We Have No Choice: Health Care Delivery Must be Improved: The Key Lies In The Use of Operations Research

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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)

\[ y = 1081.7x^2 - 14364x + 76620 \]

\[ R^2 = 0.9977 \]

Source: OECD Health Data 2004, 2nd 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

Average = 10.2% for 1961-2002
Average = 7.98% for 1985-2002

Source: OECD Health Data 2004, 2nd Edition

Introduction and implement. of ProsPaySys.
Hey-Day years of Managed Care
“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

<table>
<thead>
<tr>
<th>Factor</th>
<th>Increase Due To</th>
<th>Share of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Increase</td>
<td>790%</td>
<td>---</td>
</tr>
<tr>
<td><strong>Static Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographics</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Income</td>
<td>37</td>
<td>5</td>
</tr>
<tr>
<td>Spread of Insurance</td>
<td>100</td>
<td>13</td>
</tr>
<tr>
<td>Relative Price Change</td>
<td>147</td>
<td>19</td>
</tr>
<tr>
<td>Administrative Expense</td>
<td>101</td>
<td>13</td>
</tr>
<tr>
<td>Factor Rents</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>391%</td>
<td>49%</td>
</tr>
</tbody>
</table>

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

Source: National Projections Program, Population Division, U.S. Census Bureau, Washington, D.C. 20233
(NP-P4) Projected Resident Population of the United States as of July 1, 2050, Middle Series.

Source: National Projections Program, Population Division, U.S. Census Bureau, Washington, D.C. 20233
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.

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 21st 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)

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**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

WATCHDOG GROUP PROMOTES STRATEGY TO END MEDICAL ERRORS

You'll be happy to know we have new procedures that'll prevent mistakes, Mrs. Brown.

My name's Smith!
FRANK & ERNEST®

by Bob Thaves

CITY CLINIC
A MANGLED CARE FACILITY

YEAH, BUT SUPPOSE IT'S NOT A TYPO.
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 eluding 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 eluding stents will likely fail to function effectively in 5-10% of the cases within a few years.

Drug eluding stents are now the stents of choice but at a significantly higher cost per stent.
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
HELLO, I'M RALPH DRABBLE

I'M HERE FOR MY 2:30 DOCTOR'S APPOINTMENT.

2:30?? IT'S NOW 3:45!!

WE DON'T GET AROUND TO OUR 2:30 APPOINTMENTS UNTIL AT LEAST 4:15!

I LIKE TO BE EARLY.
Hi, I'm here for a blood test. Your hospital card and identification, please.

Take a number. Thirty two?

Wow. Some of these magazines are over 4 years old!

They were new when I got here.
So What is OR/MS Doing?

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

Arranging for Care
Insurance Choice, Appointments, Admissions, Referrals

Delivering Care
Diagnoses, Therapies, Rehab, Hospice

Maintaining Health
Prevention, Disease Management

Administrative Processes
Financial & Administrative Transactions
A few OR/MS examples

 Delivering Care
 Assess, treat and document care

 Bioinformatics$^1$/Genomics/Proteinology
 Model Treatment Decisions$^2$
 Treatment Provision$^3$

1. Bioinformatics and Management Science: Some Common Tools and techniques

2. Modeling Medical Treatment Using Markov Decision Processes,
   Andrew J. Schaefer, Matthew D. Bailey, Steven M. Shechter and Mark S. Roberts,

3. Radiotherapy Treatment Design and Linear Programming,
   Allen Holder,


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
Bob's HMO wouldn't pay for his medical tests.

They rejected his medications.

His surgery was deemed unnecessary.

Now he's fully covered.

Bob
THE LATEST DINOSAUR EXTINCTION THEORY

Don’t worry we’ll take care of you

HMO
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
- 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

Patient/Physician/Organization Involvement through the Internet
Medical / Healthcare Databases
Security & Privacy
Internet Integration
Object Oriented Environment / Java
Power of the Shared Environment (ASP)
Networks (LANs & WANs)
User Interfaces
Open Architecture

CONVERGENCE
And We Need
Much More Patient-Centered Focus

- The Broader Political and Economic Environment
- The IDS
- The Organization
- The Care Team
- PATIENT
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

<table>
<thead>
<tr>
<th>DECISION SUPPORT SYSTEM</th>
<th>SYSTEMS</th>
<th>WIDE-SPREAD USE</th>
<th>ISSUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations Management Strategy</td>
<td>Yes</td>
<td>Medium</td>
<td>Don’t know the questions to ask</td>
</tr>
<tr>
<td>Demand Forecasting</td>
<td>Yes</td>
<td>Low</td>
<td>Limited Availability—don’t always like the answer</td>
</tr>
<tr>
<td>Capacity Planning</td>
<td>Yes</td>
<td>Low</td>
<td>Cost</td>
</tr>
<tr>
<td>Location Decisions</td>
<td>Yes</td>
<td>Low</td>
<td>Lack of management understanding</td>
</tr>
<tr>
<td>Process and Layout Design</td>
<td>Yes</td>
<td>Consulting</td>
<td>Acceptable systems and data</td>
</tr>
<tr>
<td>Scheduling and Staffing</td>
<td>Yes</td>
<td>Medium</td>
<td>High use by consultants</td>
</tr>
<tr>
<td>Productivity</td>
<td>Yes</td>
<td>Medium</td>
<td>Future will require these types of decisions (therefore systems)</td>
</tr>
<tr>
<td>Quality Control Data and Methods</td>
<td>No</td>
<td>Low-Med</td>
<td>Large organizations support these systems</td>
</tr>
<tr>
<td>Health Status and Severity Assessment</td>
<td>Yes</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Quality Assurance</td>
<td>Yes</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Total Quality Management</td>
<td>Limited</td>
<td>Low-Med</td>
<td></td>
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<tr>
<td>Purchaser’s Perspective on Quality</td>
<td>Market Research</td>
<td>Low</td>
<td>Growing through e-health companies</td>
</tr>
<tr>
<td>Inventory and Maintenance</td>
<td>Yes</td>
<td>High</td>
<td>Government focus</td>
</tr>
<tr>
<td>Regional Planning</td>
<td>Yes</td>
<td>High</td>
<td></td>
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<tr>
<td>Clinical Decision Support System</td>
<td>Systems</td>
<td>Widespread Use</td>
<td>Issues</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>CPOE</td>
<td>yes</td>
<td>No</td>
<td>Only in a few advanced health care systems</td>
</tr>
<tr>
<td>Diagnostic</td>
<td>A few</td>
<td>No</td>
<td>Still in research mode</td>
</tr>
<tr>
<td>Therapeutic</td>
<td>A few</td>
<td>No</td>
<td>Still in research mode</td>
</tr>
<tr>
<td>Preventive</td>
<td>A few</td>
<td>No</td>
<td>Still in research mode</td>
</tr>
<tr>
<td>Disease management</td>
<td>A few</td>
<td>No</td>
<td>Only in a few large managed care org.s and only a few chronic diseases-also still in research mode</td>
</tr>
<tr>
<td>Progressive care</td>
<td>None</td>
<td>No</td>
<td>Not yet even in research</td>
</tr>
</tbody>
</table>
A More-Integrated Systems and Applications Future

Physicians/IDS
- Enterprise Applications
- Customer Service
- EHR
- Scheduling registration
- Reporting Health Management

Payers
- Administrative Transaction Processing
- Science
- WEB SITE Subportals
- WEB SITE

PATIENT
Care Delivery

Paper and EDI

Customer Service
Marketing
Financial
Customer Service
Reporting Health Management

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