

**We Have No Choice:**

**Health Care Delivery Must be Improved:**

**The Key Lies In The Use of Operations Research**

**INFORMS Denver 2004 Conference**

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# **We will continue to move to new crises in Health Care Delivery in the United States (as well as in most or all other developed countries)**

- they will begin to surface strongly in the years 2005-2008 (probably in 2007 or 2008) and then they will continue to gain momentum unless war, terrorism or other major event is dominating the news.**



**Why do I believe this?**

**Because they will again become  
a major political agenda item**

**DRIVEN BY:**

- Costs
- Quality
- Technology
- Access
- Aging of Baby Boomers - 2011
- Social Security/Medicare Financial Crises



# Should we be Optimistic or Pessimistic about this?

- **Optimistic:** Because OR/MS has answers to many of these problems and the research capabilities to resolve many others
- **Somewhat Pessimistic:** Because OR/MS may not be at the table when the crises demand solution



# Where are we and what can be done?

- First: the crises areas:
  - Costs
  - Quality
  - Technology
  - Access
  - Aging of Baby Boomers
  - Social Security/Medicare Financial Crises
- Second: What OR/MS is doing and can do to help
- Third: What is now beginning to change



# COSTS





"Each of them is named after one of my medications."



# YEAR 2003

- Health Care spending per person in USA increased by 7.4% (\$1.6 trillion)
- US GDP grew by 3.8%
- Who paid: Employees and the Elderly!  
(Employers?)
  - Disposable wages →
  - Co-payments and deductibles ↑
  - Insurance premiums ↑
  - Medicare payments ↑



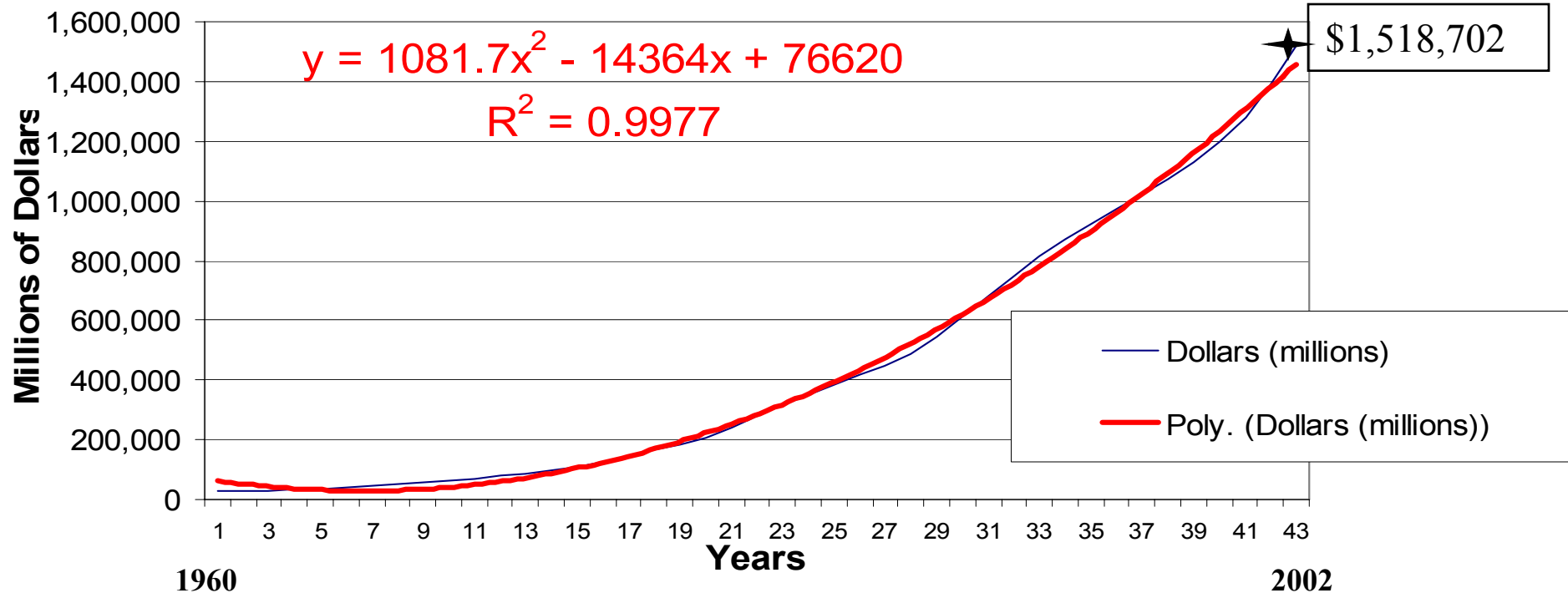


# YEAR 2004

- Health Care spending per person in USA has slowed slightly from 2002 to 2003 and may continue to do so this year
- May be slowing due to higher out of pocket costs to patients (demand elasticity) and to the slow growth of the economy
- Slowing not likely to continue in 2005-2006 as the economy further improves and labor markets get tighter



# Total U.S. Health Expenditures in Actual Dollars 1960-2002 (millions)

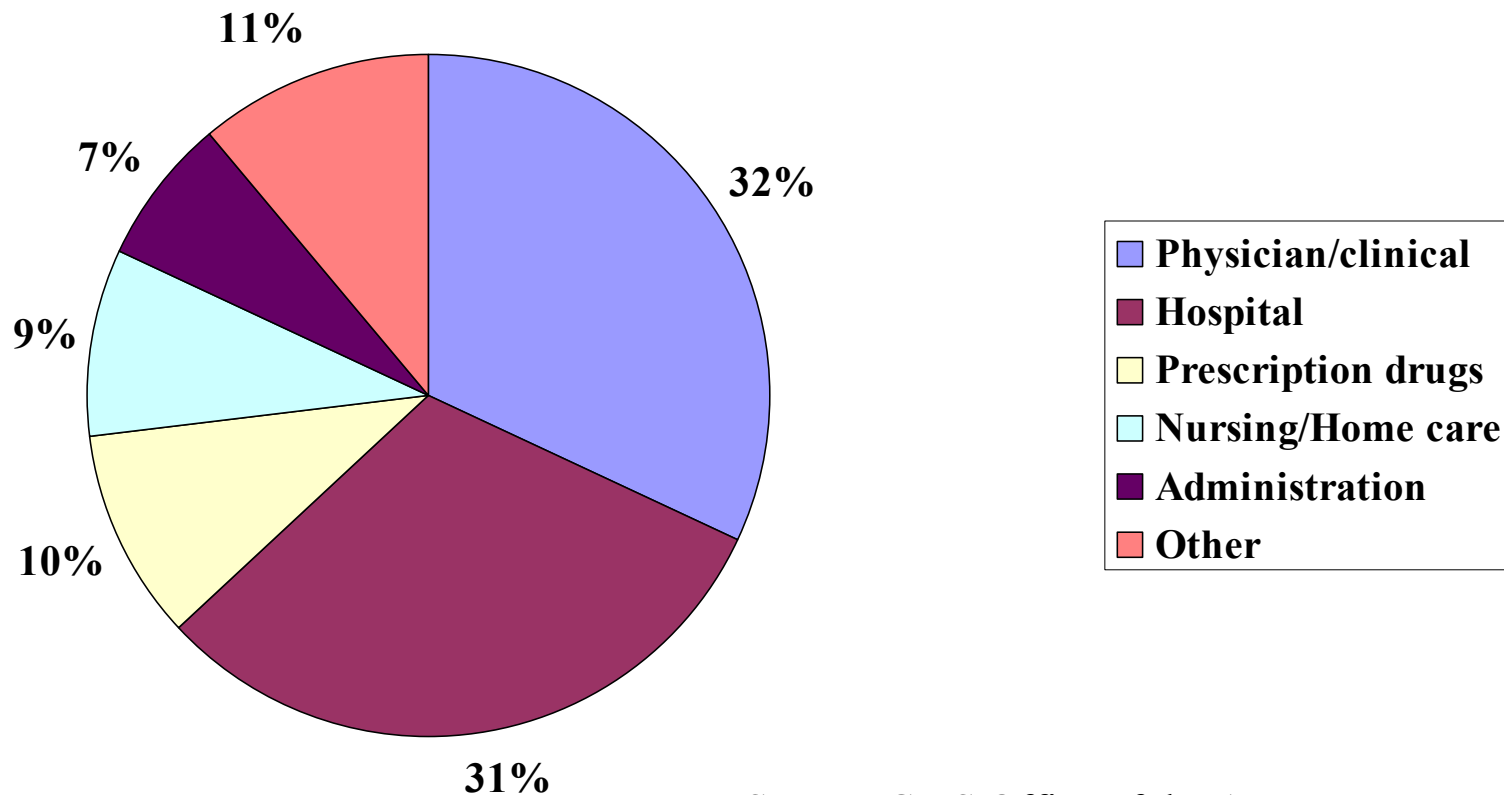


Quadratic Trend Line  $y$  in red



Source: OECD Health Data 2004, 2<sup>nd</sup> Edition

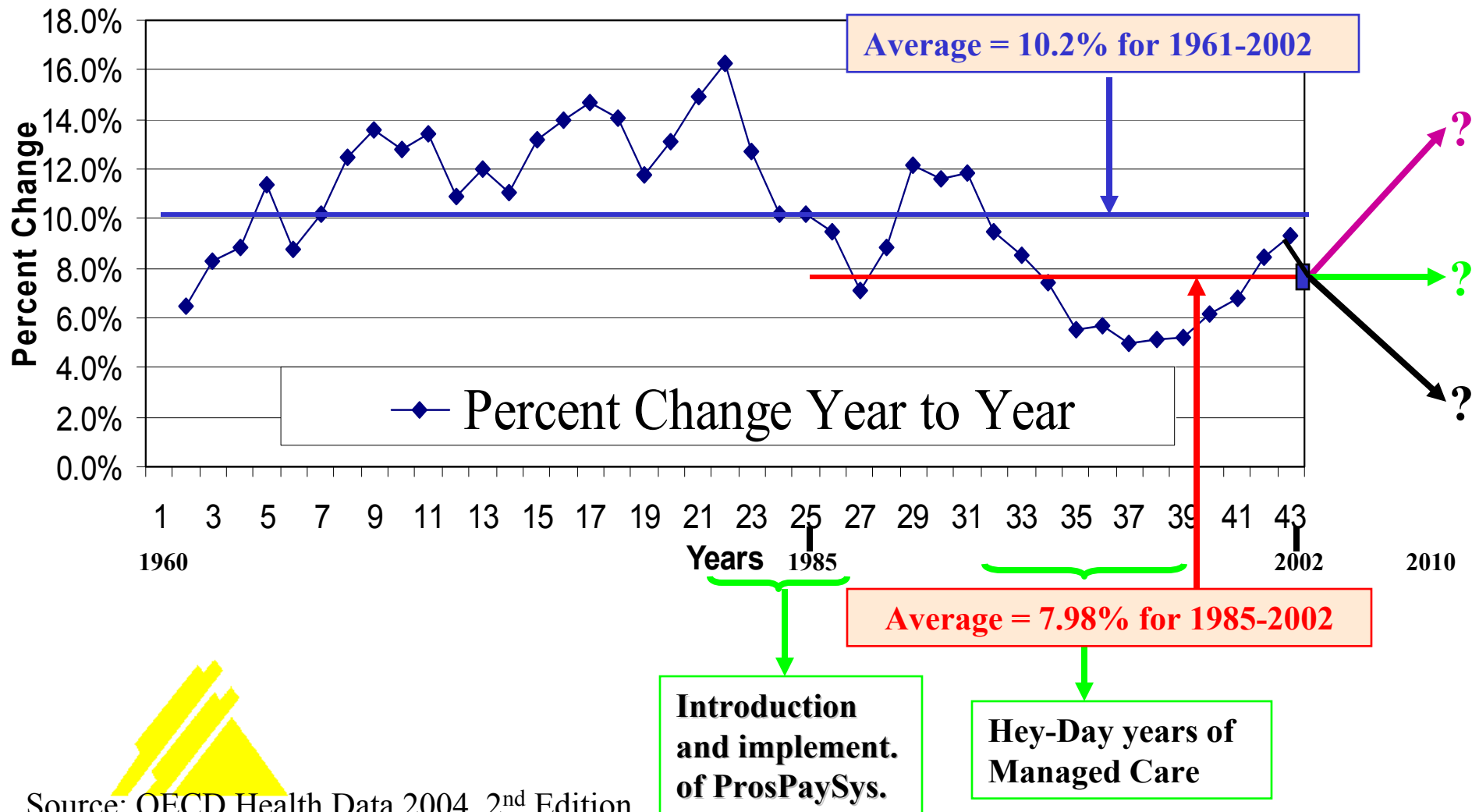
# BREAKDOWN OF THE U.S. HEALTH CARE DOLLAR - 2002



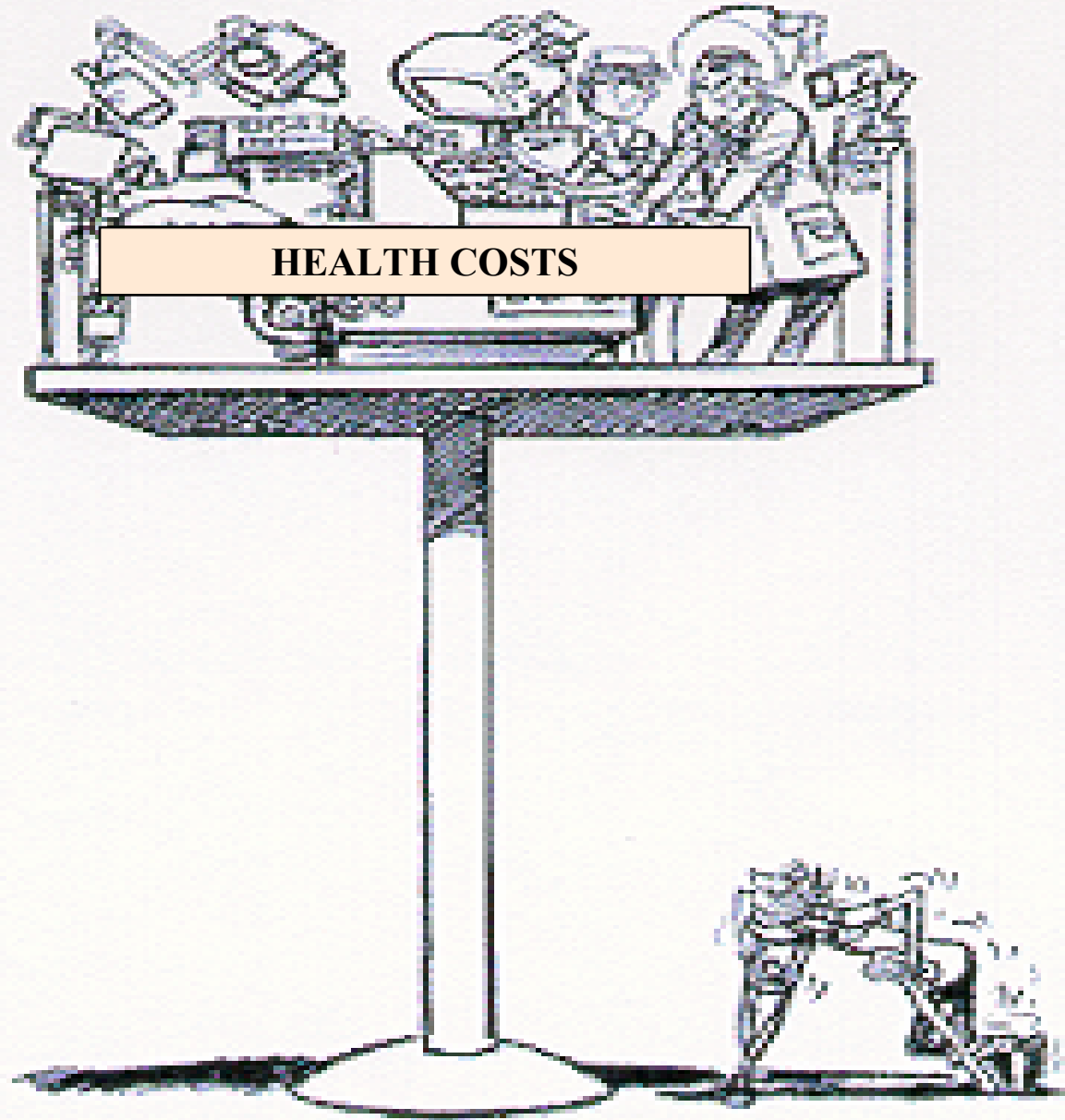
Source: CMS Office of the Actuary,  
National Health Statistics Group 2002



# Percent Change in Health Care Expenditures 1961-2002



**“CLIMB UP HERE AND LET’S HAVE A LOOK AT YOU”**



# The Causes of Health Expenditure Increases

- **Demographics**
- **Income Level Increases**
- **Insurance**
- **Price Inflation / non Wages**
- **Administrative Expenses**
- **Factor Rents**
- **Technologies**



## Table 2: Accounting for the Increase in Health Costs 1940-1990

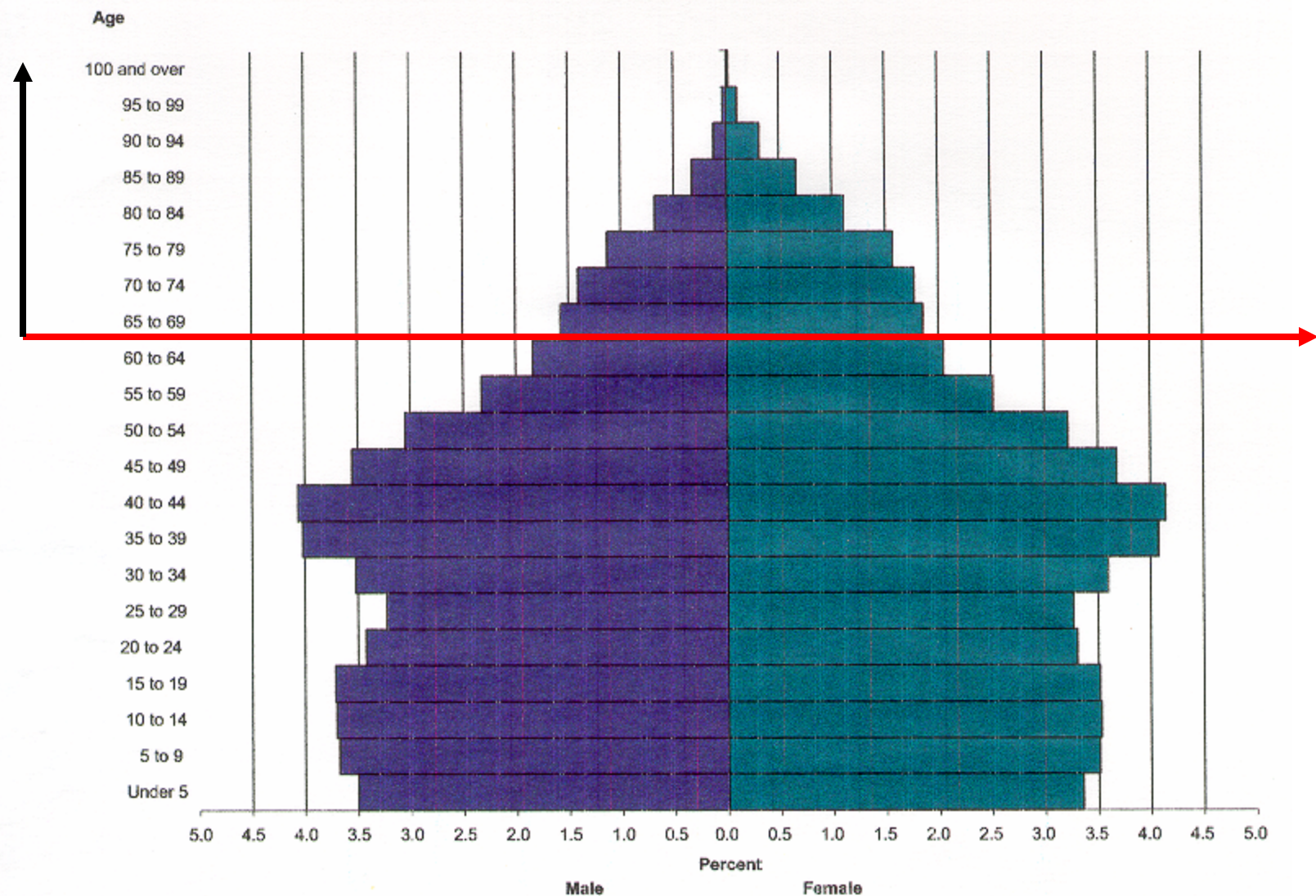
<u>Factor</u>	<u>Increase Due To</u>	<u>Share of Total</u>
<b>Total Increase</b>	<b>790%</b>	<b>---</b>
<b>Static Factors</b>	<b>399%</b>	<b>51%</b>
Demographics	14	2
Income	37	5
Spread of Insurance	100	13
Relative Price Change	147	19
Administrative Expense	101	13
Factor Rents	0	0
<b>Technology</b>	<b>391%</b>	<b>49%</b>



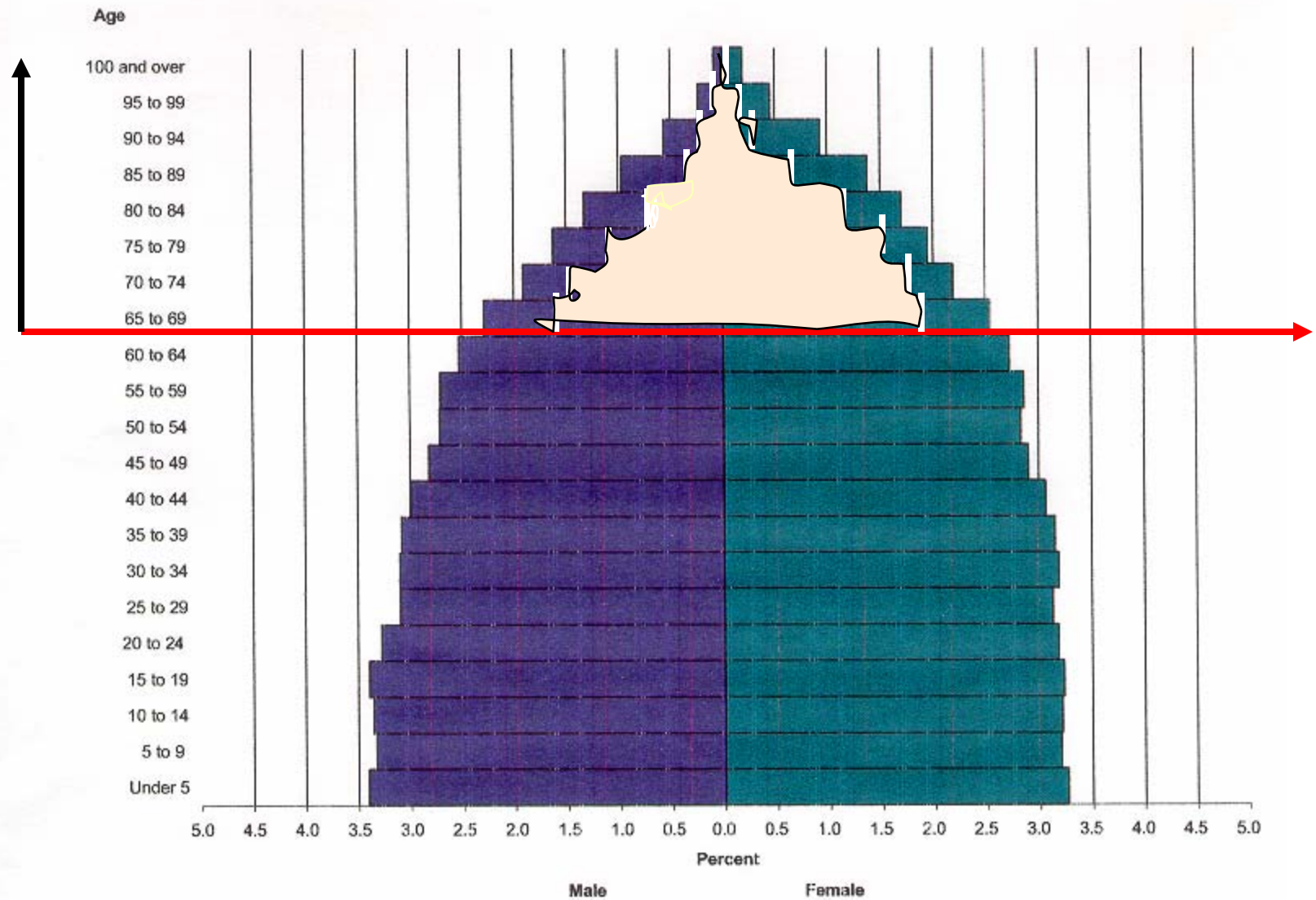
Source: David M. Cutler, "Technology, Health Costs and NIH," Harvard University and NBER paper presented at the NIH Economics Roundtable on Biomedical Research, October, 1995.



(NP-P2) Projected Resident Population of the United States as of July 1, 2000, Middle Series.



(NP-P4) Projected Resident Population of the United States as of July 1, 2050, Middle Series.



# Quality



# Adverse Event\*

an unintended injury or complication which results in disability, death or prolonged hospital stay **and is caused by health care (patient) management.**



\*Wilson McL, Ross, et al., "The Quality in Australian Health Care Study", The Medical Journal of Australia, November, 1995, Vol 163

# Five of IOM's Quality Reports

- **November 1999: “To Err Is Human”**
  - Found that 44,000 to 98,000 Americans die each year as a result of medical errors.
- **March 2001: “Crossing the Quality Chasm: A New Health System for the 21<sup>st</sup> Century”**
  - Found that the healthcare system is “plagued by a serious quality gap” and called for eliminating handwritten clinical information by 2010 and refocusing the healthcare system on treating chronic illnesses.
- **October 2002: “Leadership by Example: Coordinating Government Roles in Improving Health Care Quality”**
  - Argued that the federal government should lead the development of clinical standards for measuring care and proposed financial incentives for organizations that improve quality.
- **November 2003: “Keeping Patients Safe: Transforming the Work Environment of Nurses”**
  - Identifies solutions to problems in hospital, nursing home, and other health care organization work environments that threaten patient safety through their effect on nursing care.
- **In 2004 or 2005 (NAE and IOM): “Report of the Committee on Engineering and the Health Care System”**
  - “Purpose is to forge a new partnership between Systems Engineering and Medicine”



# Institute of Medicine Study: *TO ERR IS HUMAN\**

- Estimated Unnecessary Deaths\*\* in Hospitals in 1997:
  - Lower Boundary 44,000
  - Upper Boundary 98,000
  - Seventh Leading Cause of Deaths exceeding motor vehicle accidents (43,454), breast cancer (42,297) or AIDS (16,516)

\*To Err Is Human: Building a Safer Health System, L.T. Kohn, J.M. Corrigan, and M.S. Donaldson, *Editors*, Institute of Medicine, National Academy Press, Washington, D.C., 2000.

\*\*One of the worst outcomes of an adverse event.





# Institute of Medicine Study: **TO ERR IS HUMAN\***

- Estimated National Costs of Preventable Adverse Events:
  - Between \$17 Billion and \$29 Billions (not counting Opportunity Costs where this money could be spent for Better Purposes)

**To put this in perspective the cost of the new air quality standards recently set by the federal court will be around \$60 billion and is estimated to prevent 15,000 premature deaths and 350,000 cases of asthma (total)---**LA Times 11-14-02



\*To Err Is Human: Building a Safer Health System, L.T. Kohn, J.M. Corrigan, and M.S. Donaldson, *Editors*, Institute of Medicine, National Academy Press, Washington, D.C., 2000.



# WATCHDOG GROUP PROMOTES STRATEGY TO END MEDICAL ERRORS



BY STAYSKAL FOR THE TAMPA TRIBUNE

FRANK & ERNEST®

by Bob Thaves



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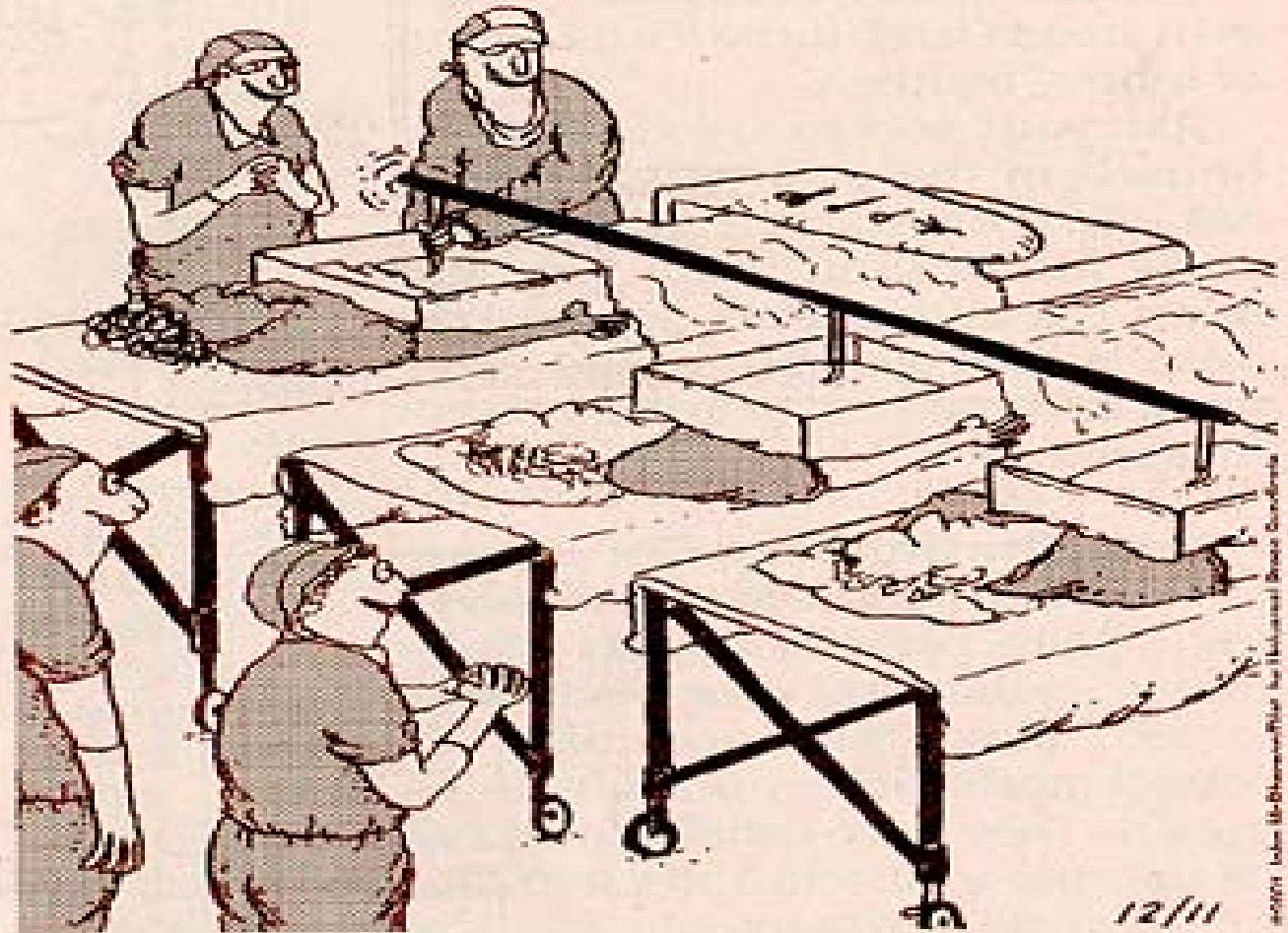


# TECHNOLOGY



# **CLOSE TO HOME** By John McPherson

closetohome@ucomics.com *McPherson*



Always striving to cut health-care costs, Dr. Rimley tests his new triple-scalpel device.



**Non-drug eluting stents fail to function effectively in 35-50% of the cases within a few years due to scarring of the coronary arteries where they are inserted.**

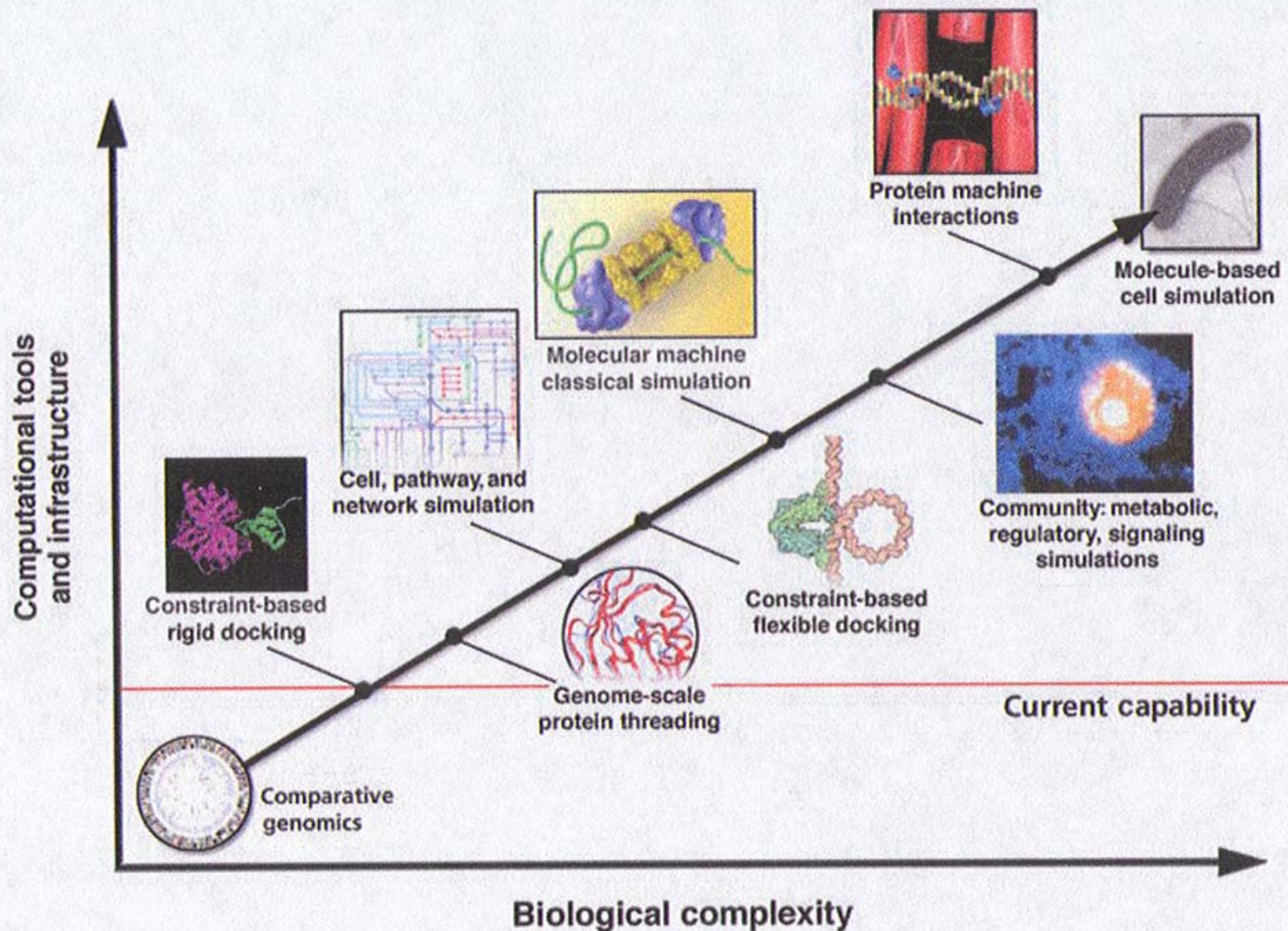
**It is estimated from trials that the drug eluting stents will likely fail to function effectively in 5-10% of the cases within a few years.**



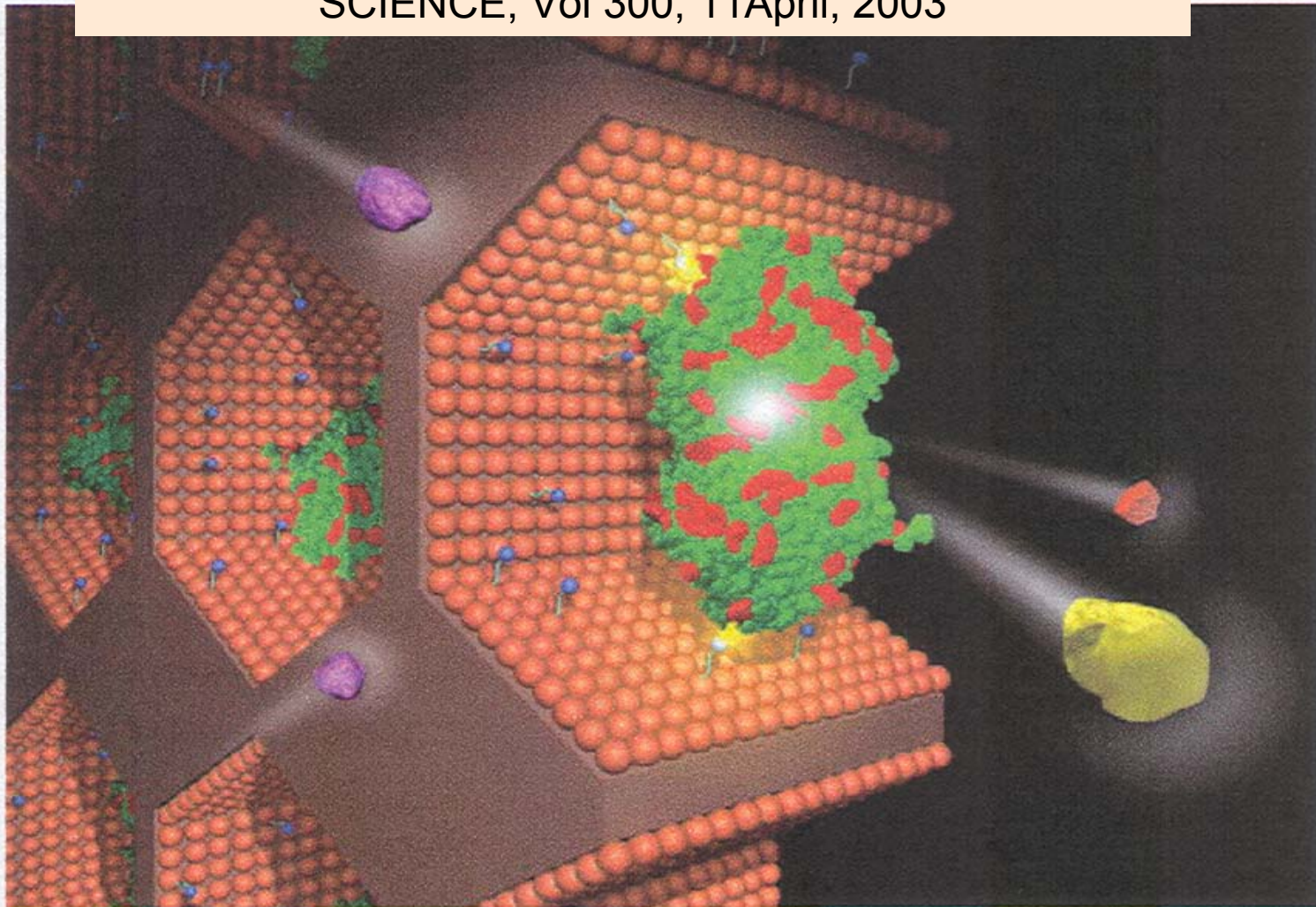
**Drug eluting stents are now the stents of choice but at a significantly higher cost per stent**



# Genomes to Life Computing







**Fig. 2.** A biomimetic future. The figure depicts an enzyme, organophosphorous hydrolase (green), embedded in a synthetic membrane that enhances its activity and stability. The enzyme transforms toxic substances (purple molecule at left) to harmless by-products (yellow and red molecules at right). Such nanostructures could eventually be used to develop efficient enzyme-based methods, implemented on an industrial scale, to produce energy, remove or inactivate contaminants, and store carbon to mitigate global climate change. Other potential highly useful applications are food processing, pharmaceuticals, separations, and the production of industrial chemicals. [Image: M. Perkins, Pacific Northwest National Laboratory]



**Access**



# Access Problems

- “Emergency Rooms See a Growing Emergency”  
“Ambulances are being turned away, patients are being billeted in hospital hallways.”--LA Times Aug 6, 2001
- Over 40 million people without health insurance and will continue to grow as more small employers drop/reduce coverage for employees
- Network Instability—”Maxicare, Tower (two HMOs) to Cease by Year’s End”—LA Times Sept 28, 2001



**DRABBLE** By Kevin Fagan





# FOR BETTER OR FOR WORSE By Lynn Johnston



# So What is OR/MS Doing?

- A great deal but far from what could and will be done in the future.





Operations Research  
and Health Care: A  
Handbook of Methods  
and Applications,  
Margaret L. Brandeau,  
Francois Sainfort and  
William P. Pierskalla  
(editors), Kluwer  
Academic Publishers,  
Boston, 2004.



Kluwer's  
International Series



ADVANCING THE  
STATE-OF-THE-ART

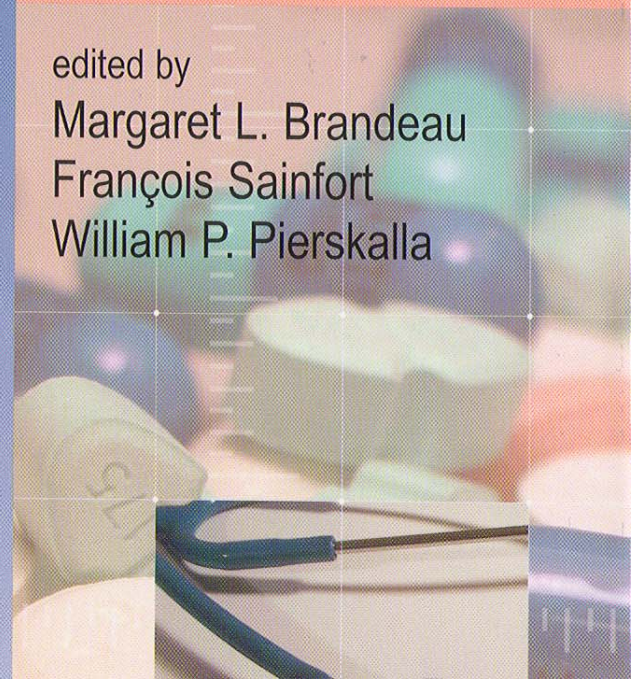
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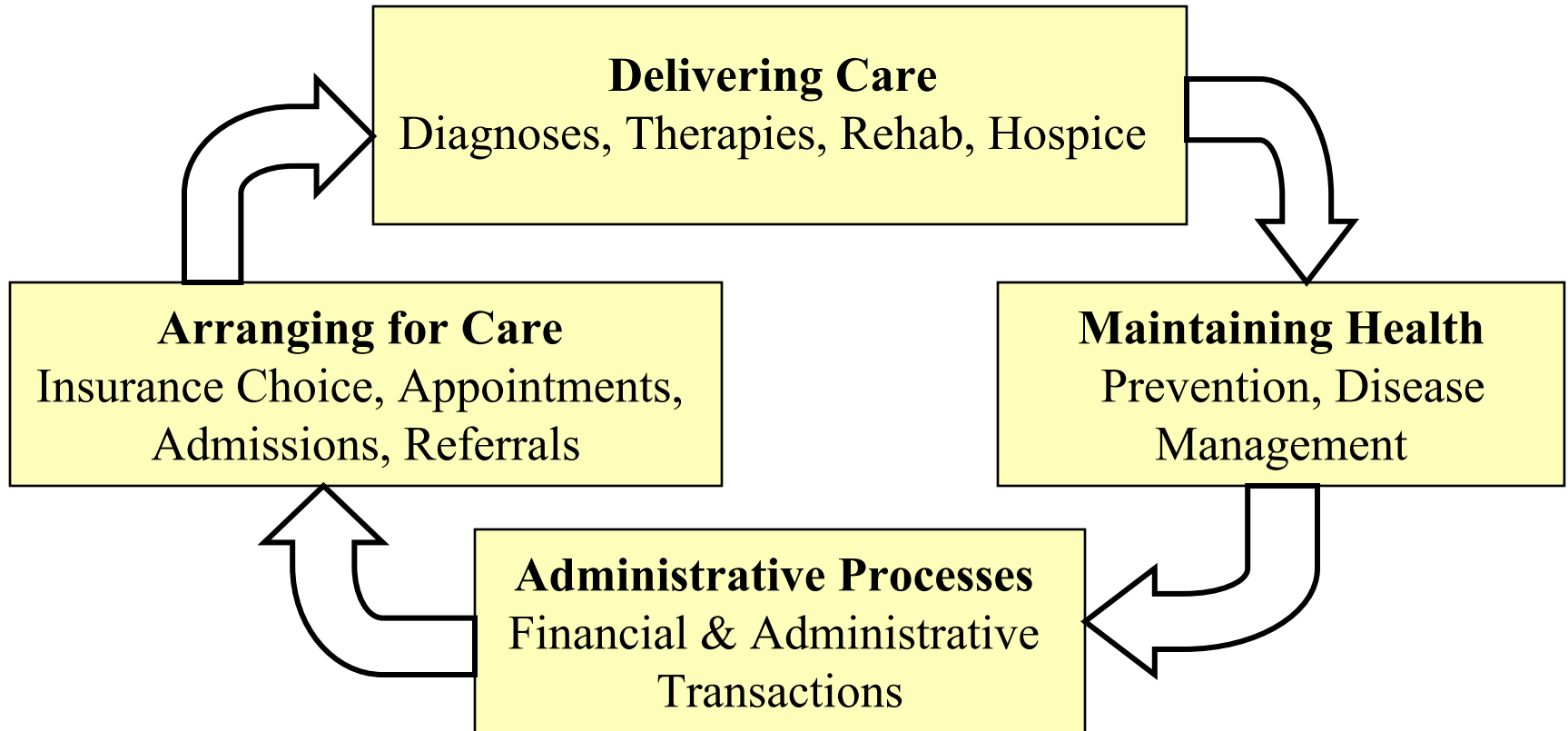
# OPERATIONS RESEARCH AND HEALTH CARE

A Handbook of  
Methods and  
Applications

edited by  
Margaret L. Brandeau  
François Sainfort  
William P. Pierskalla

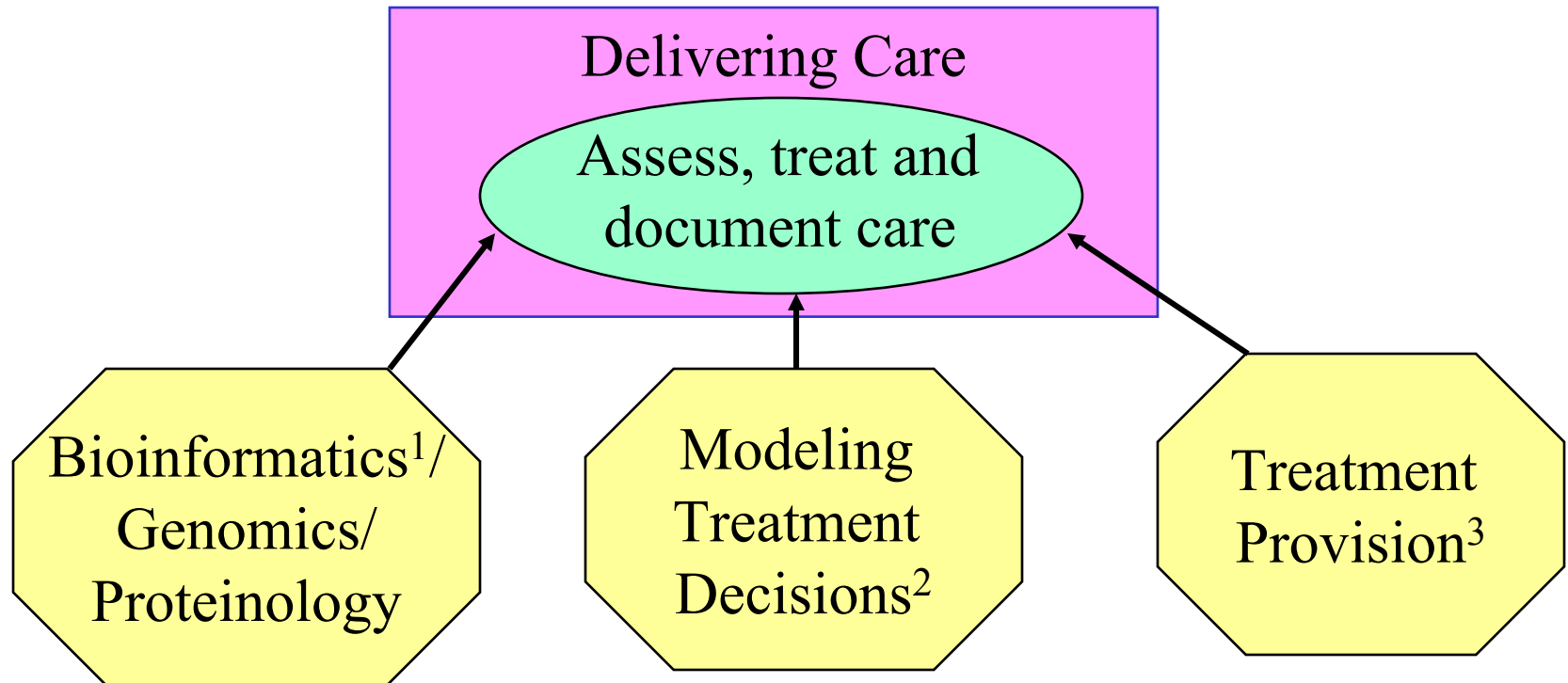


# Healthcare Processes



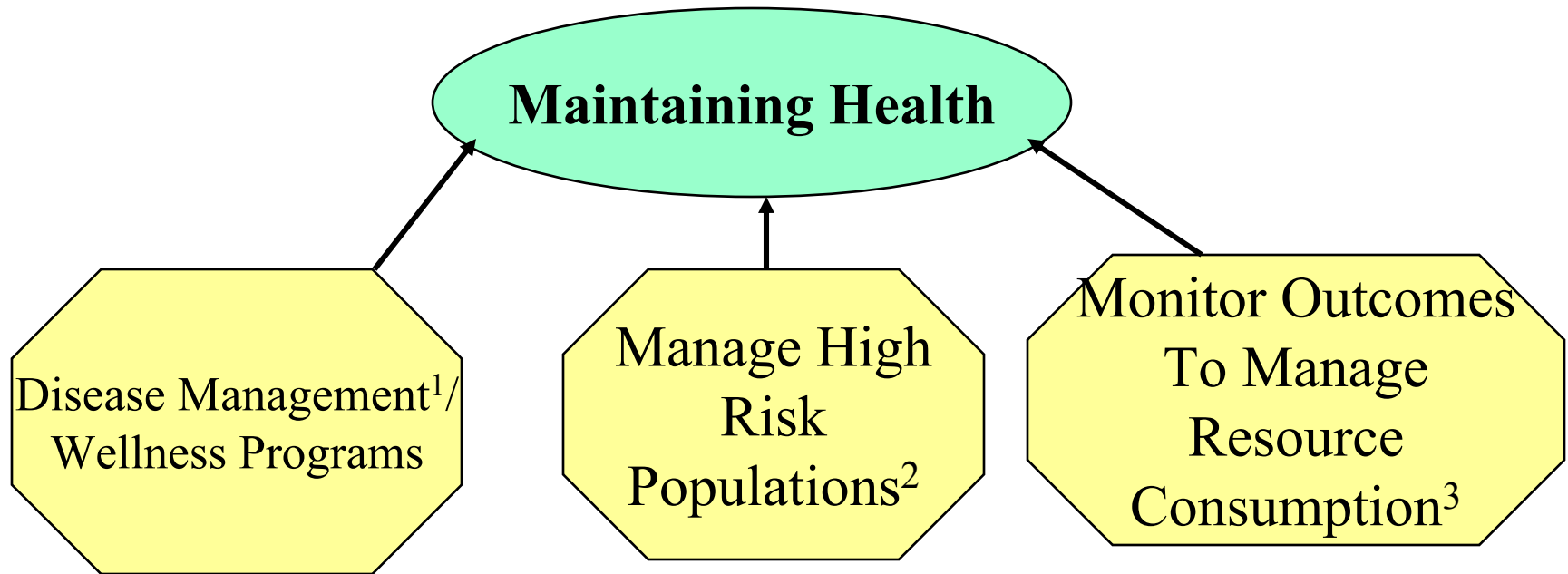


## A few OR/MS examples



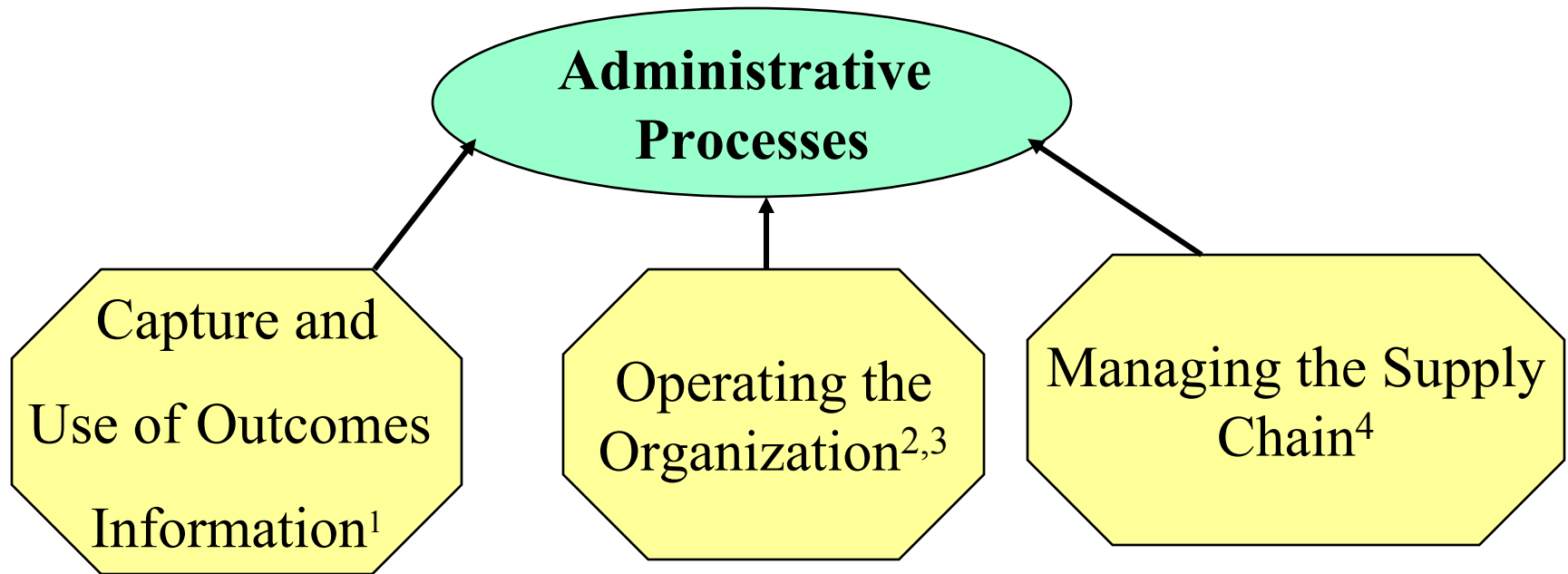
1. Bioinformatics and Management Science: Some Common Tools and techniques  
Ali E. Abbas and Susan P. Holmes, Operations Research, 52, 2, 165-190.
2. Modeling Medical Treatment Using Markov Decision Processes, Andrew J. Schaefer, Matthew D. Bailey, Steven M. Shechter and Mark S. Roberts,  
Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.
3. Radiotherapy Treatment Design and Linear Programming, Allen Holder,  
Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.





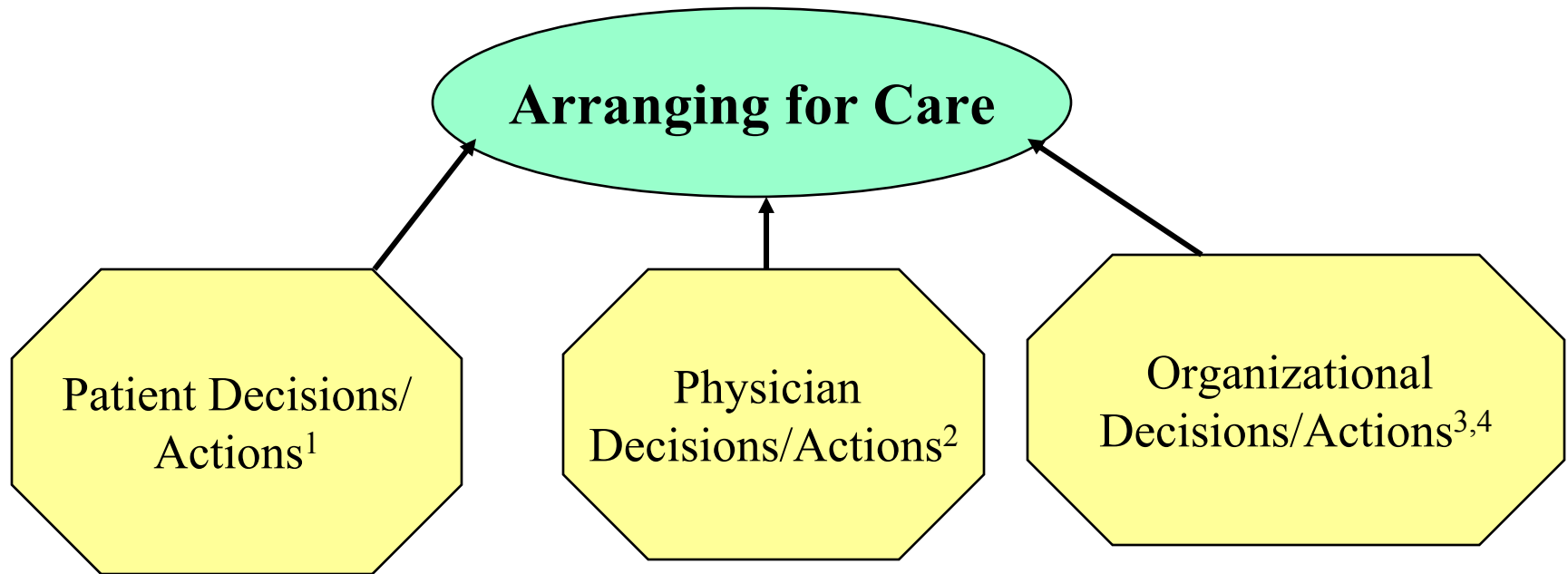
1. An Asthma Policy Model, A. David Paltiel, Karen M. Kuntz, Scott T. Weiss and Anne L Fuhlbrigge, Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.
2. Modeling the Costs and Effects of Maintenance Treatment for Opiate Addiction, Gregory S. Zaric, Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.
3. Allocating Resources to Control Infectious Diseases, Margaret L. Brandeau, Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.





1. Modeling Health Outcomes for Economic Analysis, Thitima Kongnakorn and Francois Sainfort, Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.
2. Capacity Planning and Management in Hospitals, Linda V, Green, Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.
3. Evaluating the Efficiency of Hospitals' Perioperative Services, Liam O'Neill and Franklin Dexter, Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.
4. Supply Chain Management of Blood Banks, William P. Pierskalla, Operations Research and Health Care, (Brandeau et al editors), Kluwer,2004.





1. Increasing Understanding of Patient Needs During and After Hospitalization, Gustafson, D.H., Arora, N.K., Nelson, E.C., and Boberg, E.W., The Joint Commission Journal on Quality Improvement, 27(2):81-92, 2001.
2. Determination of Optimal Variable-sized Multiple-block Appointment Systems, Brant E. Fries and V.P. Marathe, Operations Research, 29, 324-345.
3. Ambulance Service Planning: Simulation and Data Visualization, Shane G. Henderson and Andrew J. Mason, Operations Research and Health Care, (Brandeau et al editors), Kluwer, 2004.
4. Using Simulation in an Acute Care Hospital: Easier Said Than Done, Michael W. Carter and John T. Blake, Operations Research and Health Care, (Brandeau et al editors), Kluwer, 2004.



**So Where Are We Going Over  
the Next Decade?**



**We Know the Forces Described  
Previously Will Keep Pressing  
Forward**



# **We Also Know that**

## **Managed Care Has Retreated starting about 1998**

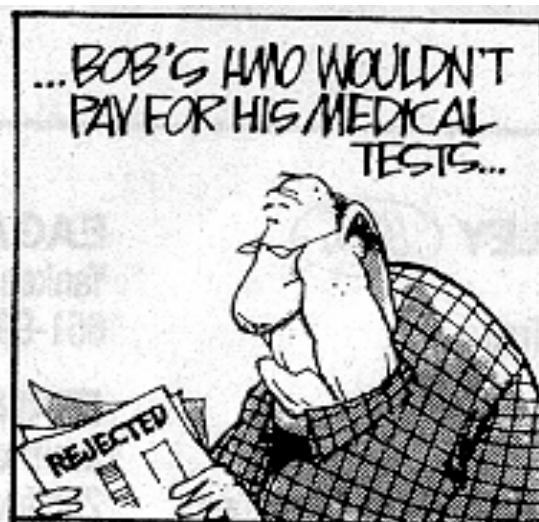
- **The Promise**

- Lower Costs
- Higher Quality
- Prevention of Disease
- Better access

- **The Results**

- Restricted Consumer Access
- Employers Retreated on Cost Control
- Physician Incomes Dropped
- Hospital Revenues Dropped
- Strong social and political pressure for Freedom of Choice
- Increased Government Mandates and Regulations of MCOs
- No improvement in quality/errors
- No improvement in prevention

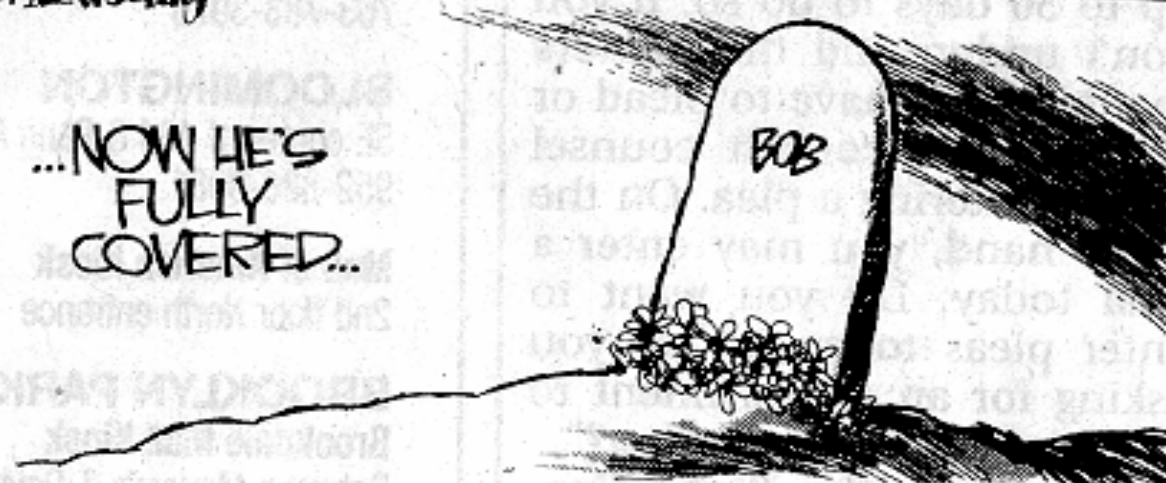




NATHANIELSMAN © 2001 Newsday



...NOW HE'S  
FULLY  
COVERED...



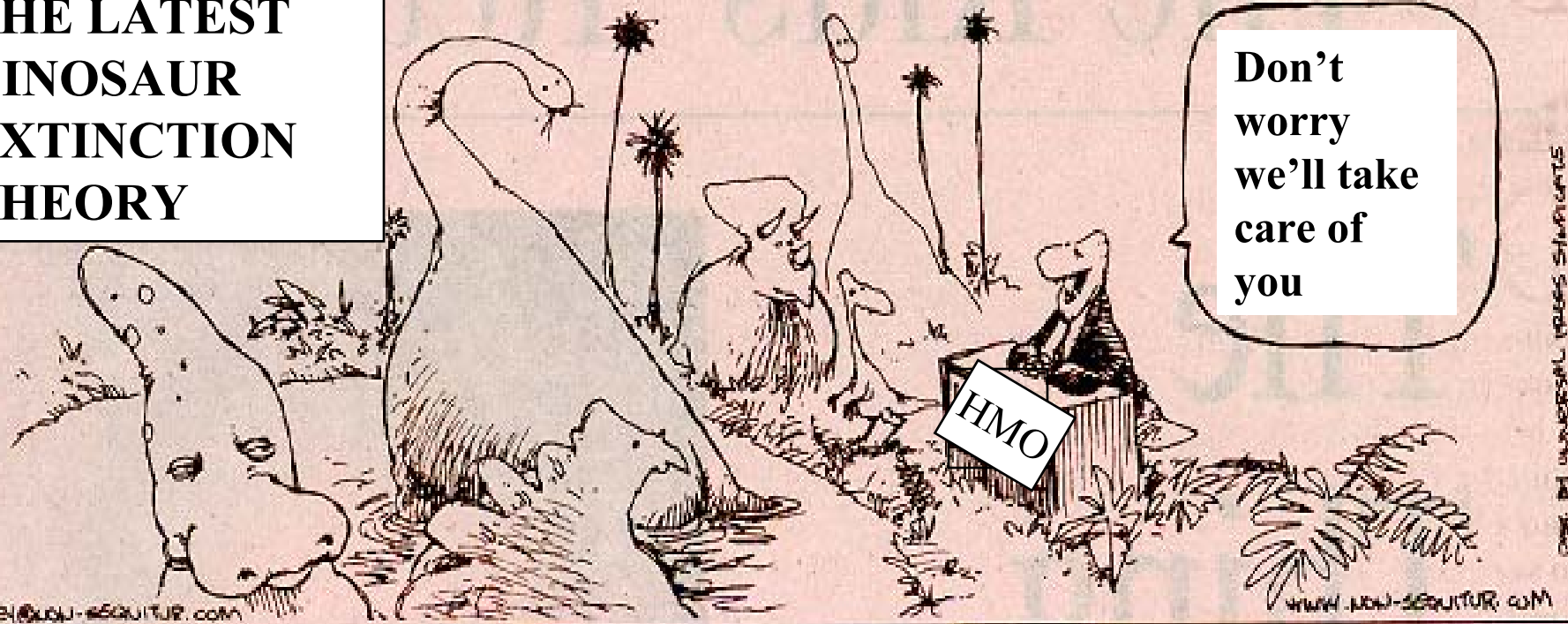


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# Integrated Delivery Systems Have Retreated starting about 1998

- **Potential Benefits of IDS**

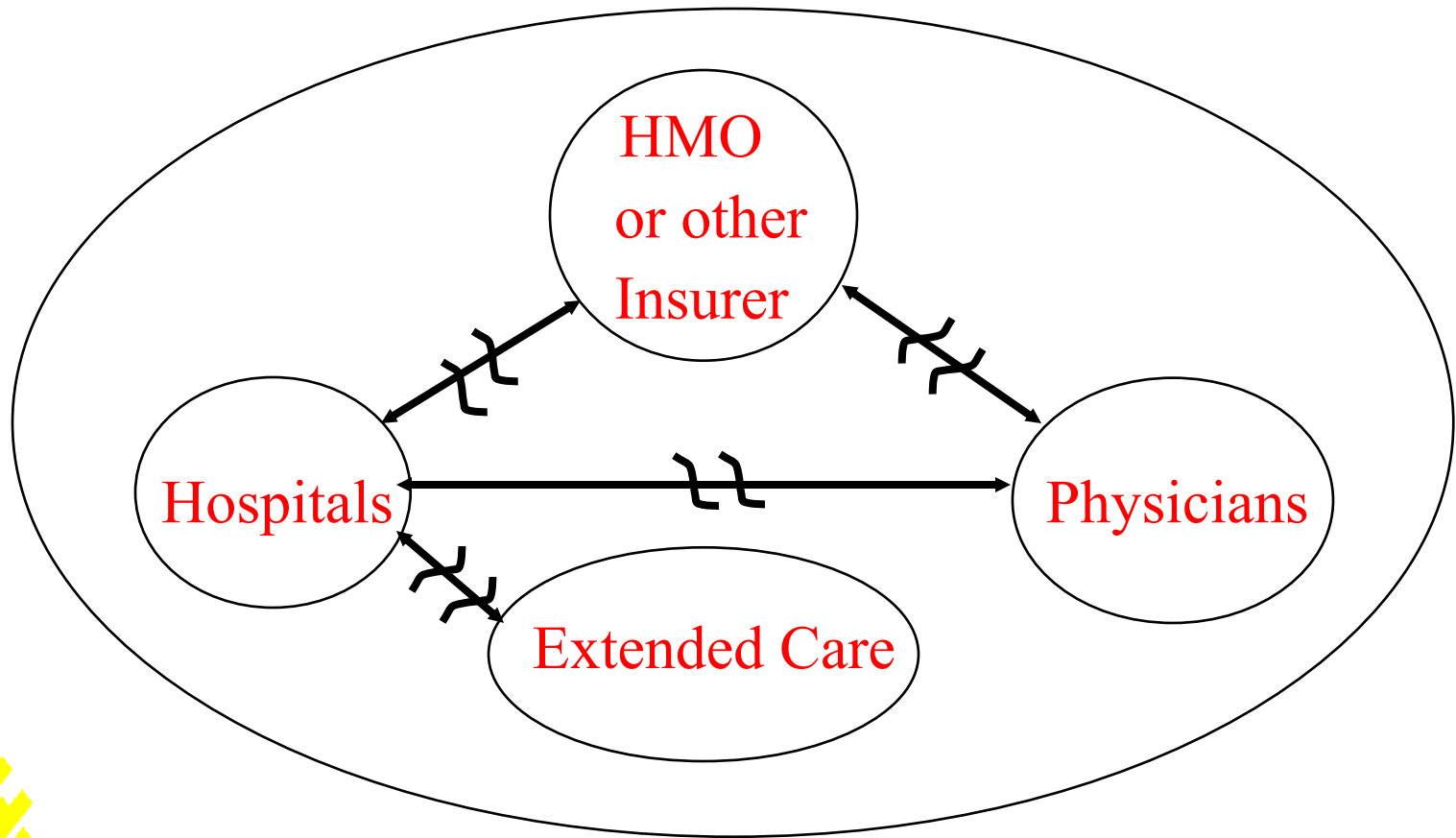
- A focus on the “patient”
- Greater economies of scale
- Better information systems
- Continuity of care and higher quality
- Cost effective allocation of clinical resources
- Greater ability to influence provider behavior
- Emphasis on prevention of disease

- **Results**

- **They didn’t significantly accomplish any of these benefits!**



# Integrated Delivery Systems (IDS) Dismantling



# Change is Coming

- Information technologies will eventually be embraced for major cost, quality and access improvements
- Then systems management and integrated care delivery will re-emerge as critical key needs
- Effectively the later years of this decade and the next decade will likely see the information and systems integration and the use of operations management and OR/MS that we have seen in manufacturing and services industries in the past fifteen years



# Why Now? - A Better Alignment of Strong Interest Groups

- Employers
  - Business Roundtable
  - Leapfrog Group
  - National Assn. Of Mfgs.
- NGOs
  - NCQA
  - JCAHO
  - IOM/NAE
- Some Professional Groups
  - Physicians and nurses
- The Elderly
  - AARP
- Unions
- Government
  - HIT
  - NSF





## The Government



David Brailer, MD, PhD, National IT Director, HHS

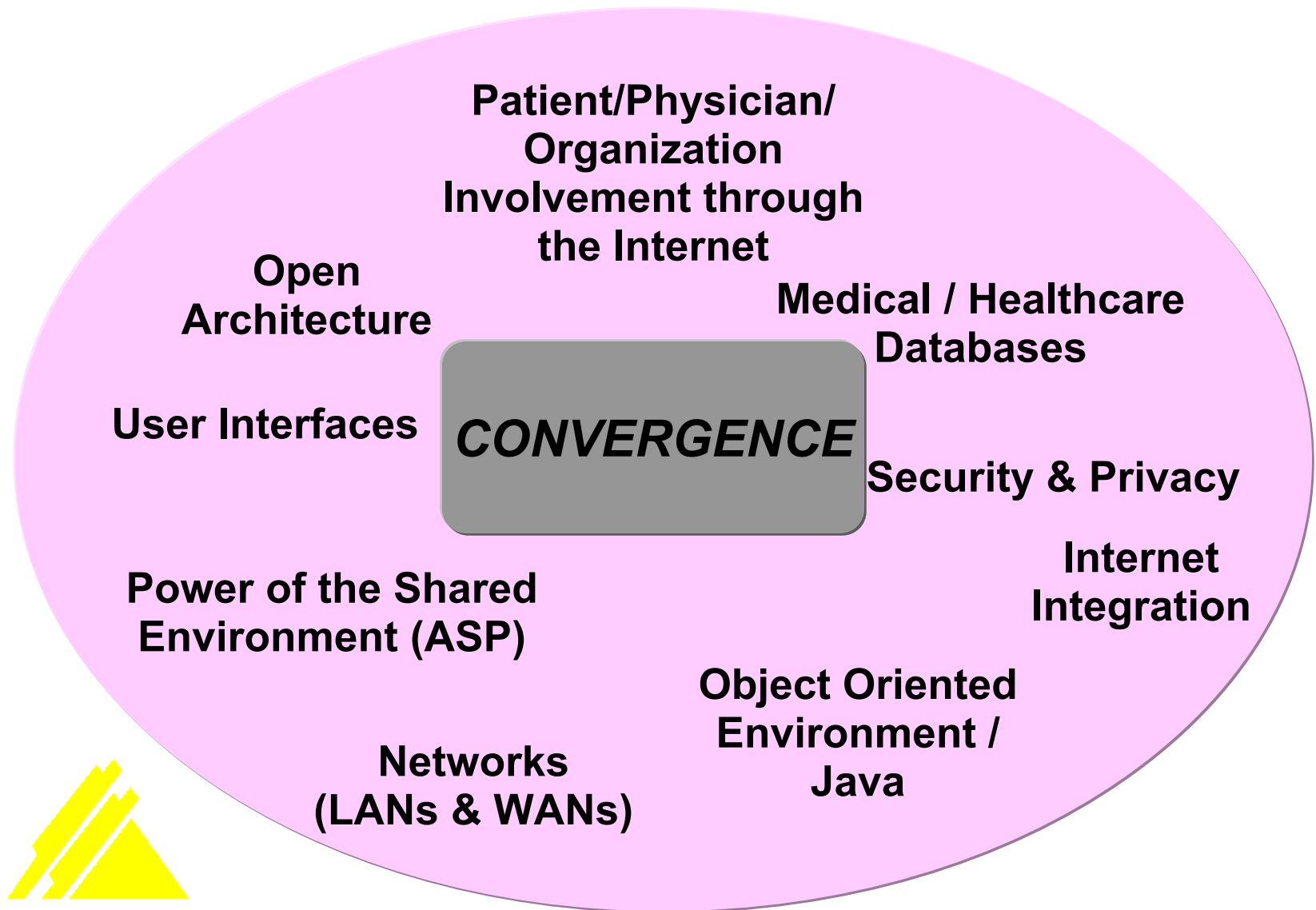


# IT and SYSTEM NEEDS

- Controlled Medical Vocabulary
- Master Patient Index
- Electronic Health (Patient) Record
- Speech/handwriting/ natural language recognition
- Computerized Physician Order Entry
- Centralized Patient Scheduling
- Enterprise Decision Support Systems
- Managed Care Systems
- Connectivity / Networks
- Integration of Disparate Legacy Systems Until They Are Replaced
- HIPAA



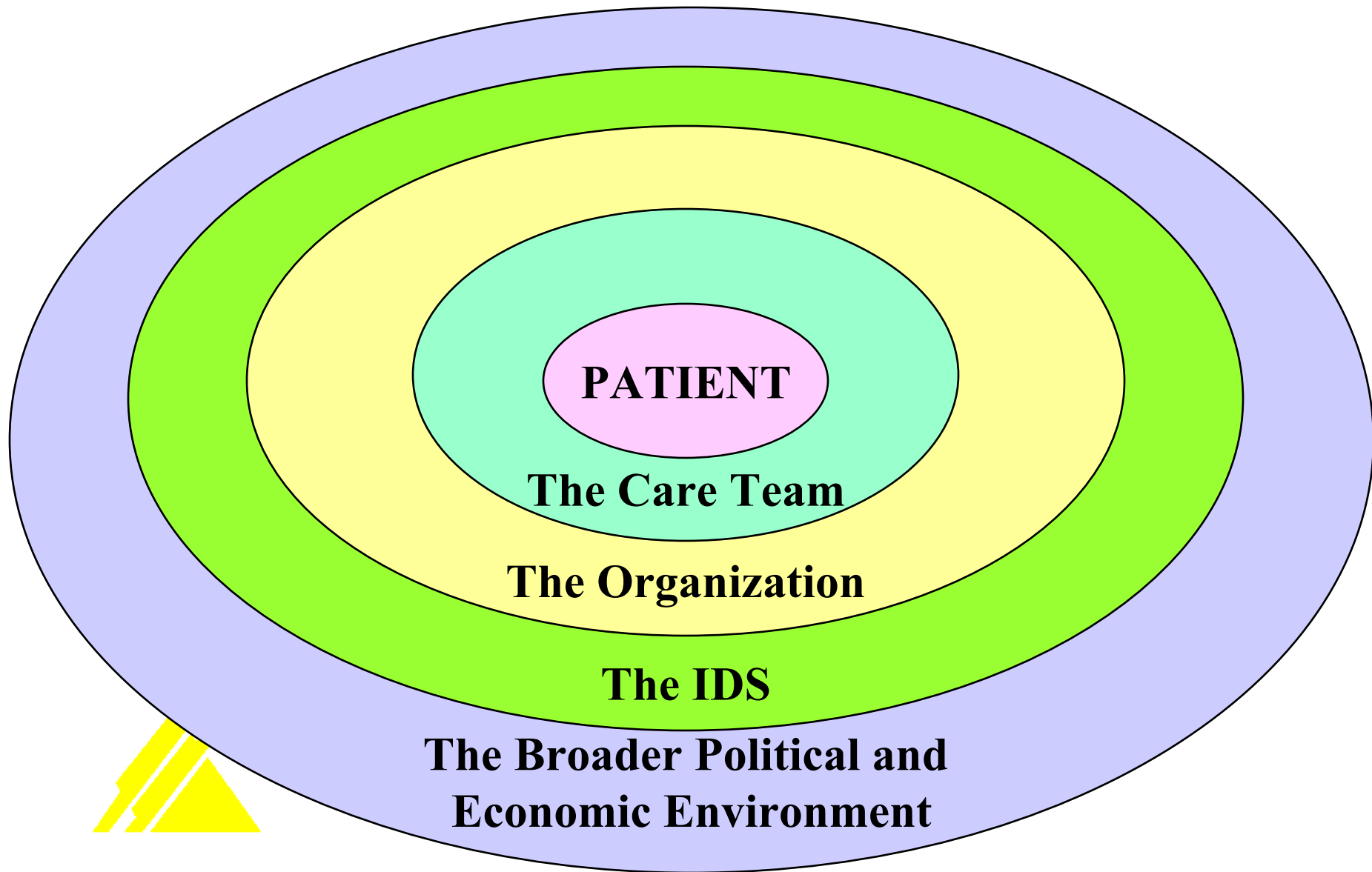
# HEALTHCARE INFORMATION TECHNOLOGY COMING



And We Need →



# Much More Patient-Centered Focus



# Much More Research

- Better Data Mining in Genomics/Proteinomics/Drugs development
- More Powerful Optimum-seeking Nonlinear Algorithms
- Better Decision Analytic Tools – Stochastic Branching Processes
- Better Outcomes Measures
- Integrated Models of the Patient-Centered Supply and Delivery Chains
  - In the Home
  - In the Outpatient Setting
  - In the Hospital
  - In Long-term Care
- What are Best Practices for Patient-Centered Care?
- Individual and Organizational Change



Much More Applications →





# DECISION SUPPORT SYSTEM USE & ISSUES

DECISION SUPPORT SYSTEM	SYSTEMS	WIDE-SPREAD USE	ISSUES
Operations Management Strategy	Yes	Medium	Don't know the questions to ask
Demand Forecasting	Yes	Low	Limited Availability—don't always like the answer
Capacity Planning	Yes	Low	Cost
Location Decisions	Yes	Low	Lack of management understanding
Process and Layout Design	Yes	Consulting	Acceptable systems and data
Scheduling and Staffing	Yes	Medium	High use by consultants
Productivity	Yes	Medium	Future will require these types of decisions (therefore systems)
Quality Control Data and Methods	No	Low-Med	Large organizations support these systems
Health Status and Severity Assessment	Yes	Medium	
Quality Assurance	Yes	High	
Total Quality Management	Limited	Low-Med	
Purchaser's Perspective on Quality	Market Research	Low	Growing through e-health companies
Inventory and Maintenance	Yes	High	
Regional Planning	Yes	High	Government focus



# Clinical Decision Support System Use & Issues

Clinical Decision Support System	Systems	Widespread Use	Issues
CPOE	yes	No	Only in a few advanced health care systems
Diagnostic	A few	No	Still in research mode
Therapeutic	A few	No	Still in research mode
Preventive	A few	No	Still in research mode
Disease management	A few	No	Only in a few large managed care org.s and only a few chronic diseases-also still in research mode
Progressive care	None	No	Not yet even in research



# A More-Integrated Systems and Applications Future

## Physicians/IDS

Enterprise  
Applications

Customer Service

EHR

Scheduling  
registration

Reporting  
Health Management

Science

WEB  
SITE

Subportals

## Payers

Administrative Transaction  
Processing

Care management

Marketing

Financial

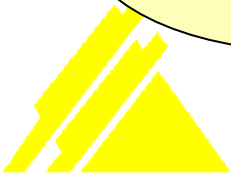
Customer Service

Reporting  
Health Management

Care Delivery

Paper and EDI

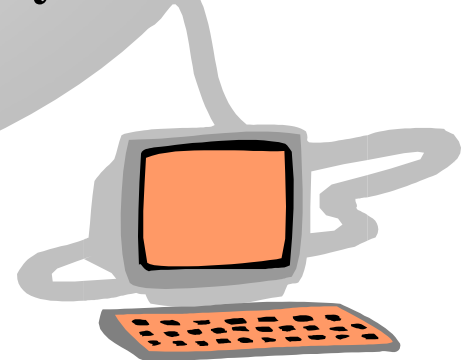
**PATIENT**



# HEALTHCARE INFORMATION TECHNOLOGY

## **Key Issues/Problems**

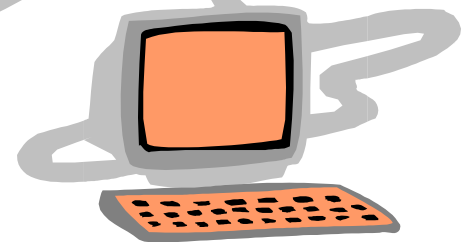
- **Insufficient Spending**
- **NIH (Not Invented Here)**
- **Reporting Relationship  
(CIO/CFO/CEO)**
- **Lack of Champion / Acceptability**



# HEALTHCARE INFORMATION TECHNOLOGY

## **Key Issues/Problems**

- **Lacks Significant Data for Total Quality Management**
- **Lacks Communication Insight**
- **Poor Data Quality**

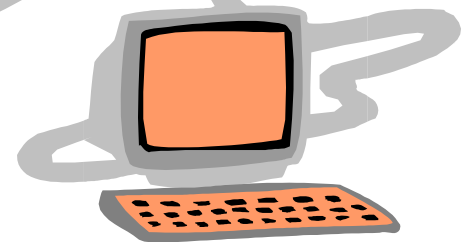




# HEALTHCARE INFORMATION TECHNOLOGY

## Key Issues/Problems

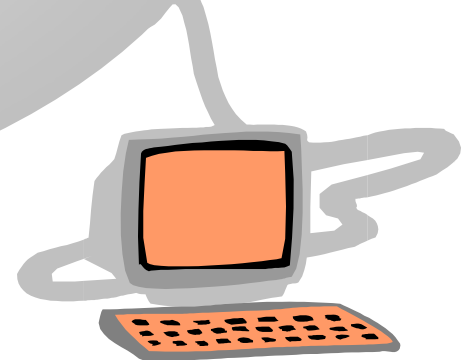
- Lacks Functionality
- Mainframe
  - PC phenomena
  - Specialized sub-systems
- Implementation Problems



# HEALTHCARE INFORMATION TECHNOLOGY

## **Key Issues/Problems**

- **Lack of Vendor Upgrades (Cost)**
- **Lack of System Integration**
- **Computerization Has Not Created Changes in Procedures/Systems**



# HEALTHCARE INFORMATION TECHNOLOGY

## Key Issues/Problems

- **Physician Issues**
  - Mom & pop operations
  - Cost
  - Physician lack of involvement
  - Office staff
  - Workflow / change

