# Beyond the Industrial Age: Moving to an Information Age Model for Healthcare

"The Potential of Medical Science – The Practice of Medicine: How to Close the Gap"

The Brookings Institution
Washington, DC – December 15, 2006

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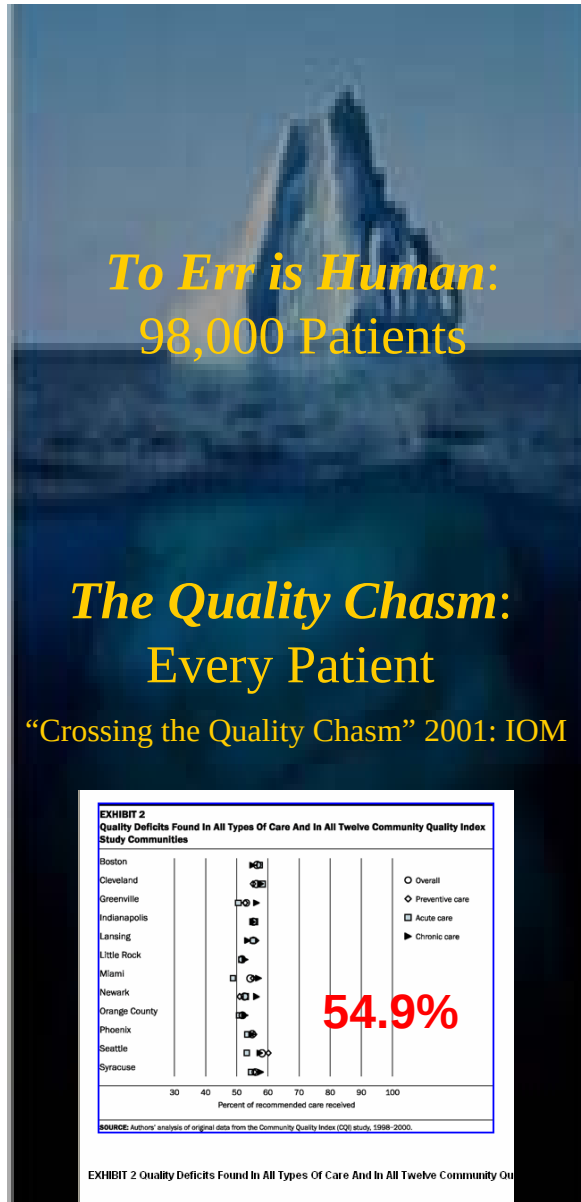
# Overview:

1. **The Current System Is Failing**
   - Information lapses contribute to failure; IT underpins success
2. **Healthcare is "Decentralizing"**
   - Exacerbates information discontinuity & failure
3. **Finding, Evaluating, and Using the most Relevant Information Becomes the New Challenge**
   - VA EHR Example 1
4. **New Knowledge Can be a Systematic By-Product of Healthcare Delivery**
   - VA EHR Example 2
5. **Information Engines Support Personalized Healthcare**
   - The information age potential of science realized

# 1) From the Industrial to the Information Age: Some Planning Assumptions for Desired Attributes

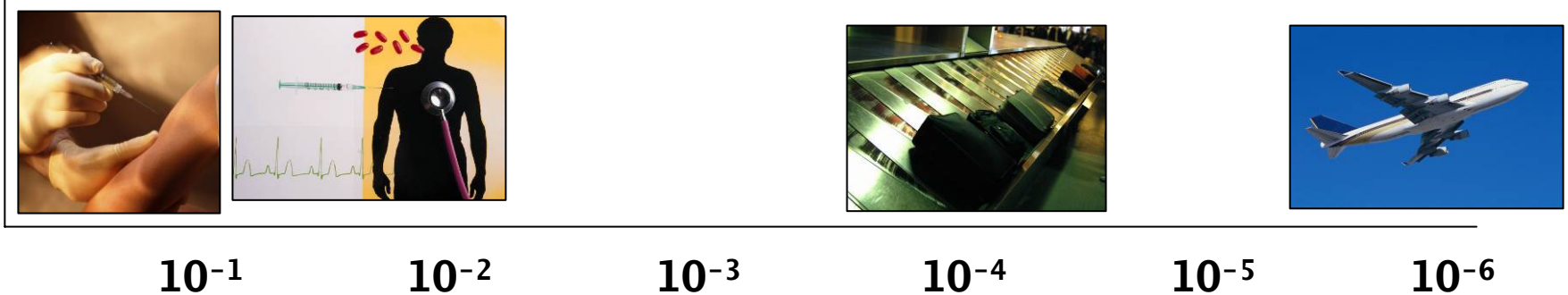
- **Safety – is Fundamental**
  - Goal: Avoid Getting It Wrong
- **Effectiveness – To Close to Chasm**
  - Expect effectiveness in maintaining & improving health, managing disease & distress
  - Goal: Getting It Right . . . Consistently
- **Efficiency:**
  - Goal: Reduce waste; Use resources for maximal benefit
- **Compassionate (Patient-Centered, Coordinated) Care**
  - Patient (or lay caregiver) is locus of control
  - Seamless across environments
  - Seamless across health & disease(s)
  - Anticipates needs, rather than just reacting to them

- **Goal: Safe, Effective, Efficient & Compassionate Care**
  - **Litmus Test: Without the need for an advocate**



# 1) How Badly Are We Failing?
# Safety & Quality in Healthcare & Aviation

- Airline Safety: > 99.999999
- Airline Baggage Handling: > 99.9999
- B-Blocker p MI: 70 – 99%
- Immunization: 55 – 94%



# 1) Why is Information Technology a Central Issue?

- System Failures:
  - 12% of physician orders are not executed as written*
  - 20% of laboratory tests are requested because previous studies are not accessible.*
  - 1 in 6.5 hospitalizations complicated by drug error**
    - 1 in 20 outpatient prescriptions**
  - 1 in 7 hospitalizations occur because previous records not available*

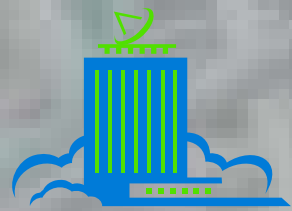
** PITAC (President's Information Technology Advisory Committee, 2004)*

*** Bates & Leape, multiple references*

- Safety Gap
- Quality (Effectiveness) Gap
- Compassion Gap
- Value Gap:
  - Health care inflation
    - Inferior outcomes per dollar
      - 31% Waste Estimated (Woolhandler, O'Neil, etcl)
    - Un-insurance / Under-insurance
  - Patients / Payors (Govt) / Providers increasingly concerned
    - Compromising Global Competitiveness

# 2) Information Must Link Decentralized Care . . .







# 2) Ultimate Decentralization:
## The "Point of Service" *is* the Patient

"A company has demonstrated a cellphone in Japan that incorporates a glucometer into the phone. The device uses blood testing strip, and insulin and glucose levels can be viewed right on the phone. Readings are uploaded to an online database for retrieval later. No word on when this phone might be available in the US."

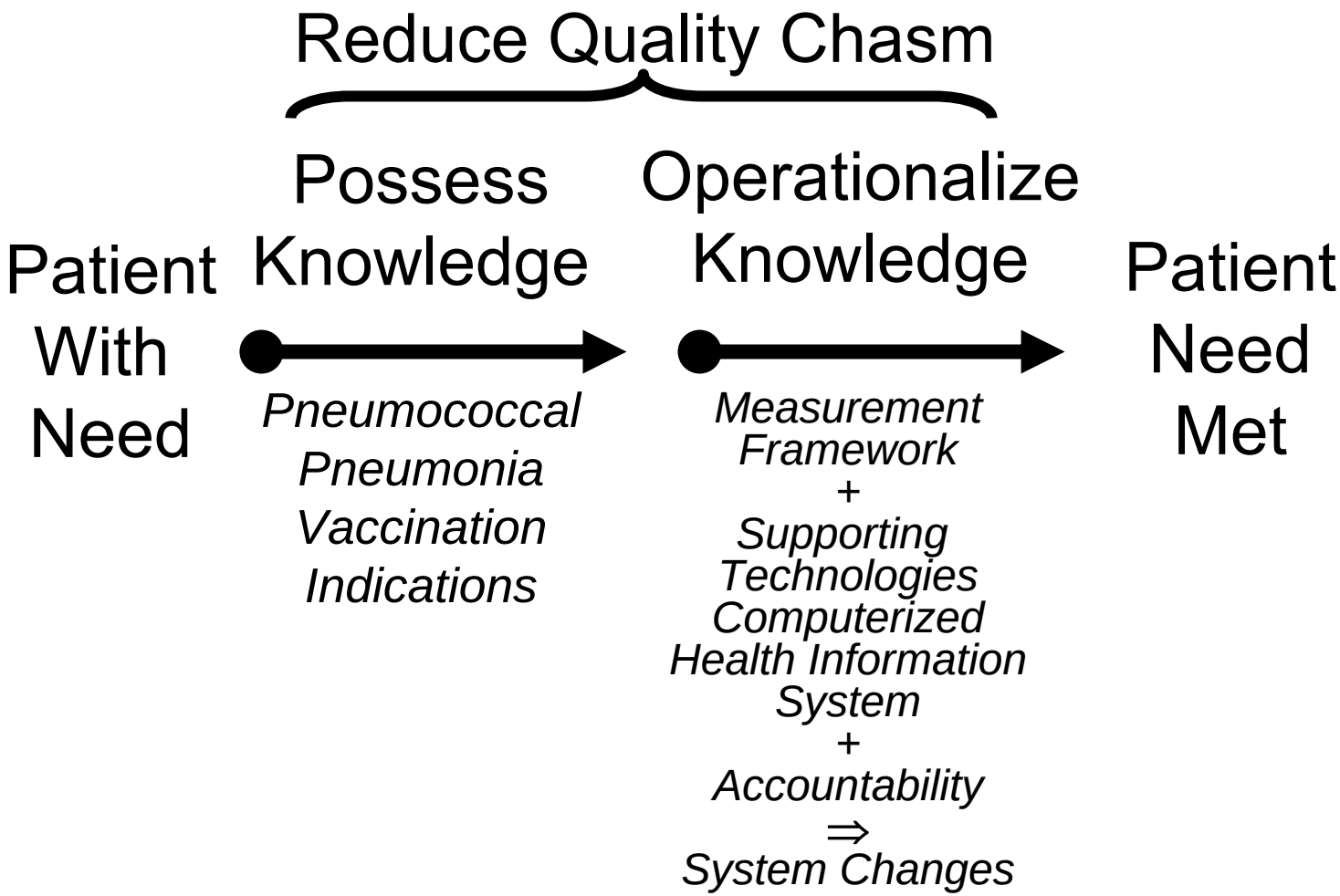
# 3) VA's Electronic Health Record Underpinned Improvement



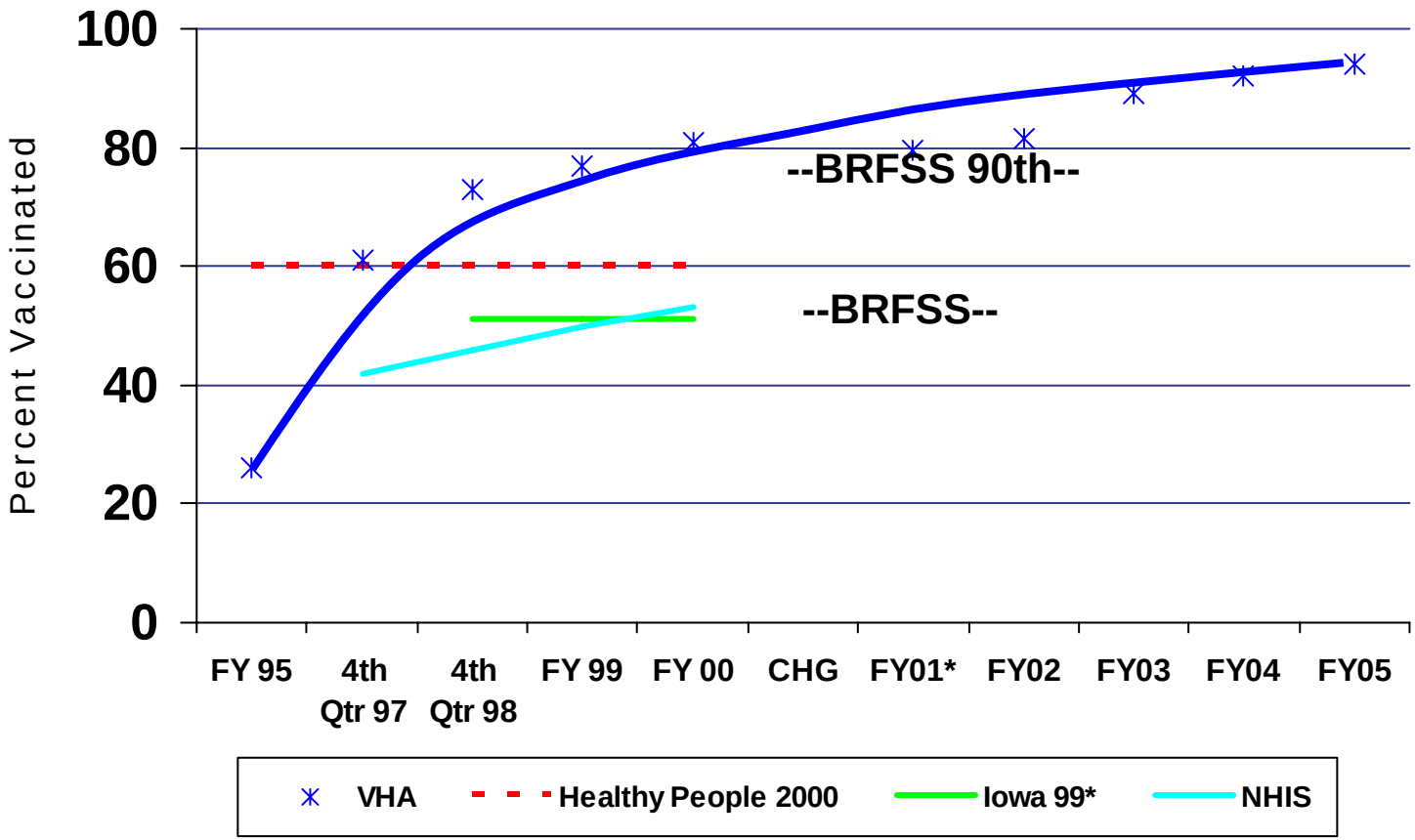



- **5.85 Sigma Performance**
- **Helped hold per prescription costs virtually constant for 5 years (~2½ % / year)**

# From Evidence to Practice…



# 3) Operationalizing Knowledge through the EHR
## - Pneumonia Vaccination Rate Improvement in VA

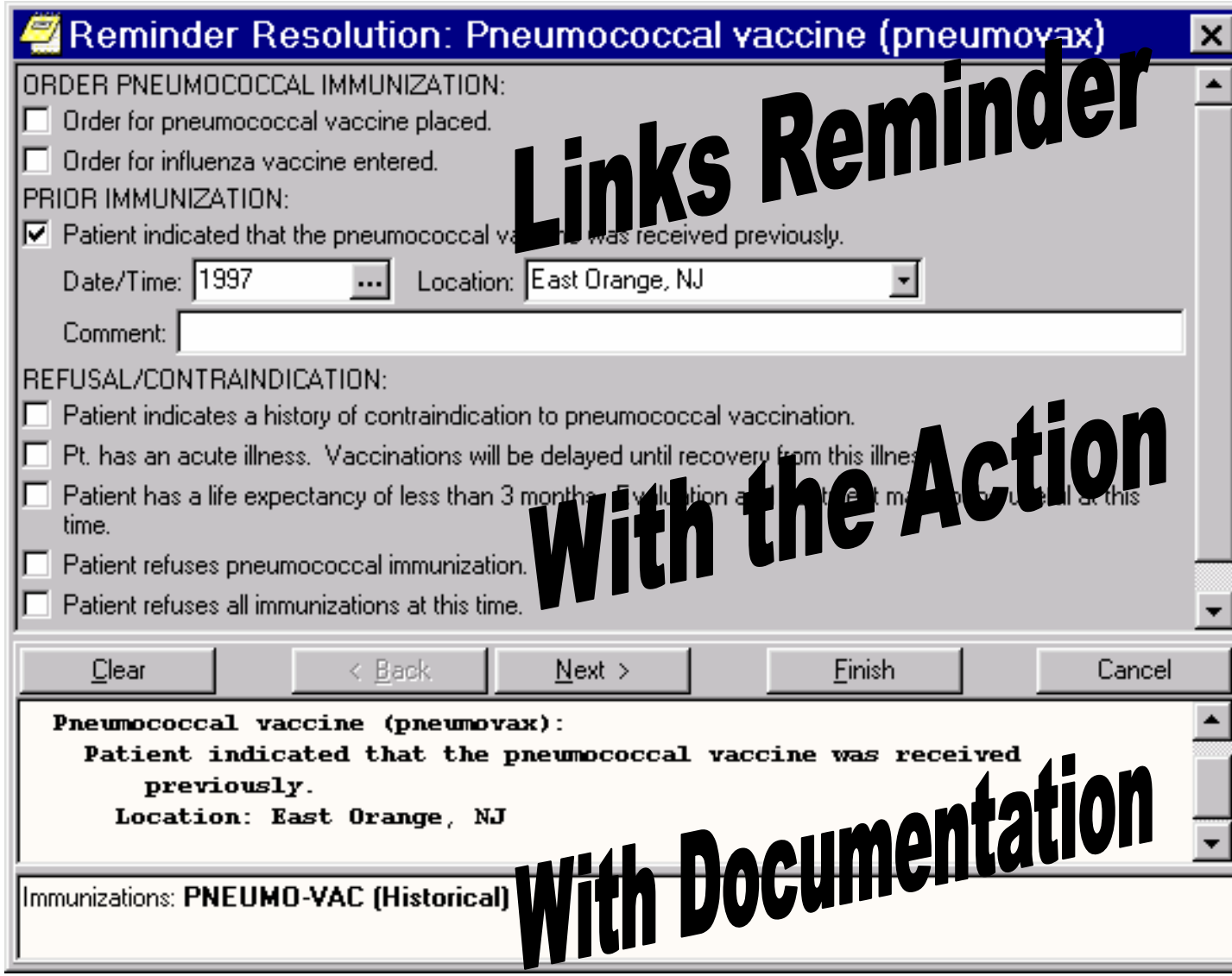



•Iowa: Petersen, *Med Care* 1999;37:502-9. >65/ch dz
•HHS: National Health Interview Survey, >64

# Clinical Reminders for Decision-Support

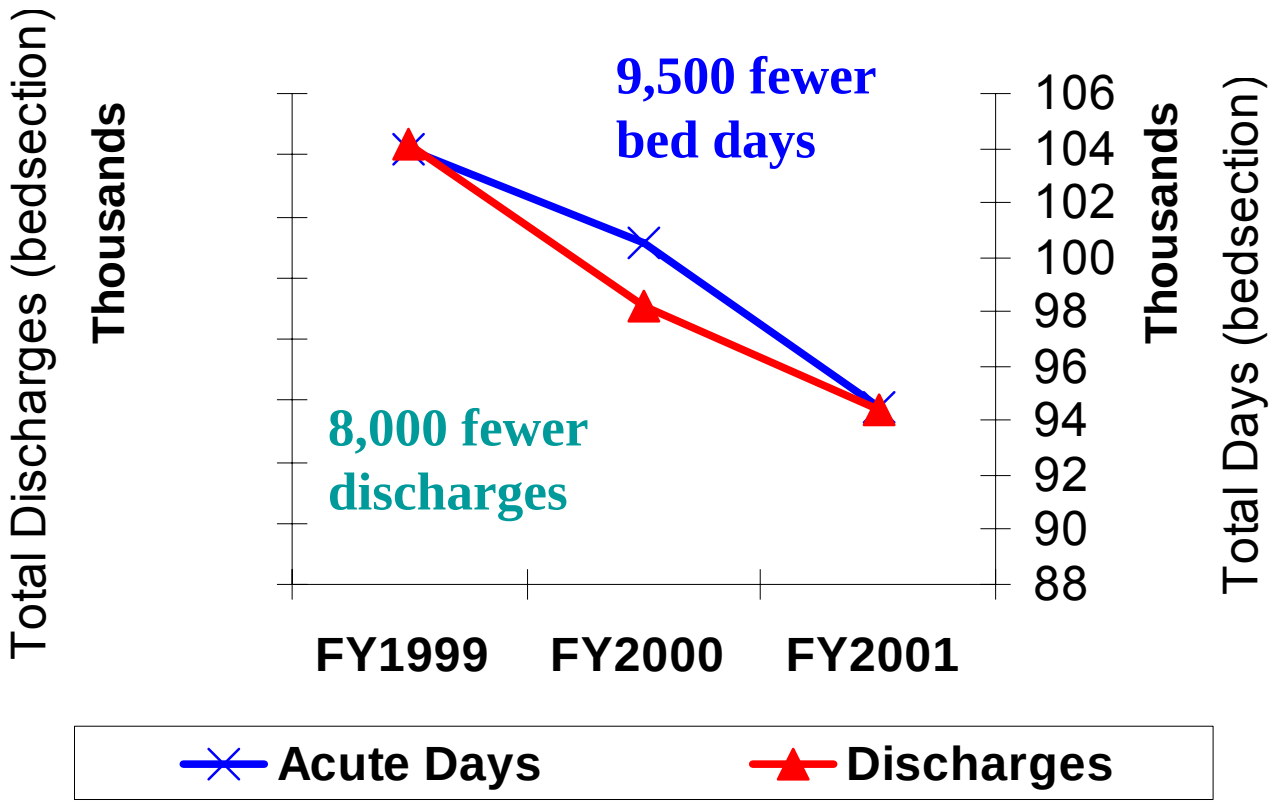
Contemporary Expression of Practice Guidelines

- Time & Context Sensitive
- Reduce Negative Variation
- Create Standard Data
- Acquire health data beyond care delivered in VA



# Pneumonia: Acute Inpatient

## DRG89-90 VHA Data - Unadjusted



**Increased Rates of Pneumococcal Vaccination have saved over 6,000 lives, just among Veterans with Emphysema !**

Extrapolated from K Nichols *et al*

# 3) QUALITY: RAND Study - Asch, McGlynn *et al*

*Annals of Internal Medicine 2004;141:938-945*

IMPROVING PATIENT CARE | Quality of Care in the Veterans Health Administration

**"VHA scored significantly higher… on 294 quality metrics"**

*Table 4.* **Adjusted Adherence to Indicators by Category***

| Indicator Category | VHA Sample | | | | National Sample | | | | Difference (95% CI), *percentage points* |
|---|---|---|---|---|---|---|---|---|---|
| | Indicators, *n*† | Patients, *n* | Eligible Events, *n*‡ | Mean Score, % | Indicators, *n*† | Patients, *n* | Eligible Events, *n*‡ | Mean Score, % | |
| Overall | 294 | 596 | 11 449 | 67 | 330 | 992 | 18 961 | 51 | 16 (14 to 18) |
| Chronic care | 202 | 561 | 5924 | 72 | 222 | 824 | 7396 | 59 | 13 (10 to 17) |
| COPD | 17 | 103 | 465 | 69 | 19 | 62 | 668 | 59 | 10 (−2 to 23) |
| Coronary artery disease | 31 | 93 | 557 | 73 | 37 | 179 | 1117 | 70 | 3 (−3 to 16) |
| Depression | 14 | 96 | 266 | 80 | 14 | 131 | 497 | 62 | 18 (11 to 26) |
| Diabetes | 13 | 232 | 1309 | 70 | 13 | 186 | 1683 | 57 | 13 (8 to 18) |
| Hyperlipidemia | 7 | 169 | 256 | 64 | 7 | 204 | 346 | 53 | 11 (1 to 21) |
| Hypertension | 24 | 405 | 1147 | 78 | 24 | 468 | 1681 | 65 | 13 (8 to 20) |
| Osteoarthritis | 3 | 173 | 216 | 65 | 3 | 154 | 236 | 57 | 8 (−1 to 18) |
| Preventive care | 27 | 596 | 4721 | 64 | 32 | 991 | 9169 | 44 | 20 (12 to 28) |
| Acute care | 60 | 153 | 804 | 53 | 76 | 334 | 2396 | 55 | −2 (−9 to 4) |
| Screening | 15 | 597 | 2254 | 68 | 16 | 991 | 5598 | 46 | 22 (20 to 26) |
| Diagnosis | 145 | 594 | 3762 | 73 | 139 | 992 | 6502 | 61 | 12 (8 to 16) |
| Treatment | 103 | 596 | 3155 | 56 | 126 | 992 | 4845 | 41 | 15 (12 to 18) |
| Follow-up | 37 | 477 | 2016 | 72 | 43 | 524 | 2278 | 58 | 14 (10 to 18) |
| VHA performance measures | 26 | 596 | 3976 | 67 | 26 | 992 | 6699 | 43 | 24 (21 to 26) |
| VHA performance conditions | 144 | 596 | 5875 | 70 | 152 | 992 | 8590 | 58 | 12 (10 to 15) |
| Non-VHA performance conditions | 124 | 394 | 1598 | 55 | 152 | 579 | 3672 | 50 | 5 (0 to 10) |

* Adjusted for age, number of chronic conditions, number of acute conditions, and number of outpatient visits. COPD = chronic obstructive pulmonary disease; VHA = Veterans Health Administration.
† Number of unique indicators in category with at least 1 eligible patient.
‡ The number of eligible events is the number of times indicators in the category were triggered.

**Annals of Internal Medicine**
*Established in 1927 by the American College of Physicians*



"*. . . Overall, VHA patients receive better care than patients in other settings*"

IMPROVING PATIENT CARE

Improving Patient Care is a special section within *Annals* supported in part by the U.S. Department of Health and Human Services (HH
Agency for Healthcare Research and Quality (AHRQ). The opinions expressed in this article are those of the authors and do not repres
the position or endorsement of AHRQ or HHS.

# Comparison of Quality of Care for Patients in the Veterans Health Administration and Patients in a National Sample

Steven M. Asch, MD, MPH; Elizabeth A. McGlynn, PhD; Mary M. Hogan, PhD; Rodney A. Hayward, MD; Paul Shekelle, MD, MPH; Lisa Rubenstein, MD; Joan Keesey, BA; John Adams, PhD; and Eve A. Kerr, MD, MPH

21 December 2004 | Volume 141 Issue 12 | Pages 938-945

**Background:** The Veterans Health Administration (VHA) has introduced an integrated electronic medical record, performance measurement, and other system changes directed at improving care. Recent comparisons with other delivery systems have been limited to a small set of indicators.

**Objective:** To compare the quality of VHA care with that of care in a national sample by using a comprehensive quality-of-care measure.

**Design:** Cross-sectional comparison.

**Setting:** 12 VHA health care systems and 12 communities.

**Patients:** 596 VHA patients and 992 patients identified through random-digit dialing. All were men

**Measurements:** Between 1997 and 2000, quality was measured by using a chart-based quality i
were adjusted for clustering, age, number of visits, and medical conditions.

**Results:** Patients from the VHA scored significantly higher for adjusted overall quality (67% vs. 51
chronic disease care (72% vs. 59%; difference, 13 percentage points [CI, 10 to 17 percentage poi
[CI, 12 to 28 percentage points]), but not for acute care. The VHA advantage was most prominent

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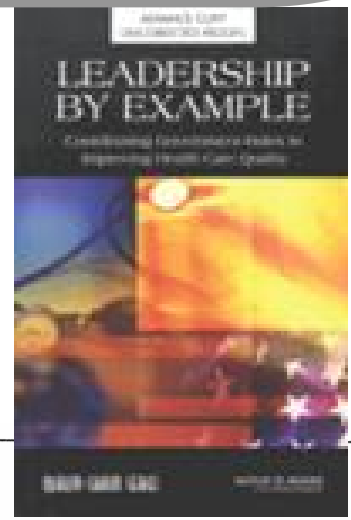



EDITORIAL

## Creating a Culture of Quality: The Remarkable Transformation of the Department of Veterans Affairs Health Care System

For decades, fairly or unfairly, the Department of Veterans Affairs (VA) health care system had a suboptimal image in the quality of care it provided and in the evalua-

come, diabetes severity, and other comorbid conditions) uniformly across systems and used these measures to adjust for differences other than sex between the VA and com-

The Veterans Health Administratio
Quality, Value, Accountability, and Inform
Transforming Strategies for Patient-Cente

*Jonathan B. Perlin, MD, PhD, MSHA; Robert M. Kolodne and Robert H. Roswell, MD*

IMPROVING PATIENT CARE

## Diabetes Care Quality in the Veterans Affairs Health Care System and Commercial Managed Care: The TRIAD Study

Eve A. Kerr, MD, MPH; Robert B. Gerzoff, MS; Sarah L. Krein, PhD, RN; Joseph V. Selby, MD, MPH; John D. Piette, PhD; J. David Curb, MD, MPH; William H. Herman, MD, MPH; David G. Marrero, PhD; K.M. Venkat Narayan, MD, MSc, MBA; Monika M. Safford, MD; Theodore Thompson, MS; and Carol M. Mangione, MD, MSPH

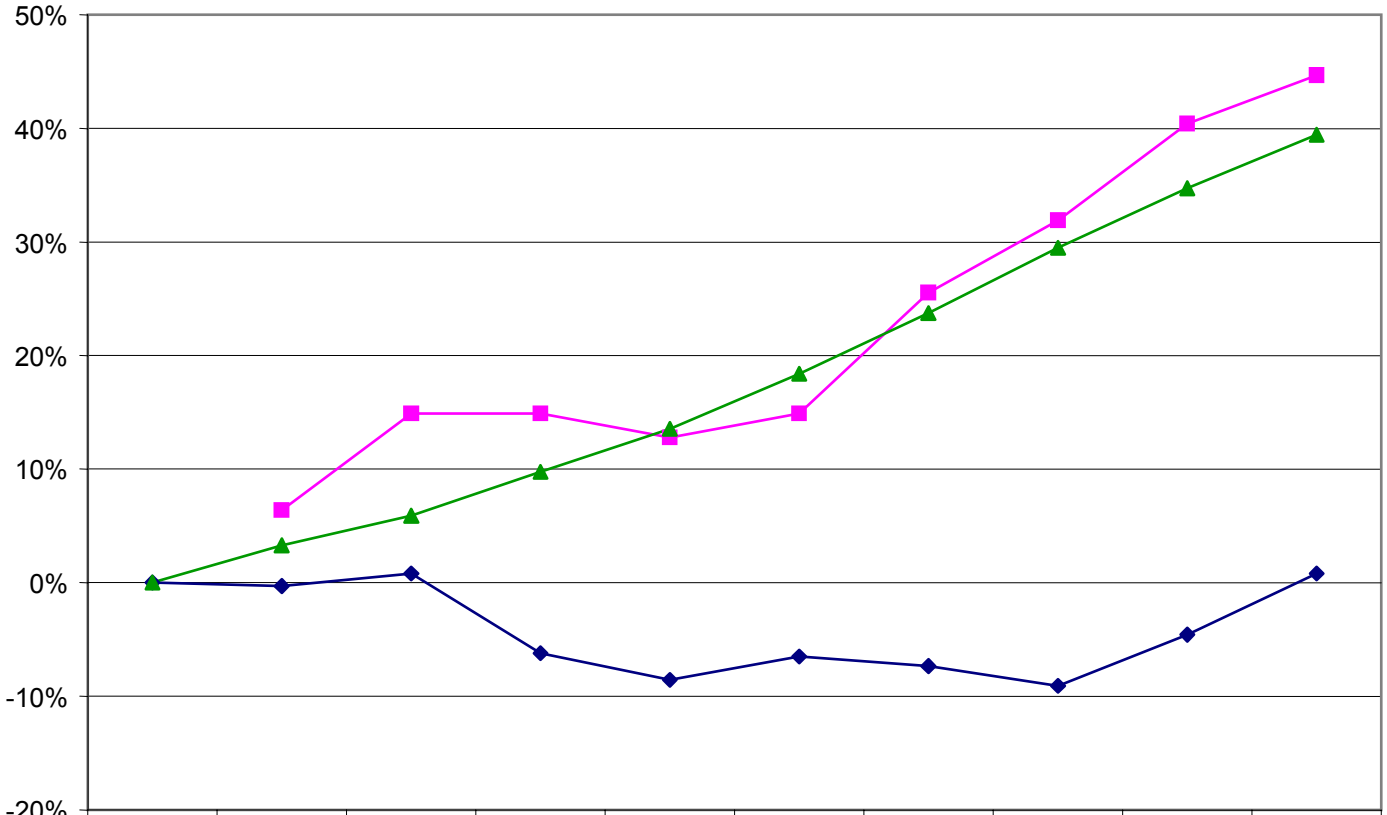
Background: **No studies have compared care in the Department of Veterans Affairs (VA) with that delivered in commercial managed care organizations, nor have studies focused in depth on care comparisons for chronic, outpatient conditions.**

Results: **Patients in the VA system had better scores than patients in commercial managed care on all process measures (for example, 93% vs. 83% for annual hemoglobin $A_{1c}$; $P = 0.006$; 91% vs. 75% for annual eye examination: $P < 0.001$). Blood**

# 3) COST-EFFECTIVENESS:

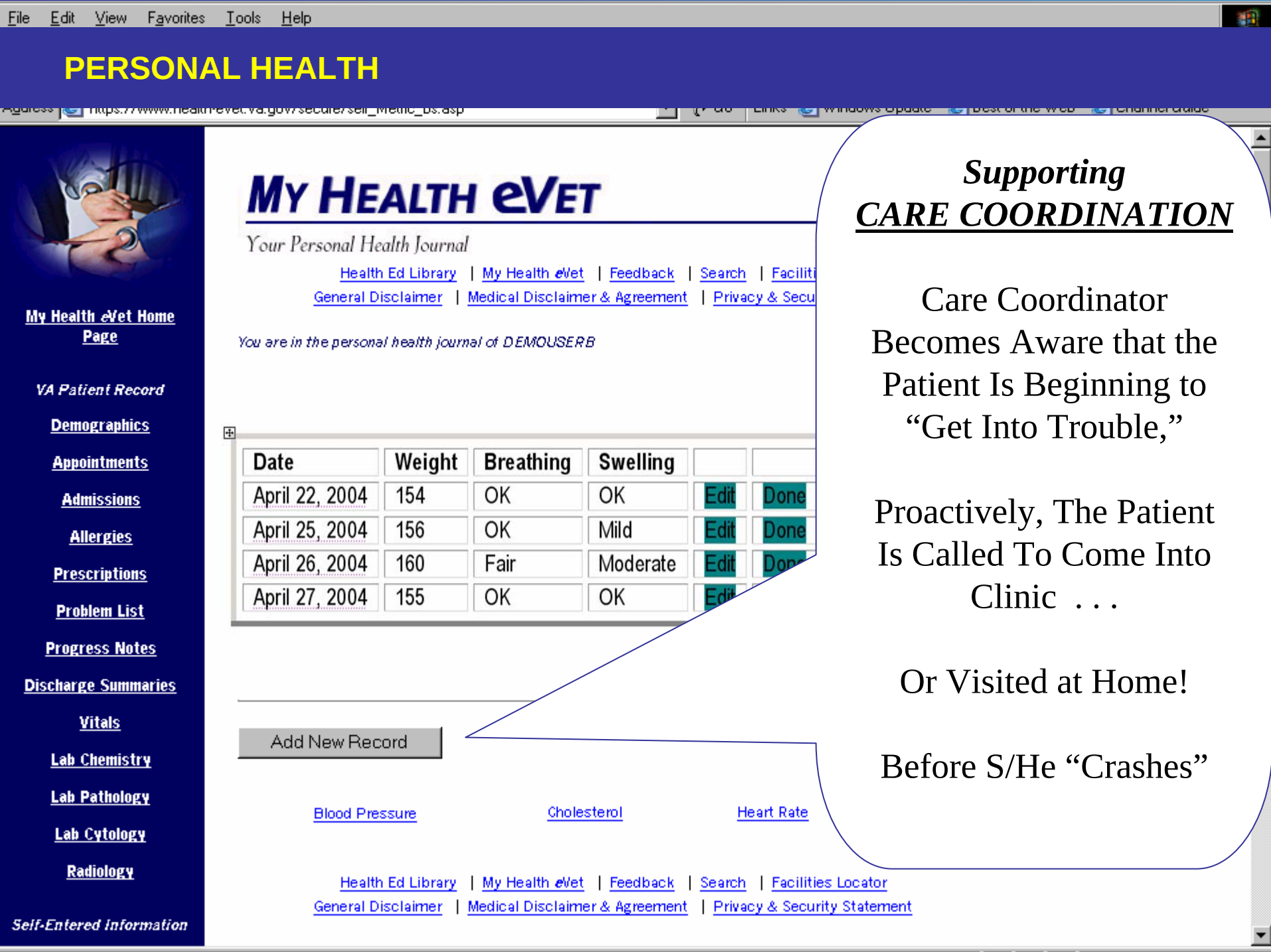
## Ten Year Cumulative Percent Change in Costs

- VHA Cost per Patient– Total Medical Care Obligations (including MAMOE) per Total Unique Patients (including non Veterans)
- Average Medicare Payment per Enrollee—Medicare Program Benefits per Enrollee (www.cms.hhs.gov/researchers/pubs/datacompendium)
- Medical Consumer Price Index-- Bureau of Labor Statistics (household "out of pocket" medical expenses including insurance and co-payments)




| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|
| VHA Cost Per Patient | - | -0.3% | 0.8% | -6.2% | -8.6% | -6.5% | -7.3% | -9.1% | -4.6% | 0.8% |
| Avg. Medicare Payment/Enrollee | | 6.4% | 14.9% | 14.9% | 12.8% | 14.9% | 25.5% | 31.9% | 40.4% | 44.7% |
| Medical CPI | - | 3.3% | 5.9% | 9.8% | 13.5% | 18.4% | 23.7% | 29.5% | 34.7% | 39.4% |

# PERSONAL HEALTH




***Supporting***
***CARE COORDINATION***

Care Coordinator Becomes Aware that the Patient Is Beginning to "Get Into Trouble,"

Proactively, The Patient Is Called To Come Into Clinic . . .

Or Visited at Home!

Before S/He "Crashes"

# COMMUNITY HEALTH: Hurricane Katrina

- 50,000 New Orleans VA Patients did not lose their medical records, even when they lost their City
  - Their Electronic Health Records followed them around the USA!
- VA Mobile Clinics served Veterans & Community

# 3) VA's Electronic Health Record Underpinned Improvement

TIME

FROM THE MAGAZINE

Sunday, Aug. 27, 2006

## How VA Hospitals Became The Best

No longer a nation's shame, veteran care is acing competitors

By DOUGLAS WALLER

Most private hospitals can only dream of the futuristic medicine Dr. Divya Shroff practices today. Outside an elderly patient's room, the attending physician gathers her residents around a wireless laptop propped on a mobile cart. Shroff accesses the patient's entire medical history--a stack of paper in most private hospitals. And instead of trekking to the radiology lab to view the latest X-ray, she brings it up on her computer screen. While Shroff is visiting the patient, a resident types in a request for pain medication, then punches the SEND button. Seconds later, the printer in the hospital pharmacy spits out the order. The druggist stuffs a plastic bag of pills into what looks like a tiny space capsule, then shoots it up to the ward in a vacuum tube. By the time Shroff wheels away her computer, a nurse walks up with the drugs.

Life in a big-name institution like the Mayo Clinic? Not hardly. Shroff, 31, a specialist in internal medicine, works at the Veterans Affairs hospital in Washington, where the vets who come for the cutting-edge treatment are mostly poor.

BusinessWeek online

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JULY 17, 2006

HEALTH

Back to Main Story

## Winning Scorecard

Hospitals in the Veterans Affairs system outpace those in the private sector by many measures

### QUALITY of Care

The latest Rand Corp. study found that VA patients, on average, received about two-thirds of the care recommended by national standards, compared with just half for patients at a sample of the nation's other hospitals. Here's the breakdown:

| HEALTH INDICATOR | VA SCORE* | NATIONAL SAMPLE** |
|---|---|---|
| Overall | 67% | 51% |
| Chronic care | 72 | 59 |
| Lung disease | 69 | 59 |
| Heart disease | 73 | 70 |
| Depression | 80 | 62 |
| Diabetes | 70 | 47 |
| Hypertension | 78 | 65 |
| High cholesterol | 64 | 53 |
| Osteoarthritis | 65 | 57 |
| Preventive care | 64 | 44 |
| Acute care | 53 | 55 |
| Screening | 68 | 46 |
| Diagnosis | 73 | 61 |
| Treatment | 56 | 41 |
| Follow-up | 73 | 58 |

*596 VA patients **992 patients at non-VA hospitals
Data: Rand Corp.; Agency for Healthcare Research & Quality

### Patient SATISFACTION

For the sixth year in a row, veterans in 2005 were happier than other patients with their health care.

| | VA | PRIVATE SECTOR |
|---|---|---|
| Inpatient | 83* | 73 |
| Outpatient | 80 | 75 |

*Out of 100 Data: American Customer Satisfaction Index

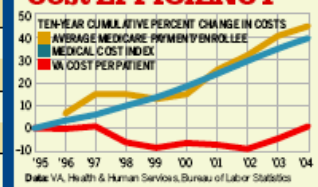
### TECHNOLOGY Use

The VA has the most advanced electronic-records system in the U.S.

| PERCENTAGE OF NEW-DRUG AND PROCEDURE ORDERS ENTERED ELECTRONICALLY | |
|---|---|
| VA | 94% |
| Academic medical centers | 30 |
| Nationwide | 8 |

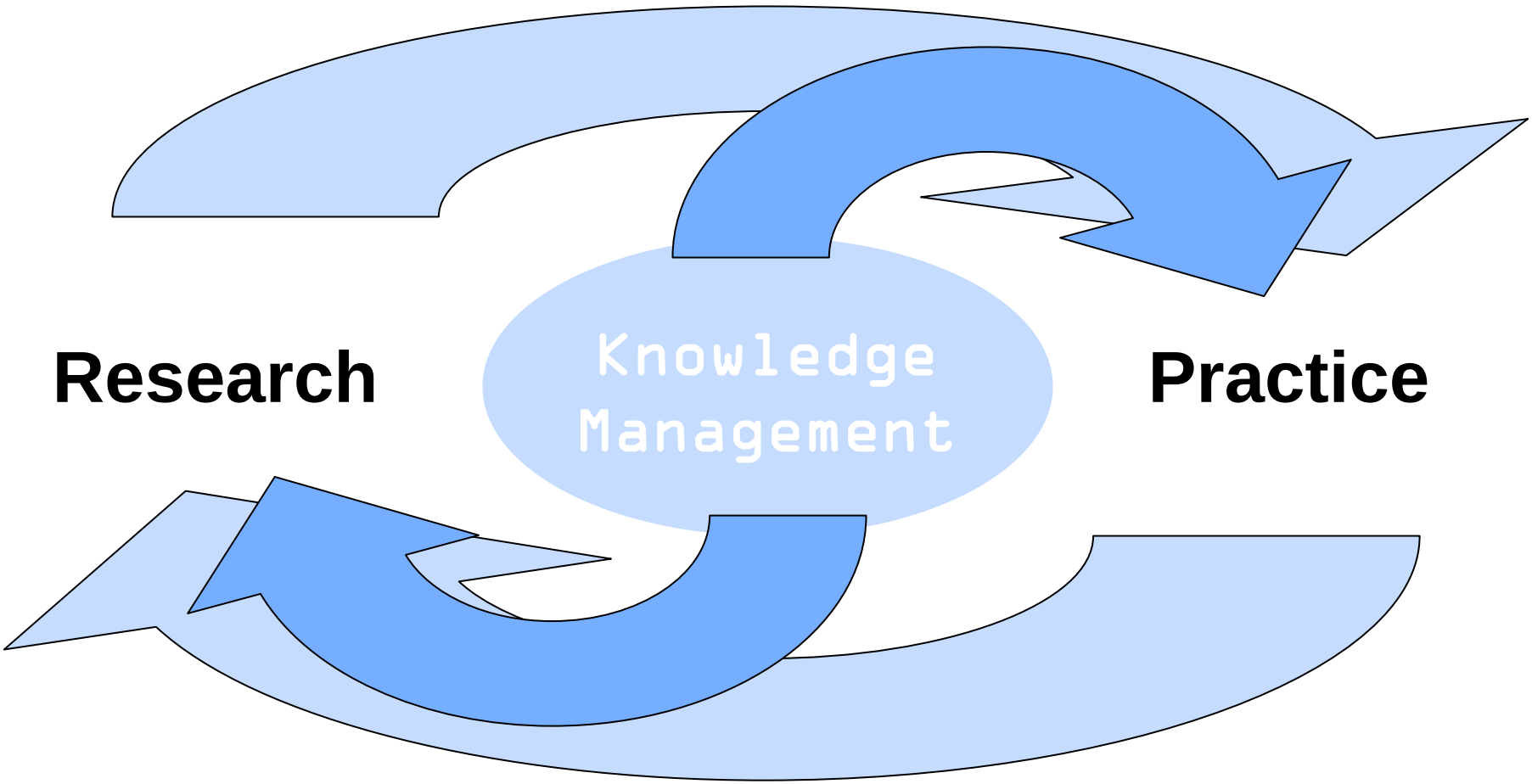
Data: Commonwealth Foundation

### Cost EFFICIENCY




Data: VA, Health & Human Services, Bureau of Labor Statistics

# 4) New Knowledge as a Transparent By-Product of Care From TRIP to TPIR & TPIP. . .

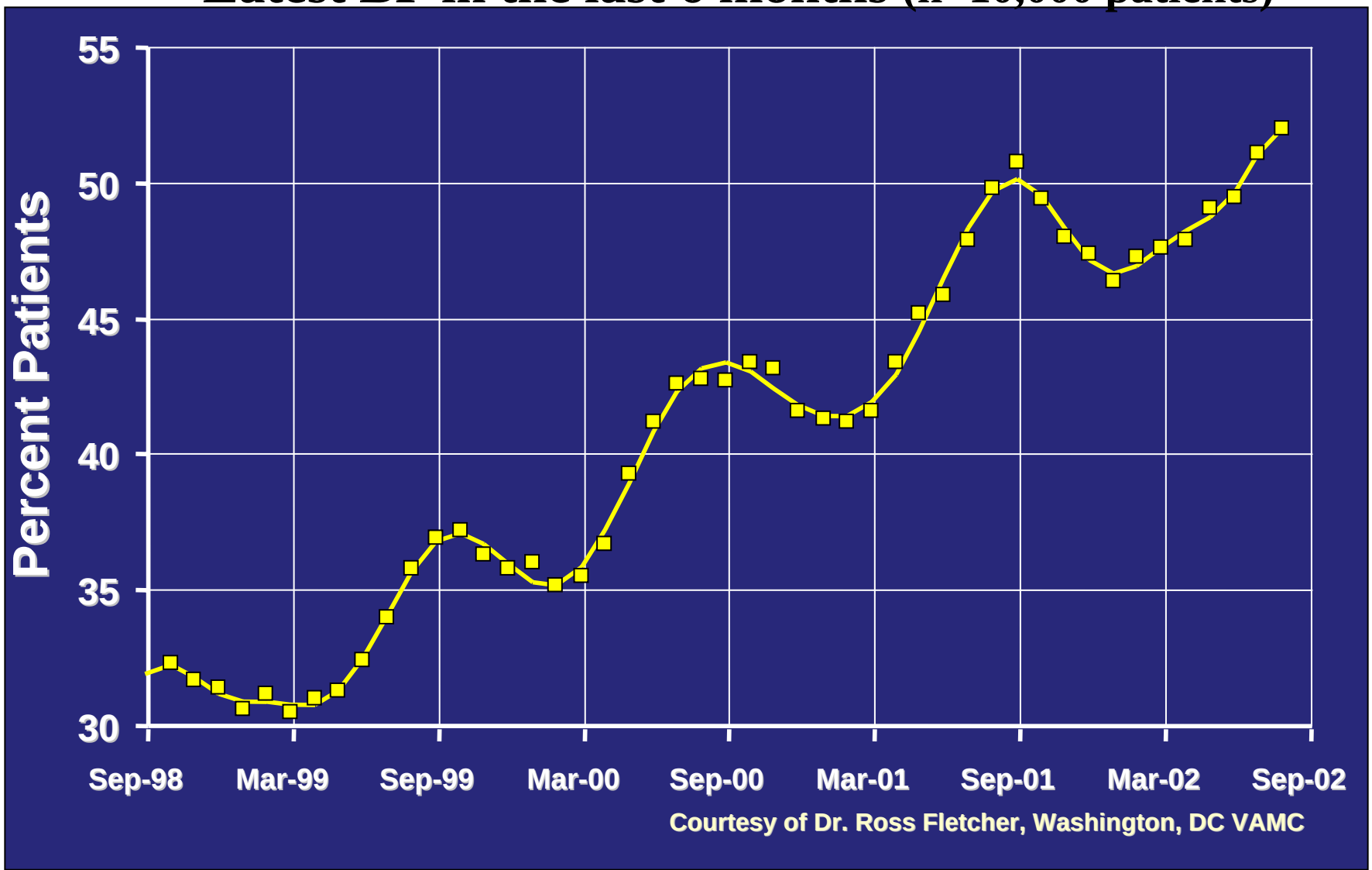


# 4) Creating Discovery From Care . . .

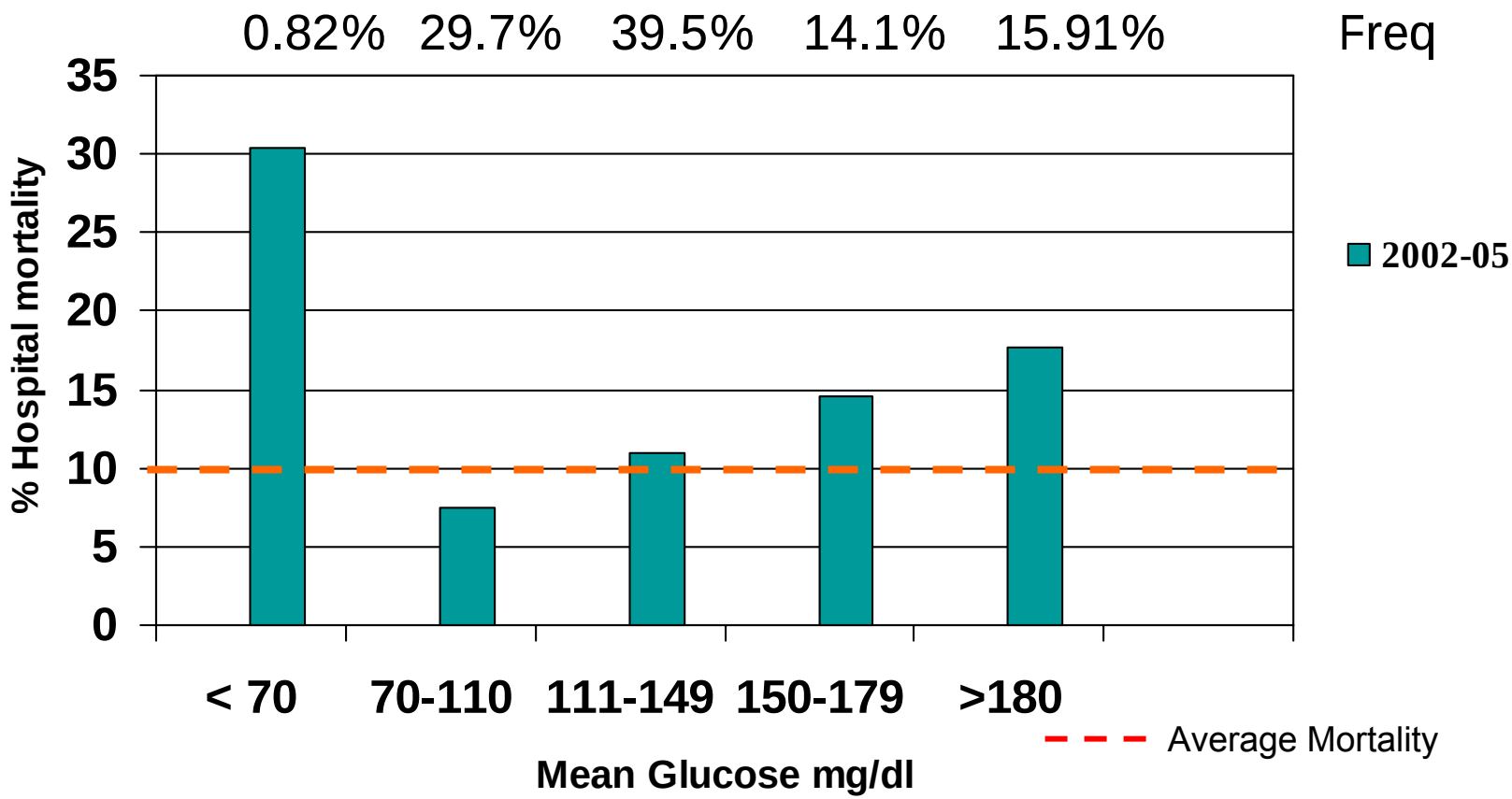
- Vast Data Repositories as By-Product of Care
  - Ubiquitous Health Data Input
  - Large Data Sets (VA, Kaiser, NHS, HCA) or Interoperable Health Information
- Current Process: Hypothesis and Data-Mining
- Cue from other Industries (Machine Learning)
  - NSA
  - Google Searches → Profile
    - e.g. ≤3 searches → Male, 35-45, blue suits, Japanese car
- Future State: Hypothesis Generation?
    - Task: Evaluate Biological Plausibility / Clinical Relevance
- Need Work in Novel Research Methods
  - Quasi-Experimental & Adaptive Designs

# Discovery: Seasonal Variation in Blood Pressure of Hypertensive Patients Returning to < 140 / < 90

## Latest BP in the last 6 months (n=10,000 patients)



# Unadjusted Mortality, Frequency and Mean Glucose in VA ICU's




N=221,035

# Adjusted Odds Ratios for Mortality (2002-05) in VA ICU's

## Mean Glucose is Independently Associated with Increased Mortality

| | Odds Ratio (95% CI) | | | |
|---|---|---|---|---|
| | Mean Glucose (mg/dl) | | | |
| | 111-145 | 146-199 | 200-300 | > 300 |
| Entire cohort | 1.3 (1.2-1.3) | 1.7 (1.6-1.8) | 2.0 (1.9-2.1) | 2.6 (2.3-2.9) |
| No DM | 1.3 (1.2-1.4) | 1.9 (1.8-2.0) | 2.7 (2.4-2.9) | 3.8 (3.1-4.6) |
| + DM | 1.1 (1.0-1.3) | 1.4 (1.2-1.6) | 1.8 (1.5-2.0) | 2.4 (2.0-2.9) |

## 5) Getting to Genomics, Proteomics & Personalized Health Care: Some Examples. . .

- Pharmacogenomics
  - "Blockbuster" BP Drugs
  - Pediatric Leukemia
  - Alcohol Addiction
    - Naltrexone sensitive vs. insensitive patients
- Multifactorial Pattern Recognition
  - Hormone Replacement Therapy
  - Clinical Trials & Data Insensitivity
    - Not just surveillance for "bad" outcomes
      - Novel CTX agent & B6
  - Biomarker Patterns and Personalized Care
      - Colon CA met to Liver and Breast CA

# From Industrial Age to an Information Age Model . . .

- **Industrial Age:**
  - Care is centralized; the hospital is prominent
    - Provider-Centric
      - Patient expects to negotiate system
  - Knowledge vested in provider (almost) exclusively
    - Memory: Try to Know Everything
  - Knowledge development done mostly by researchers
  - Mass Production
    - Productivity is best evidence applied consistently
      - Population Guideline
- **Information Age:**
  - Care is decentralized; the point of service is the patient
    - Patient-Centric
      - System responsiveness to patient expectations
  - Knowledge accessible to professionals & patients
    - Skill: Know how to find information on anything & evaluate information quality
  - Knowledge development increasingly a by-product of care
  - Mass Customization
    - Productivity is best evidence applied uniquely
      - Personalized Health Care