
N Engl J Med 2010; 363:1985-1988November 18, 2010

Variation 2008

The wide variation in medical prices within U.S. markets that creates an opportunity for transparency to reduce spending. This variation exists even for relatively common procedures.

New Hampshire-2008

Average payment for arthroscopic knee surgery - $2,406 with a standard deviation of $1,203 in hospital settings and $2,120 with a standard deviation of $1,358 in nonhospital settings.

Tu HA, Lauer JR. Impact of health care price transparency on price variation: the New Hampshire experience. Issue brief no. 128. Washington, DC: Center for Studying Health System Change, 2009.

Massachusetts-

Median hospital cost in 2006 and 2007 for magnetic resonance imaging (MRI) of the lumbar spine, performed without contrast material, ranged from $450 to $1,675.2

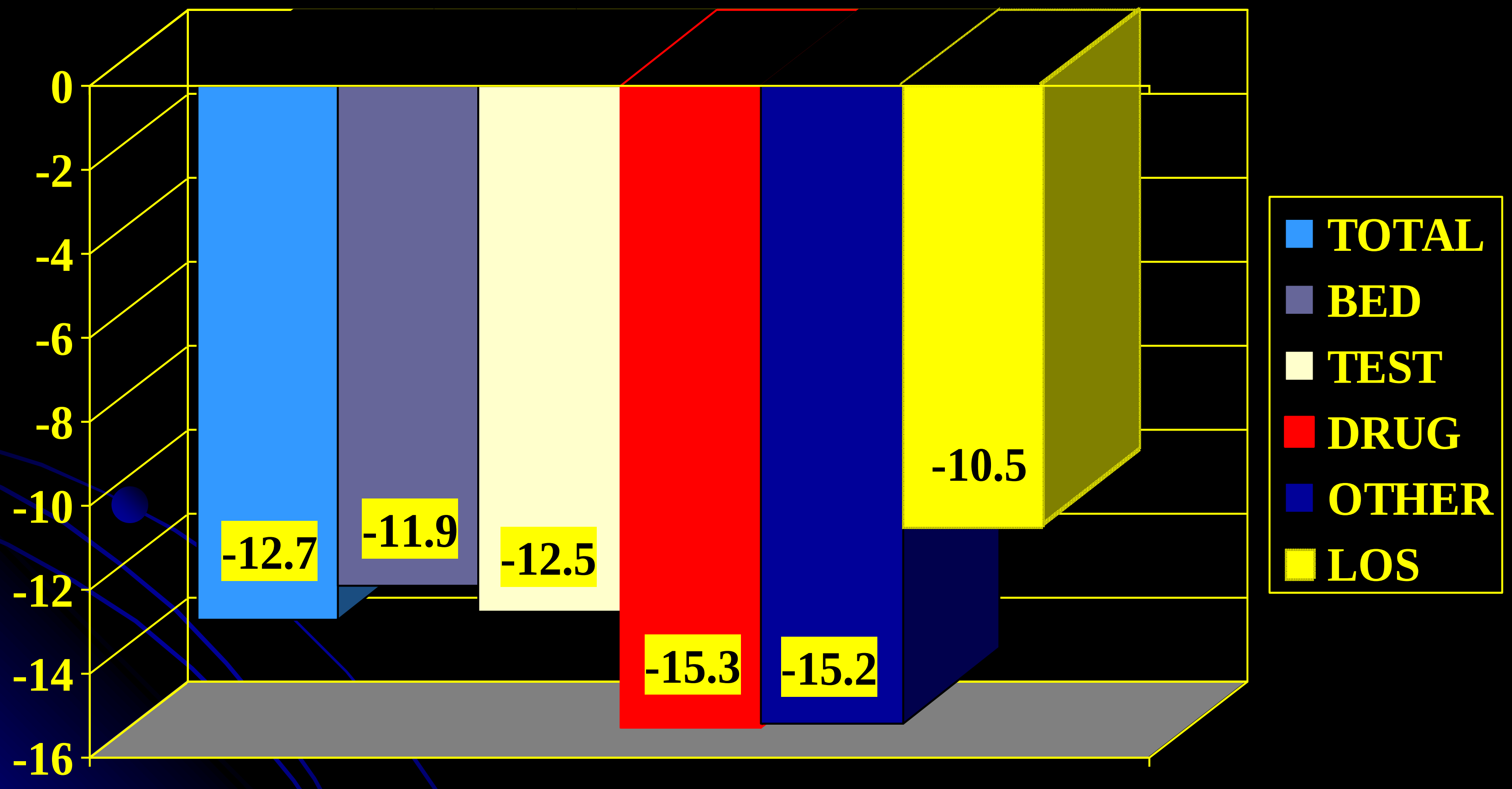
Massachusetts Division of Healthcare Finance and Policy. Measuring healthcare quality and cost in Massachusetts. (http://www.mass.gov/Eeohhs2/docs/dhcfp/r/pubs/09/measuring_hc_quality_cost_mass_nov-09.pdf.)

CCDSS TOOLS IN CLINICAL MEDICINE-REQUIREMENTS

1. ALERTING
2. REMINDING
3. INTERPRETATION
4. ASSISTING
5. CRITIQUING
6. DIAGNOSING
7. MANAGING
8. KNOWLEDGE ACCESS

Pryor TA, Clayton PD. Decision support systems for clinical medicine. Tutorial 11.15th SCAMC.Nov. 17. 1991.

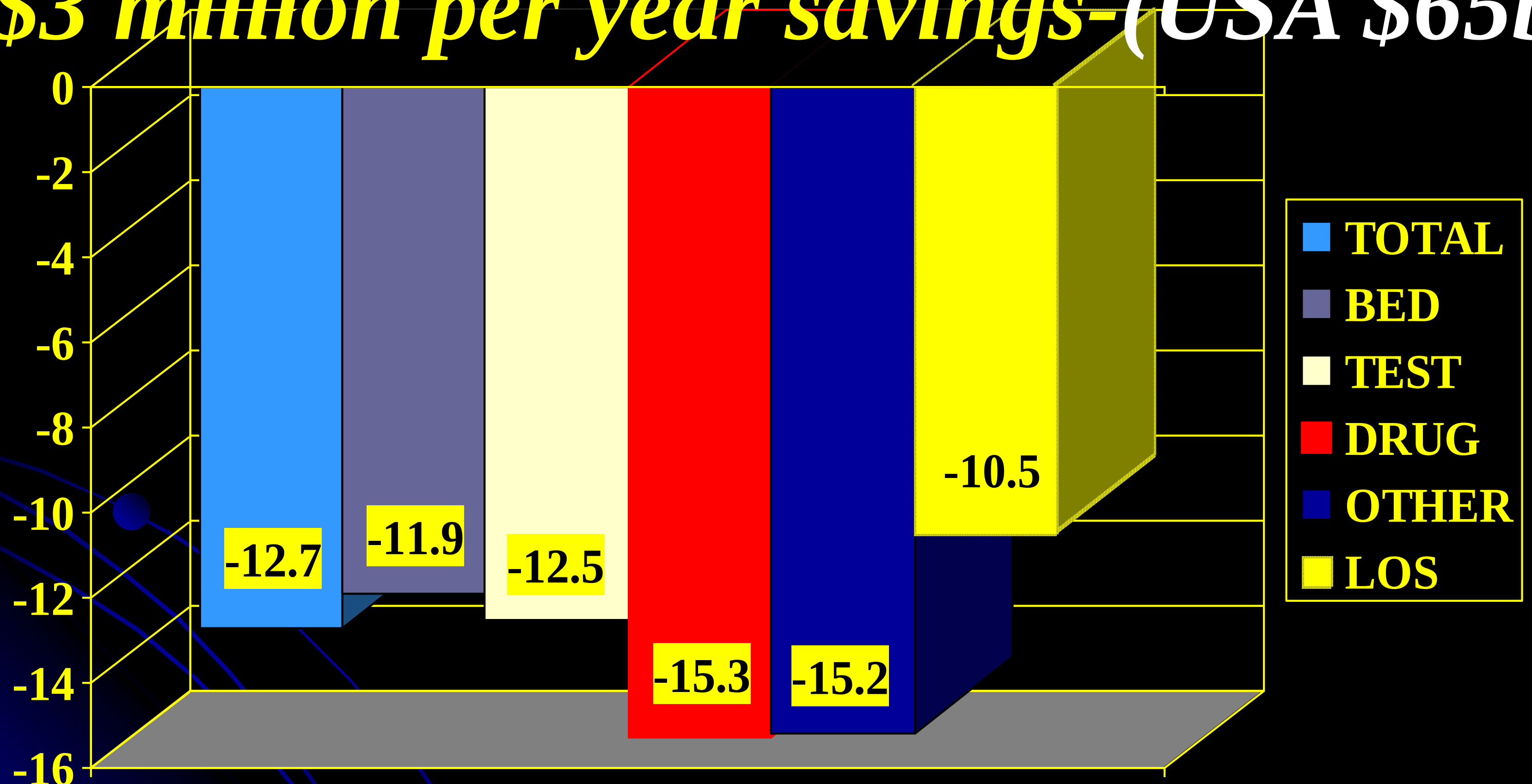
USING PHYSICIAN INPATIENT ORDER WRITING ON MICROCOMPUTER WORKSTATIONS. REDUCTION IN HEALTH CARE RESOURCE UTILISATION



Physician inpatient order writing on microcomputer workstations-effects on resource utilisation. WM Tierney and others. JAMA 1993;269:379-383

USING PHYSICIAN INPATIENT ORDER WRITING ON MICROCOMPUTER WORKSTATIONS. REDUCTION IN HEALTH CARE RESOURCE UTILISATION

$3 million per year savings-(USA $65b)



Physician inpatient order writing on microcomputer workstations-effects on resource utilisation. WM Tierney and others. JAMA 1993;269:379-383

High Tech – High Touch-Personal Computing

Foreign or Familiar territory?

Age

Gender

Previous computer experience

-NOT factors in usage

[W.Slack 1976 and 2010]

Mike Mcmahon / AP

ADULT INTERNET ACCESS – 2007

USA adults > 50 years-54% use Internet (38% in 2002)
25% high speed Internet access (5% in 2002)
Greatest use 50-69 yrs. Rapid fall > 70 years

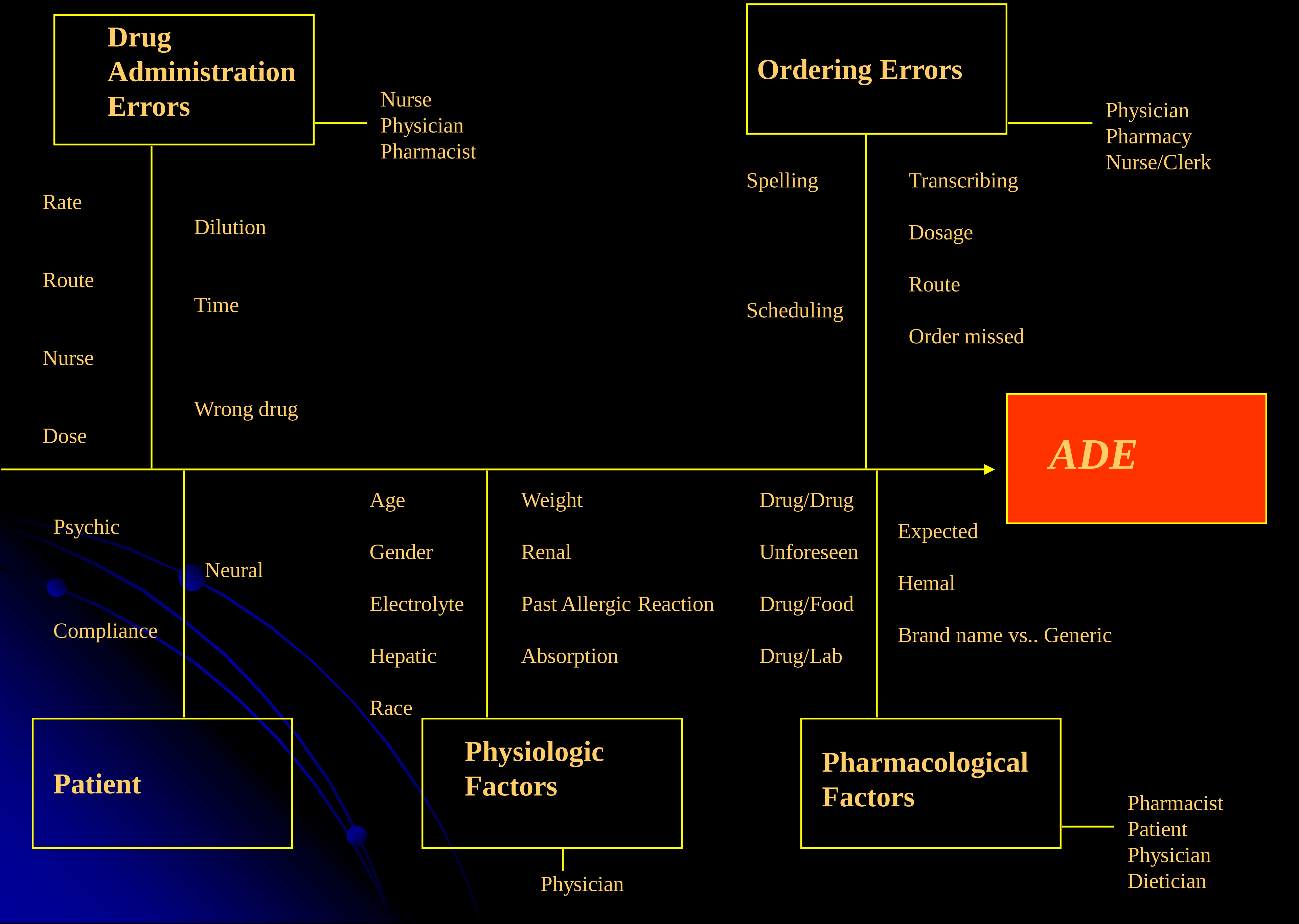
Of those > 50 years who use Internet

- **87% use email**
- **81% use Google**
- **Average 9 hrs/week on line**

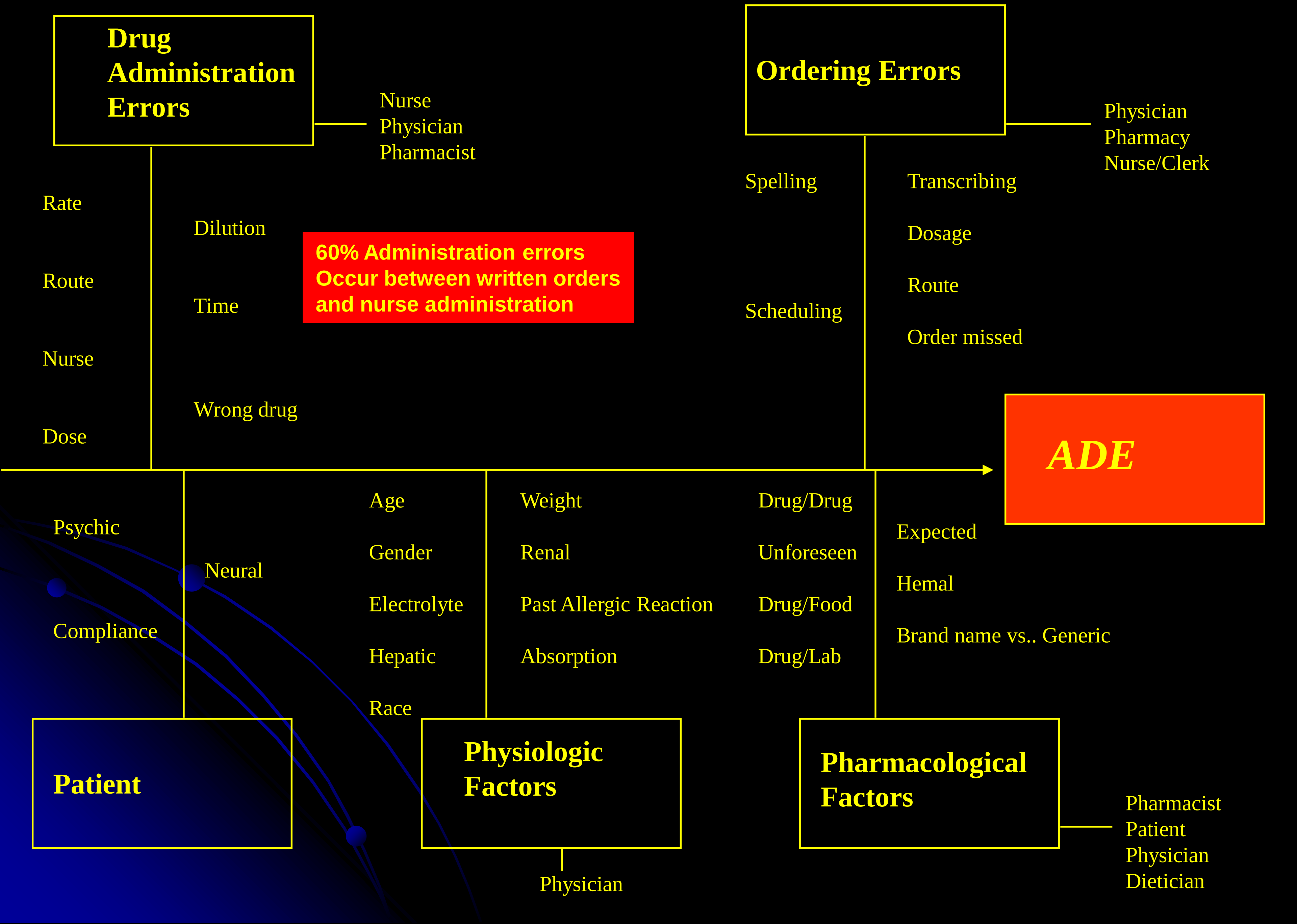
"The idea of being able to discover your own world is very exciting … the computer enables us to stay in the work force longer."

Senior Netizens-D. Kadlec, TIME, February 12. 2007

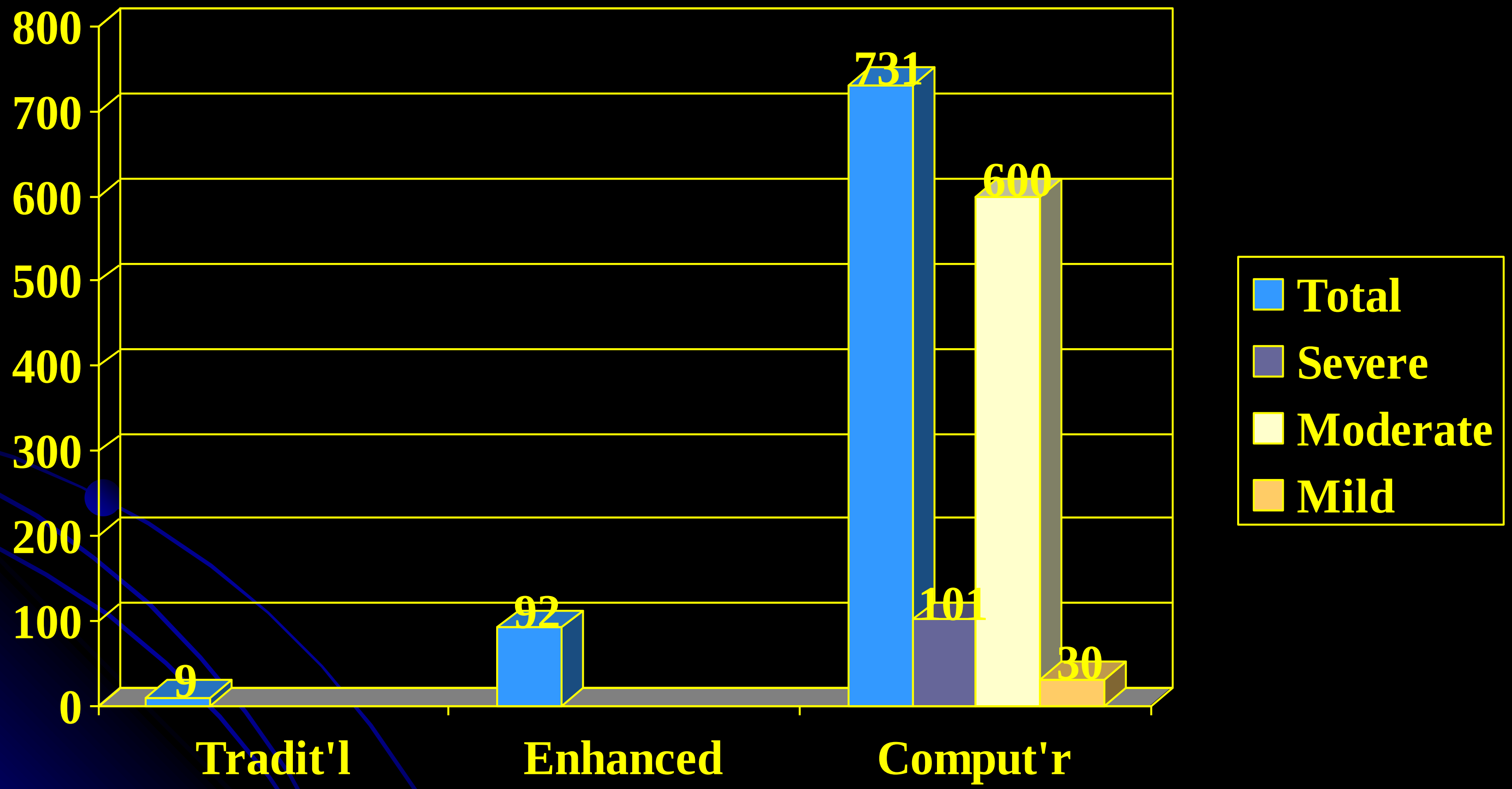
Cause and effect of potential causes of ADEs.(From L.Grandia. IHC,Utah-with permission)



Cause and effect of potential causes of ADEs.(From L.Grandia. IHC,Utah-with permission)



Computerized surveillance of adverse drug events in hospital patients



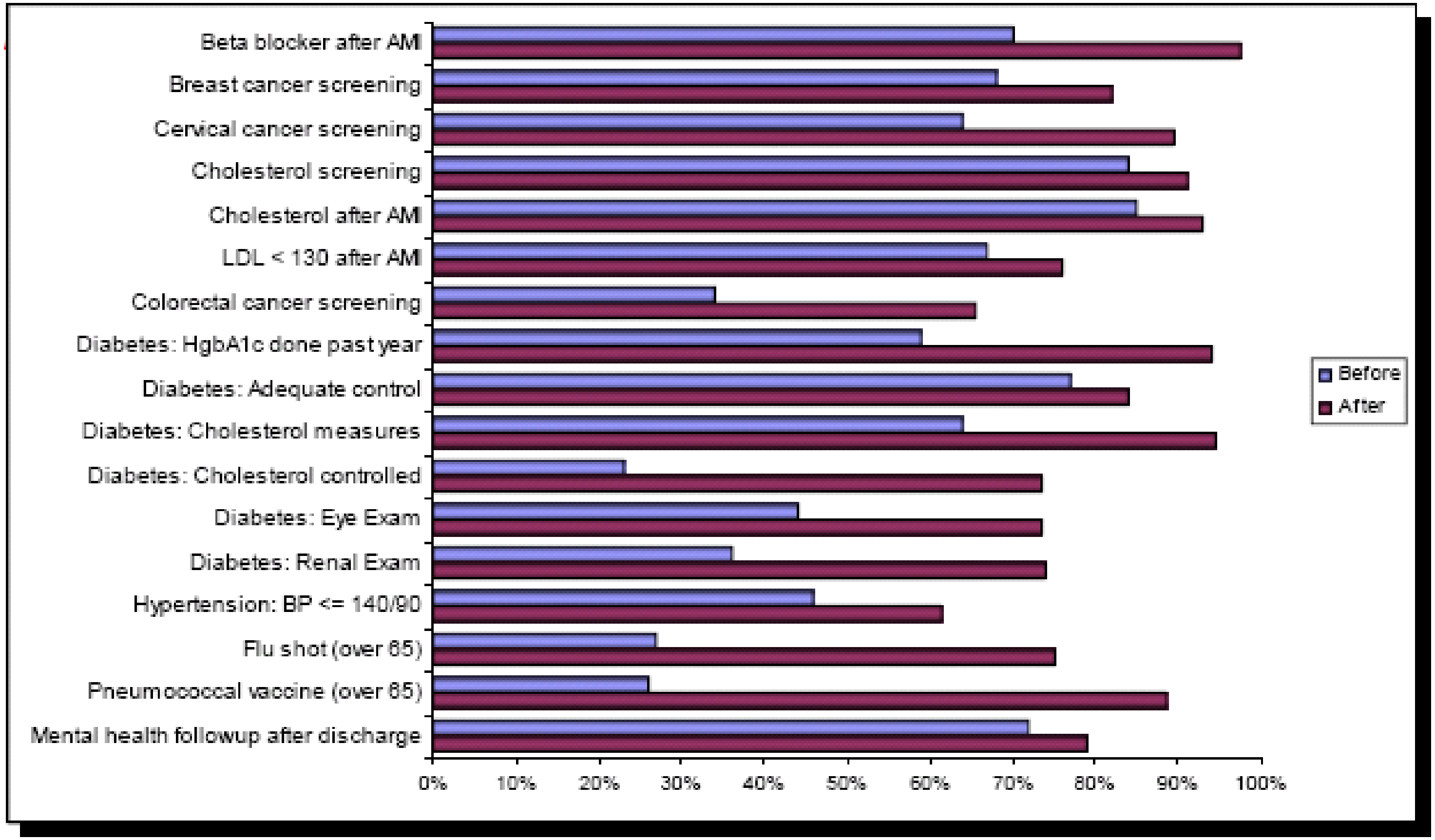
Classen DC, Pestotnik SL, Evans RS, Burke JP. JAMA 1991;266:2847-2851.

ADVERSE EVENTS -IDENTIFICATION AND PREVENTION

"Most hospitals rely on spontaneous voluntary reporting to identify adverse events, but this method *overlooks more than 90%* of adverse events detected by other methods...............*Retrospective chart review* improves the rate of adverse event detection but is *expensive and does not facilitate prevention*."

Potential identifiability and preventability of adverse events using information systems. D Bates et.al J Am Med Informatics Assoc. 1994;1:404-411

VA's Success with Decision Support



Data Source: Thomson TG, Brailer DJ. The Decade of Health Information Technology: Delivering Consumer-centric and Information-rich Health Care. Washington, DC: US Department of Health and Human Services; 2004.

Intermountain Health Care, Salt Lake City, Utah, USA

STUDY DESIGN

- **Computer-based EMR system**
- **Patients discharged January 1, 1988 to December 31, 1994**
- **162,196 patients**
- **Goal: to determine clinical and financial outcomes of the**
- **antibiotic practice guidelines implemented through the**
- **computer system**

Pestotnik, S. L. Classen, D. C. Evans, R. S. Burke, J. P. Implementing antibiotic practice guidelines through computer-assisted decision support: clinical and financial outcomes. Ann Intern Med 1996 May 15

Intermountain Health Care, Salt Lake City, Utah, USA

Overall antibiotic use:	d**ecreased 22.8%**
Mortality rates:	**decreased from 3.65% to 2.65%**
Antibiotic-associated ADE:	**decreased 30%**
<u>Antibiotic resistance:</u>	**<u>remained STABLE</u>**
Appropriately timed preoperative a/biotics:	**40% to 99.1%**
Antibiotic costs per treated patient:	decreased $122.66 to $51.90
Acquisition costs for antibiotics:	**fell 24.8% to 12.9%**
	($987,547) to ($612,500)

Our case-mix index which measures patient acuity levels <u>INCREASED</u> during this period, meaning we were treating sicker and sicker patients while better utilizing the delivery of antibiotics.

Pestotnik, S. L. Classen, D. C. Evans, R. S. Burke, J. P. Implementing antibiotic practice guidelines through computer-assisted decision support: clinical and financial outcomes.Ann Intern Med 1996 May *15*

Amarasingham found impressive relationships between the presence of several technologies and complication and mortality rates and lower costs.

The specific technologies evaluated included **order entry, clinical decision support, and automated notes.**

Higher order entry scores were associated with 9% and 55% decreases in mortality rate for patients with myocardial infarction and coronary artery bypass surgery, respectively.

The results for decision support were impressive:
higher decision support scores were associated with;

- 21% decrease in the risk of complications.
- Perhaps of most interest from the informatics perspective was the impact of automated notes, which were associated with a 15% decrease in the risk of fatal hospitalizations among all causes.

1. Bates DW. ARCH INTERN MED/VOL 169 (NO. 2), JAN 26, 2009 Editorial

2. Amarasingham R, Plantinga L, Diener-West M, Gaskin DJ, Powe NR. Clinical information technologies and inpatient outcomes: a multiple hospital study. *Arch Intern Med*. 2009;169(2):108-114.

Not all HIT are beneficial.

There were also some instances in which relationships in the opposite direction were found; for example, electronic documentation was associated with a 35% increase in the risk of complications in patients with heart failure, though this may have been present because it was easier to find these events since better documentation
was present.

1. Bates DW. ARCH INTERN MED/VOL 169 (NO. 2), JAN 26, 2009 Editorial

2. Amarasingham R, Plantinga L, Diener-West M, Gaskin DJ, Powe NR. Clinical information technologies and inpatient outcomes: a multiple hospital study. *Arch Intern Med*. 2009;169(2):108-114.

Questions.

1. Are the technologies—computer order entry, decision support, and clinical documentation—sufficiently mature that hospitals should be adopting them now?

Bates: the answer is a clear yes for large hospitals. For smaller hospitals, which use a different set of vendors, the answer is less clear, but studies are currently under way that should provide additional information regarding this.

2. For clinical documentation, the benefits are still only beginning to be determined and are likely to be spread across a wide range of areas, but this will likely prove to be beneficial as well.

Bates DW. REPRINTED) ARCH INTERN MED/VOL 169 (NO. 2), JAN 26, 2009 WWW.ARCHINTERNMED.COM

Amarasingham R, Plantinga L, Diener-West M, Gaskin DJ, Powe NR. Clinical information technologies and inpatient outcomes: a multiple hospital study. *Arch Intern Med*. 2009;169(2):108-114.

Do the negative consequences of implementing HIT in hospitals overwhelm or wash out the positive ones?

Current evidence is that they do not overall.

EVALUATION is critical with technology after implementation and making multiple changes to it—points that are all too often ignored.

Bates DW. ARCH INTERN MED/VOL 169 (NO. 2), JAN 26, 2009

Figure 2 PDA form example.

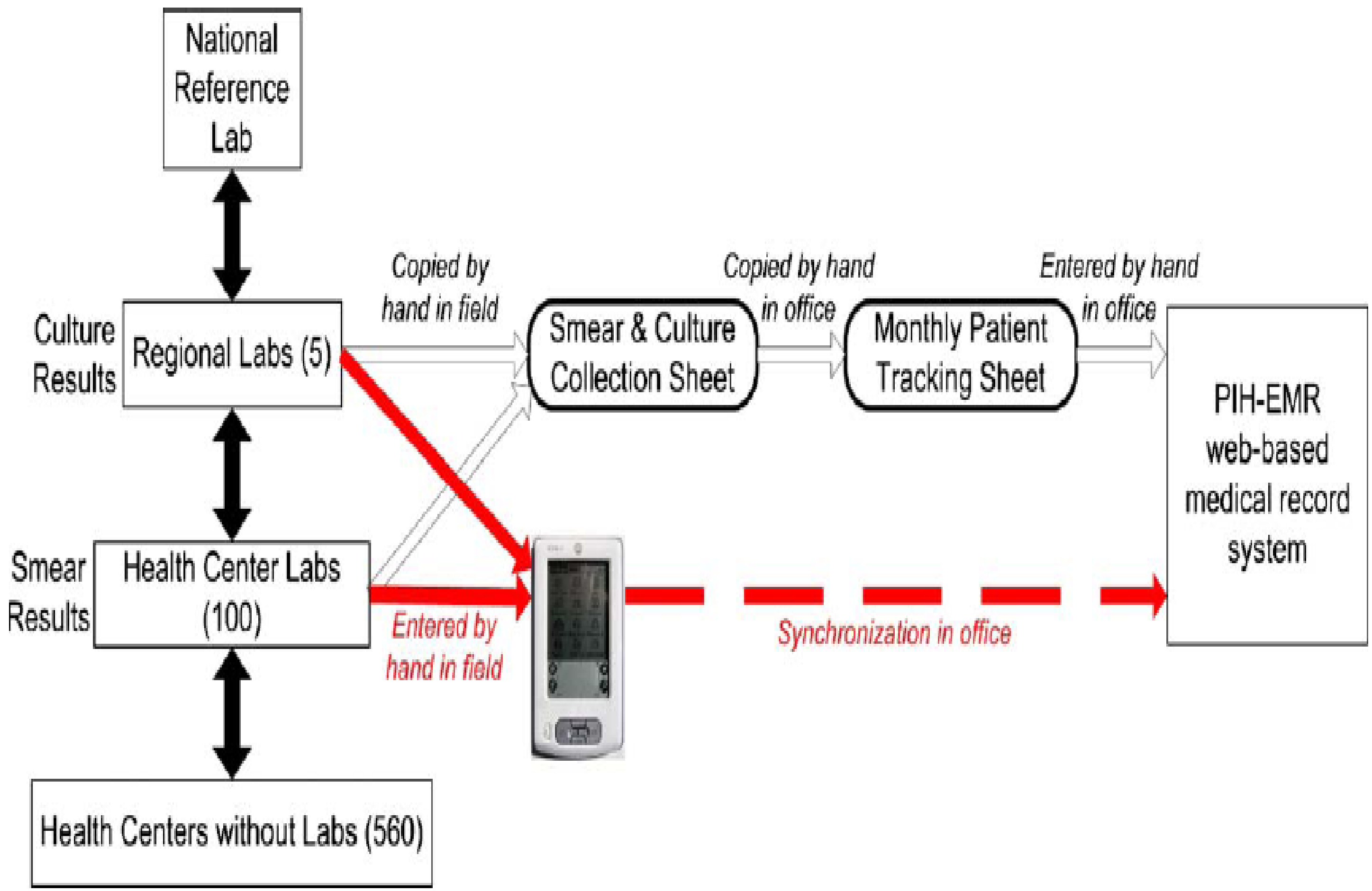
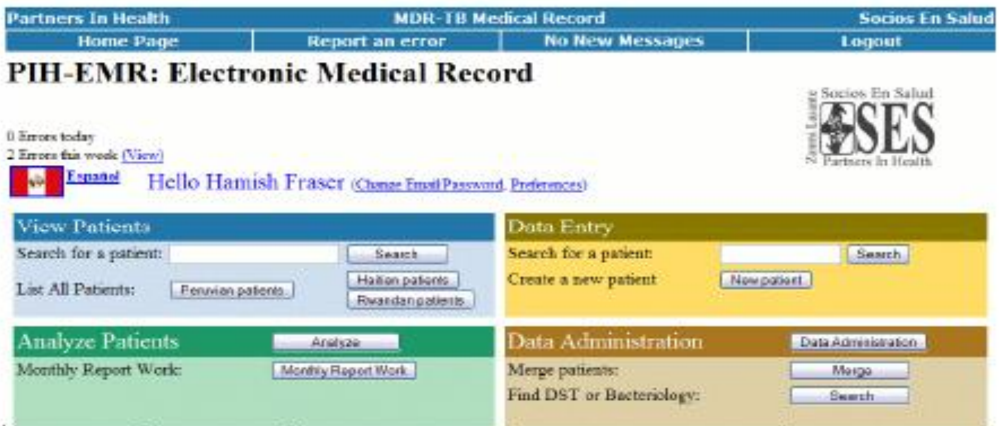


Figure 1 Peruvian laboratory structure, and workflow of the bacteriology data collection team with the current paper system (white lines) and with the PDA-based system (red lines).

PIH-EMR data



Smears
Cultures
Drug sensitivity

Biochem.
Hematology

Registration form
History/exam
Previous Rx
Previous Dx
Contacts

Follow up
Chest X-ray

Drug regimens
Pharmacy

Figure 1

An example a clipboard with PDA. Photograph shows the form of interviewing through a PDA put into a clipboard.

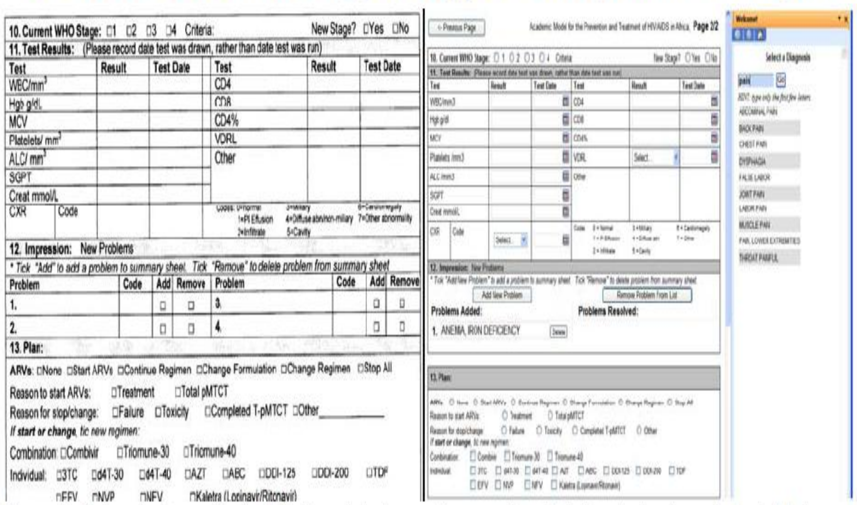


Figure 3. Data entry form. On the left, the original paper form; on the right, the electronic equivalent able to deliver data directly to the central repository.

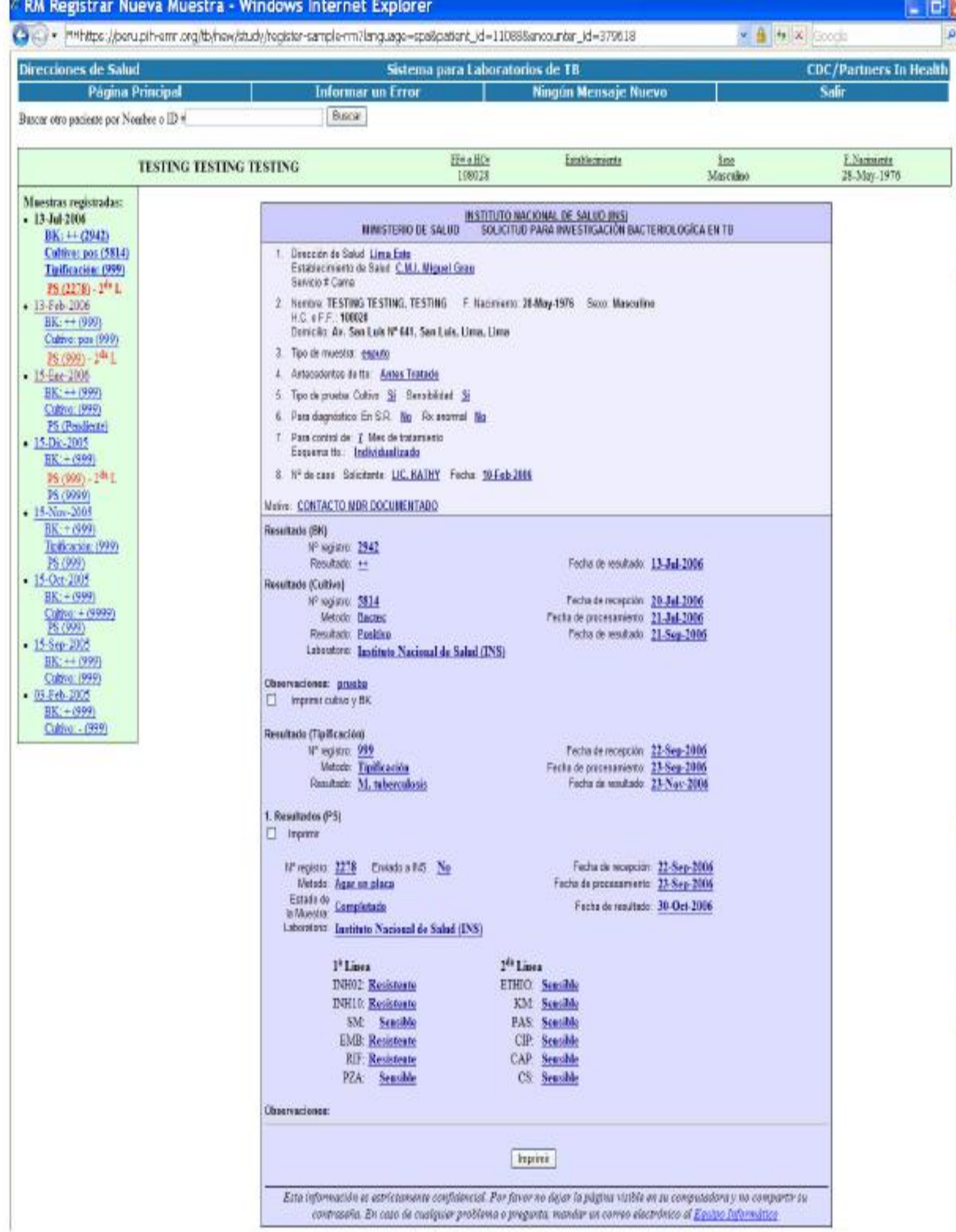


Figure 2

e-Chasqui main patient page. This page shows the patient's full bacteriological history on the left sidebar and with bolded sample date for the sample whose results were being displayed on main part of page.

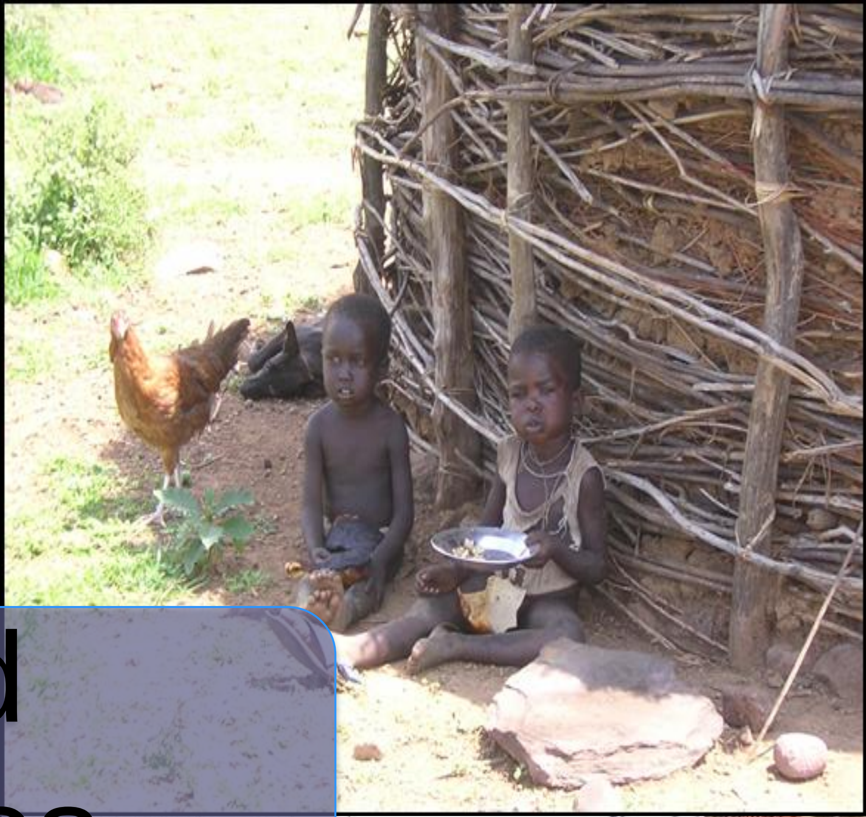
A web-based laboratory information system to improve quality of care of tuberculosis patients in Peru: functional requirements, implementation and usage statistics.

- March 2006-2007
- 29,944 smear microscopy
- 31,797 culture and 7,675 drug susceptibility test results have been entered.
- Over 99% of these results have been viewed online by the health centres.
- High user satisfaction
- Heavy use has led to the expansion of e-Chasqui to additional institutions.
- In total, e-Chasqui will serve a network of institutions providing medical care for over 3.1 million people.
- The cost to maintain this system is ~US$0.53 per sample or 1% of the National Peruvian TB program's 2006 budget.

PIH-EMR Impact

- Over 12,500 records of patients who have received MDR-TB treatment in Peru
- eChasqui module showed significant reductions in delays in delivering drug sensitivity test results to physicians
- Order entry system shown to reduce errors in drug regimens
- Drug forecasting tools reduced the errors in predicting medication requirements six months in advance

Fraser et al, AMIA fall symp. 2006, 264-268
Blaya J, PhD Thesis, MIT 2008



Limited resources

- **40 million PLWA (People Living With AIDS)**

What are the information management needs here?


REPUBLIC OF KENYA
UNINTERRUPTIBLE POWER SUPPLY

MMRS data (2 years)

63,728 visits

Diagnoses	# Visits	Drugs	# Visits
Malaria	17,495	Paracetamol	24,944
URI	8,479	Fansidar	11,550
Septic wound	1,329	Quinine, injected	8,769
Gastroenteritis	964	Penicillin, injected	8,058
Tonsilitis	938	Quinine, oral	7,851
Wound (unspec.)	791	Penicillin, oral	4,753
Myalgia	700	Amoxicillin	4,725
Amebiasis	629	Depoprovera	4,443
Laceration	618	Piriton	3,766
Worms (unspec.)	544	Brufen	3,323

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NO HIV and NO TB

http://www.who.int/features/africaworking/en/index.html

WHO/Evelyn Hockstein
Clinical officers like Lillian Boit provide most patient care and maintain charts. "The electronic record-keeping system allows us to provide care to more people and take better care of patients", she says.

WHO/Evelyn Hockstein
At every monthly check-up patients are given their charts and hand-carry them to the nurse, clinical officer and other providers they are seeing that day. Updates to the chart are made at each station.

An innovative home-care programme using hand-held computers is also being piloted in the region. Monica Korir, who is living with HIV and is trained as an outreach worker, interviews Paul Ekorok, 52, at his home in Captarit village and records his answers.

WHO/Evelyn Hockstein

Outreach workers download completed forms into Mosoriot clinic's data management system daily. Automated alerts flag any alarming new symptoms to the attention of the responsible clinical officer, or when a patient has missed an appointment so that outreach workers can find out what is wrong.

OpenMRS Western Kenya-cumulative visits 11/01-09/09

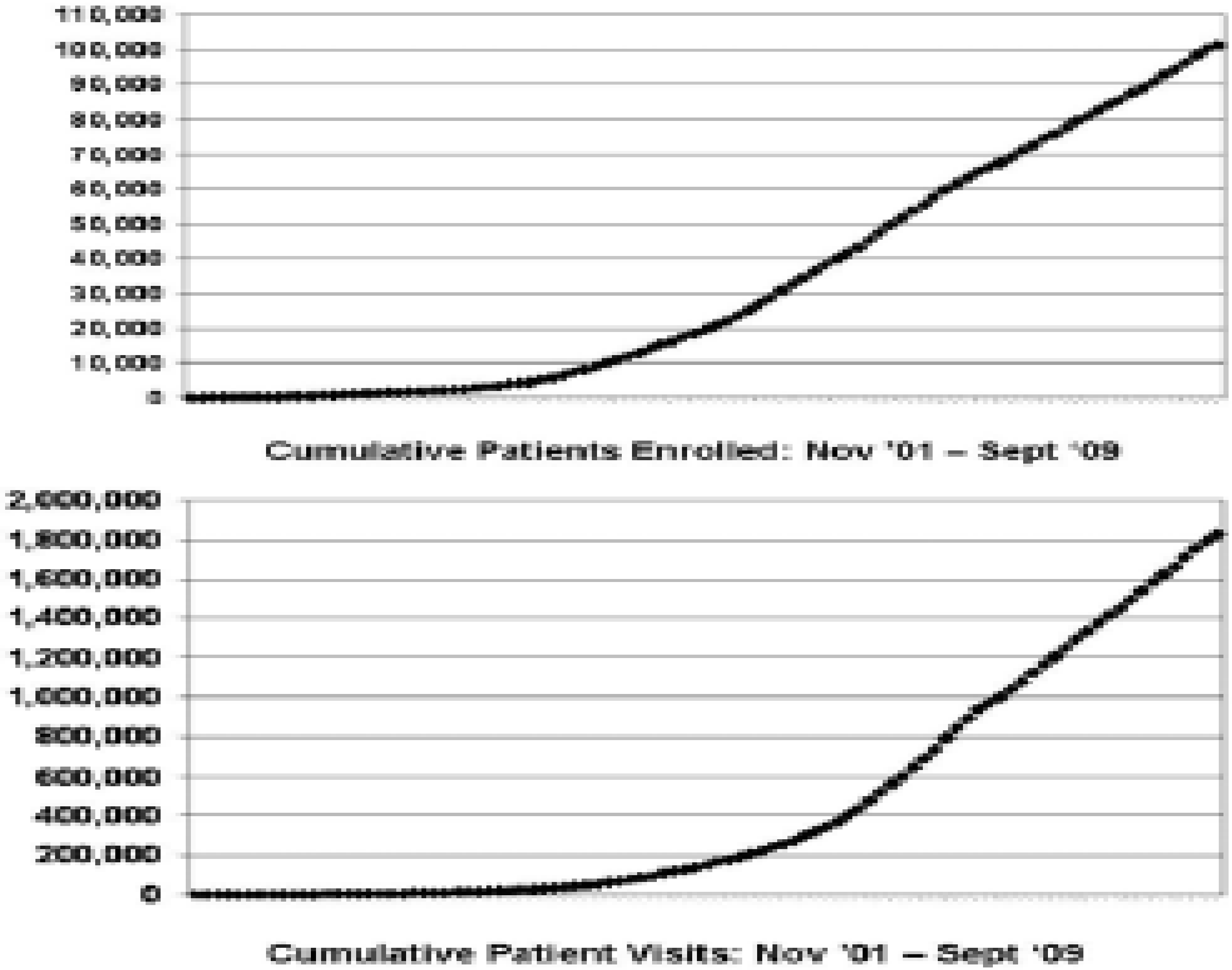


Figure 1- Cumulative patients enrolled and visit records

Besides antiretroviral drugs (which are provided by USAID), care by AMPATH cost only $175/patient/year in 2007 and is now less than $100/patient/year in 2009.

P. Park, et al., *Case Report: The Academic Model for the Prevention and Treatment of HIV/AIDS*. Harvard Business School, Boston, 2008.

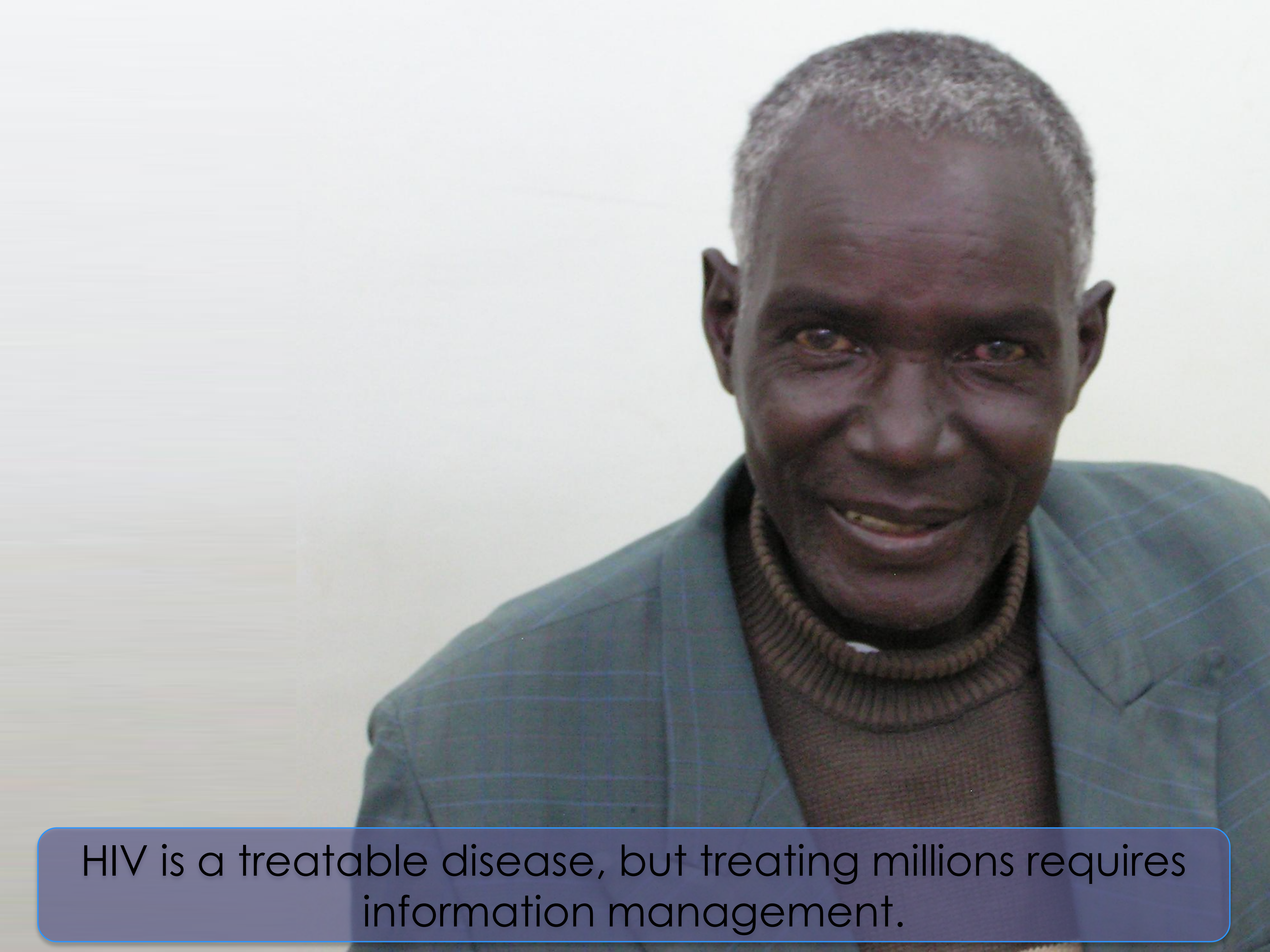
In addition to the monthly, quarterly, and annual reports required by funding and agencies and the MOH, the AMRS also provides data to a robust multidisciplinary research program:

Researchers from more than a dozen North American universities and Moi University currently have more than 30 ongoing studies in East Africa, supported by >$26 million in grants from U.S. federal granting agencies and various foundations.

Salina- “Rattling bones syndrome”

Salina on anti-retroviral therapy

A response to HIV

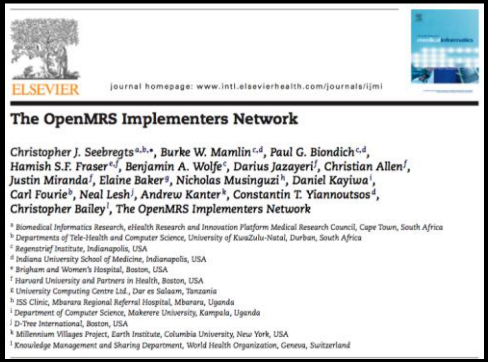


HIV is a treatable disease, but treating millions requires information management.

OpenMRS is…

- An Electronic Medical Record System-web based
- A data model
- An API
- An HIV system
- A TB system
- A Primary Care system
- A developer community
- An implementer community

… and more.



ELSEVIER journal homepage: www.intl.elsevierhealth.com/journals/ijmi

The OpenMRS Implementers Network

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[c] Regenstrief Institute, Indianapolis, USA
[d] Indiana University School of Medicine, Indianapolis, USA
[e] Brigham and Women's Hospital, Boston, USA
[f] Harvard University and Partners in Health, Boston, USA
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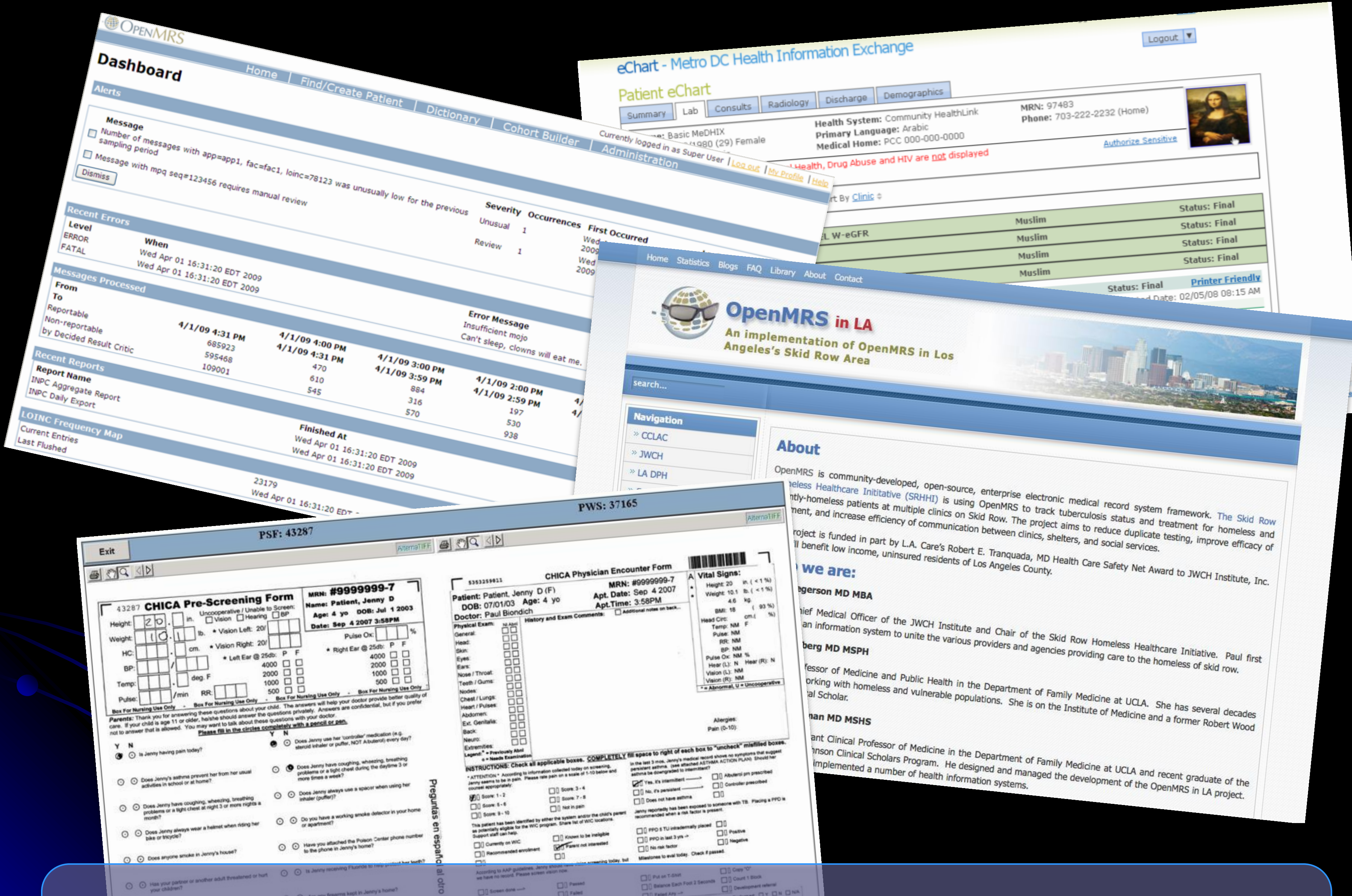
[h] ISS Clinic, Mbarara Regional Referral Hospital, Mbarara, Uganda
[i] Department of Computer Science, Makerere University, Kampala, Uganda
[j] D-Tree International, Boston, USA
[k] Millennium Villages Project, Earth Institute, Columbia University, New York, USA
[l] Knowledge Management and Sharing Department, World Health Organization, Geneva, Switzerland

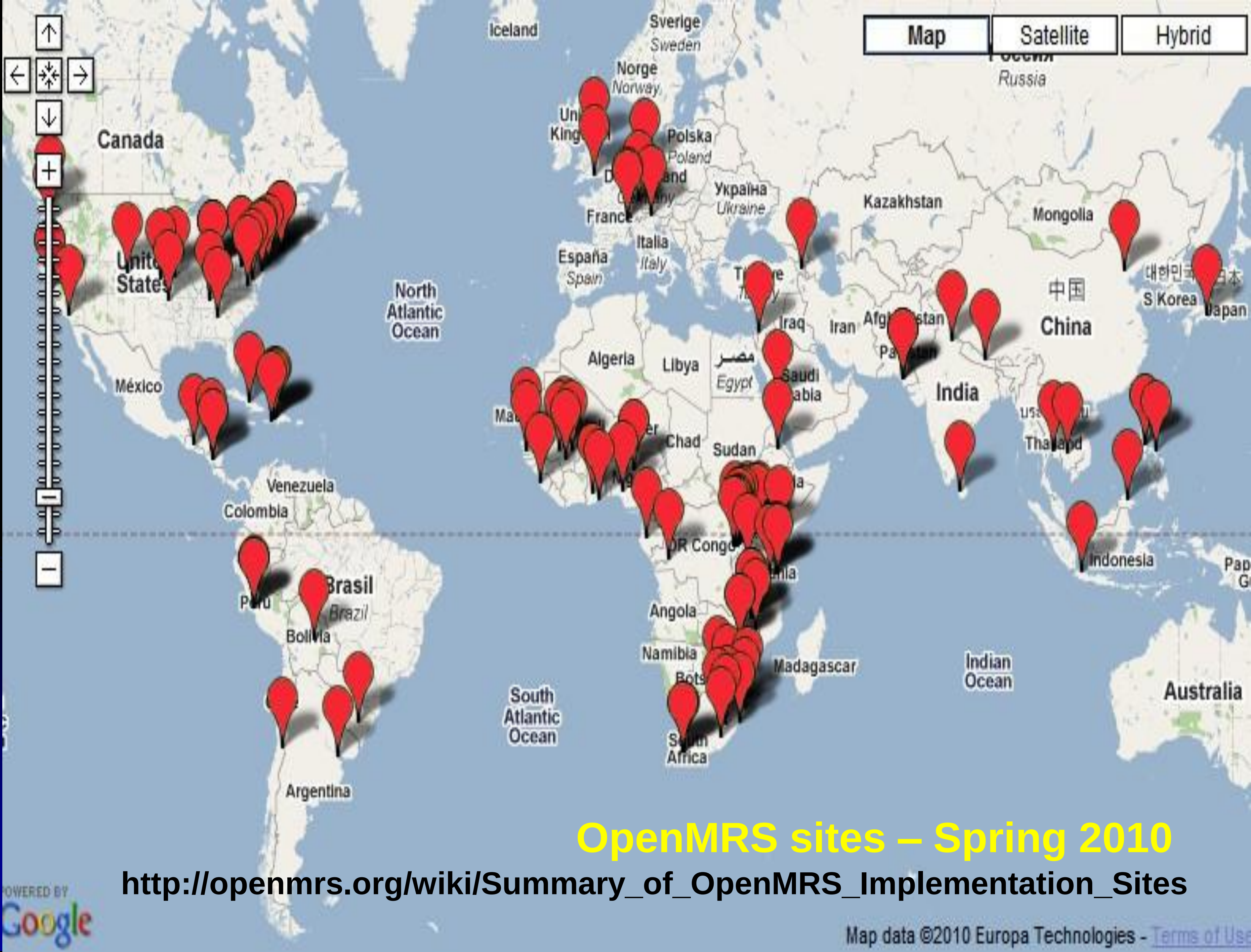
Clinical data collected

- The patient's clinical status
- Bacteriology results
- Drug sensitivity testing results
- The current drug regimen.
- Previous drug regimens.
- Bio-chemistry and hematology results
- Drug complications and adverse events.
- Chest x-ray (CXR) reports and digital images.
- Background data (occupation, housing, contacts)



Multiple uses- flexibility of a platform approach

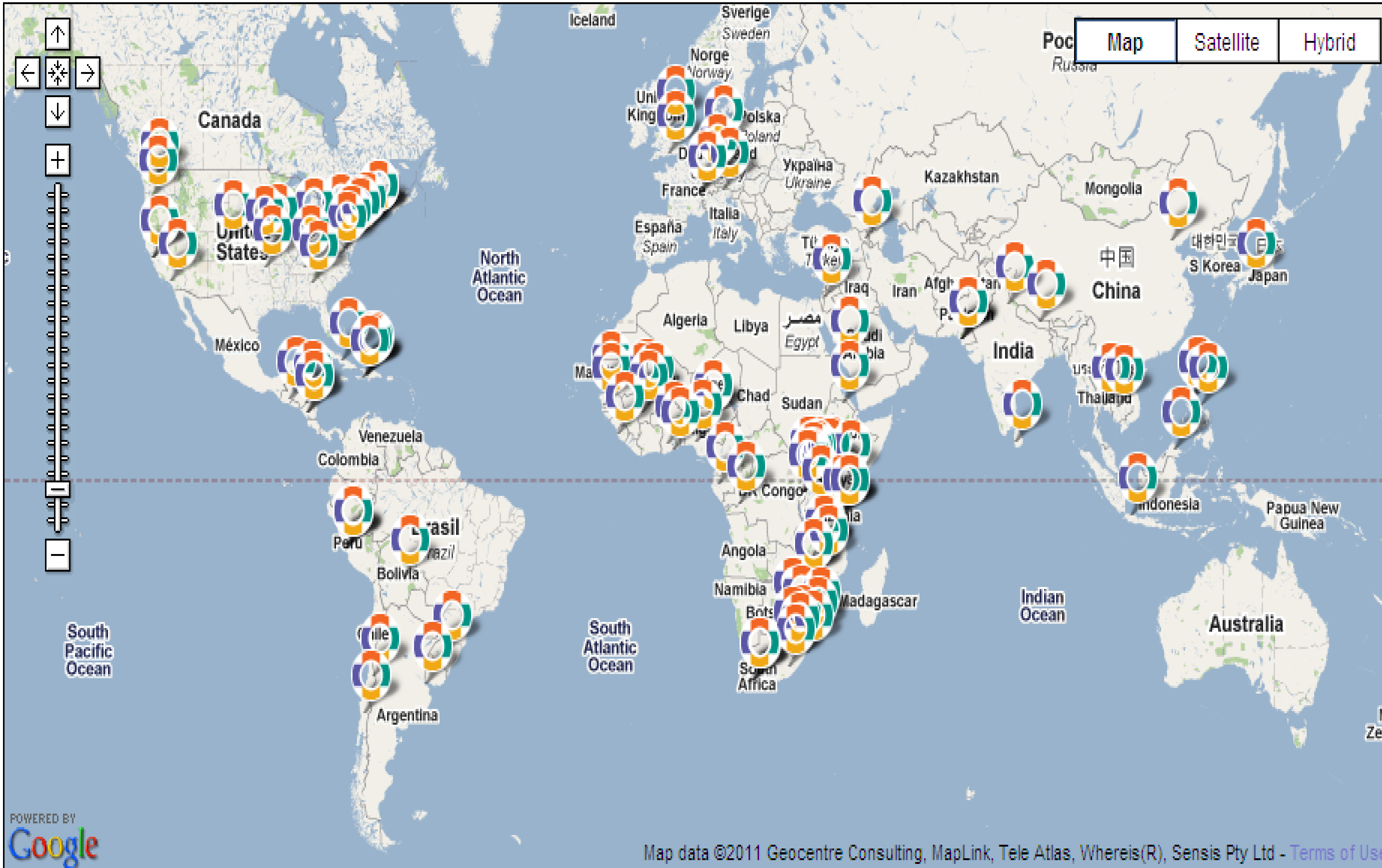

CANADA
UNITED STATES
RUSSIA
CHINA
Antarctica
OpenMRS sites - fall 2008



OpenMRS sites – Spring 2010

http://openmrs.org/wiki/Summary_of_OpenMRS_Implementation_Sites

OpenMRS Atlas



OpenMRS Sites : Clinical & Research Sites

Implementation Time Frames and support.

It took us about 6 weeks … to configure our ER and Surgery modules in OpenMRS. … Thanks again to Andy at MVP and James at HAS among others for considerable guidance and support … There are only a couple of us working on this project at MSF with limited resources, and without the help of the implementers group we would have been stopped in our tracks.

On June 1 we went live with the production database in Port au Prince. … the system is run by local staff with limited technical training. … Overall we have been impressed with the stability of OpenMRS on Linux; server reboots are sometimes necessary once or twice a day because of Tomcat memory errors. With three months of data in the system now and stability and output tried and true … Thanks. John John Brooks. Médecins Sans Frontières (MSF)/Doctors Without Borders

Figure 1. Design Goals used for the AMRS

Collaboration – systems need to be developed openly and built upon a common infrastructure, the sharing of "best of breed" modules can best occur within a shared infrastructure

Scalability – the infrastructure must not only handle thousands of patients and hundreds of thousands of observations, but also be scalable to tens of thousands of patients and millions of observations

Flexibility – systems must support not only HIV-centered care, but also general medical care, since clinical care is not limited to HIV care

Rapid form design – data collection needs are a moving target; therefore, form design and deployment must allow for continual change

Clinically useful – feedback to providers and caregivers is critical – if the system is not *clinically* useful, it will not be used

Use of standards – to maximize the flexibility and extensibility of the system

Support high-quality research – via non-ambiguous, coded data

Web-based with support for intermittent connections – *developing countries do not always have reliable power or internet connections, but when available, internet-based technologies offer increased scalability*

Low cost – if the system is to be widely available and adaptable in developing countries, cost must not prohibit adoption. Ideally, the nuts and bolts of the system should be downloadable for free.

Collaborators and Funders

- Partners In Health
- Regenstrief institute
- Medical Research Council, South Africa
- World Health Organization
- US Centers for Disease Control
- Brigham and Women hospital
- Harvard Medical School
- University of KwaZulu-Natal
- Millennium Villages Project
- International Development Research Centre, Ottawa
- Rockefeller Foundation
- Fogarty International Center, NIH
- Boston Consulting Group
- Google Inc