THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

COMMITTEE ON HUMAN-SYSTEMS INTEGRATION

Public Meeting

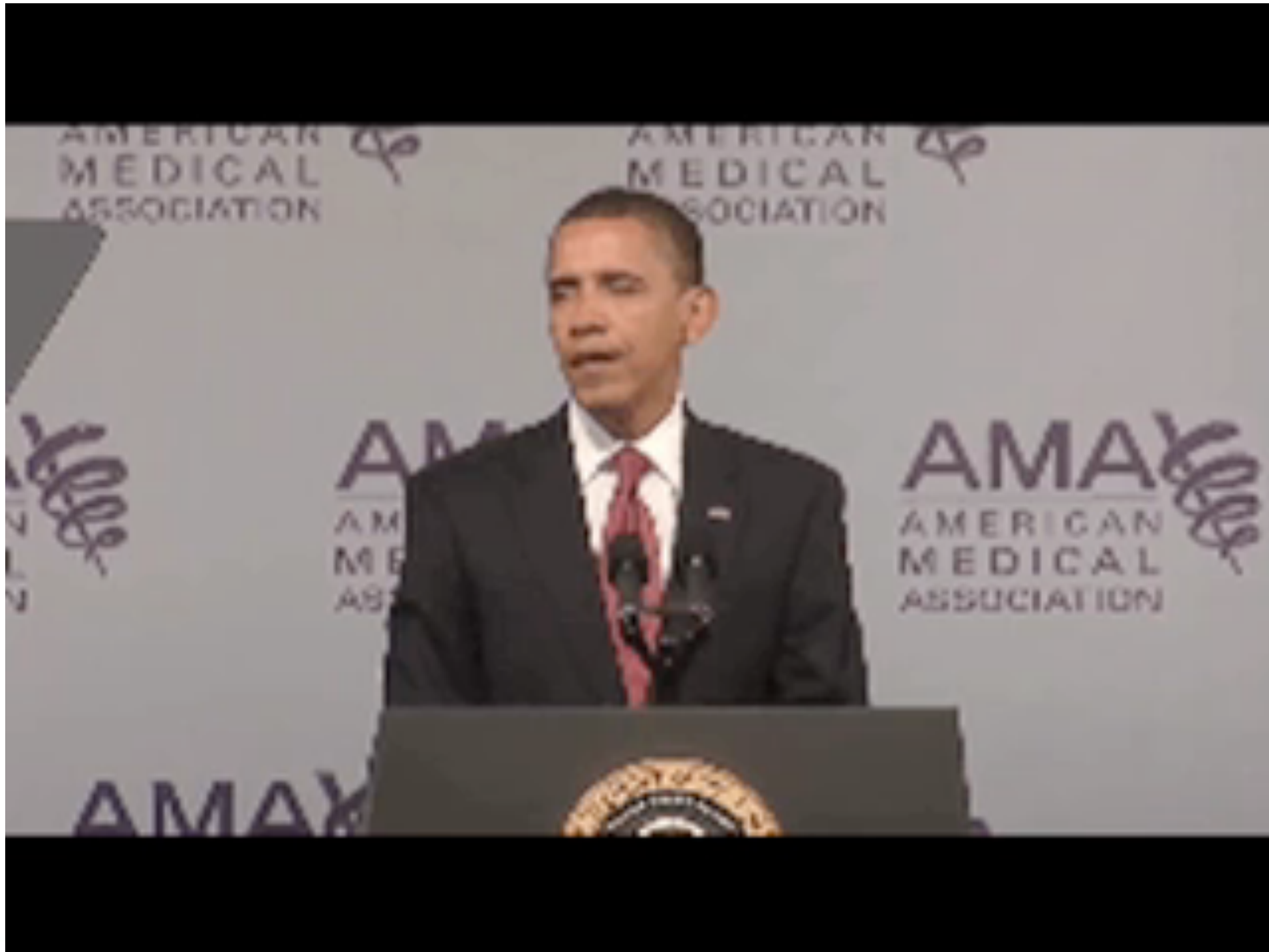Coordinating Systems to Accelerate Successes Against Cancer
Bradford Hesse
National Cancer Institute

Monday, August 24, 2009

June 15, 2009

Why Are Electronic Records So Important?

PEHR 2009

Personal Electronic Health Records

ANNUAL CONFERENCE

MAY 20 – MAY 21

Electronic Health Records and Economic Recovery

David M. Cutler
Department of Economics
Harvard University

PEHR 2009
Personal Electronic Health Records

ANNUAL CONFERENCE
MAY 20 – MAY 21

The Challenges Facing the United States

- Spend more now – any spending is good in a recession

- Put us on a path towards long-term economic growth
  - Investment in key infrastructure
  - Solving the Federal budget

- Both of these lead to health care IT
  - ARRA: $19 billion in health IT with goal of 90% uptake by 2014

PEHR 2009

Personal Electronic Health Records

ANNUAL CONFERENCE

MAY 20 – MAY 21

A modest increase in productivity would significantly 'bend the curve'
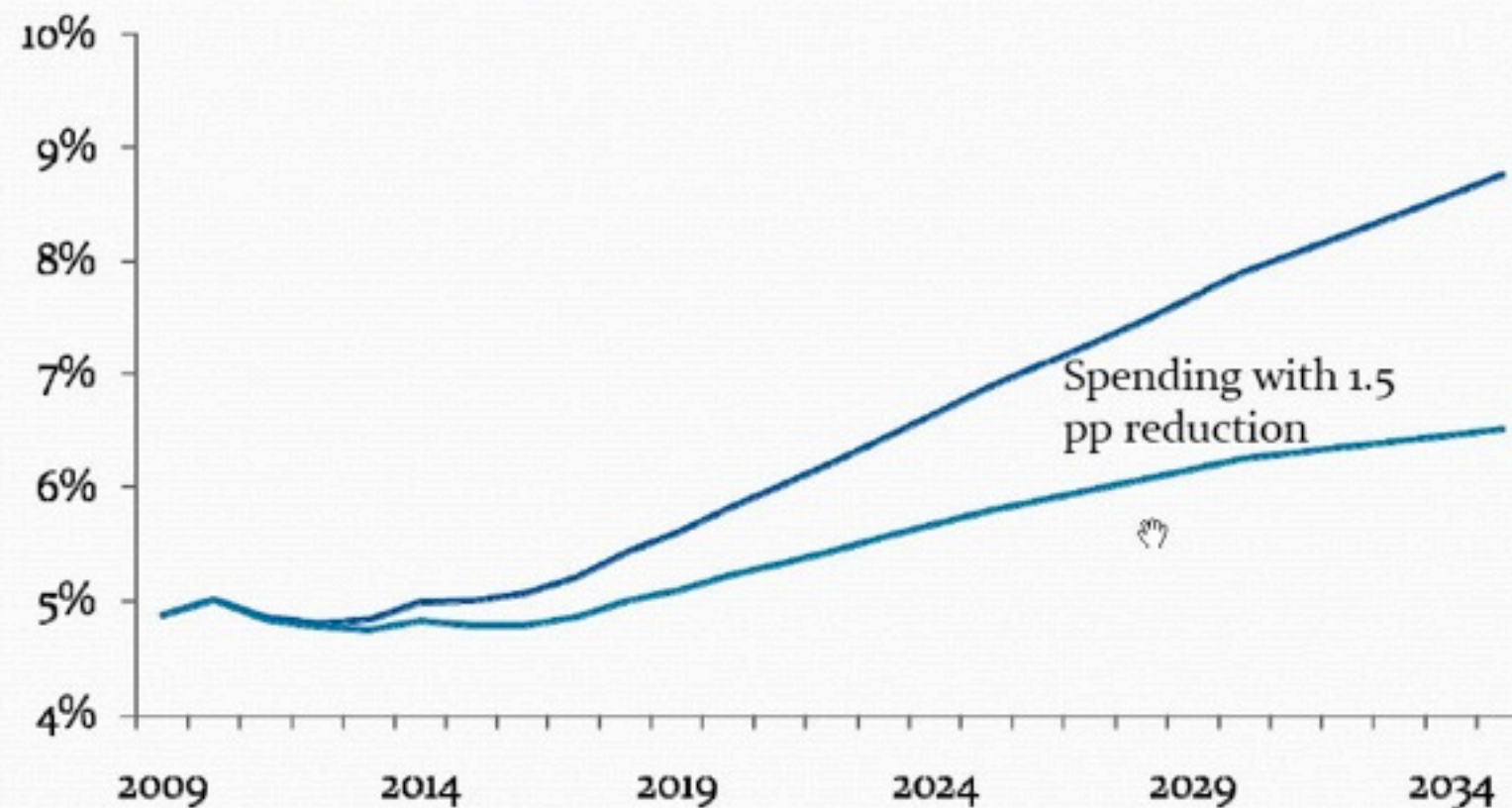
Spending with 1.5 pp reduction

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Personal Electronic Health Records

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MAY 20 – MAY 21

Health care is projected to blow up the Federal budget

PEHR 2009
Personal Electronic Health Records
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MAY 20 – MAY 21

Three lessons about productivity come from industry studies

- **Information** – knowing what is done

- **Compensation arrangements** – supporting productivity

- **Worker empowerment** – allowing workers to make changes to production

Why Are Electronic Records So Important?

PEHR 2009
Personal Electronic Health Records
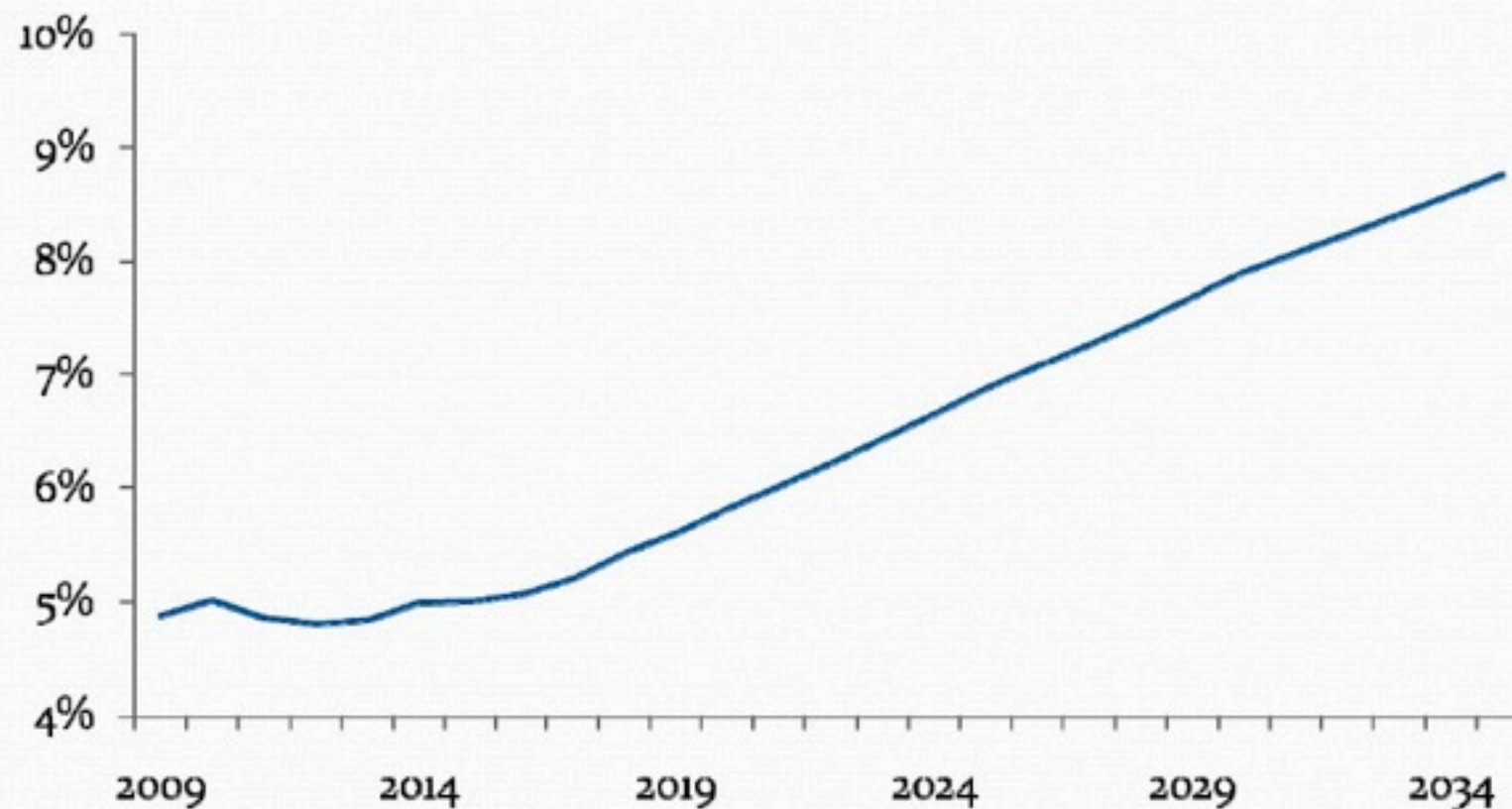ANNUAL CONFERENCE
MAY 20 – MAY 21

Productivity Growth by Industry, 1995-2005
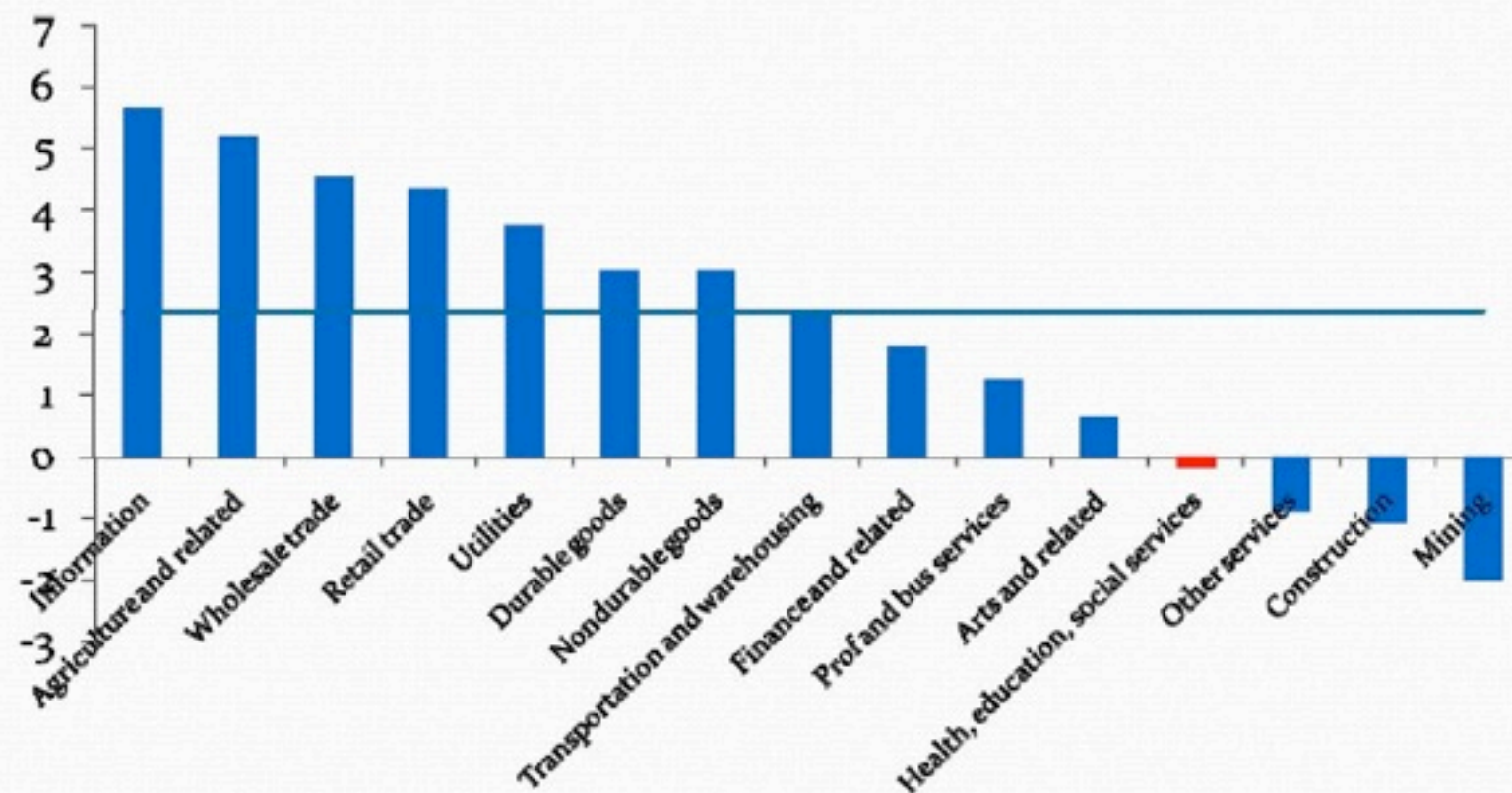
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Conclusion

- Electronic medical records are the beginning, not the end.

eHealth Research from the User's Perspective

Bradford W. Hesse, PhD[1] and **Ben Shneiderman, PhD**[2]

[1]*National Cancer Institute, Bethesda, Maryland* [2]*University of Maryland, College Park, Maryland*

Abstract

The application of Information Technology (IT) to issues of healthcare delivery has had a long and tortuous history in the U.S. Within the field of eHealth, vanguard applications of advanced computing techniques, such as applications in artificial intelligence or expert systems, have languished in spite of a track record of scholarly publication and decisional accuracy. The problem is one of purpose, of asking the right questions for the science to solve. Historically, many computer science pioneers have been tempted to ask "what can the *computer* do?" New advances in eHealth are prompting developers to ask "what can *people* do?" How can eHealth take part in national goals for healthcare reform to empower relationships between healthcare professionals and patients, healthcare teams and families, and hospitals and communities to improve health equitably throughout the population? To do this, eHealth researchers must combine best evidence from the user sciences (human factors engineering, human-computer interaction, psychology, and usability) with best evidence in medicine to create transformational improvements in the quality of care that medicine offers. These improvements should follow recommendations from the Institute of Medicine to create a health care system that is (a) safe, (b) effective (evidence-based), (c) patient-centered, and (d) timely. Relying on the eHealth researcher's intuitive grasp of systems issues, improvements should be made with considerations of users and beneficiaries at the individual (patient/physician), group (family/staff), community, and broad environmental levels.

BACKGROUND

The application of information technology (IT) to issues of personal health and healthcare has had a long and surprisingly complex history within the United States. It was not long after the first mainframe computer systems began automating record keeping that hospitals began applying IT to the tasks of billing and financial record keeping.[1] Yet, in spite of an early application of IT to administrative and actuarial tasks, the challenge of developing a consistent, interoperable system for transporting patients' medical records across health care systems has been an elusive and seemingly intractable goal.[2] Reasons given for delays in this and other areas of health IT include grappling with competing incentive structures, dealing with issues

Informaticians have generally asked: "What can the computer do?"

Expert systems » MYCIN

Work on MYCIN, an expert system for treating blood infections, began at Stanford University in 1972. MYCIN would attempt to diagnose patients based on reported symptoms and medical test results. The program could request further information concerning the patient, as well as suggest additional laboratory tests, to arrive at a probable diagnosis, after which it would recommend a course of treatment. If requested, MYCIN would explain the reasoning that led to its diagnosis and recommendation. Using about 500 production rules, MYCIN operated at roughly the same level of competence as human specialists in blood infections and rather better than general practitioners.

Nevertheless, expert systems have no common sense or understanding of the limits of their expertise. For instance, if MYCIN were told that a patient who had received a **gunshot wound** was bleeding to death, the program would attempt to diagnose a bacterial cause for the patient's symptoms. Expert systems can also act on absurd clerical errors, such as prescribing an obviously incorrect dosage of a drug for a patient whose weight and age data were accidentally transposed.

Biomedical Informatics
Computer Applications in Health Care and Biomedicine

Edward H. Shortliffe *Editor*
James J. Cimino *Associate Editor*

Third Edition

Robot doctor gets thumbs-up from patients

Half of those surveyed prefer virtual visit by their own physician to real visit by unfamiliar doctor

msnbc.com staff and news service reports
updated 1:43 p.m. ET, Tues., May 11, 2004

Which would you rather have come to your hospital room: a doctor you've never met before, or a robot that lets you interact with your personal physician? A new study indicates that many patients would prefer the robot they know to the human they don't know.

The study, conducted by researchers at Johns Hopkins University and presented Saturday at the American Urological Association's annual meeting in San Francisco, focused on how patients reacted to a "rounding robot." Fifteen of the mobile robo-docs, manufactured by California-based InTouch Health, have been placed in hospitals and nursing homes

ELEVATORS →
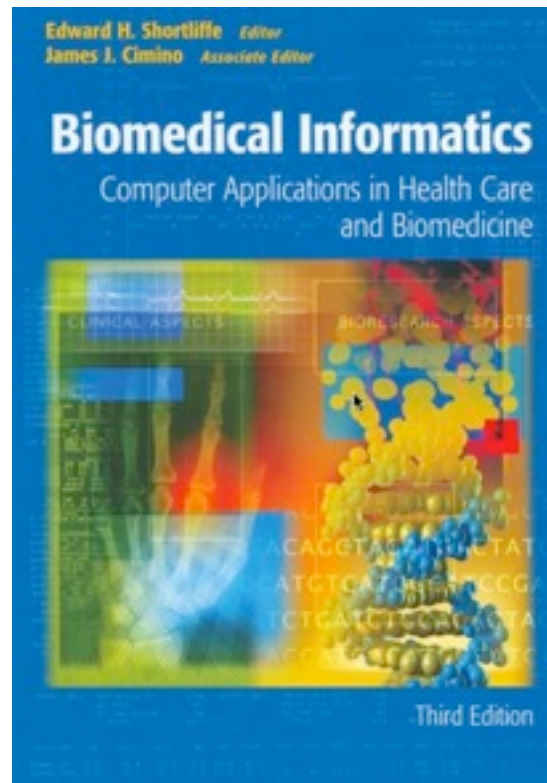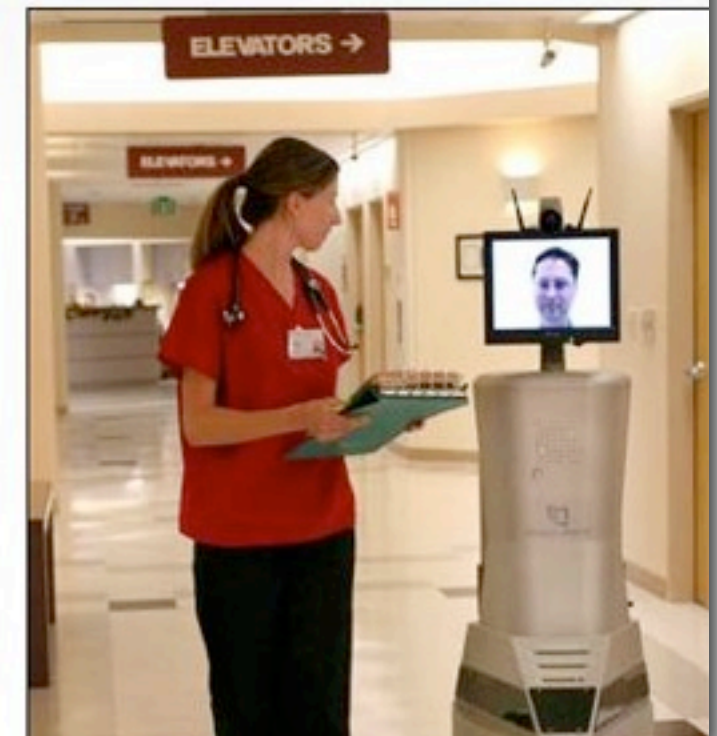
With Stagnation and Problems in Results

Computer Technology and Clinical Work
Still Waiting for Godot

Robert L. Wears, MD, MS
Marc Berg, MA, MD, PhD

PROCESS-SUPPORTING INFORMATION TECHNOLOGY (IT) has been heralded as an important building block in attempts to improve the quality and safety of health care. Two areas in particular have drawn both attention and funding. The first is clinical decision support; that is, information systems designed to improve clinicians' decision making. The second is computerized physician order entry (CPOE) as a means for reducing medication errors. The literature in these fields has been characterized by frequent reports of success, often accompanied by predictions of a bright new (and near) future; however, the future seems never to arrive. Behind the cheers and high hopes that dominate conference proceedings, vendor information, and large parts of the scientific literature, the reality is that systems that are in use in multiple locations, that have satisfied users, and that effectively and efficiently contribute to the quality and safety of care are few and far between.[1]

In this issue of *JAMA*, 2 articles report results in these areas. Garg et al[2] provide an updated systematic review evaluating the impact of computerized clinical decision support systems, and Koppel et al[3] examine the specific failures introduced by a CPOE system intended (at least in part) to reduce such failures.

The summary by Garg et al of 100 trials of clinical decision support systems over a 6-year span is critical. About two thirds of the studies claimed improved clinician performance, but these assessments were often biased; when the authors were not also the system developers, less than half of the systems showed an improvement. In fact, "grading oneself" was the only factor that was consistently associated with good evaluations.

Clinical decision support systems come in many different forms, have myriad aims, and can be implemented in many ways, so it is fair to ask if these systems can really be approached as a single intervention, as Garg et al do. In addition, lack of improved performance could be due to poorly designed decision technology or to poor use of the technology by clinicians. This, in turn, could be due to a poor human-computer interface or to much simpler factors such as goal conflicts or lack of time or support among colleagues.[4] So, it is not clear exactly what is being measured.

In a different design, the study by Koppel et al of users of a single CPOE system in a large academic medical center identified 24 different types of failures of which users were aware; roughly half the participants said these faults occurred from several times per week to daily. While this study examined only the problems, not the successes of CPOE, it serves as a cautionary balance to reports of success, particularly because it studied a mature, widely used, commercially available system, as opposed to a "one-off," single-site system assessed by its own developers.

These results are disappointing but should not be surprising. There is a long-standing, rich, and abundant literature on the problems associated with the introduction of computer technology into complex work in other domains,[5-9] as well as occasional notes in health care.[10-15] Clearly, there is no reason to expect health care, which is from an organizational standpoint probably the most complex enterprise in modern society, to be immune to them. Taken together, these 2 studies[2,3] suggest that important lessons about introducing new technologies into complex work seem to have been missed. For a small but important example, it has long been established in software engineering that systems cannot be adequately evaluated by their developers,[16] a principle that seems to be commonly overlooked in health care. Since roughly 75% of all large IT projects in health care fail,[17] inattention to these lessons is, at best, wasteful of time and resources and, at worst, harmful to patients and clinicians.

To begin to move forward, it is necessary to dispense with the commonly held notion that these problems are simply bits of bad programming or poor implementation that can easily be excised or avoided the next time around. The reality is that many of the difficulties do not result from bad parts of the systems but are inherent in the perspectives and theories of medical work (and the role of IT in this work) that are prevalent among health informaticians and those who make decisions on acquisition and implementation. In

Author Affiliations: Department of Emergency Medicine, University of Florida, Jacksonville (Dr Wears); Clinical Safety Research Unit, St Mary's Hospital, Imperial College, London, England (Dr Wears); and Department of Social Medical Sciences, Institute of Health Policy and Management, Erasmus University, Rotterdam, the Netherlands (Dr Berg).
Corresponding Author: Robert L. Wears, MD, MS, Clinical Safety Research Unit, 10th Floor, Queen Elizabeth the Queen Mother Building, St Mary's Hospital, South Wharf Road, Paddington, London W2 1NY, England (wears@ufl.edu).

See also pp 1197 and 1223.

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(Reprinted) JAMA, March 9, 2005—Vol 293, No. 10   1261

Downloaded from www.jama.com at National Institute of Hlth on August 19, 2009

Two-thirds of studies on clinical decision support systems revealed improvement, but …

- Reports are biased, improvements only noted by internal (not external) reviewers.

- Some technologies (e.g., computerized ordering) introduce more errors than they resolve.

- Applications rarely scaled up

"What can people do?"

Ben Shneiderman
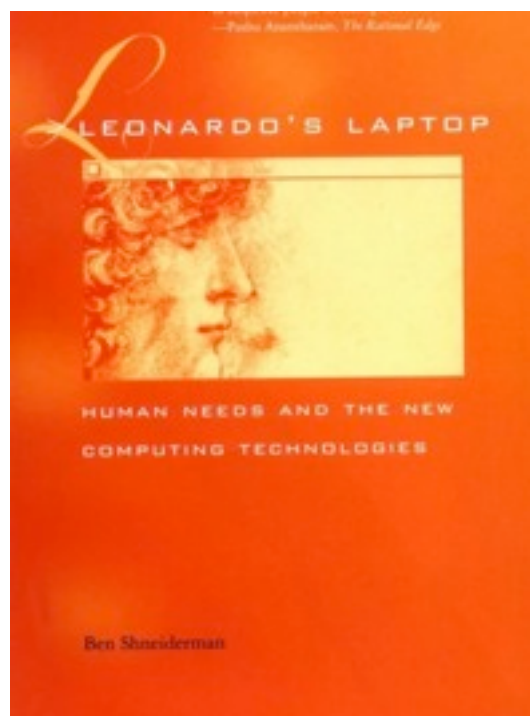
A transformation from "old computing" to "new computing:"

- A shift in what users value

- A shift from machine-centered automation to user-centered services and tools

Health I.T. is About Patient Outcomes

David Brailer, M.D.
First National Coordinator for Health Information Technology (2004-2006) and Chairman, Health Evolution Partners

"Everyone thought Health I.T. was about computers, but we've refined that to say that IT is about healthcare — it's about the experience we really have."

-David Brailer, 2005

National Research Council Report

January 2009

Computational Technology for Effective Health Care advocates re-balancing the portfolio of investments in health care IT

- Greater cognitive support for physicians, patients, and caregivers

- Observing user-centered design principles

- Accelerating research related to health care in the computer and social sciences and in health/biomedical informatics

American Recovery and Reinvestment Act of 2009
$19 Billion

TITLE XIII—HEALTH INFORMATION TECHNOLOGY

SEC. 13001. SHORT TITLE; TABLE OF CONTENTS OF TITLE.

(a) SHORT TITLE.—This title (and title IV of division B) may be cited as the "Health Information Technology for Economic and Clinical Health Act" or the "HITECH Act".

(b) TABLE OF CONTENTS OF TITLE.—The table of contents of this title is as follows:

Sec. 13001. Short title; table of contents of title.

Subtitle A—Promotion of Health Information Technology

PART 1—IMPROVING HEALTH CARE QUALITY, SAFETY, AND EFFICIENCY

Sec. 13101. ONCHIT; standards development and adoption.

"TITLE XXX—HEALTH INFORMATION TECHNOLOGY AND QUALITY

"Sec. 3000. Definitions.

American Recovery and Reinvestment Act of 2009
$19 Billion

TITLE XIII—HEALTH INFORMATION TECHNOLOGY

SEC. 13001. SHORT TITLE; TABLE OF CONTENTS OF TITLE.

(a) SHORT TITLE.—This title (and title IV of division B) may

- Key goals*:
  - Improve quality, safety, & efficiency
  - Engage patients & their families
  - Improve care coordination
  - Improve population and public health; reduce disparities
  - Ensure privacy and security protections

*Adapted from National Priorities Partnership. National Priorities and Goals: Aligning Our Efforts to Transform America's Healthcare. Washington, DC: National Quality Forum; 2008.

Accelerating Success Against Cancer

Clifton Leaf on the Charlie Rose Show: April 29, 2004

Clifton Leaf on the Charlie Rose Show:
April 29, 2004

565,650 deaths

Cancer Facts & Figures 2008

WA 32,380
OR 19,230
MT 5,090
ID 6,430
WY 2,570
ND 3,090
MN 23,160
NH 7,030
VT 3,530
ME 8,140
MA 34,470
NY 97,130
RI 6,120
CT 19,190
NV 11,370
UT 7,760
CO 18,900
SD 4,080
WI 27,590
MI 51,150
PA 70,110
NJ 45,900
DE 4,590
MD 27,380
DC 2,560
CA 156,530
NE 8,710
IA 16,150
IL 59,130
IN 29,550
OH 56,840
WV 10,250
VA 35,590
AZ 25,540
NM 8,260
KS 12,520
MO 29,390
KY 23,270
NC 40,420
OK 17,860
AR 14,840
TN 29,390
SC 20,740
MS 13,400
AL 22,340
GA 36,980
TX 96,320
LA 23,360
FL 101,920
AK 2,650
HI 6,310
US 1,437,180
PR N/A

Newsweek

BETWEEN THE LINES | **Jonathan Alter**

What the Next President Can Do

If a war were killing 565,000 Americans a year, you'd hear more than one or two references to it at the party conventions.

Published Sep 6, 2008
From the magazine issue dated Sep 15, 2008

From the Editors (2)
- Rethinking the War on Cancer
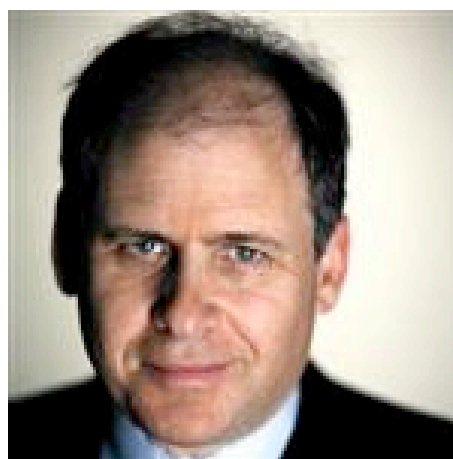- Alter: Why Sarah Palin Is Likely to Belly-
- ▼ See All

Recommended (6)
- Samuelson: The Attack on American Affluence
- ▼ See All

Topics (2)
- John McCain
- Barack Obama
- ▼ See All

I'm a four-year cancer survivor, and when people inquire how I'm feeling nowadays I say "good" and sincerely thank them for asking. But some well-wishers respond awkwardly. One politician I know has me in his mental file under "cancer" and accompanies his hearty hello with "Glad you beat it!" As anyone who has had advanced cancer can tell you, this is understandable but unhelpful. It also reflects why politicians are still so out of touch about the disease.

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THE OBAMA-BIDEN PLAN TO COMBAT CANCER

Nearly 1.5 million Americans are expected to be diagnosed with cancer this year, joining over 10 million Americans who have experienced cancer in their lifetime.[1] Fighting cancer cost families and businesses $78 billion in medical costs last year, and the overall cost of cancer to our economy was estimated to be over $200 billion.[2]   Barack Obama understands firsthand the toll cancer takes on families – his mother died from ovarian cancer in her early 50s and his grandfather battled prostate cancer. Barack Obama has spent his career fighting to improve prevention and treatment of cancer. As an Illinois State Senator, Obama passed laws to mandate insurance coverage of colorectal cancer examinations, ensure Medicaid coverage for treatment of breast and cervical cancers, promote early detection of prostate and testicular cancers, and helped create the Illinois Task Force on Cervical Cancer Elimination. As United States Senator, he has fought for increased funding for cancer research, and championed genomics and personalized medicine to identify new and better treatments for cancer and other diseases. As president, Barack Obama will build upon his career-long efforts and launch a new campaign to combat cancer and provide greater lifetime support to cancer survivors and their families.

Double Funding for Cancer Research: The National Institutes of Health (NIH), National Cancer Institute (NCI) and Centers for Disease Control and Prevention (CDC) have made significant advances in understanding cancer biology, and translating that knowledge into effective prevention programs, diagnostics, treatments and cures. Notably, this knowledge has also benefited individuals with other diseases, such as autoimmune disorders. Despite these advances, cancer funding has stagnated in recent federal budgets.[3] Barack Obama and Joe Biden are committed to reversing this trend, and providing our nation's scientists with the resources they need to expand and accelerate bench-to-bedside research that will lead to enhanced prevention and diagnostic tools and innovative treatments. The Obama-Biden plan will double federal funding for cancer research within 5 years, focusing on NIH and NCI. Obama and Biden will also work with Congress to increase funding for the

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Access to preventive care

Evidence-based quality improvement

Support advances in personalized medicine

Improve federal coordination of research, treatment, and awareness

Provide new supports for cancer survivors and their families

OBAMA BIDEN
WWW.BARACKOBAMA.COM

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Ensure All Americans Have Affordable, Accessible and Quality Health Care: Individuals who lack health insurance or are underinsured receive fewer preventive cancer screenings, have a greater likelihood of being diagnosed with late stages of cancer, and experience poorer health outcomes than cancer patients who have adequate insurance.[4] The Obama-Biden administration will ensure affordable health coverage for all Americans. His plan maintains patient choice, and establishes a National Health Insurance Exchange with a range of private insurance options as well as a new public health plan to allow individuals and small businesses to buy affordable and accessible health coverage similar to that available to federal employees. The Obama-Biden health plan will provide tax credits to people so they can afford health care and will reduce the typical family's medical expenditures by $2,500 per year while providing them with more health care options and greater security.

Ensure All Americans Have Access to Preventive Health Care: The Obama-Biden health plan will ensure that all Americans have access to preventive health care services. Their proposal creates a voluntary national pool, the National Health Insurance Exchange, comprised of a range of private plans and a new public plan.
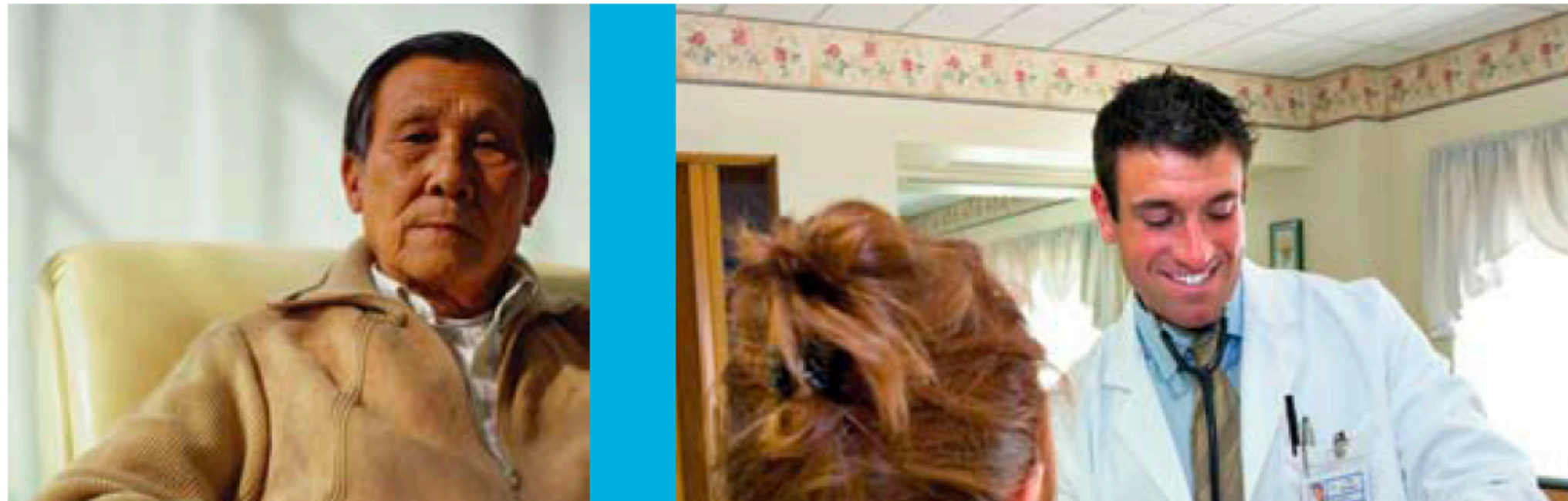
NCI Cancer Center Directors' Report, 2006

Economists at UIC: 1% reduction in cancer deaths = $400 billion savings

and 3) re-engineering the clinical research enterprise and incorporating community-based physicians, in order to place more patients in innovative clinical trials. The Nation's Cancer Centers and academic cancer research programs are leading the way in all three of these areas, and have been doing so for decades. By their very nature, research programs in NCI-designated Cancer Centers bring together basic, clinical, and population scientists to focus on cancer. Since their inception, the Cancer Centers have been peer-reviewed and scored by NCI based upon the strength of their
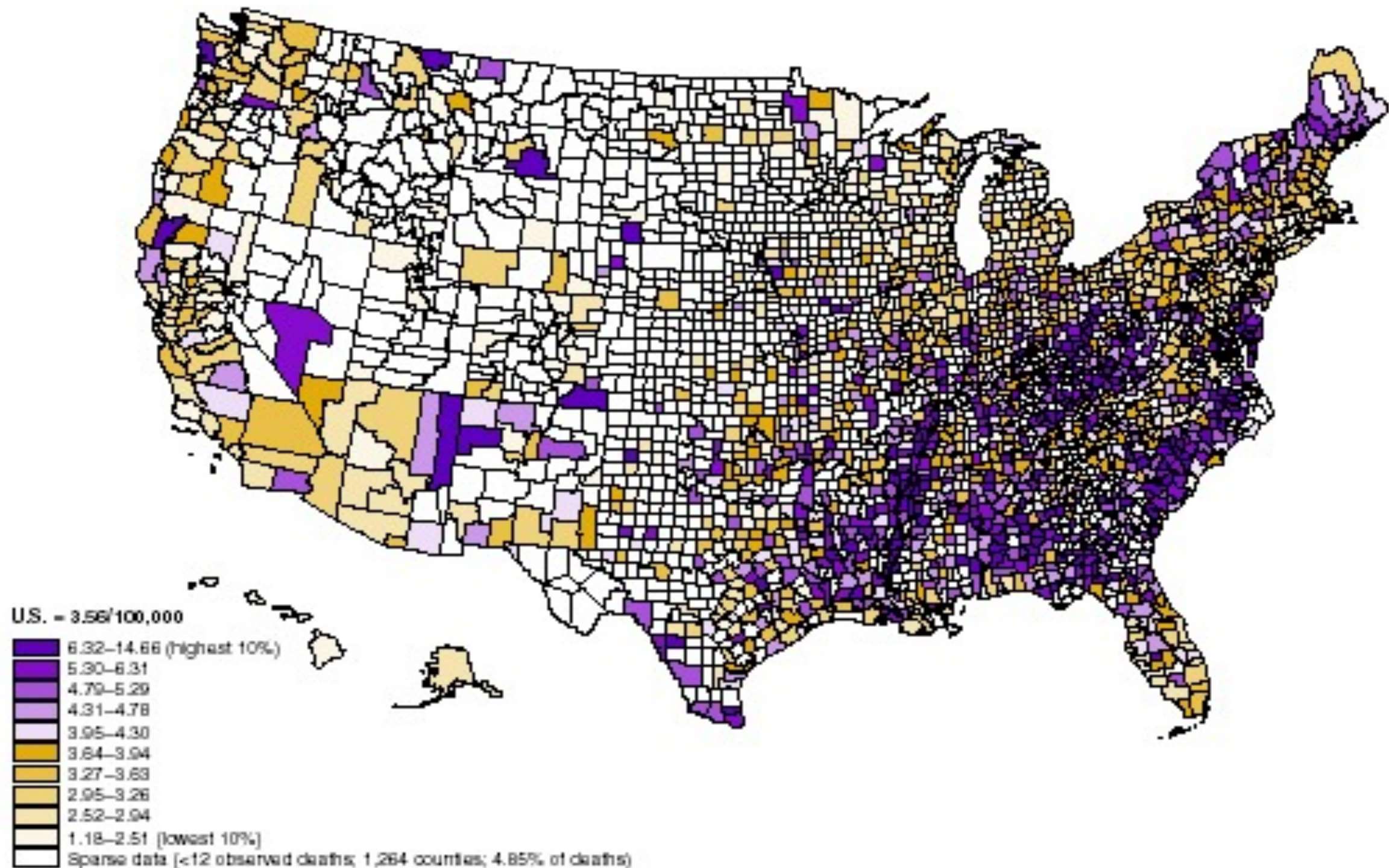
and cancer is a disease whose risk increases with aging. <u>We can substantially reduce deaths from cancer just by broadening the application of knowledge we have today. By expanding our knowledge through further research, even greater gains are well within our reach.</u>

The total impact of cancer on health is high. It was recently reported that for Americans under the age of 85, cancer is the leading cause of death. The American Cancer Society reported that last year there were 1,399,790 new cases of cancer and 564,830 deaths. Economists at the University of
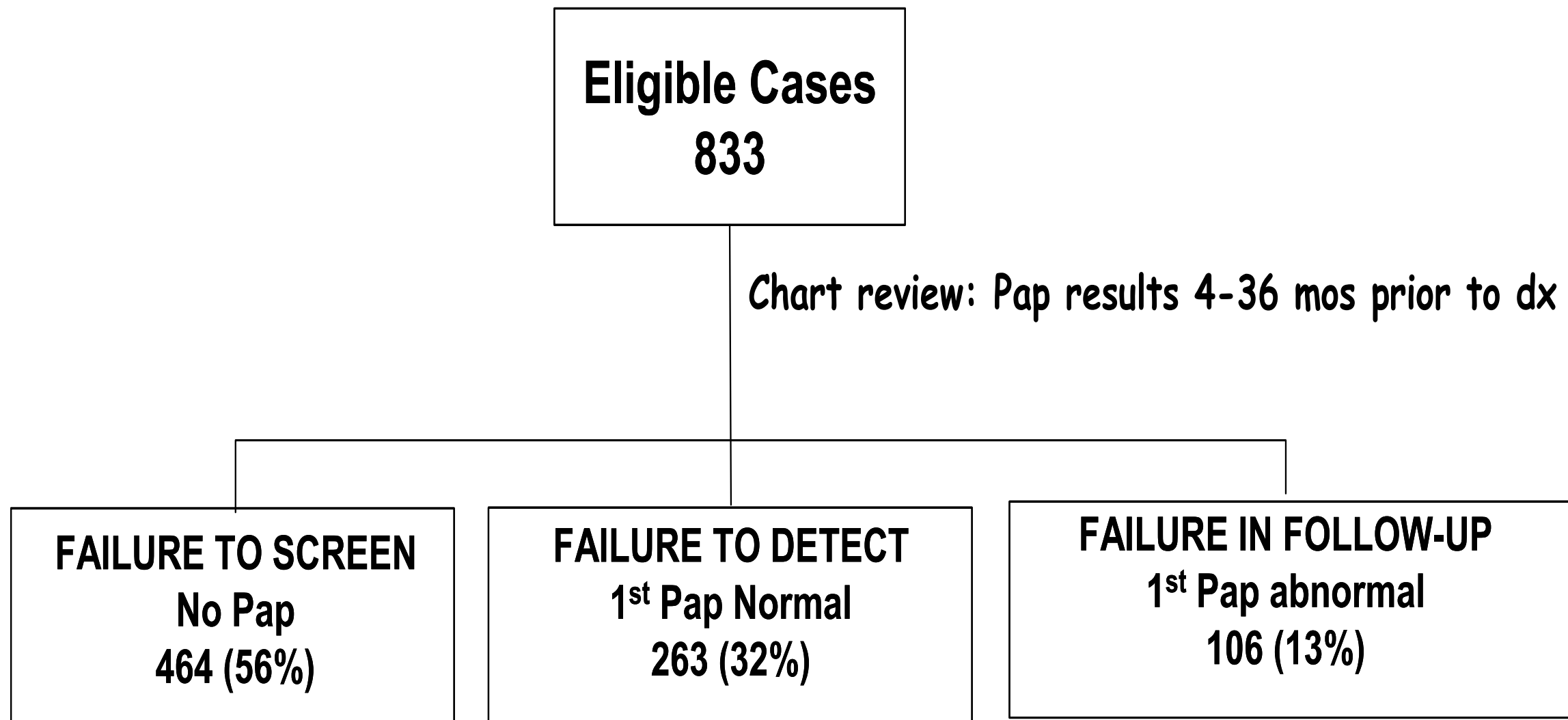
"We can substantially reduce deaths from cancer just by broadening the application of knowledge we have today..."

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"E.g., No One Should Die from Cervical Cancer in 21st Century"

Map 1. Cancer Mortality Rates by County (Age-adjusted 1970 U.S. Population)
Cervix Uteri: All Races, Females, 1970–1998

U.S. = 3.56/100,000

6.32–14.66 (highest 10%)
5.30–6.31
4.79–5.29
4.31–4.78
3.95–4.30
3.64–3.94
3.27–3.63
2.95–3.26
2.52–2.94
1.18–2.51 (lowest 10%)
Sparse data (<12 observed deaths; 1,264 counties; 4.85% of deaths)

Case Report: Late Stage Cervical Cancer

Eligible Cases
833

Chart review: Pap results 4-36 mos prior to dx

FAILURE TO SCREEN
No Pap
464 (56%)

FAILURE TO DETECT
1st Pap Normal
263 (32%)

FAILURE IN FOLLOW-UP
1st Pap abnormal
106 (13%)

Source: Leyden WA, Manos MM, Geiger AM, Weinmann S, Mouchawar J, Bischoff K, Yood JG, Taplin SH (2005). Cervical cancer in women with comprehensive health care access: Attributable factors in the screening process. JNCI, 97(9), 675-683.

Monday, August 24, 2009

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Cancer Burden

Life Span

Birth

Natural Death

Etiology & Progression of Cancer

Bradford W. Hesse
National Cancer Institute

Cancer Burden

Lethal Phenotype

Evolution/
Progression

Death
Due to
Cancer

Malignant
Transformation

Susceptibility

Pre-initiation

Birth

Life Span

Natural
Death

Monday, August 24, 2009

Avert or Delay its Onset

Susceptibility

Birth

Life Span

Natural Death

Figure E2. U.S. death rates for common cancers: 1975-2003

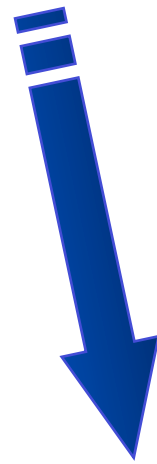Figure E2. U.S. death rates for common cancers: 1975-2003

Death
Due to
Cancer

Pre-initiation

Birth

Life Span

Natural
Death

National Cancer Institute

colonoscopy (KOH-luh-NOS-koh-pee)

Examination of the inside of the colon using a colonoscope, inserted into the rectum. A colonoscope is a thin, tube-like instrument with a light and a lens for viewing. It may also have a tool to remove tissue to be checked under a microscope for signs of disease.

Enlarge

Colonoscopy

Colon

Rectum
Colonoscope — Anus

Detect and Eradicate its Presence

Pre-initiation
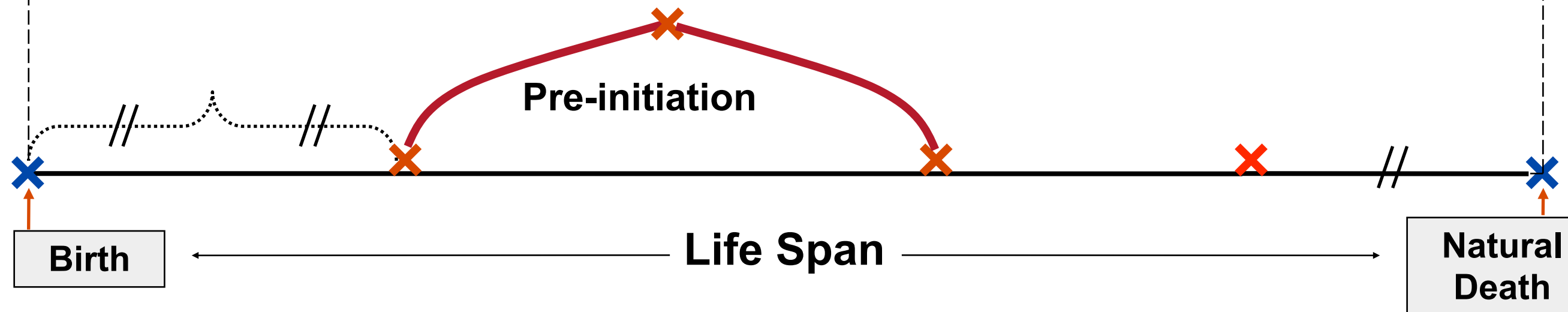
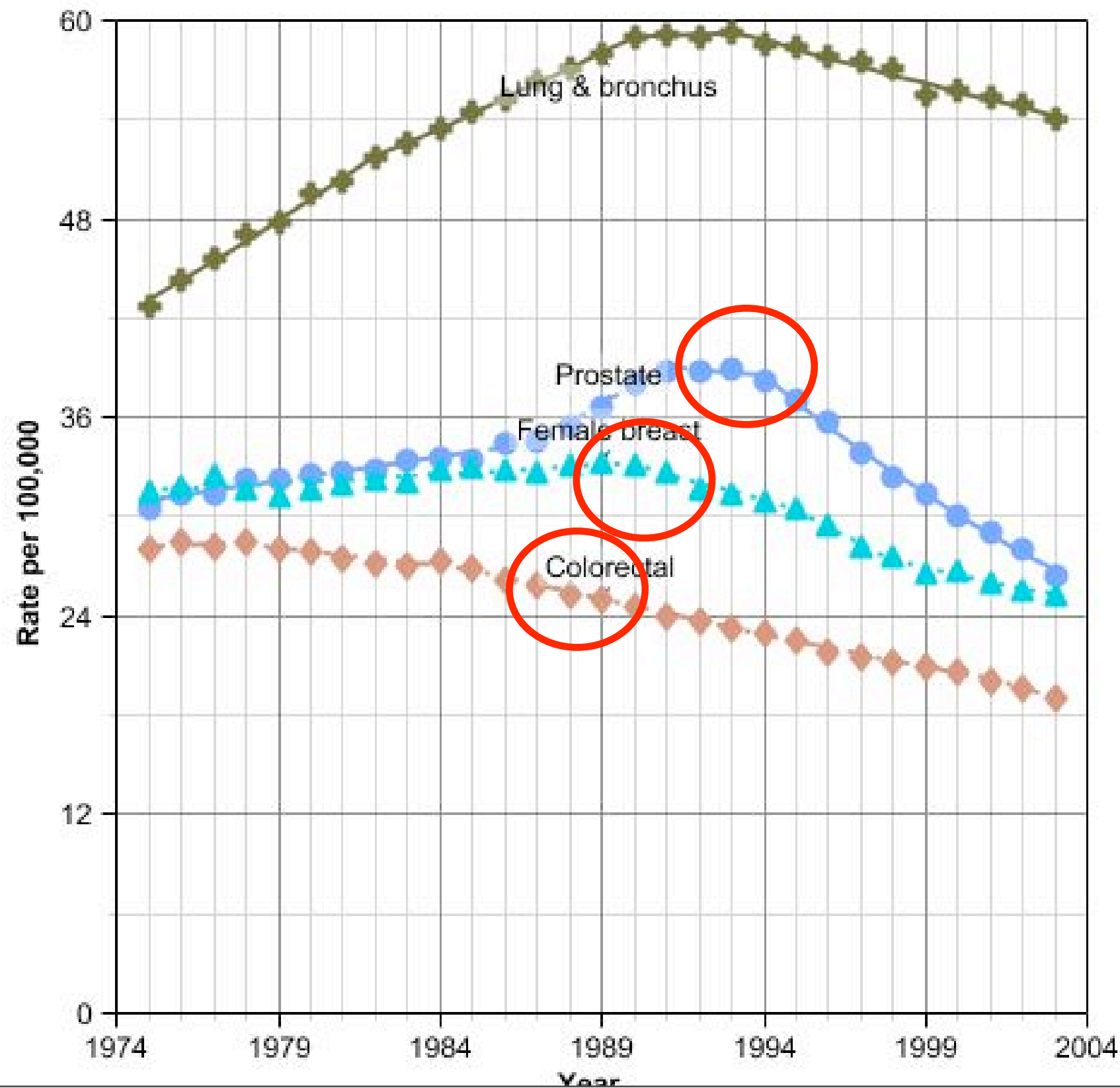**Birth**

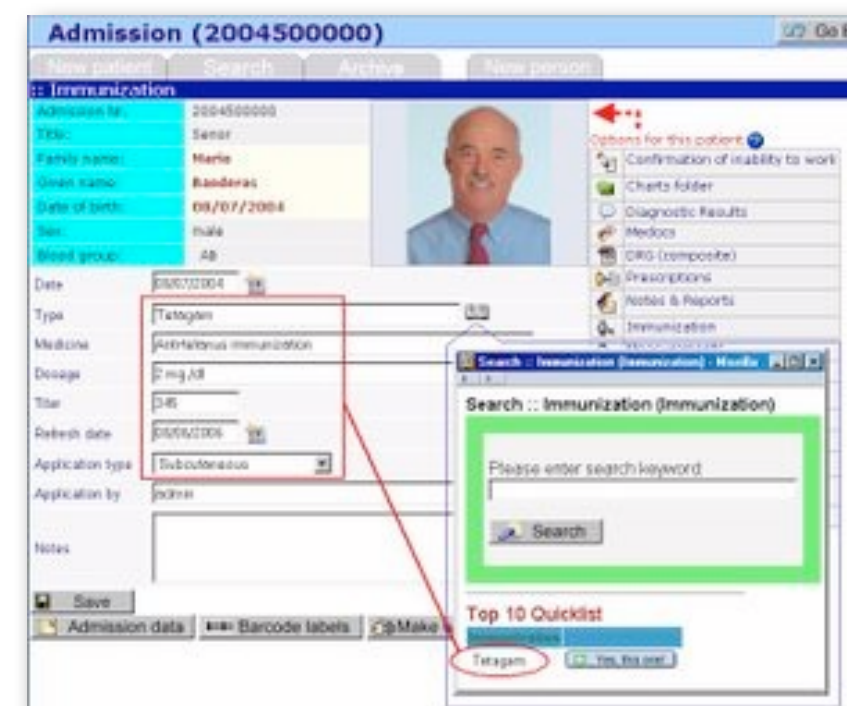**Life Span**

Natural Death

Monday, August 24, 2009

Figure E2. U.S. death rates for common cancers: 1975-2003
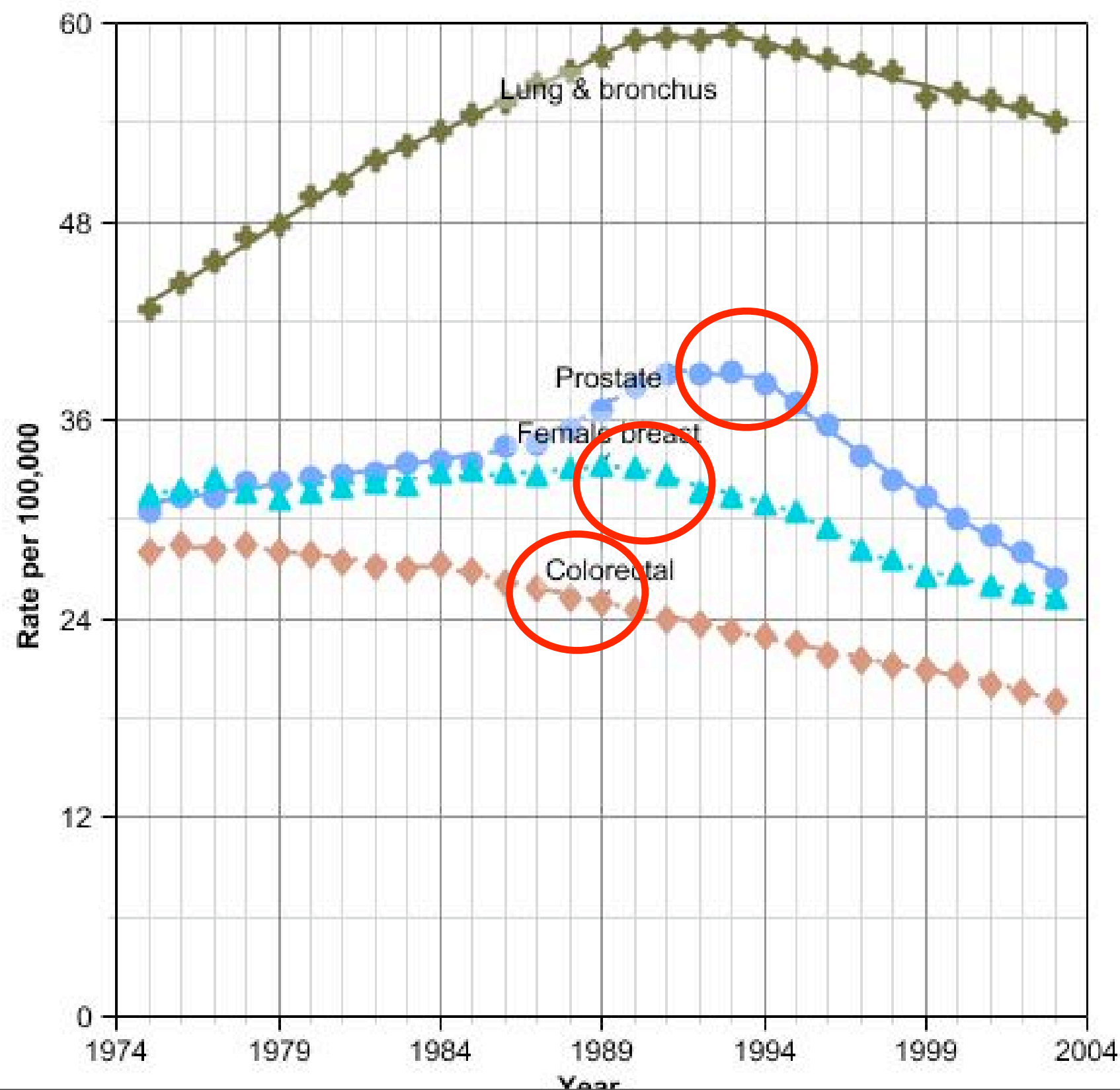
Figure E2. U.S. death rates for common cancers: 1975-2003
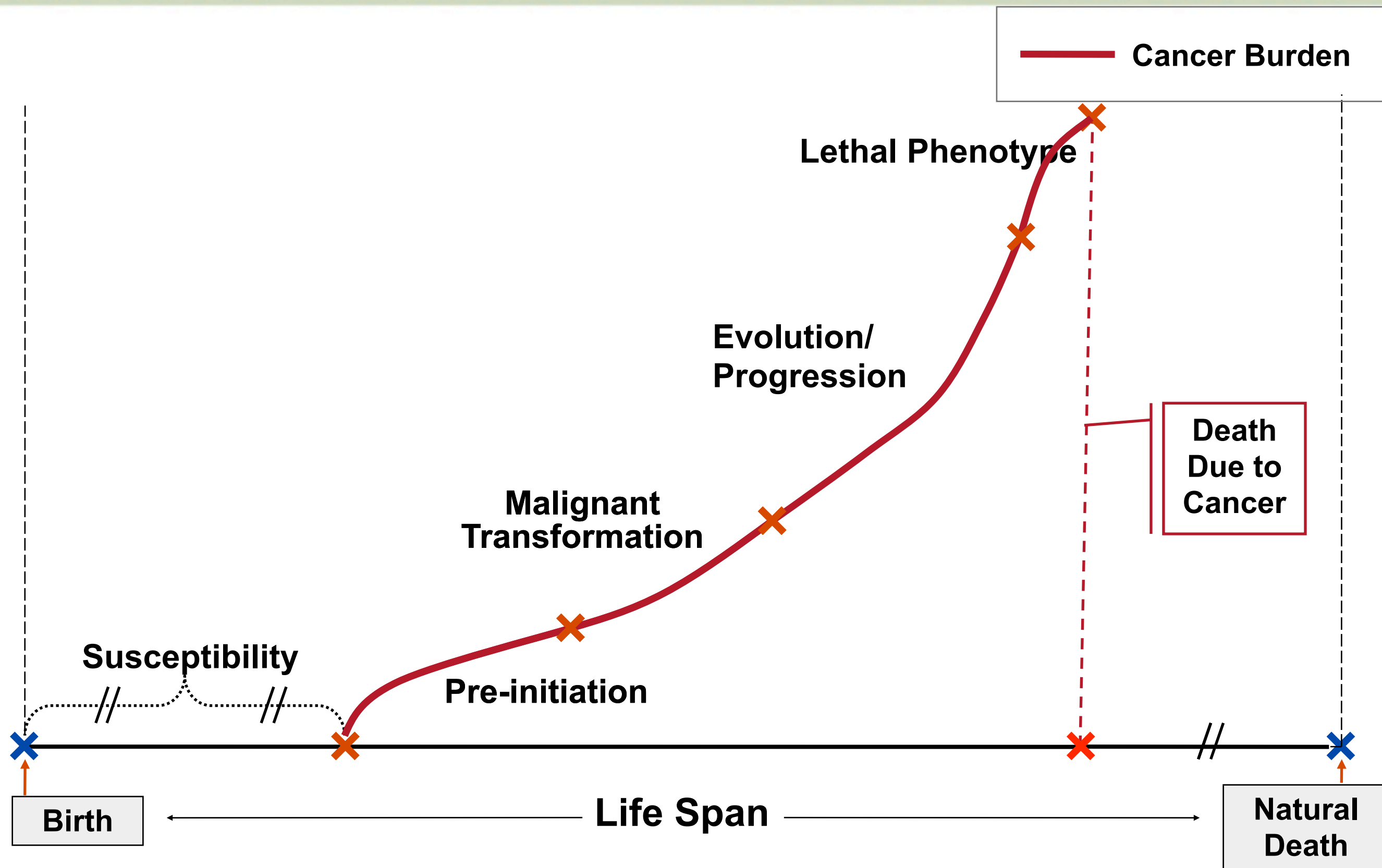
"Moving toward a streaming, life-sensitive medical record – where data are collected continuously over a life time."
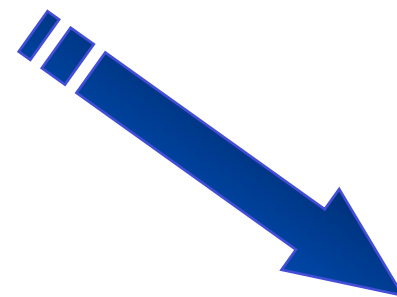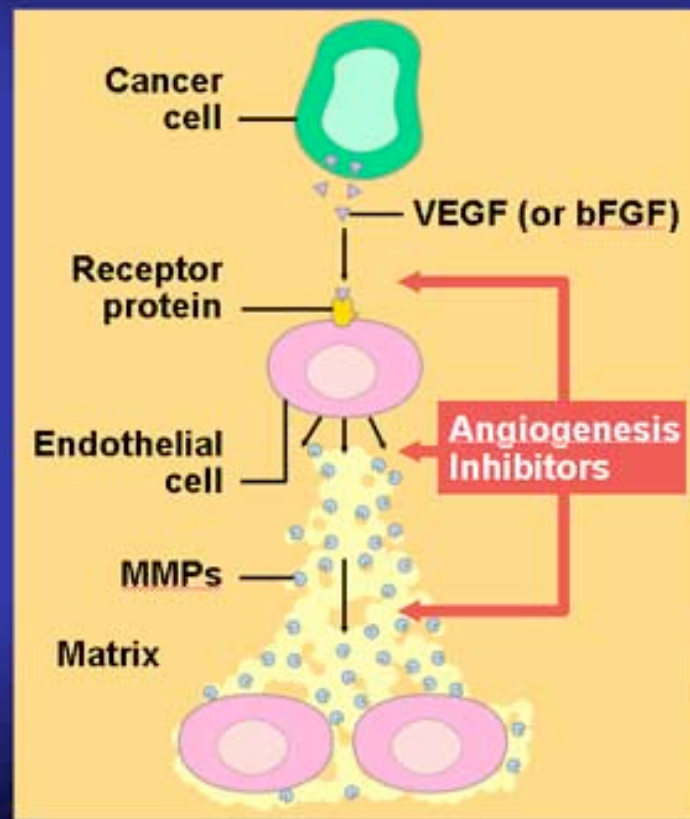
-Dr. David Brailer
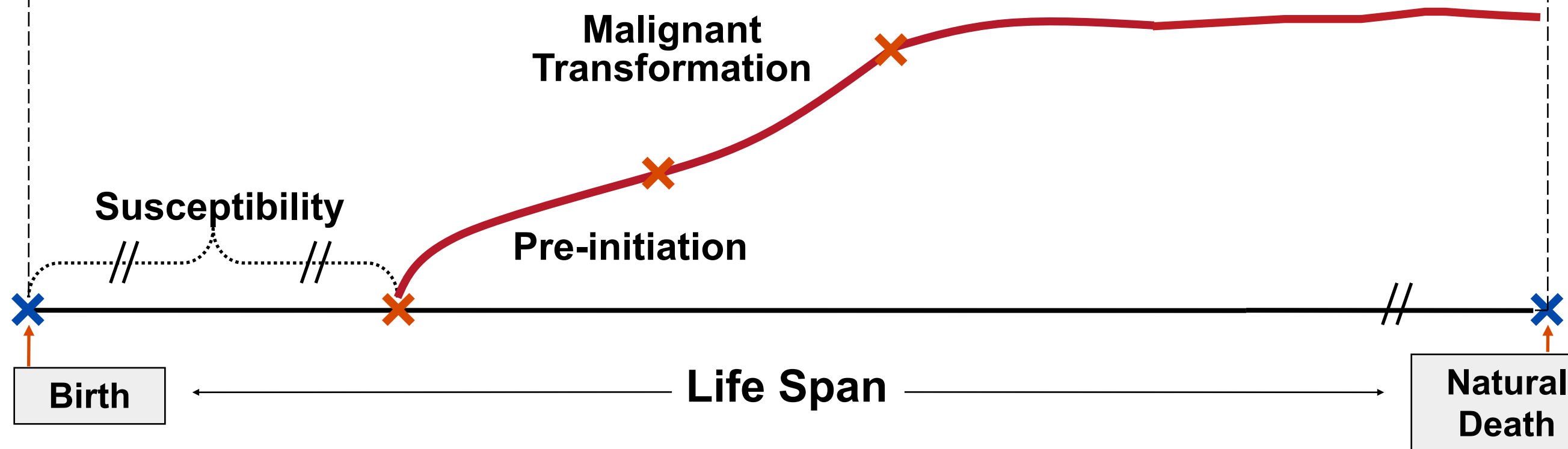
Comprehensive Health Enhancement Support System (CHESS): Lung Cancer Support Module
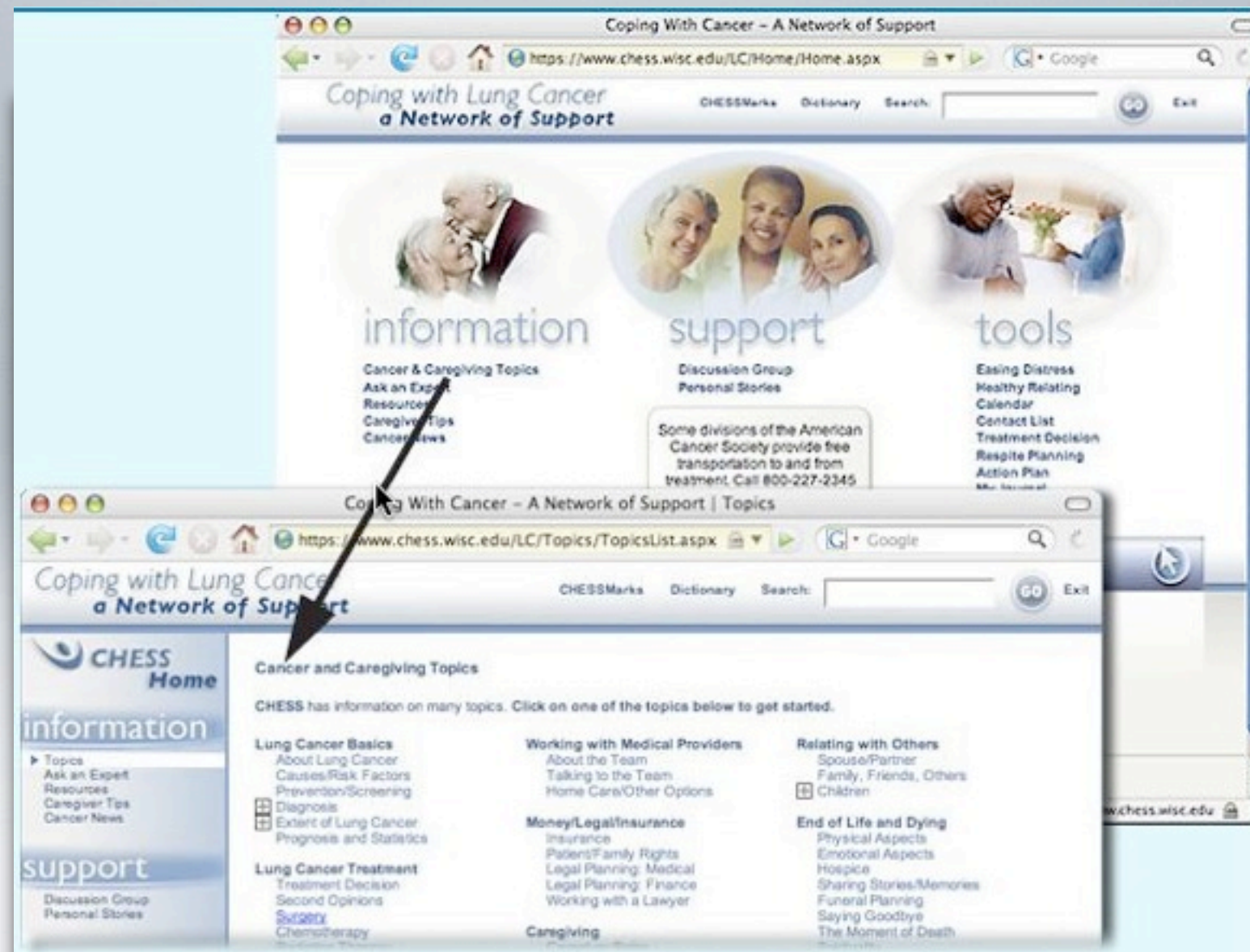
Comprehensive Health Enhancement Support System (CHESS): Lung Cancer Support Module
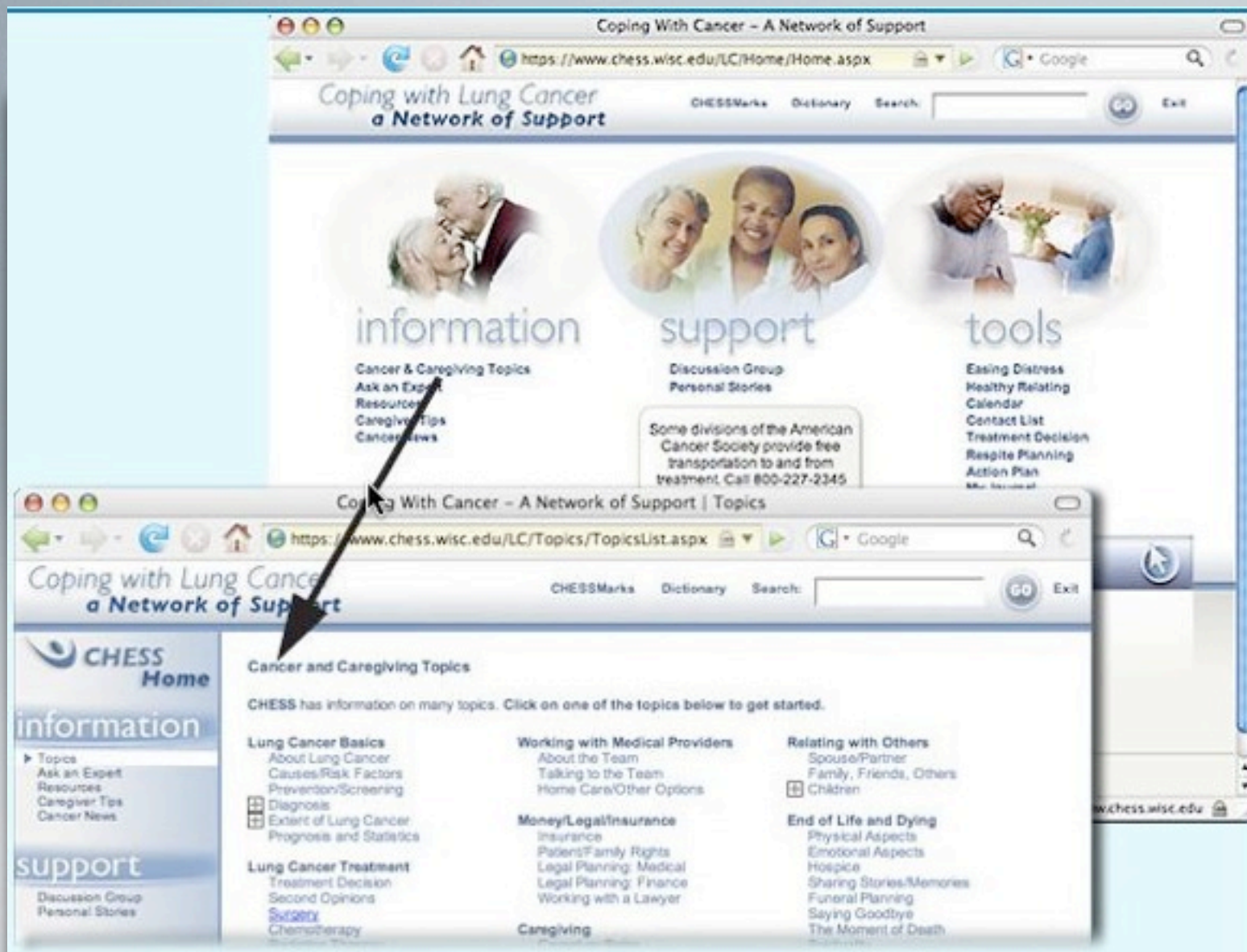
What is the Role of Human Systems Integration Research?

Improving Quality in Health Care
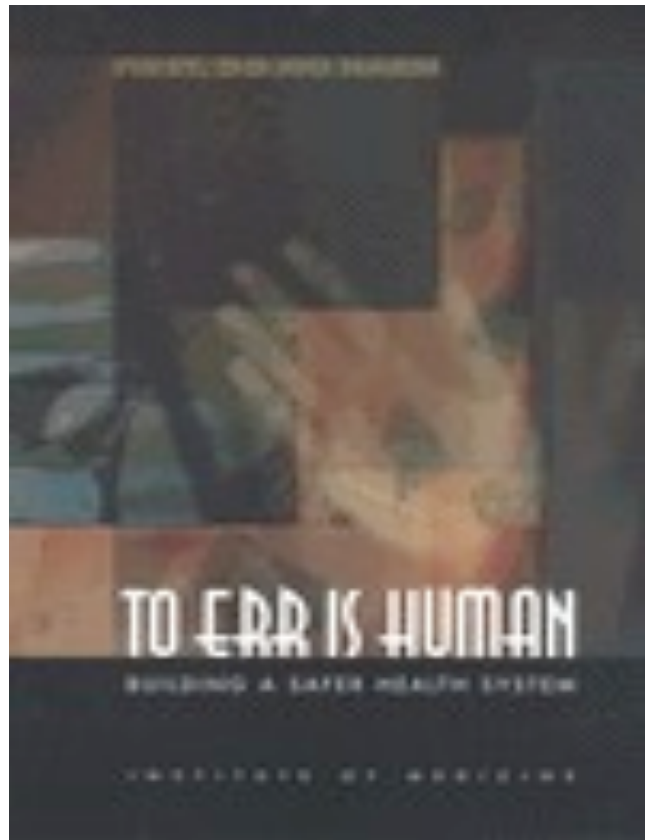
Deliver Care that is:

- Safe
- Effective (Evidence-based)
- Patient-centered
- Equitable
- Timely
- Efficient

Users within Healthcare

Health Care Environment

- Hospital
- HMO
- PPO

Care Delivery Team

Physician

Patient

Family & Friends

- Churches
- Community
- Services
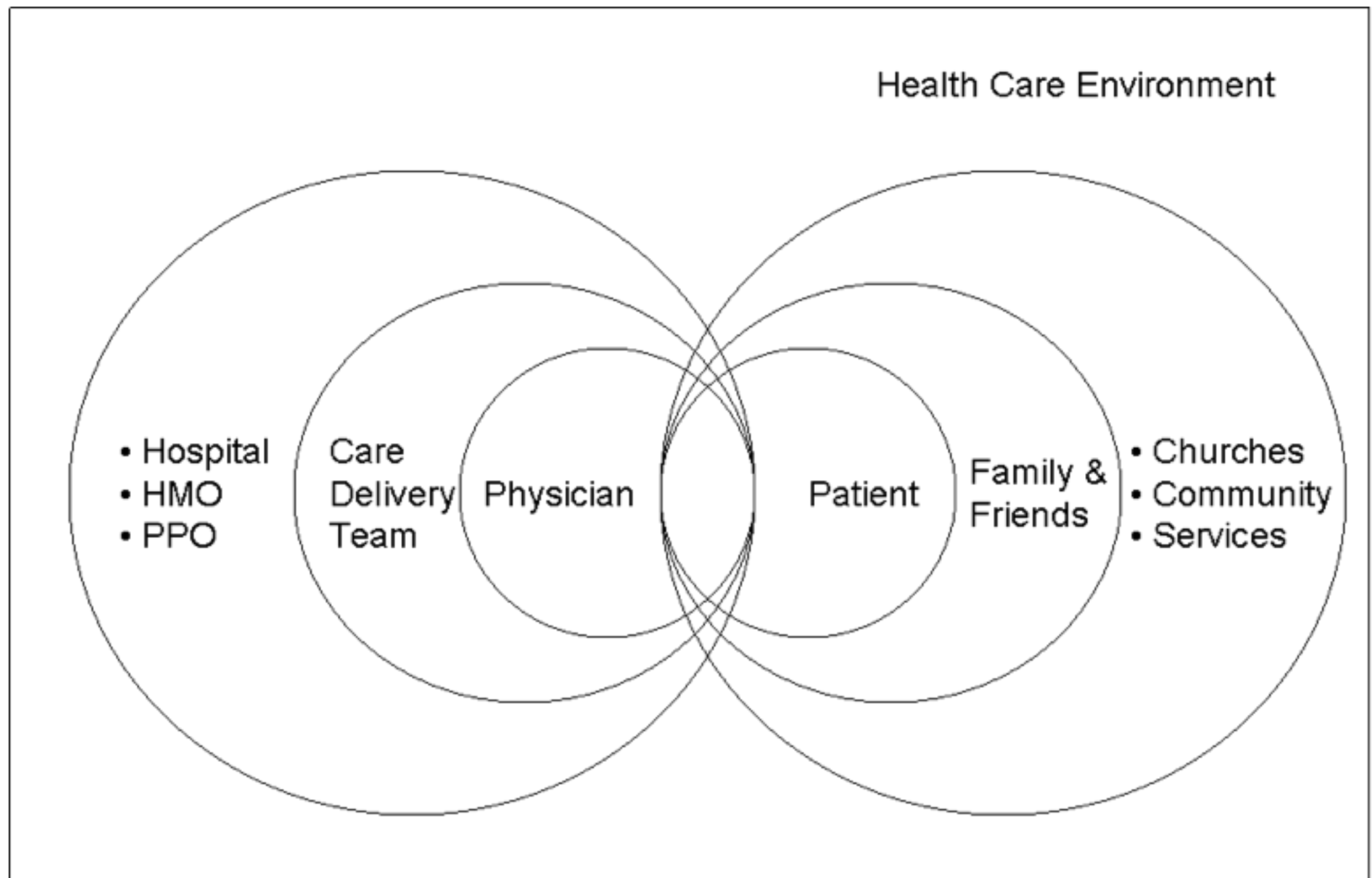
Goal: Safety

Patient/Family ⬌ Physician/Team

Patient/Family

- Usable design on all patient interfaces
- Patient as participant in safety management
- Systems accessible 24 X 7

Physician/Team

- Human factors engineering to prevent error
- Coordinated system of safeguards
- Culture of safety

E.g. Redesigned Pill Bottle (Target)

Error Prevention in Electronic Systems

Goal: Effectiveness (Evidence-based)

Patient/Family ⟷ Physician/Team

Patient/Family

- Informed, healthy public
- "Vital Information" available as needed to guide decision making

Physician/Team

- Practice anchored on medical evidence
- Displays ensure effective use of data
- Health I.T. puts the right information into hands of medical team at the right time

Trusted, Reliable Sources

Research needed on effective displays
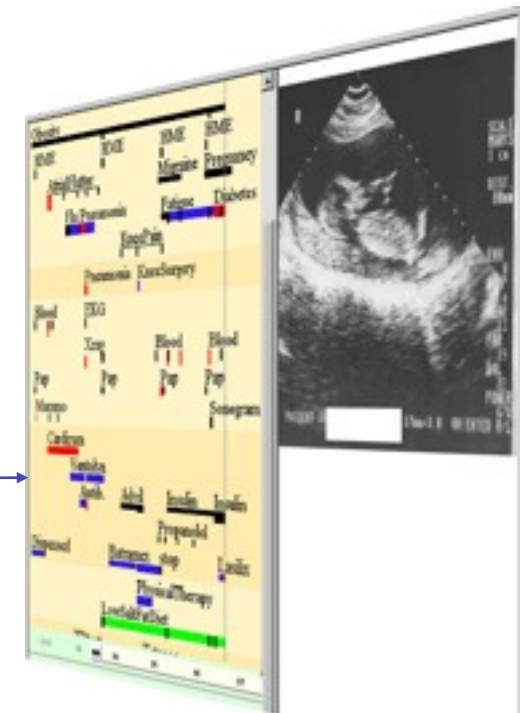
Goal: Patient-Centered

Patient/Family ⇔ Physician/Team

Patient/Family

- Activated, empowered patient

- Patient has access to, and control over, personal health information

- Care is equitable throughout population

Physician/Team

- Coordinated systems of care

- Personalized health care oriented to needs of patient

- Communication centered on improving outcomes, quality of life

Personal Health Record guides decision making

Personalized delivery of health care

Goal: Timely

Patient/Family ⇔ Physician/Team

Patient/Family

- Time as "currency of 21st Century"

- "Healing Relationships" over time

- Efficient balance of in-office, out-of-office resources

Physician/Team

- Clinical systems support work flow

- Reminder systems ensure that all steps are followed in sequence of care

AMERICAN COLLEGE OF PHYSICIANS

INTERNAL MEDICINE

HOME | SITE MAP | SEARCH

ip | Clinical Information | Your Practice | Advocacy | CME/Meetings | ABIM/

Internists to Write Patients "Prescriptions for Information"

ACP Foundation and National Library of Medicine Launch National Consumer Information Program For Internists and Their Patients
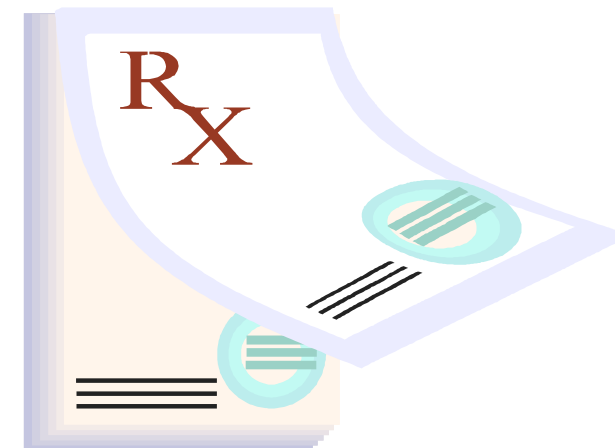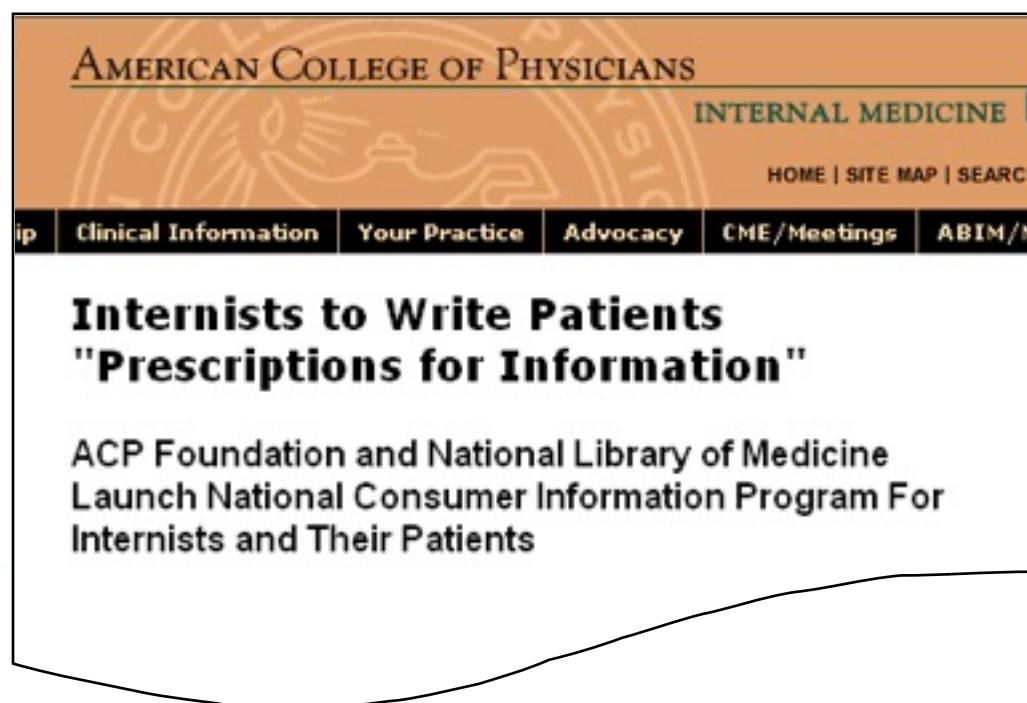
Goal: Equity

Patient/Family ⟺ Physician/Team

- "Universal Design" addresses health literacy issues

- Communication reach extended to bridge "knowledge gaps"

- Trust is high in equitable systems of care

- Clinical information systems enforce uniform standards of care

- Support systems offer culturally sensitive linkages

How can information systems be used to ensure high quality delivery to all segments of population?

Map 1. Cancer Mortality Rates by County (Age-adjusted 1970 U.S. Population)
Cervix Uteri: All Races, Females, 1970–1998
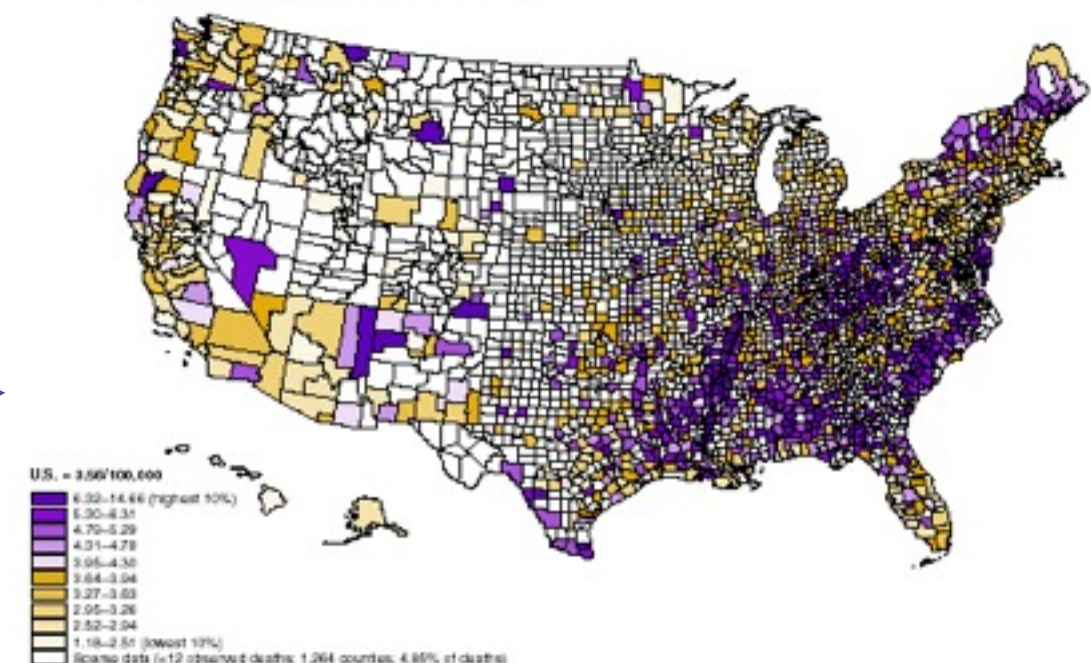
Patient/Family ⇔ Physician/Team

- Focus on relationship minimizes unproductive interactions
- Information is available as needed
- Connective technologies improve support among caregivers

- Coordination between systems is reliable and seamless
- Efficiencies in delivery improve cost-effectiveness

How can information systems be used to deliver interventions in cost-effective ways?

EXHIBIT 2
Changes In Office Visit Versus Telephone Visit Rates Among Kaiser Permanente (KP) Hawaii Members, 1999–2007

Visits per member

- Electronic health record implemented
- Office visits
- Scheduled phone visits

(Years: 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007)
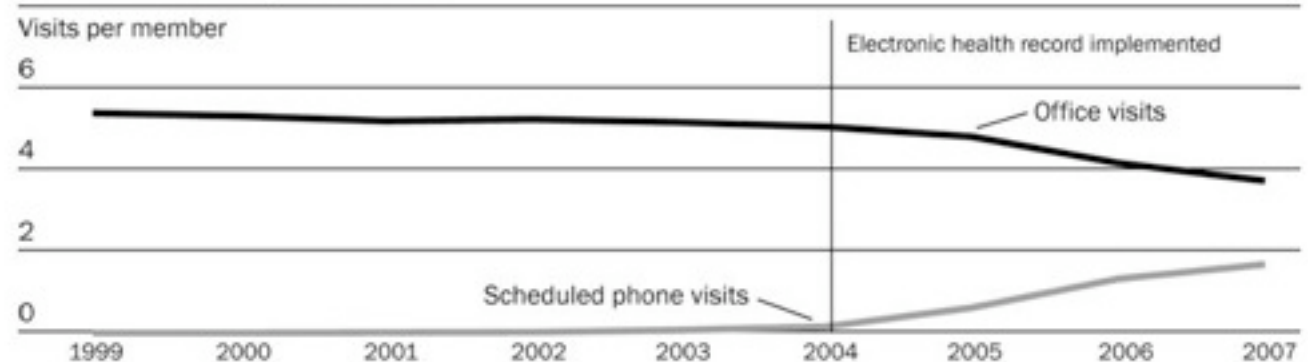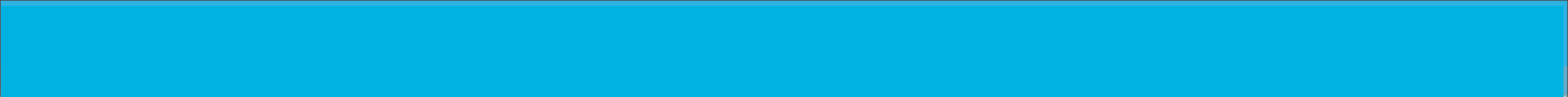
SOURCE: Authors' analysis using data from the Kaiser Permanente Hawaii Data Warehouse and secure messaging database.

HEALTH AFFAIRS

Catherine Chen, Terhilda Garrido, Don Chock, Grant Okawa, and Louise Liang, The Kaiser Permanente Electronic Health Record: Transforming And Streamlining Modalities Of Care, Health Affairs, Vol 28, Issue 2, 323-333

Closing Thoughts

"Medicine used to be *simple*, *ineffective*, and relatively *safe*.

Now it is *complex*, *effective*, and potentially *dangerous*."

§ Chantler, Cyril. The role and education of doctors in the delivery of health care. Lancet 1999; 353:1178-81.

People & Technology: Sociotechnical Design

Computer Technology and Clinical Work
Still Waiting for Godot

Robert L. Wears, MD, MS

Marc Berg, MA, MD, PhD

PROCESS-SUPPORTING INFORMATION TECHNOLOGY (IT) has been heralded as an important building block in attempts to improve the quality and safety of health care. Two areas in particular have drawn both attention and funding. The first is clinical decision support; that is, information systems designed to improve clinicians' decision making. The second is computerized physician order entry (CPOE) as a means for reducing medication errors. The l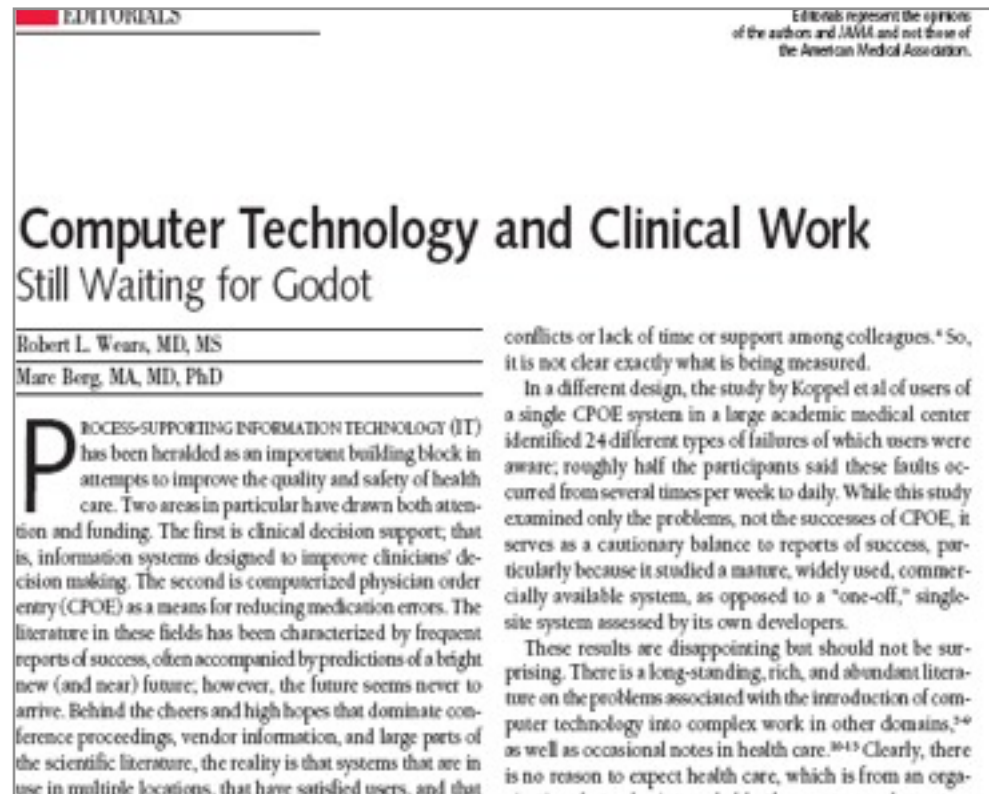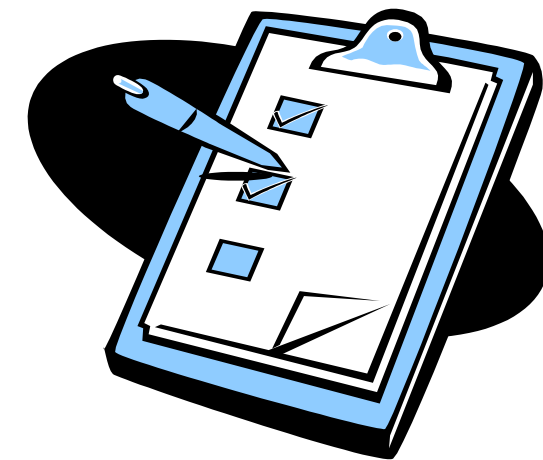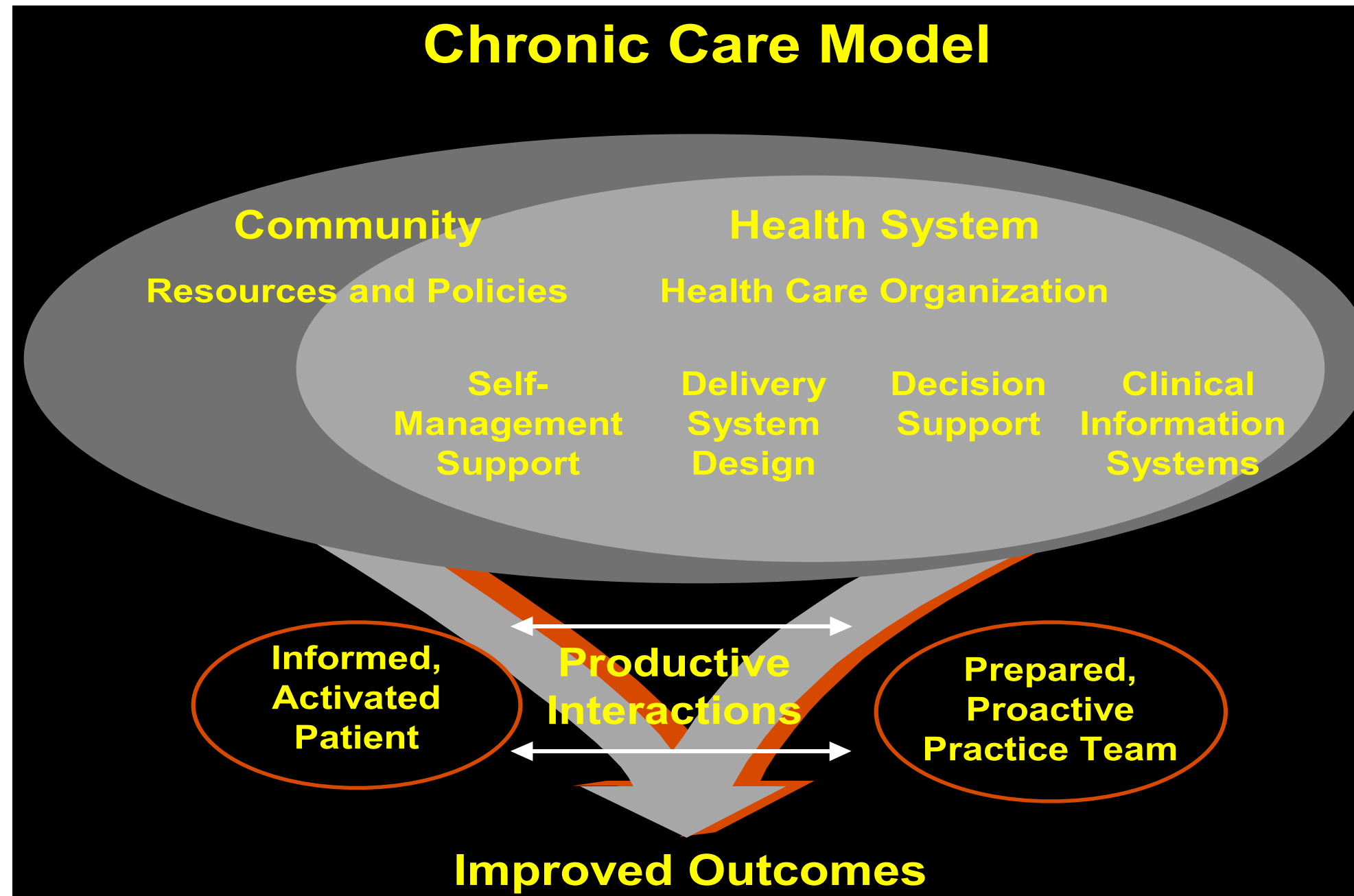iterature in these fields has been characterized by frequent reports of success, often accompanied by predictions of a bright new (and near) future; however, the future seems never to arrive. Behind the cheers and high hopes that dominate conference proceedings, vendor information, and large parts of the scientific literature, the reality is that systems that are in use in multiple locations, that have satisfied users, and that

conflicts or lack of time or support among colleagues.⁶ So, it is not clear exactly what is being measured.

In a different design, the study by Koppel et al of users of a single CPOE system in a large academic medical center identified 24 different types of failures of which users were aware; roughly half the participants said these faults occurred from several times per week to daily. While this study examined only the problems, not the successes of CPOE, it serves as a cautionary balance to reports of success, particularly because it studied a mature, widely used, commercially available system, as opposed to a "one-off," single-site system assessed by its own developers.

These results are disappointing but should not be surprising. There is a long-standing, rich, and abundant literature on the problems associated with the introduction of computer technology into complex work in other domains,³⁻⁹ as well as occasional notes in health care.¹⁰⁻¹³ Clearly, there is no reason to expect health care, which is from an orga-

Early evidence is riddled with failure in delivering on quality objectives through Information Technology solutions alone

☑Technical systems have social consequences

☑ Social systems have technical consequences

☑ We don't design technology, we design sociotechnical systems

☑ Understand how people and technologies interact

Chronic Care Model

Community — Resources and Policies

Health System — Health Care Organization

- Self-Management Support
- Delivery System Design
- Decision Support
- Clinical Information Systems

Informed, Activated Patient

Productive Interactions

Prepared, Proactive Practice Team

Improved Outcomes

The "Activated Patient" from the *Chronic Care Model* (Wagner, 2004)*

*Source: Wagner EH. Chronic disease care. Bmj 2004; 328(7433):177-8.

Questions for Committee

- How can the methodologies of HSI be marshaled to improve system design?

- Can we elevate all "software maturity" processes in HIT to include HSI?

- Is medicine different from other sectors; will models for elevating HSI in other sectors work in medicine?

- How do we fund HSI work in medicine and informatics?

- Can we influence design before norms crystallize?