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Evidence-based care management: the landscape for predictive models

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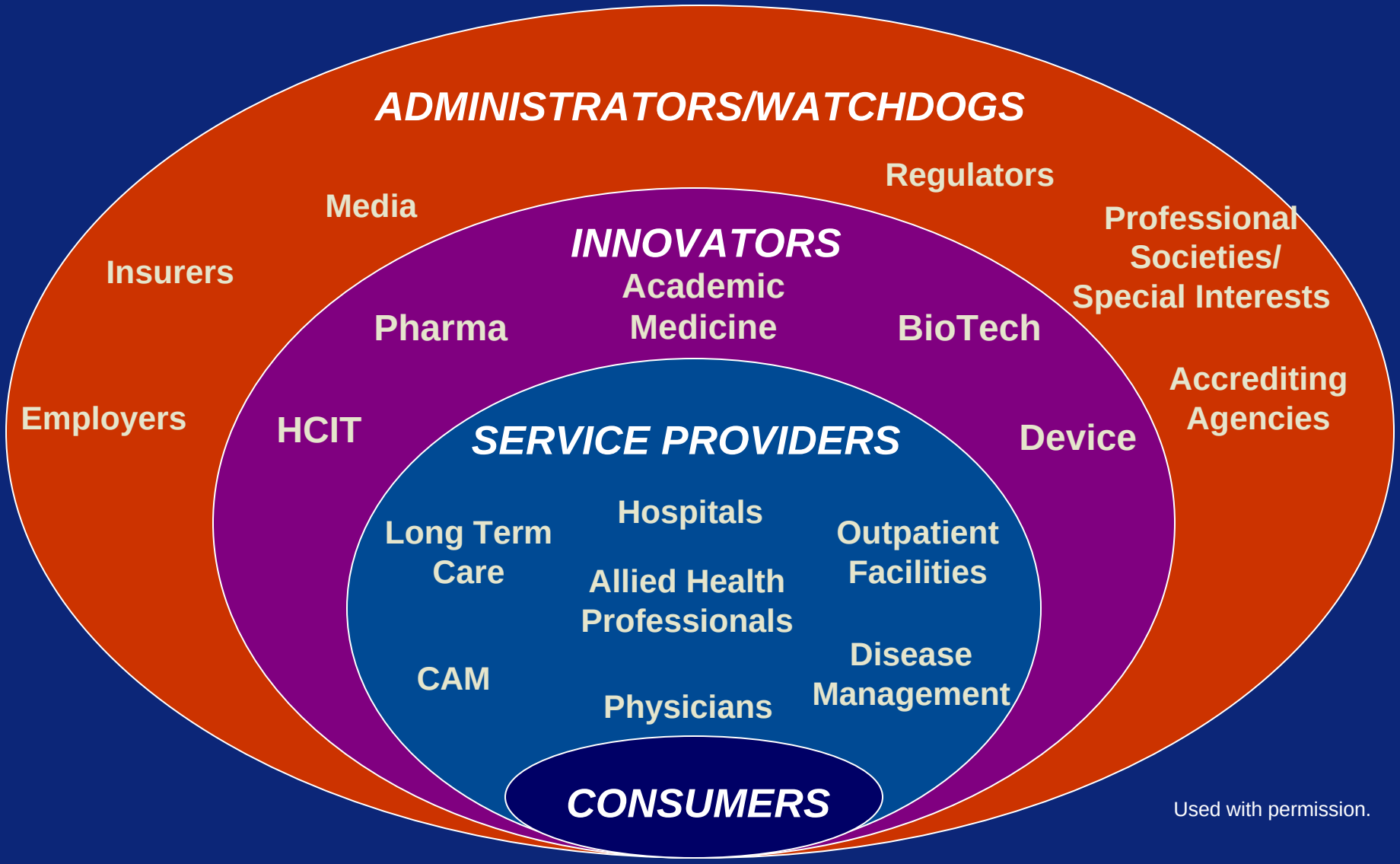
The National Predictive Modeling Summit

December 13, 2007

System: big, complex, change resistant . . .



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The system has achieved much . . .

The most important medical developments of the last millennium

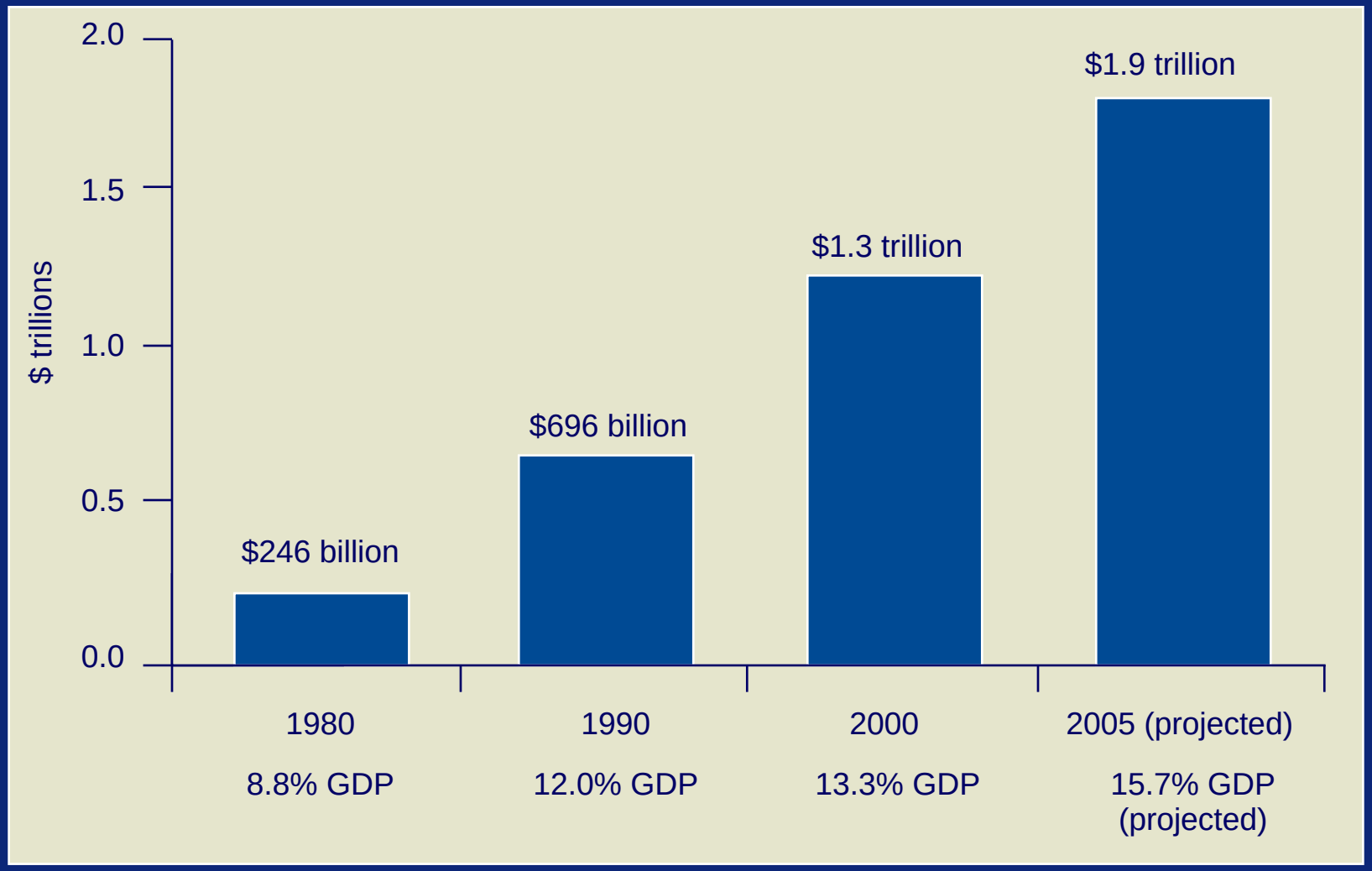
- Elucidation of Human Anatomy and Physiology
- Discovery of Cells and Their Substructures
- Elucidation of the Chemistry of Life
- Application of Statistics to Medicine
- Development of Anesthesia
- Discovery of the Relation of Microbes to Disease
- Discovery of the Immune System
- Development of Body Imaging
- Discovery of Antimicrobial Agents
- Development of Molecular Pharmacotherapy
- Sequencing of the Human Gene*
- Nanoscience tools for diagnostics and treatments*
- Biology of human behavior sequenced*
- Rational drug designs via proteomics, chemical biology, structural biology*

**** Last 10 years!!***

Results are impressive

- Virtual elimination of diphtheria, whooping cough, measles and polio
- Death rate from pneumonia reduced by 85%
- Over 90% reduction in deaths from tuberculosis
- Deaths from ulcers reduced by 60%
- In Hospital mortality form acute myocardial infraction reduced by 55% from 1975-1995 largely through the use of 3 drugs
- In industrialized nations there is a strong positive relationship between per capita pharmaceutical expenditure and life expectancy.
- In the 19 most prevalent diseases causing death, 73% of the reduction in life years lost before age 75 is due to new drug development.
- AIDS deaths in the U.S. reduced by over 50%

But it's costly: $7,523 per person in the U.S.!



Quality is suboptimal: "The quality of care we get is far from the care we should be getting" —Don Berwick, IHI

Preventive care deficiencies
- Child immunizations 76%
- Influenza vaccine 52%
- Pap smear 82%

Acute care deficiencies
- Antibiotic misuse 30%-70%
- Prenatal care 74%

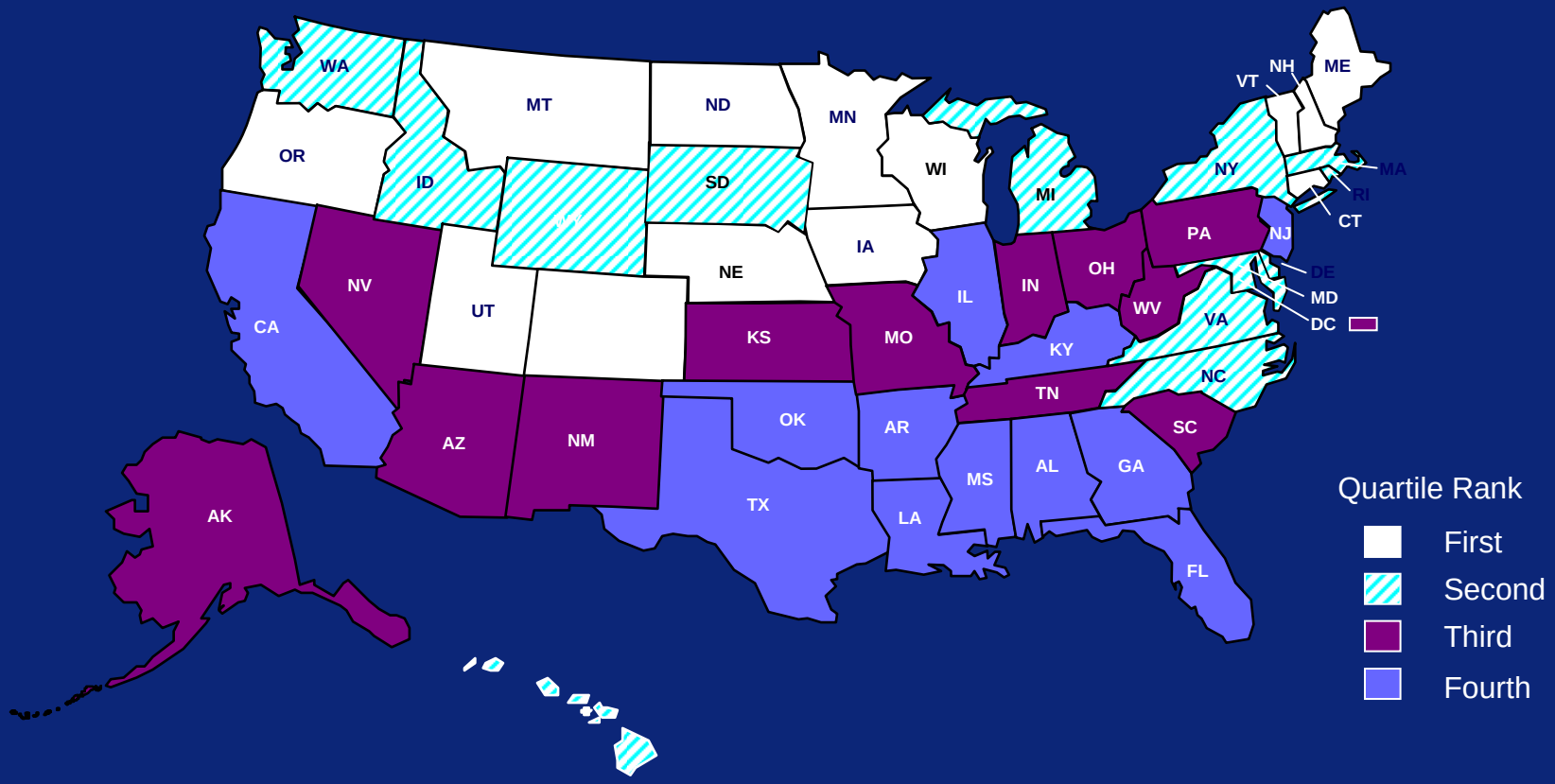
"Quality of Care"
Safe
Effective
Patient-centered
Timely
Efficient
Equitable

Surgery care deficiencies
- Inappropriate hysterectomy 16%
- Inappropriate CABG surgeries 14%

Chronic care deficiencies
- Beta blockers 50%
- Diabetes eye exam 53%

Hospital care deficiencies
- Proper CHF care 50%
- Preventable deaths 14%
- Preventable ADEs 1.8/100 admits
  - Life threatening 20%
  - Serious 43%

Quality varies depending on where you live



Note: State ranking based on 22 Medicare performance measures.

Source: S.F. Jencks, E.D. Huff, and T. Cuerdon, "Change in the Quality of Care Delivered to Medicare Beneficiaries, 1998–1999 to 2000–2001," *Journal of the American Medical Association* 289, no. 3 (Jan. 15, 2003): 305–312.

Why does “care” vary by where people live? Two possible answers . . .

- People have different medical needs and expectations (preference-sensitive care)
  - Epidemiology and population health
  - Patient preferences (preference sensitive care)

- Physicians practice differently (supply sensitive care)
  - Practice patterns vary
  - Composition of medical community vary (supply sensitive care)

“Variation”: A basic framework

- Two major categories
  - Appropriate variation: *when the evidence isn’t strong*
  - Inappropriate variation: *when the evidence is strong*

- Three types of inappropriate variation
  - Overuse
  - Underuse
  - Misuse

Example: Variation in chronic care during last six months of life

	U.S. Average	*Lowest*	*Highest*
Days Spent in Hospital	11.7	7.3 (UT)	16.4 (NY)
Days in ICU	3.2	1.5 (ND)	4.7 (FL)
Physician Visits	29.0	17.0 (UT)	35.5 (NY)
% Seeing 10 or More Physicians	27.5%	13.3% (ID)	35.6% (NY)
% Deaths Associated with Admission to ICU	18.5%	11.7% (SD)	25.1% (NJ)
% Deaths enrolled in Hospice	27.2%	6.7% (AK)	39.3% (CO)
Medicare Expenditures (A,B) in Last Two Years	$29,199	$23,855 (ND)	$39,637 (DC)

Example: Geographic variation in the appropriate use of cesarean delivery

- There is enormous geographic variation in the use of cesarean delivery:
  - For births over 2,500 grams, adjusted cesarean rates vary fourfold between low and high-use areas.
  - Even for births under 2,500 grams, high-use counties have rates that are double those of low-use ones. Higher cesarean rates are only partially explained by patient characteristics but are greatly influenced by non-medical factors such as provider density, the capacity of the local health care system, and malpractice pressure. Areas with higher usage rates perform the intervention in medically less appropriate populations—that is, relatively healthier births—and do not see improvements in maternal or neonatal mortality.

Health Affairs 25 (2006): w355-w367; 10.1377/hlthaff.25.w355

Examples of inappropriate variation

Misuse

- 22% of patients take less medication than prescribed
- Antibiotic use for acute otitis media in children
- Bed rest instead of routine activity for back pain
- Cox2 inhibitors over older NSAIDS/ibuprofen (vioxx, celebrex 8-16 x more harmful)
- 16% of hysterectomies not necessary
- 14% of CABG procedures not necessary
- 7% of hospital patients experience serious medication error
- Antibiotic use for upper respiratory infections (physicians say it increases patient satisfaction)

Underuse

- Only 45% of diabetic patients receive appropriate care
- Only 53% of diabetics have retinal exam
- Only 50% of heart attack patients receive beta blockers
- Only 82% of women of pap smear
- Only 76% of children have immunizations
- Only 50% of elderly receive pneumoccal vaccine

Overuse

- No correlation between # of prenatal visits and outcome (birth)
- Urinalysis and culture for UTI in symptomatic women
- Tests for asymptomatic patients routinely done for which there is not evidence of efficacy:
  - Chest X Ray for elderly, smokers
  - Hemoglobin for anemia
  - ESR for infammatory infective disease
  - Liver function tests in blood
  - Renal function tests
  - Calcium in blood
  - Uric acid in blood
  - PSA in men 50+
  - Glucose in blood
  - HDL/LDL ratio
  - Mammographs for women 40+
  - Ultrasound exam: ovaries
  - Bone densitometry in women
  - Resting ECG
  - Exercise ECG on treadmill
  - Ultrasound exam of aorta: males 55+
- 30% of children get excessive antibiotics for ear infections
- 20-50% of surgeries not necessary (IHI)
- 50% x-ray for low back pain not needed

Why so much variation? Adherence to evidence varies widely

Condition	% Recommended Care Received
Senile cataract	**78.7**
Breast cancer	**75.7**
Prenatal Care	**73.0**
Low back pain	**68.5**
Coronary artery disease	**68.0**
Hypertension	**64.7**
Congestive heart failure	**63.9**
Cerebrovascular disease	**59.1**
Chronic obstructive pulmonary disease	**58.0**
Depression	**57.7**
Orthopedic conditions	**57.2**
Osteoarthritis	**57.3**
Colorectal cancer	**53.9**

Condition	% Recommended Care Received
Asthma	**53.5**
Benign prostatic hyperplasia	**53.0**
Hyperlipidemia	**48.6**
Diabetes mellitus	**45.4**
Headache	**45.2**
Urinary tract infection	**40.7**
Community acquired pneumonia	**39.0**
Sexually transmitted diseases	**36.7**
Dyspepsia/peptic ulcer disease	**32.7**
Atrial fibrillation	**24.7**
Hip fracture	**22.7**
Alcohol dependence	**10.5**

McGlynn et al., “The Quality of Health Care Delivered to Adults in the United States” NEJM June 26, 2003

And, we make mistakes

1. Adverse drug events (ADEs, ADRs)
2. Iatrogenic infections
   - Post-operative deep wound infections
   - Urinary tract infections (UTI)
   - Lower respiratory infections (pneumonia or bronchitis)
   - Bacteremias and septicemias
3. Decubitus ulcers
4. Mechanical device failures
5. Complications of central and peripheral venous lines
6. Deep venous thrombosis (DVT) / pulmonary embolism (PE)
7. Strength, agility and cognition
8. Blood product transfusion
9. Patient transitions

Study: health care costs, error rates higher in U.S. than in other countries

November 4, 2005

- For the report, researchers surveyed 6,957 adults between March and June 2005 who recently had been hospitalized, had surgery or reported health problems in the U.S., Australia, Canada, Britain, New Zealand and Germany. The study also found the following:
  - 34% of U.S. patients surveyed reported getting the wrong medication or dose, incorrect test results, a mistake in their treatment or late notification of abnormal test results, compared with 30% of Canadians, 27% of Australians, 25% of New Zealanders, 23% of Germans and 22% of Britons;

Study: health care costs, error rates higher in U.S. than in other countries (cont.)

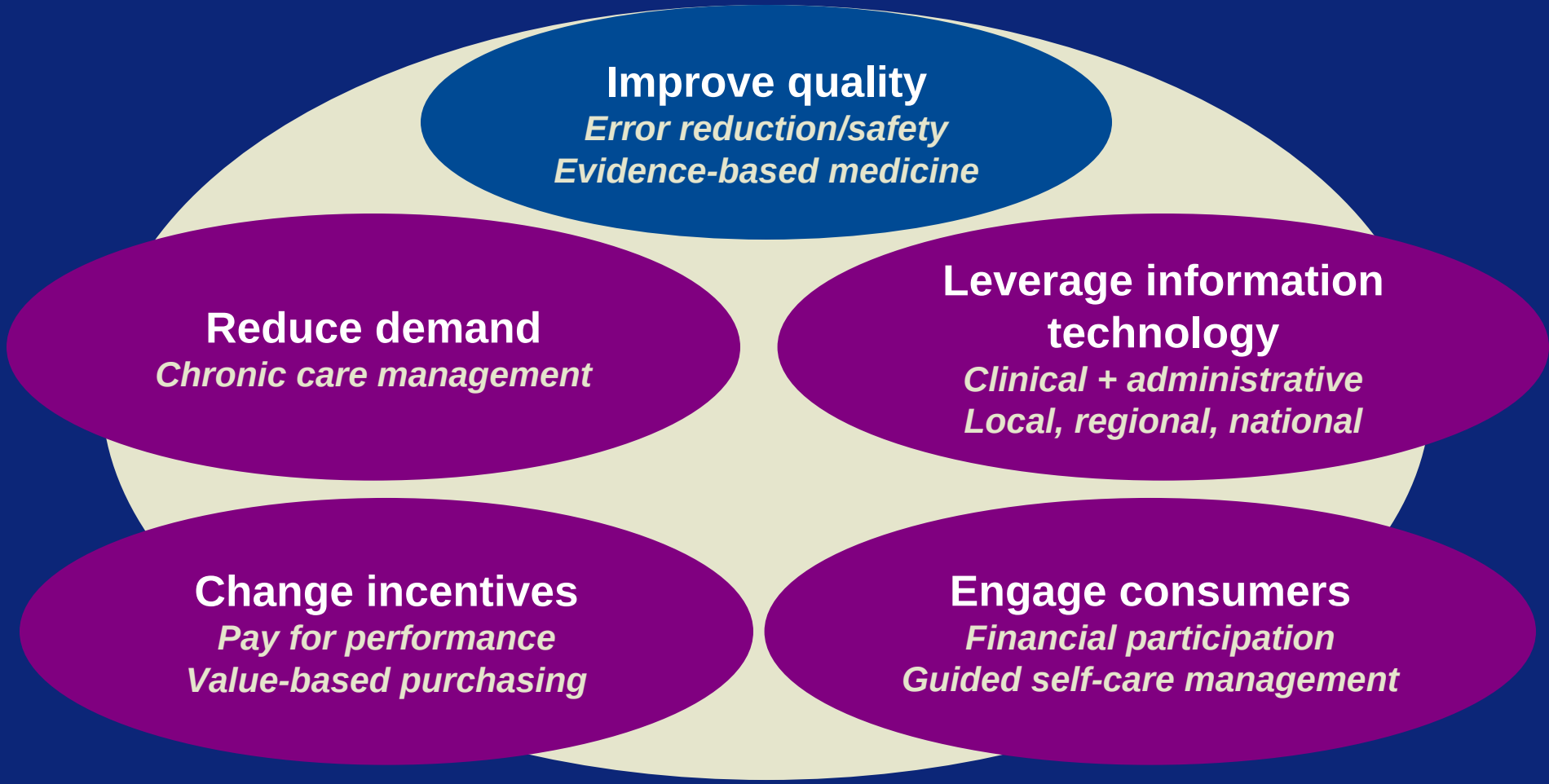
- About half of U.S. residents reported that they had decided not to fill a prescription, see a physician when sick or have recommended follow-up tests because of costs, compared with 38% of patients in New Zealand, 34% in Australia, 28% in Germany, 26% in Canada and 13% in Britain;
- Nearly one-third of U.S. patients reported paying more than $1,000 in out-of-pocket medical expenses in the past year, compared with 14% of Canadian and Australian patients and a much lower proportion of patients in the other countries (Washington Post, 11/4);
- 7% of U.S. residents who had been hospitalized in the past two years reported developing an infection while in the hospital, compared with 10% of Britons and 3% of Germans

A compounding problem: the uninsured

- **47,000,000 without insurance including 11,000,000 poor or un-insurable**
  - Most work . . .
  - Most are young . . .
  - Most would pay “something” . . .
  - Most receive services (but maybe too late or in the wrong place)

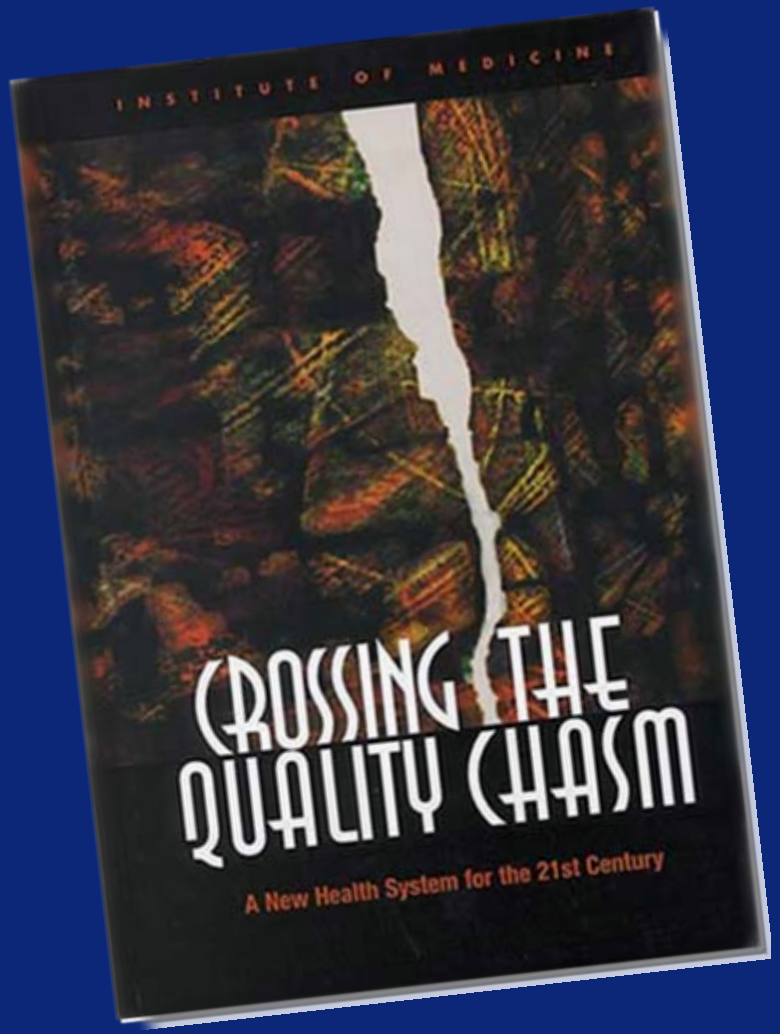
Our challenges are many . . .

Context: health system transformation



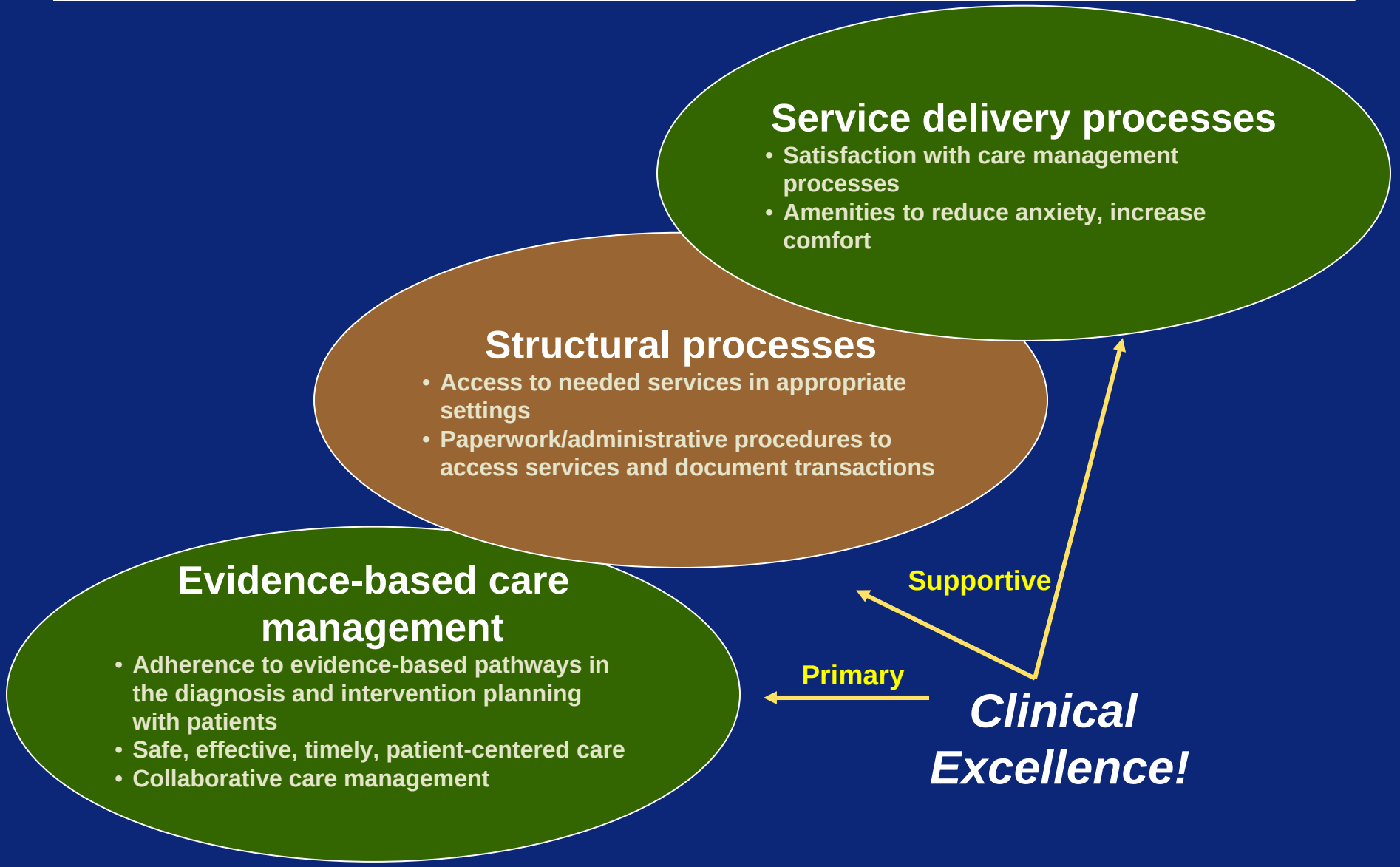
Quality is our number one concern!!

- Evidence based care
- Patient centered approach
- System orientation

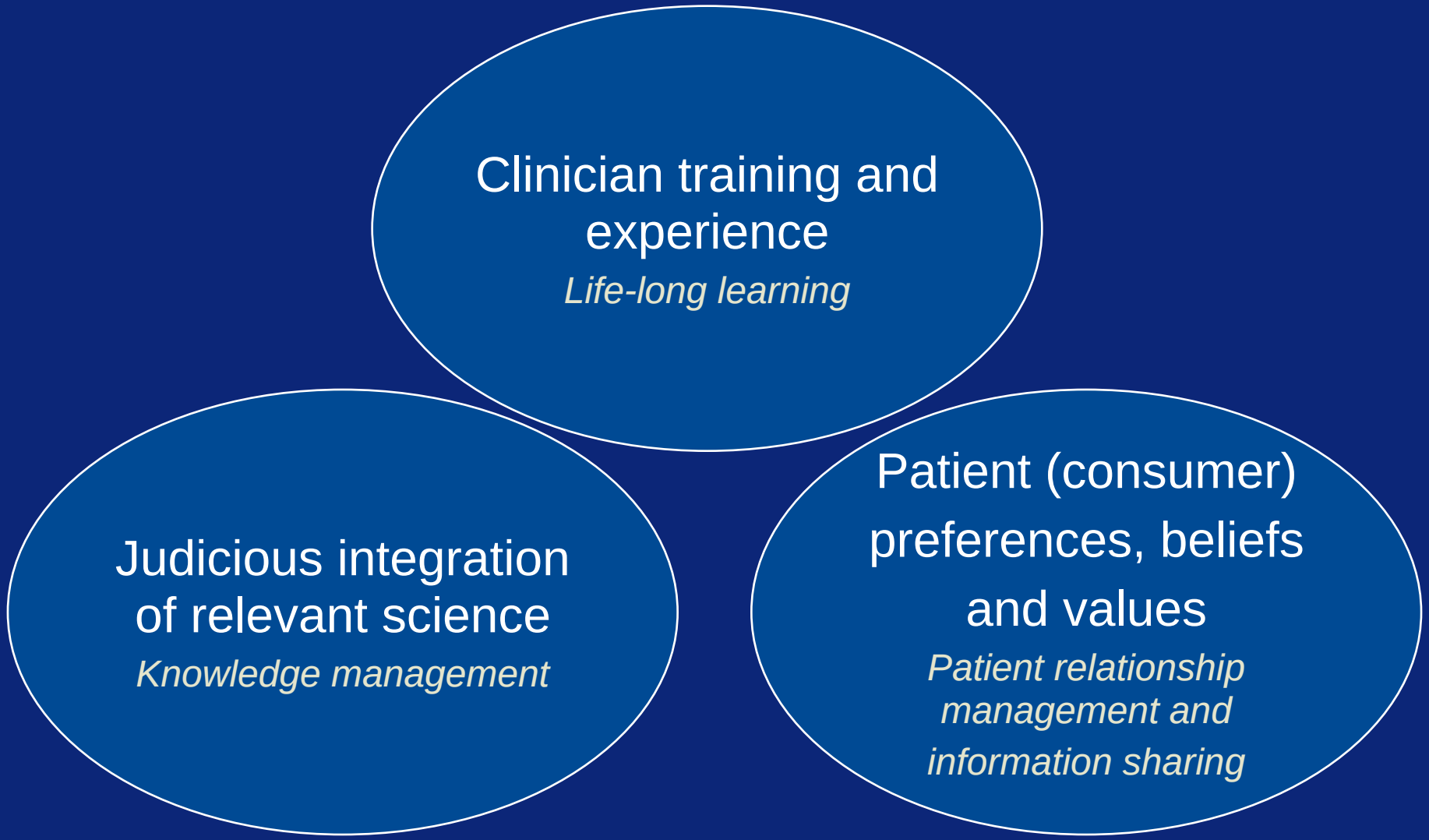


It's the basis for our purpose, worthwhile work, and making a difference

Evidence-based care management is the fundamental process for the delivery of safe and effective care



Evidence-based care management is the confluence of three ongoing processes –



"In an information dependent profession, there is far too often an alarming lack of access to needed information. It's not that doctors don't want to deliver the best care. The problem is that every physician can't always remember for a given patient what the best care ought to be. They too often can't remember or don't know if a particular test was run by another doctor, or whether a patient filled or refilled a prescription"

Quote by George Halverson, Chairman and CEO
Kaiser Foundation Health Plans Inc. and Kaiser Foundation Hospitals
"Industrial Revolution"
Managed Care Executive December, 2004 (pp. 22-26).

Common misconceptions about EBM

Misconception	*Correct Concept*
EBM is cookbook medicine	EBM is based on ***population-based guidelines***; by definition, it's not applicable to every patient
EBM is a cost-containment strategy	EBM is a ***quality improvement*** strategy; consistently applied, it can reduce costs by reducing inappropriate variation
EBM is about changing physician behavior	EBM is about increasing adherence by ***clinicians and patients***
EBM benefits payers most	EBM ***benefits patients most***

Guidelines: the framework for evidence-based medicine

"Systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances"

– IOM '92

- Derived from . . .
  - 20,000 RCTs annually
  - 4,000 guidelines since 1989
  - 2,500 periodicals in NLS

Every guideline is not evidence-based, and some guidelines are about who, what should be done

PICO: the framework for guidelines . . .

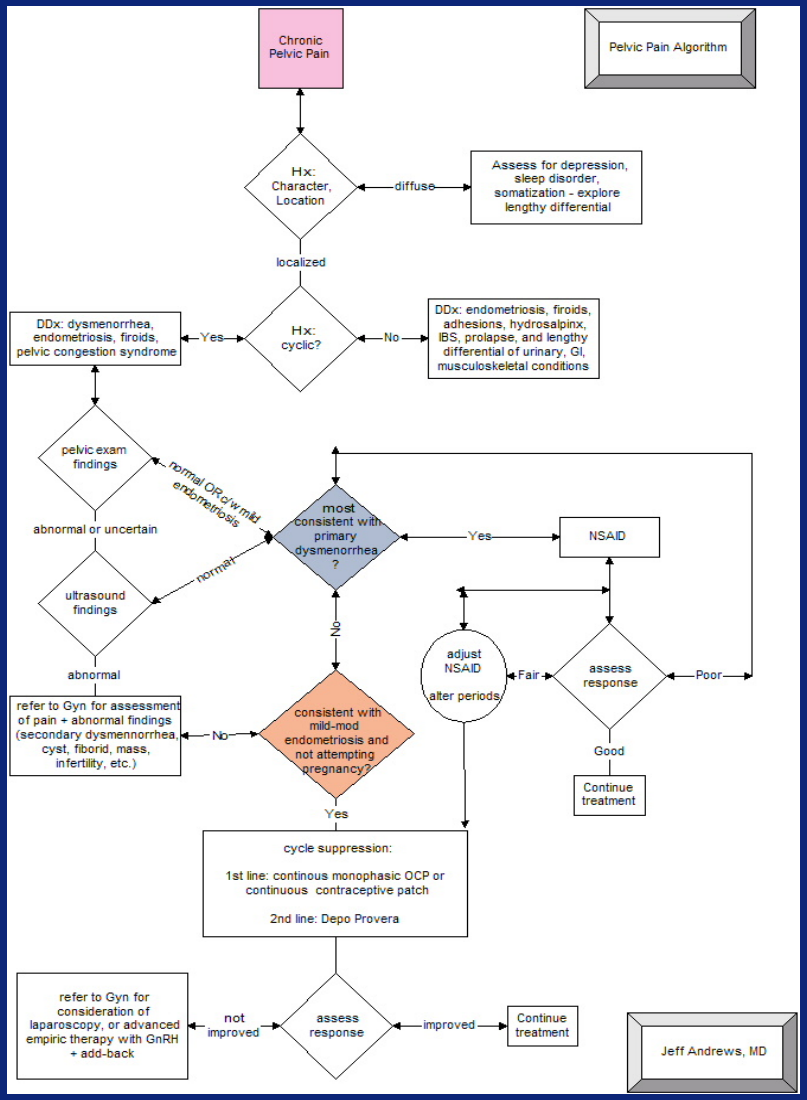
P... what's the population?

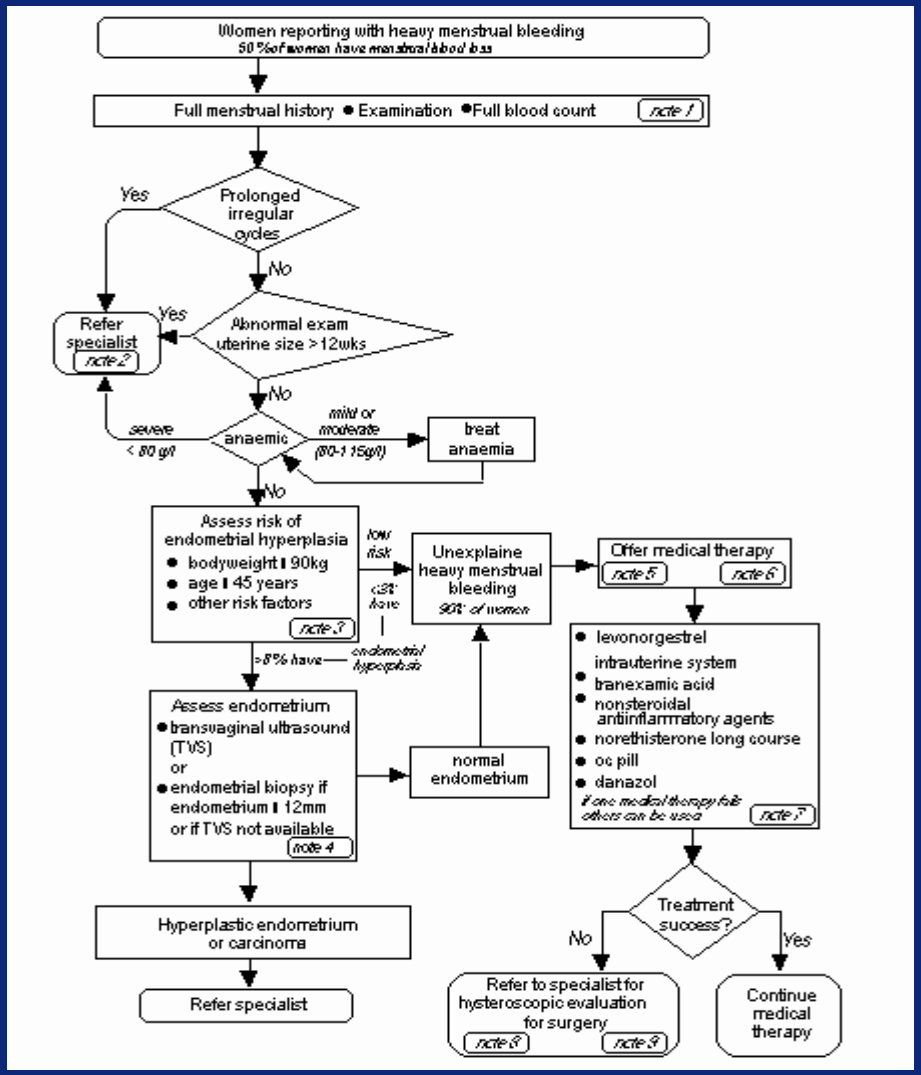
I…what intervention am I testing?

C... compared to what other intervention?

O... what outcome is being tested?

Then evidence-linked algorithms form the framework for guidelines



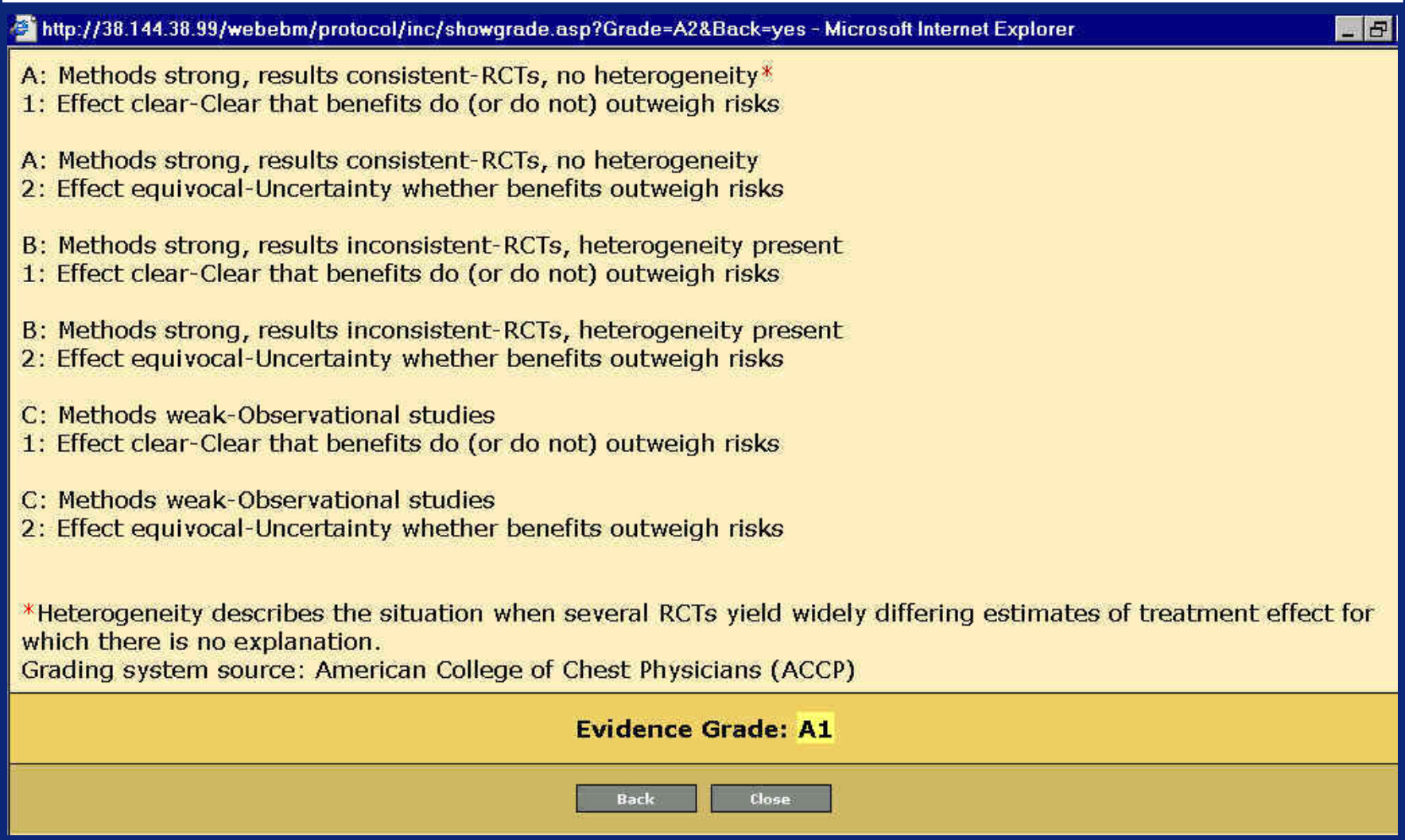


Process: evidence from scientific studies is critically appraised . . .

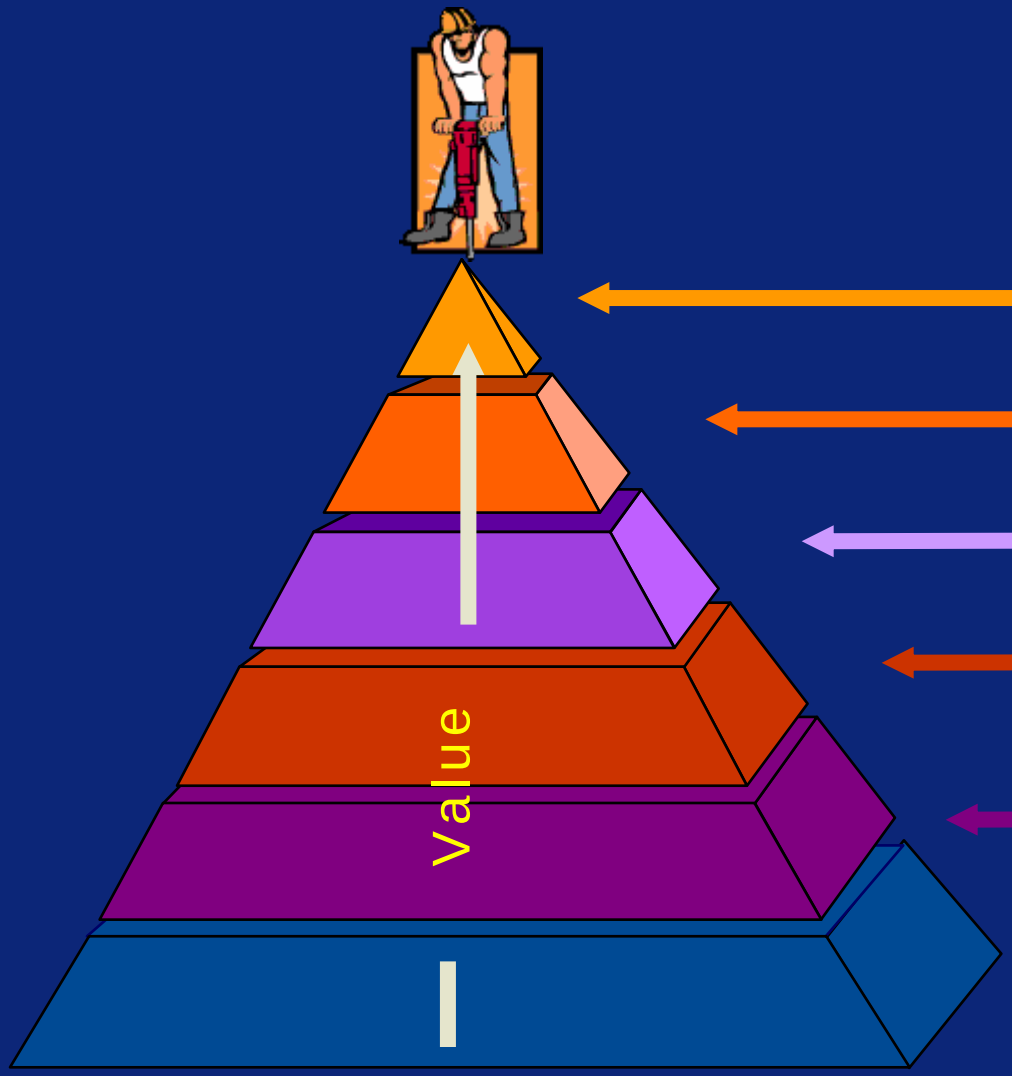
Considerations . . .

- Type of study
- Number of patients
- Quality of research
- Strength of effect
- Balance of benefits and risks
- Bias and influence
- Patient values and preferences
- Role of experience, expertise, consensus

Studies are graded using various schemes . . .



In practice, tools are used to stay abreast . . .



EBM Practice Guideline

Clinical Evidence
POEMs

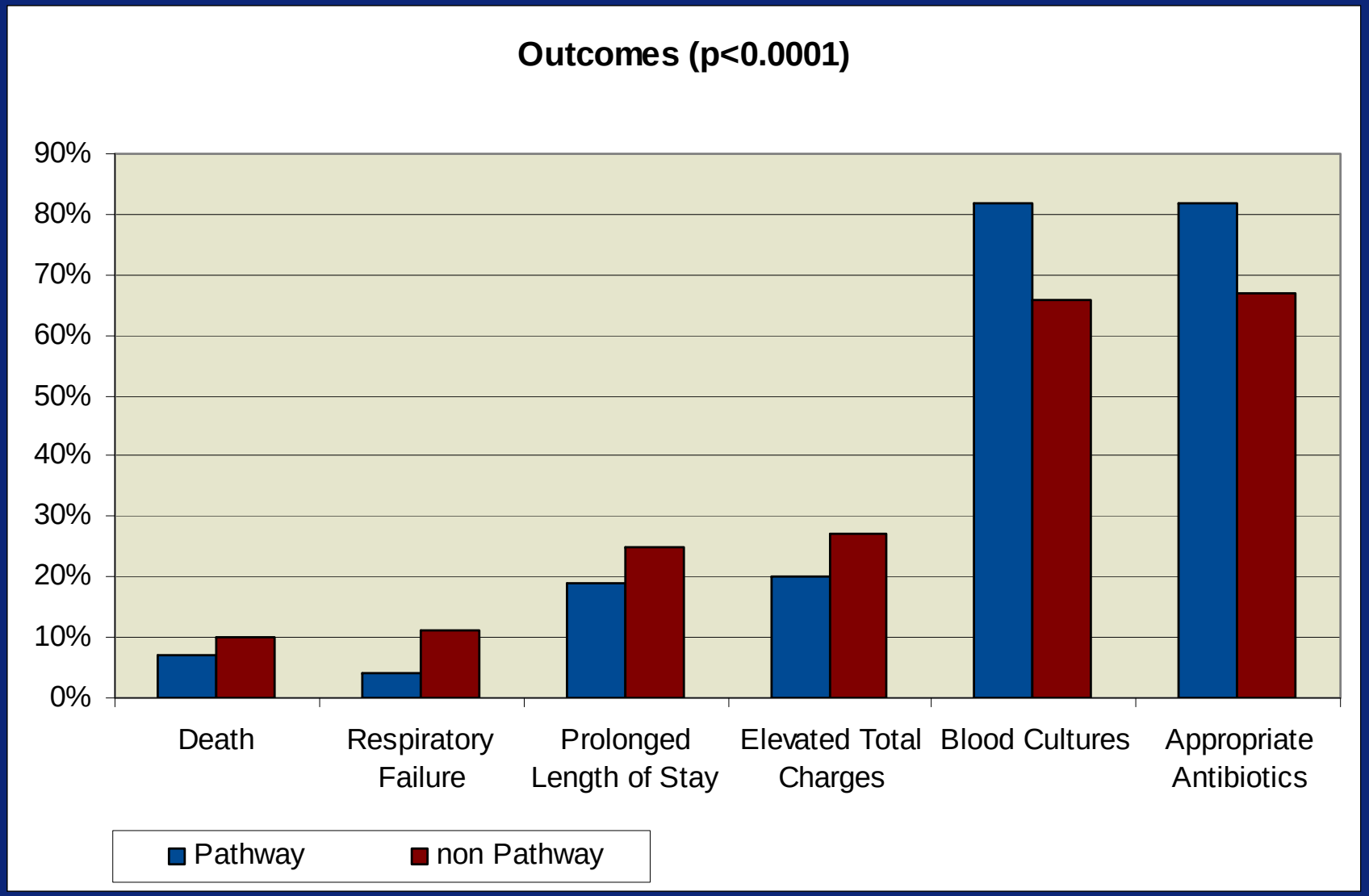
Systematic Reviews
Cochrane Library

CATs, Best Evidence,
ACP Journal Club

Reviews: Up-to-Date,
5-Min Clinical Consult

Medline, PubMed

Better care is the result; it is also a more efficient way to operate a clinical enterprise



Ann. Epidemiology 2004:14:669-675

And then we draw conclusions: what do we learn by examining the evidence?

Observational Study (n=1): why women live longer than men!

The data correlates adherence to evidence-based practice with . . .

- Improved outcomes
- Reduced variation
- Improved patient adherence
- Improved efficiency

So why is variation so prevalent?

Why is inappropriate variation a problem?

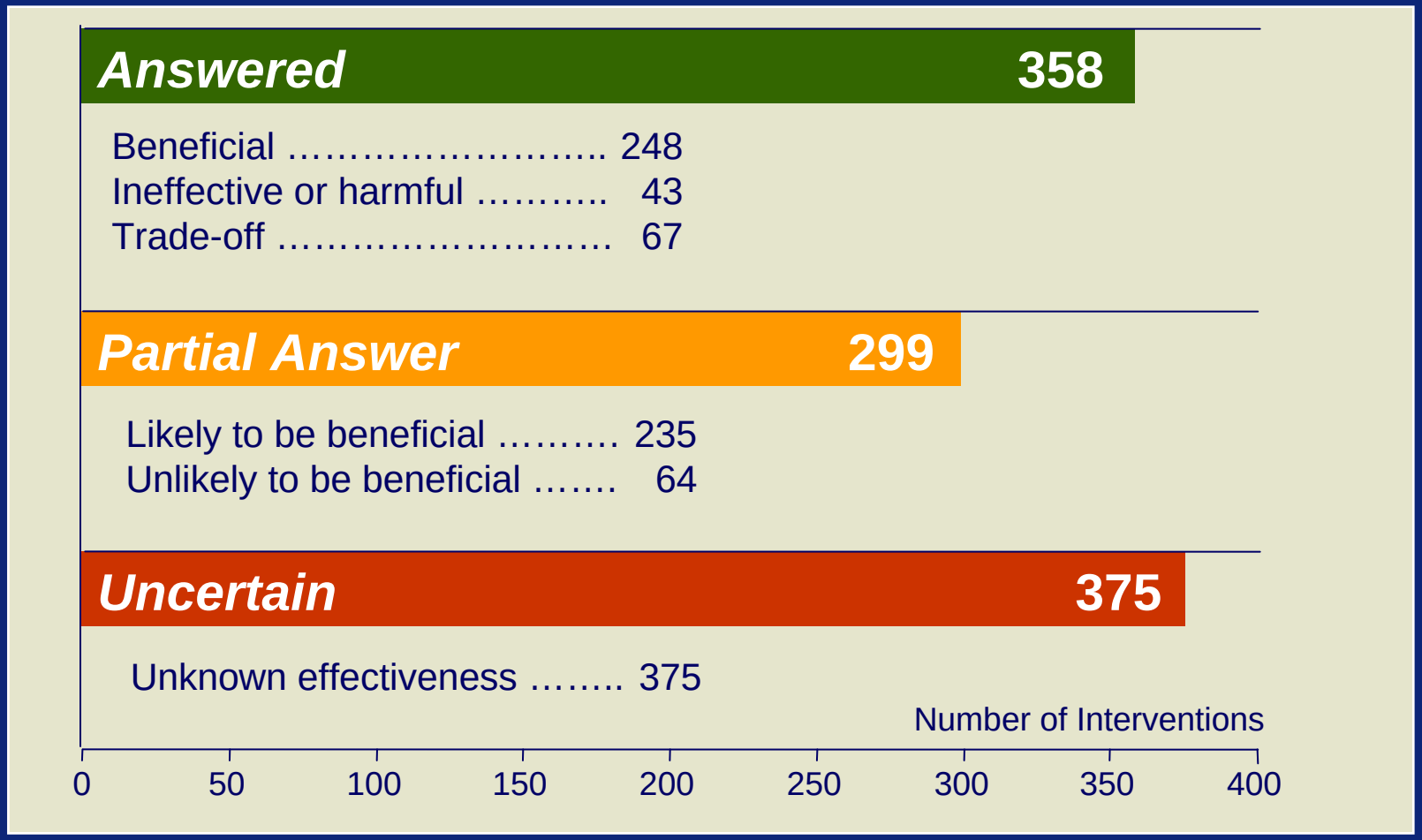
Challenge: knowledge explosion

- 20,000 biomedical journals
- >150,000 medical articles published each month
- >300,000 randomized controlled trials

"We are drowning in information but starved for knowledge."—Naisbitt, '82

Challenge: lack of evidence

- How many questions have any evidence? (BMJ 2000)



Challenge: source credibility

- *Shaneyfelt et al:* (JAMA, 1999)
  - Of 279 guidelines developed by medical societies, most do not adhere to IOM standards for methodological review (evidence-grading)
- *Grilli et al:* (Lancet, 2000)
  - 431 guidelines reviewed; 82% lack evidence-grading review assessment

Challenge: reliability

Gathering Evidence

Where to find the latest data on evidence-based guidelines

SOURCE	WEB SITE	COMMENT
National Guidelines Clearinghouse	guidelines.gov[3]	Government-sponsored site allows users to gain access to more than 1,400 guidelines and register for e-mail updates on new evidence.
Institute for Clinical System Improvement	icsi.org[4]	Guidelines cover 59 diseases and conditions; sponsored by Minnesota health plans; links to new and recently revised guidelines.
The Cochrane Library	informedhealthonline.org[5]	Australian site provides information from Cochrane Collaboration, developer of evidence-based guidelines from research world-wide.
Vanderbilt Center for Evidence-Based Medicine	ebm.vanderbilt.edu[6]	Site has links to information about evidence-based medicine and guidelines issued by specialty medical groups and international organizations.

- **Send e-mail** to Informedpatient@wsj.com[7].

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(5) http://www.informedhealthonline.org
(6) http://www.ebm.vanderbilt.edu
(7) mailto:Informedpatient@wsj.com

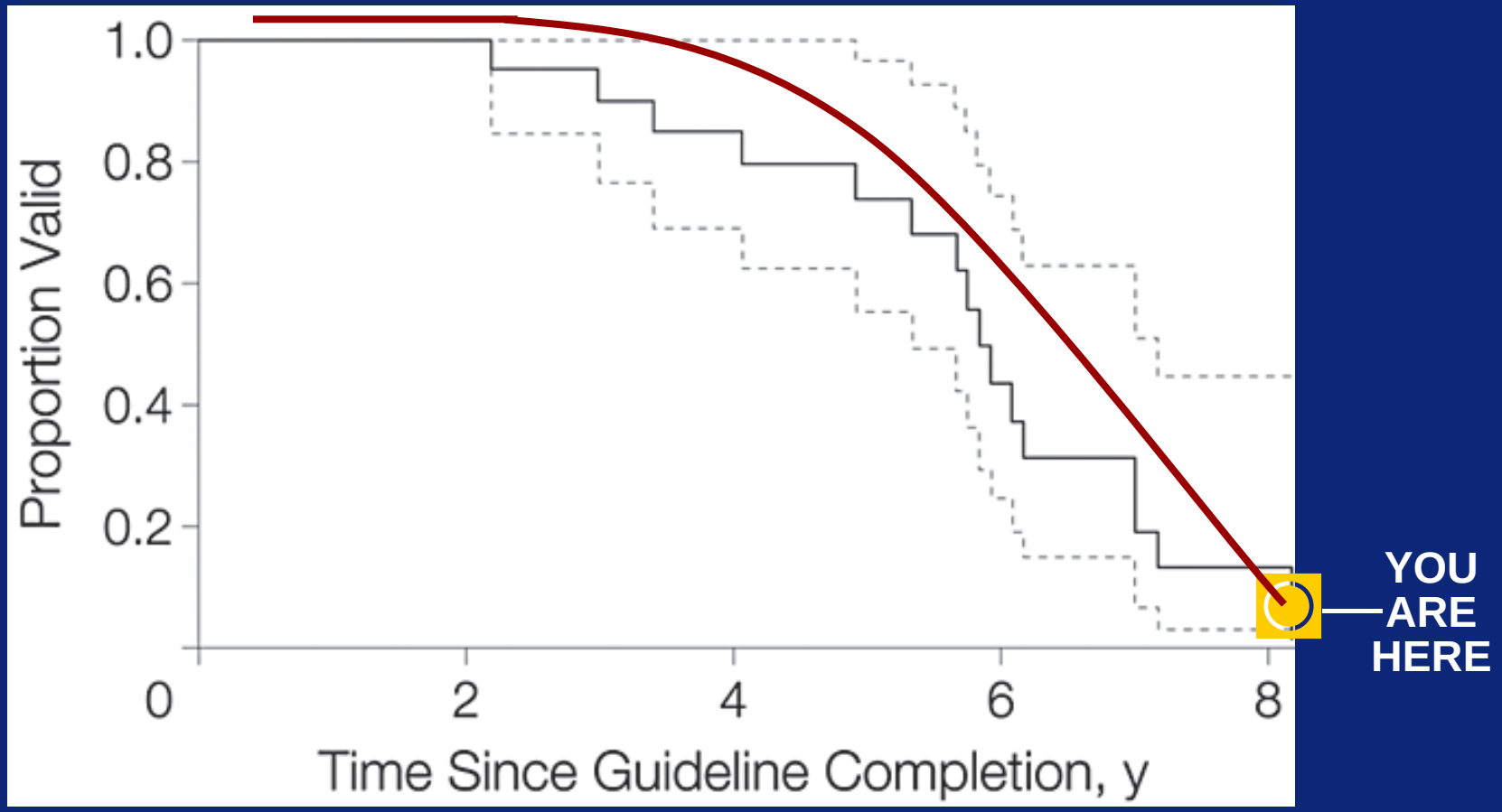
THE WALL STREET JOURNAL.

January 26, 2005

Challenge: timeliness

The solid line represents the Kaplan-Meier curve for the Agency for Healthcare Research and Quality (AHRQ) guidelines.

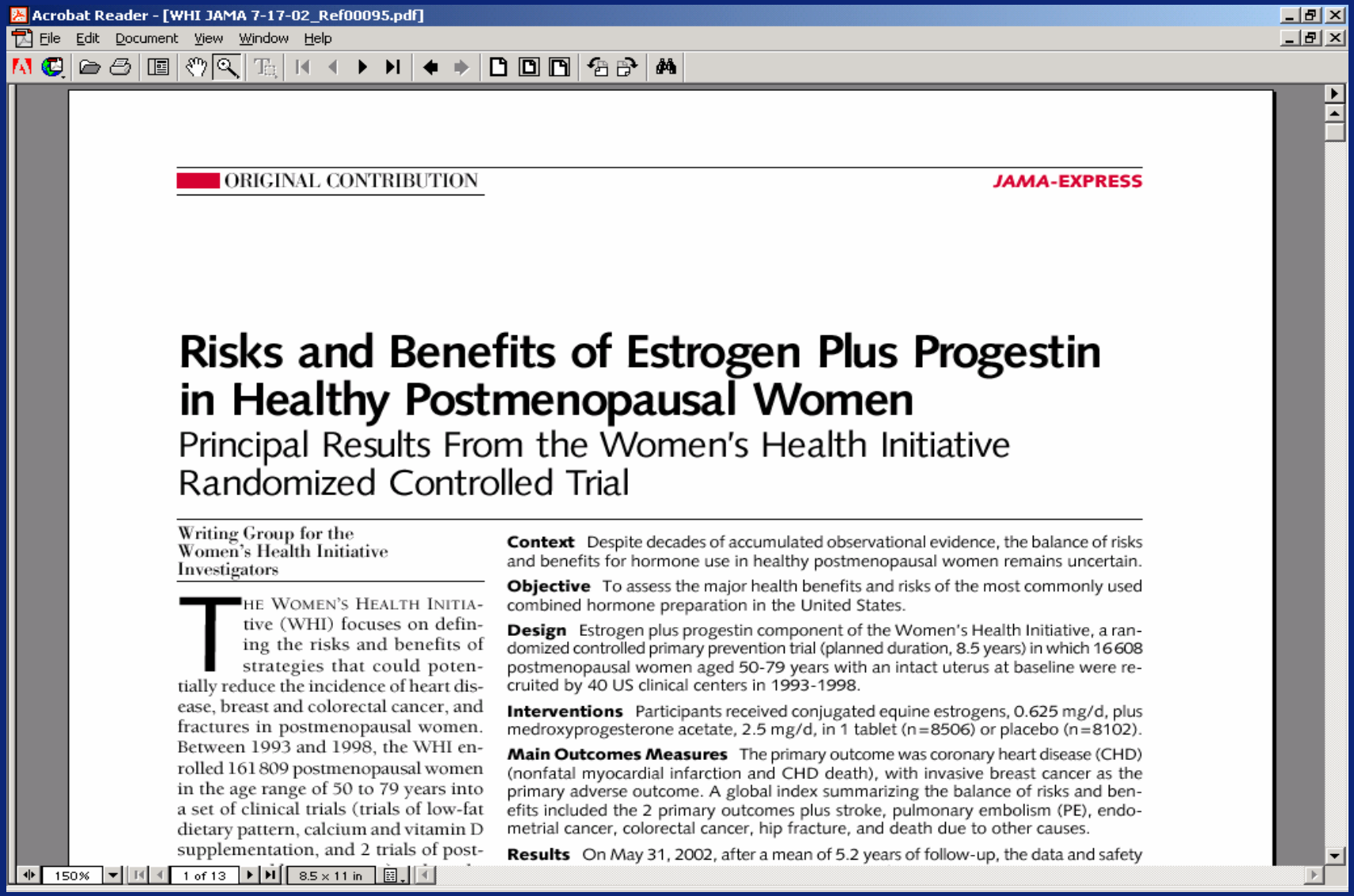
Dashed lines represent the 95% confidence interval (JAMA. 2001;286:1461-1467)



Challenge: commercial interests

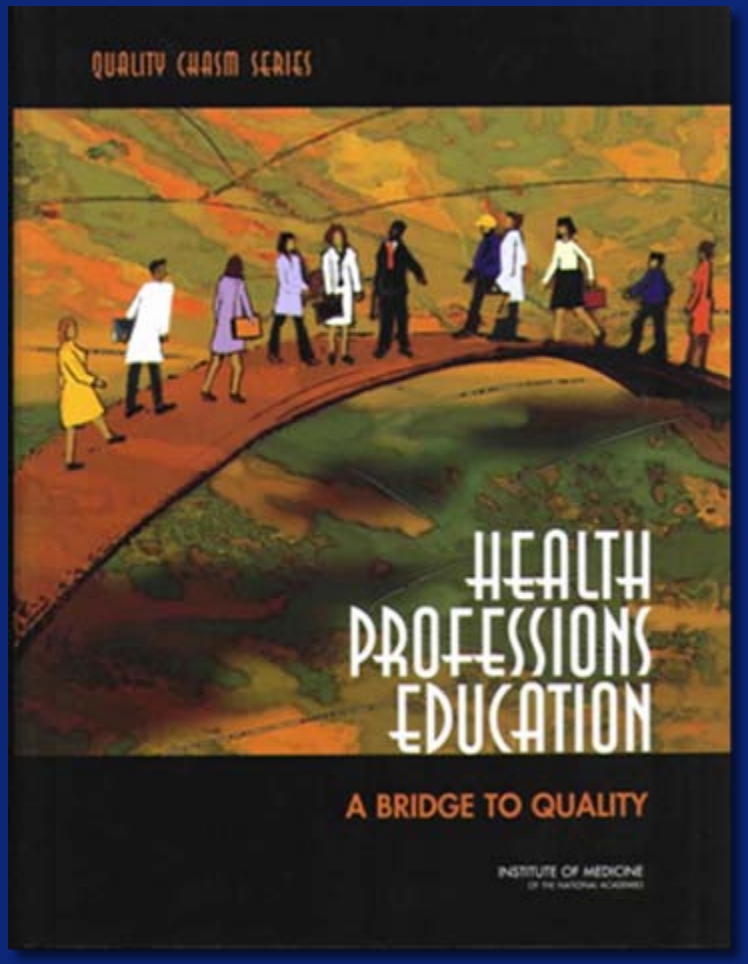
1. Digital imaging
2. Drug-coated stents
3. Oral cancer treatments
4. Minimally invasive surgery
5. Sepsis treatment
6. Implantable devices
7. Microscopic cameras
8. Diabetes devices
9. At-home health test kits
10. Embryonic stem cell research

Challenge: media attention



Challenge: physician training

- Provide patient centered care
- Work in interdisciplinary teams
- Employ evidence-based practice
- Apply quality improvement
- Utilize informatics



Health Professions Education: A Bridge to Quality
Institute of Medicine 2003

Challenge: consumer expectations

- 73% of patients depend on physicians to make decisions for them!

17.1% Strongly Agree | **45% Agree** | **11%** | **22.5% Disagree** | **4.8% Strongly disagree**

* Adapted from Guyatt et al. Incorporating Patient Values in: Guyatt et al. Users' Guide to the Medical Literature: Essentials of Evidence–based Clinical Practice. JAMA 2001

** Arora NK and McHorney CA. Med Care. 2000; 38:335

Lots of explanations . . .

- “They don’t pay for it . . .”
- “The tools aren’t available”
- “My patients don’t care”
- “It’s a fad”
- “The only evidence I need is what I know”

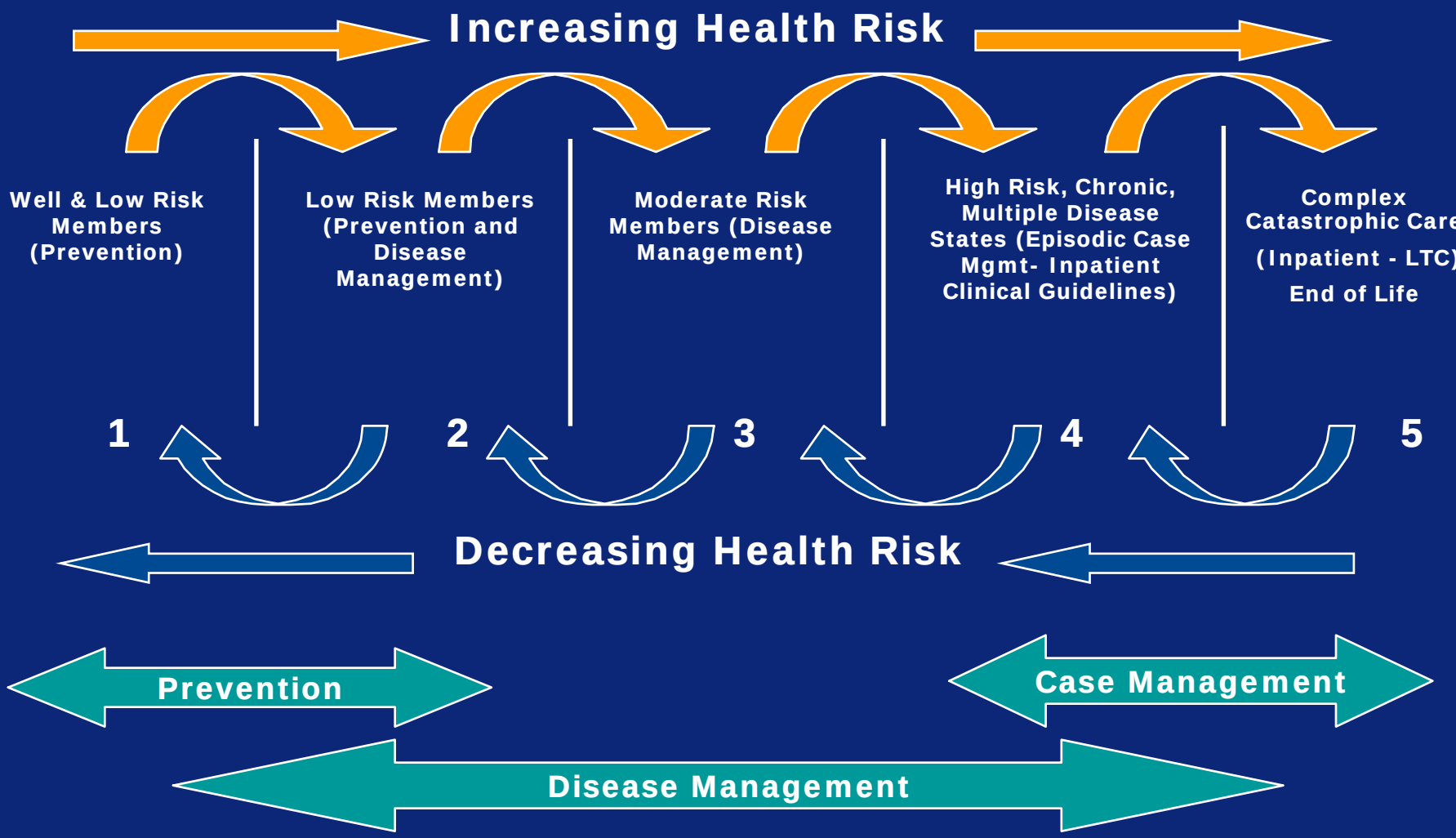
Is it going away?

Predictive models: a strategic framework

- Focus: to intervene early where there can be a positive impact on quality that yields cost savings

- Value Proposition:
  - Early identification allows clinicians to be proactive to mitigate any further deterioration in health
  - Positively influence patient habits and match to useful tools and resources

Population-based care management framework



Implications for predictive modeling

- Increased need for access to clinical data from provider and patient sources
- Increased integration with personalized therapeutics
- Increased visibility of processes (transparency)

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