



The Impact of Cognitive Computing on Healthcare

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Watson: The Next Grand Challenge



IBM



Session Description

The Impact of Cognitive Computing on Healthcare

Complex care coordination requires significant time and can tax the resources of even the most versatile organizations. IBM's Watson computer can rapidly, intelligently parse through disparate data to help coordinate care. Learn how this new evolution of computers featuring natural language processing, hypothesis generation and evaluation, and dynamic learning can augment efforts to improve health information sharing for better patient outcomes.



“Have You Started Your Data Expedition Yet?”

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#WatsonHealth
#MiHIN

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LEWIS AND CLARK EXPEDITION 1804-1806

Have You Started Your Data Expedition Yet?

Posted on May 19, 2015 by craigrhinehart

In 1803, Thomas Jefferson sent Meriwether Lewis and William Clark on their now famous expedition. The initial goal was to find a water-based route to the Pacific Ocean in addition to exploring the unmapped West. They imagined they'd find woolly mammoths, mountains of pure salt, lava-spewing volcanoes and never before seen creatures. **What they found was quite different. Why did they even risk life and limb to do this in the first place?**

It turns out that Thomas Jefferson was a visionary and a bit of an intrapreneur. When Jefferson took office in 1801, one of his top priorities was to gain control of the port of New Orleans. He saw this important water access point as an enabler of

Follow

Topics

- Introduce Cognitive Computing
- Why Cognitive Computing in Healthcare?
- An Explosion of Data and Costs
- IBM's Approach and Role in Healthcare
- How Customers Are Transforming With Cognitive Computing



Topics

- **Introduce Cognitive Computing**
 - Why Cognitive Computing in Healthcare?
 - An Explosion of Data and Costs
 - IBM's Approach and Role in Healthcare
 - How Customers Are Transforming With Cognitive Computing



The Era of Cognitive Computing Will Transform Our Future

Tabulating Systems Era



Programmable Systems Era



Cognitive Systems Era



What is Cognitive Computing?

- Cognitive computing is the simulation of human thought processes in a computerized model.
- Cognitive computing involves self-learning systems that use data mining, pattern recognition and natural language processing to mimic the way the human brain works. The goal of cognitive computing is to create automated IT systems that are capable of solving problems without requiring human assistance.
- Cognitive computing systems use machine learning algorithms. Such systems continually acquire knowledge from the data fed into them by mining data for information. The systems refine the way they look for patterns and as well as the way they process data so they become capable of anticipating new problems and modeling possible solutions.
- Cognitive computing is used in numerous artificial intelligence (AI) applications, including expert systems, natural language programming, neural networks, robotics and virtual reality. The term cognitive computing is closely associated with IBM's cognitive computer system, Watson.

Real Language is Real Hard

Chess (Traditional Computing)

- Finite, precise and mathematically well-defined
- Limited number of moves and states
- Grounded in **explicit, unambiguous mathematical rules**

Human Language

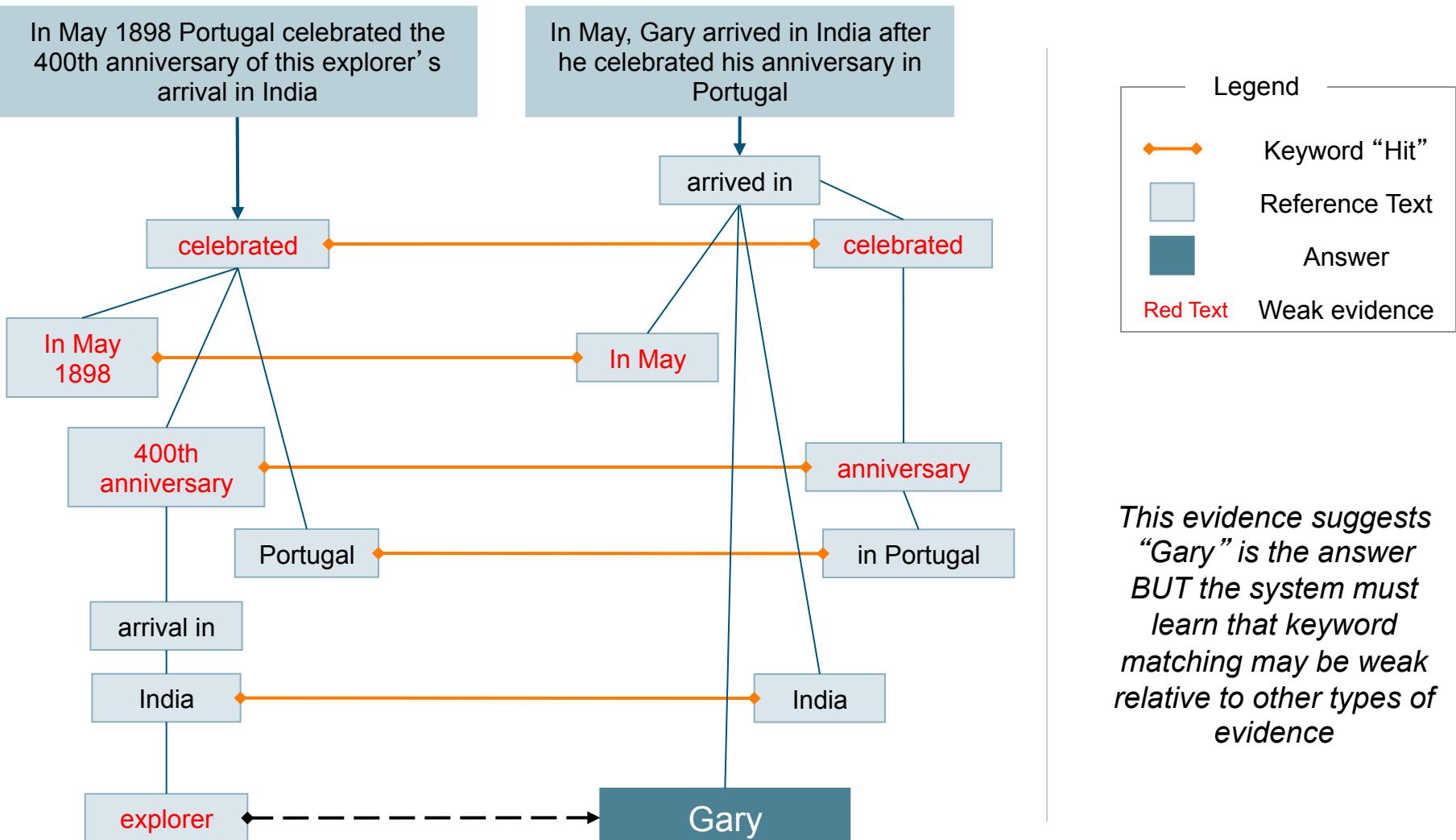
- Ambiguous, **contextual** and implicit
- Contains slang, riddles, idioms, abbreviations, acronyms, negation and more
- Grounded only in **human cognition**
- Seemingly infinite number of ways to express the same concepts and meaning



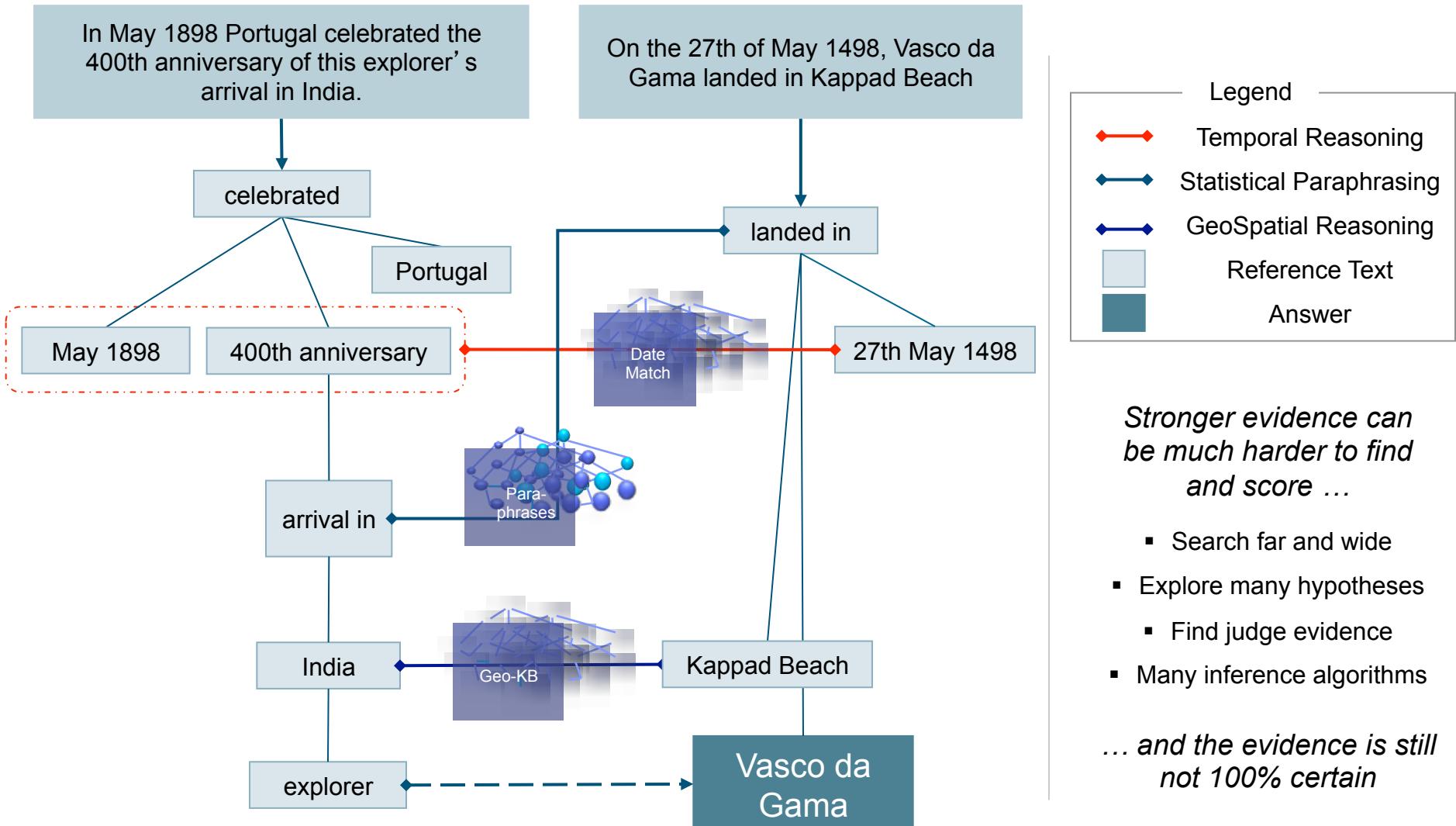
Remember to Answer in the Form of a Question ...

**In May 1898 Portugal celebrated
the 400th anniversary of this
explorer's arrival in India**

Answering Complex Natural Language Questions Requires More Than Keyword Based Evidence

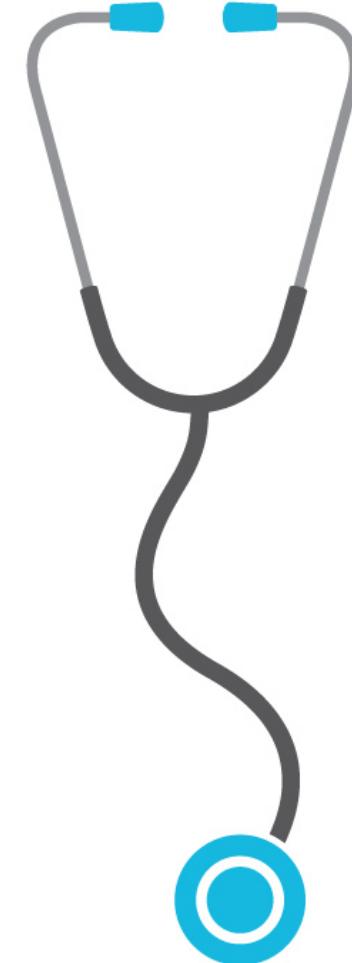


Just Like The Human Brain ... Watson Leverages Multiple Algorithms to Gather Deeper Evidence



Topics

- Introduce Cognitive Computing
- **Why Cognitive Computing in Healthcare?**
- **An Explosion of Data and Costs**
- IBM's Approach and Role in Healthcare
- How Customers Are Transforming With Cognitive Computing



IBM Watson Health

TED: Cognitive Computing Video

IBM



Leading Institutions Recognize The Promise and Value of Watson ...

Ongoing Training Partner



Memorial Sloan Kettering
Cancer Center™

**Watson for Oncology,
trained by Memorial Sloan
Kettering**
*available in clinical use in
lung, breast, colon and
rectal cancer*



**Bumrungrad
International Hospital**
HOSPITAL

**Bumrungrad
International Hospital**
5 year agreement for
Watson for Oncology

THE UNIVERSITY OF TEXAS

**MD Anderson
Cancer Center**

Making Cancer History®

MD Anderson
Introduced proprietary
solution with Watson for
clinical use for Leukemia
and Molecular Targeted
Therapies

**MAYO
CLINIC**
The Mayo Clinic shield logo, featuring three interlocking shields.

Mayo Clinic
Completed testing with
Clinical Trial Matching for
lung, breast, colon and
rectal cancer

BCM®
Baylor College of Medicine

**Baylor College of
Medicine**
Published results of use with
Watson Discovery Advisor –
identified 7 targets for P53
activation within weeks



**Watson Genomics
Advisor**
Secured 13 Cancer and
Academic medical centers
for beta testing



**Department of Veterans
Affairs**
Selected Watson to analyze
EMRs in a demo project

**MAYO
CLINIC**
The Mayo Clinic shield logo, featuring three interlocking shields.

Mayo Clinic
Selected Watson to analyze
EMRs for Clinical Efficiency
and Effectiveness Program

IBM Watson Solutions for Healthcare and Life Sciences

"Imagine having the ability within three seconds to look through all of that (medical) information ... at the moment you're caring for that patient."

Dr. Sam Nussbaum, WellPoint's Chief Medical Officer, Anthem (formerly WellPoint)

R&D Productivity

Discovery Advisor

to enable researchers to uncover new insights into relationships between genes, proteins, pathways, phenotypes and diseases

Clinical Trial Matching

to optimize patient selection and recruitment for clinical trials

IBM Watson Content Analytics

Core NLP solution platform for extracting and leverage medical facts from unstructured data

Improve Outcomes

Oncology

to assist in the creation of individualized treatment plans and enhance patient / physician experience

EMR Advisor

to identify critical attributes of a patient case and provide easy-to-consume summaries

Paths

Clinical reasoning for Medical Education & top of license care delivery

Improve Engagement

Engagement Advisor

to transform interactions and experiences with patients and physicians

Utilization Management

to streamline and automate authorizations and ensure adherence to guidelines

Healthcare Transformation: A Work in Progress

1st

US rank in Healthcare spending ¹

37th

US rank in quality of care delivered ²

<5

Hours or less per month spent reading medical journals by 81% of reporting physicians

21.7

Hours required to meet the patient care guidelines each day ³

\$585B

(Billion) Wasted on missed opportunities, unnecessary, error-prone and inefficiently delivered services ³

\$7T+

The cost for health and social programs worldwide ... and it is rising

73

... the number of days it will take for medical data to double by 2020 ⁴

80%

of the world's healthcare data is unstructured

An Ocean of Unused Data

¹ World Health Statistics 2011 from World Health Organization

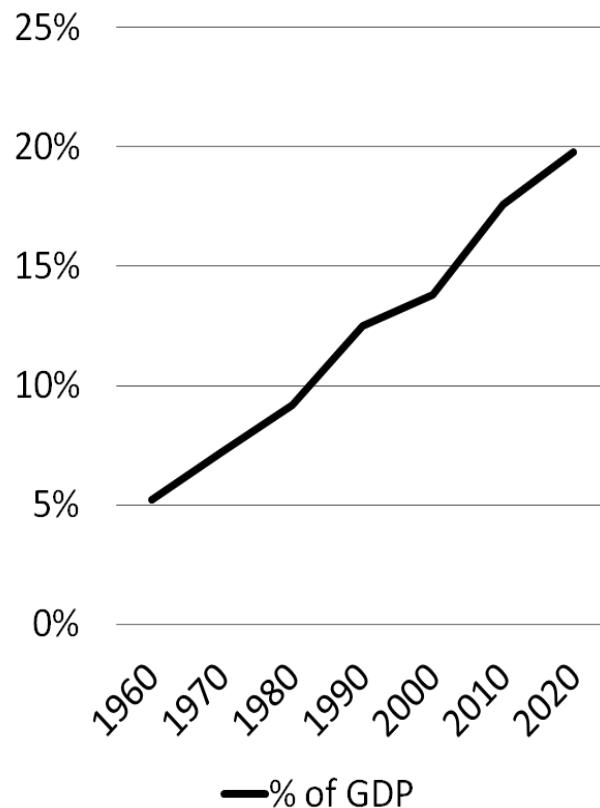
² The World Health Report 2000 – Health Systems: Improving Performance from World Health Organization

³ Best Care at Lower Cost: The Path to Continuously Learning Health Care in America from Institute of Medicine / National Academy of Sciences

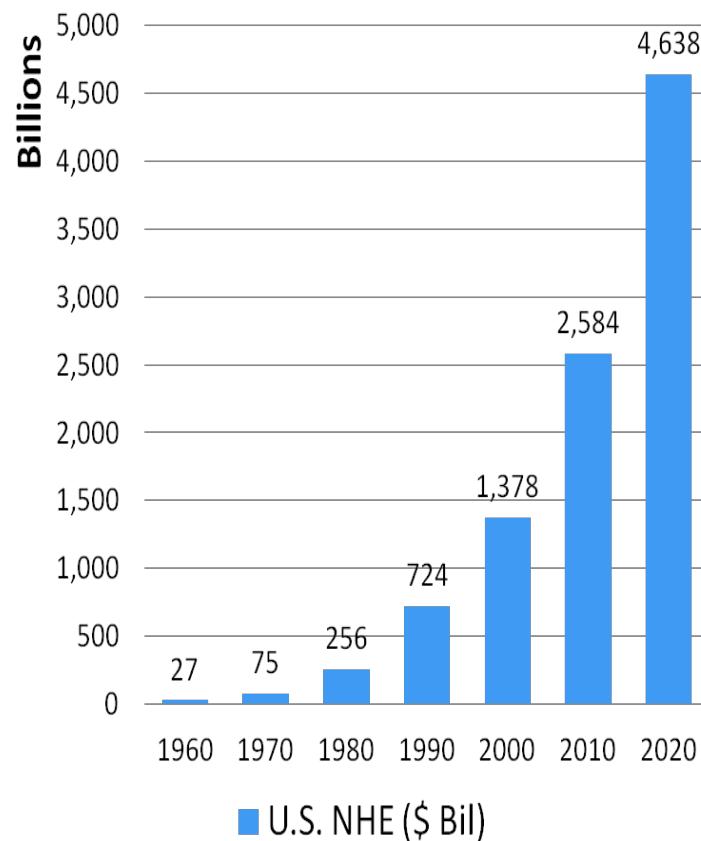
⁴ University of Iowa, Carver College of Medicine 2014

The Current Spending Projections Are Not Sustainable

Healthcare as % of US GDP

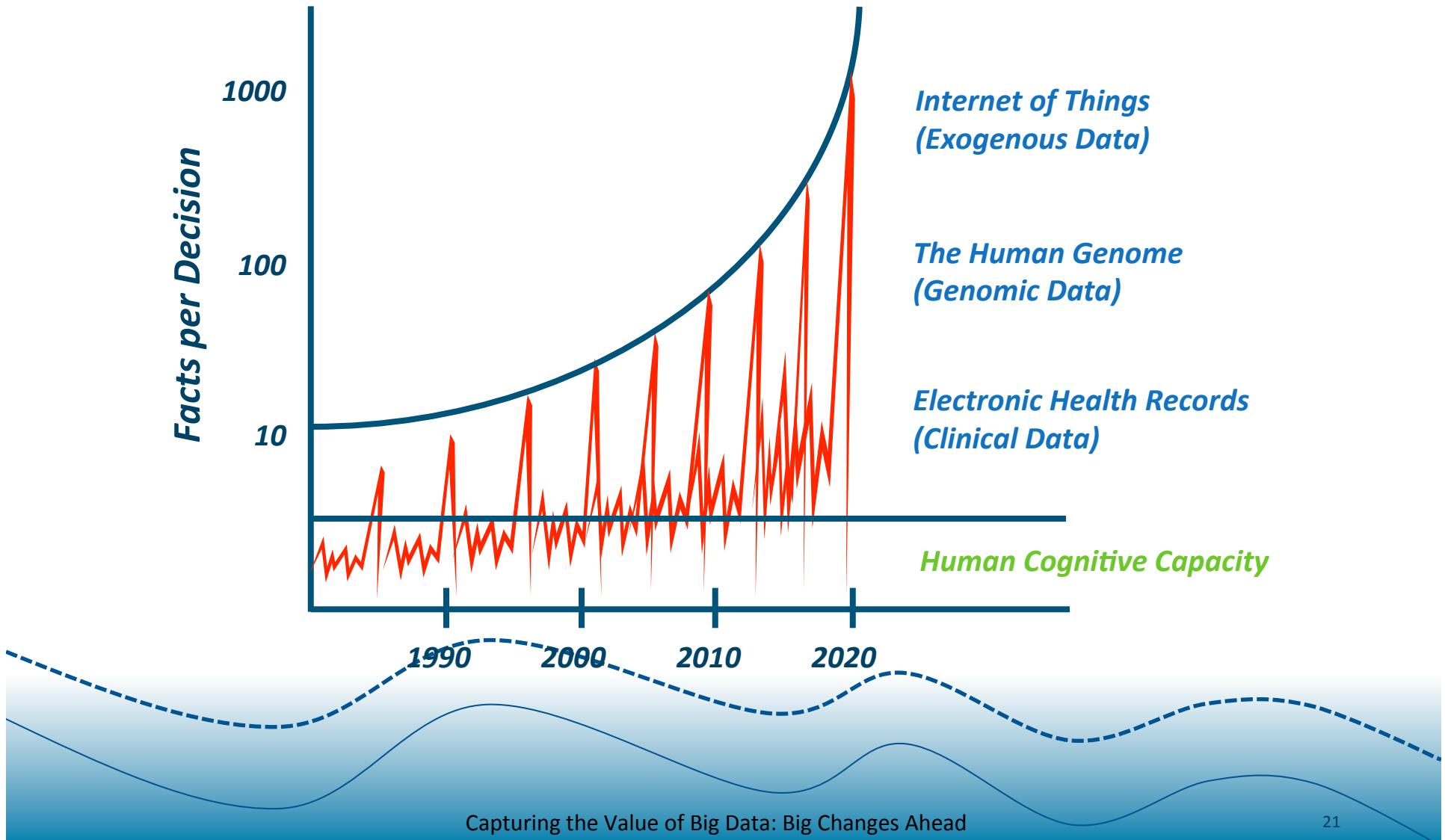


US National Health Expenditure



Source: Centers for Medicare and Medicaid Services

Leveraging Big Data – The Impossible Task Without Analytics and New Computing Models



Personal Data is Exploding

Impact on a person's health status

Exogenous Factors

60%

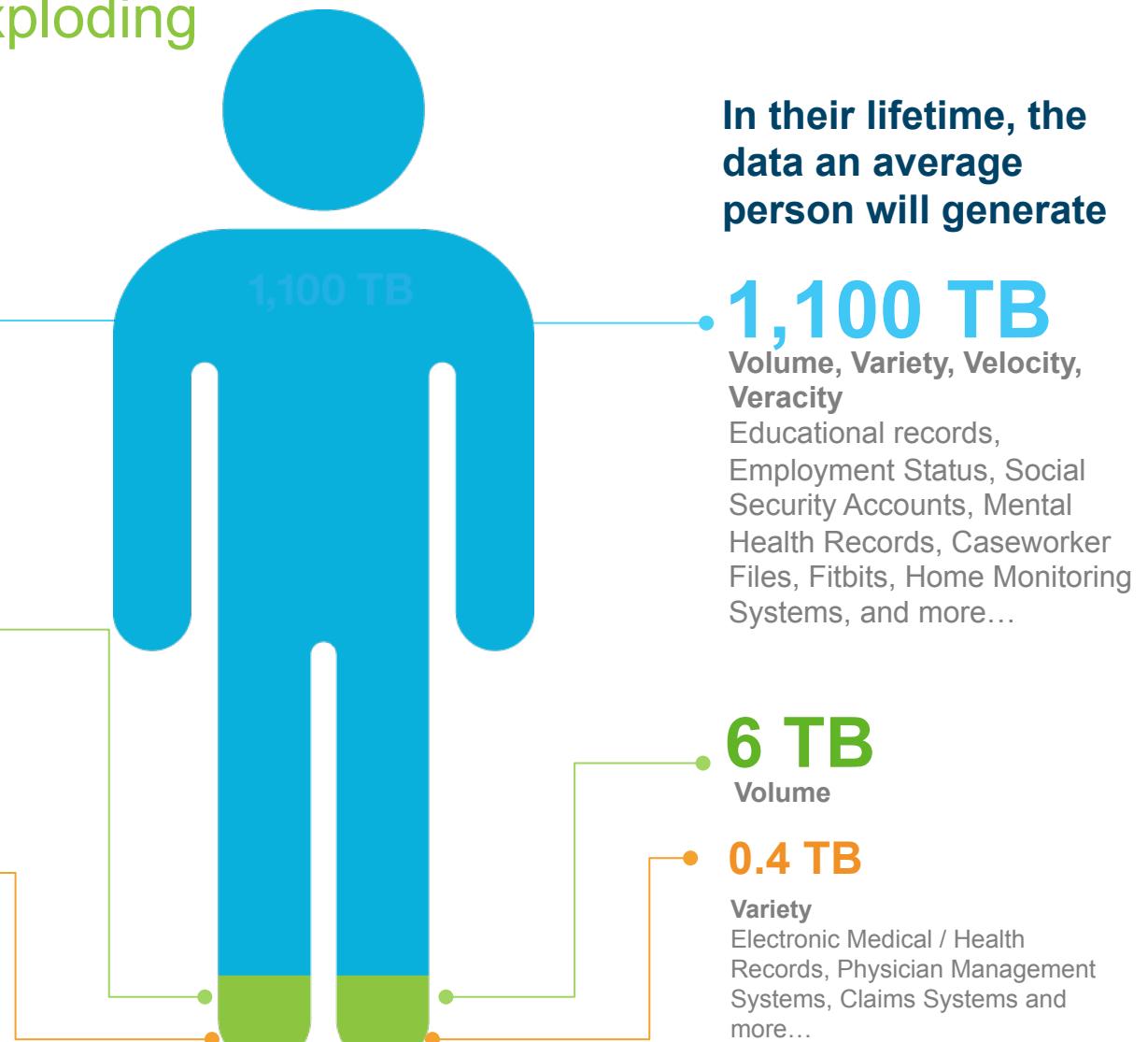
Environment & Social Context, Behavior

Genomic Factors

30%

Clinical Factors

10%



Enormous Opportunity to Leverage Big Data

A Decade of Reversal: An Analysis of 146 Contradicted Medical Practices

ARTICLE IN PRESS

ORIGINAL ARTICLE

A Decade of Reversal: An Analysis of 146 Contradicted Medical Practices

Vinay Prasad, MD; Andras Vandross, MD; Caitlin Toomey, MD; Michael Cheung, MD; Jason Rho, MD; Steven Quinn, MD; Sathish Jacob Chacko, MD; Durga Borkar, MD; Victor Gali, MD; Senthil Selvaraj, MD; Nancy Ho, MD; and Adam Giffi, MD

Abstract

Objective: To identify medical practices that offer no net benefit.

Methods: We reviewed all original articles published in 10 years (2001–2010) in one high-impact journal. Articles were classified on the basis of whether they addressed a medical practice, whether they tested a new or existing therapy, and whether results were positive or negative. Articles were then classified as 1 of 4 types: replacement, when a new practice surpasses standard of care; back to the drawing board, when a new practice is no better than current practice; reaffirmation, when an existing practice is found to be better than a lesser standard; and reversal, when an existing practice is found to be no better than a lesser therapy. This study was conducted from August 1, 2011, through October 31, 2012.

Results: We reviewed 2044 original articles, 1344 of which concerned a medical practice. Of these, 981 articles (73.0%) examined a new medical practice, whereas 363 (27.0%) tested an established practice. A total of 947 studies (70.5%) had positive findings, whereas 397 (29.5%) reached a negative conclusion. A total of 756 articles addressing a medical practice constituted replacement, 165 were back to the drawing board, 146 were medical reversals, 138 were reaffirmations, and 139 were inconclusive. Of the 363 articles testing standard of care, 146 (40.2%) reversed that practice, whereas 138 (38.0%) reaffirmed it.

Conclusion: The reversal of established medical practice is common and occurs across all classes of medical practice. This investigation sheds light on low-value practices and patterns of medical research.

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We expect that new medical practices gain popularity over older ones on the basis of robust evidence indicating clinical superiority or noninferiority with alternative benefits (eg, easier administration and fewer adverse effects). The history of medicine, however, reveals numerous exceptions to this rule. Starting for stable coronary artery disease was a multibillion-dollar a year industry when it was found to be no better than medical management for most patients with stable coronary artery disease.¹ Hormone therapy for postmenopausal women intended to improve cardiovascular outcomes was found to be worse than no intervention,² and the routine use of the pulmonary artery catheter in patients in shock was found to be inferior to less invasive management strategies.³ Previously, we have called this phenomenon (when a medical practice is found to be inferior to some lesser or prior standard of care) a medical reversal.^{4,5} Medical reversals occur when new studies—better powered, controlled, or

Funding for this research came from the National Cancer Institute, National Institutes of Health, Bethesda, MD (V.P.); Department of Defense, Bethesda, MD (V.P.); National Institutes of Health, Bethesda, MD (A.G.); University of Pennsylvania, Philadelphia, PA (P.M.C.); Mayo Clinic, Rochester, MN (S.J.C.); and Department of Surgery (V.G.), Georgia Washington University, Washington, DC (D.B.). Department of Medicine, Mayo Clinic, Rochester, MN (N.H.); Department of Medicine, University of Michigan, Ann Arbor, MI (J.R.); Department of Medicine, University of Pennsylvania, Philadelphia, PA (C.T.); and Department of Medicine, University of Chicago, Chicago, IL (A.C.).

May Clin Proc. □ August 2013;88(4):4–17. □ http://dx.doi.org/10.1016/j.mayocp.2012.05.012
www.mayoclinicproceedings.org □ Published by Elsevier Inc. on behalf of Mayo Foundation for Medical Education and Research



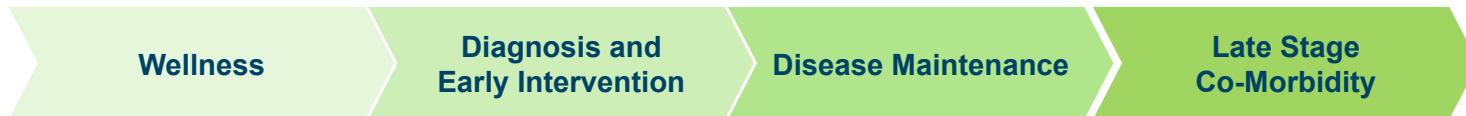
“40.2% reversed the original standard of care ... and only 38.0% reaffirmed the original standard of care”

“Medicine has become too complex (and only) about 20% of the knowledge clinicians use today is evidence-based.”

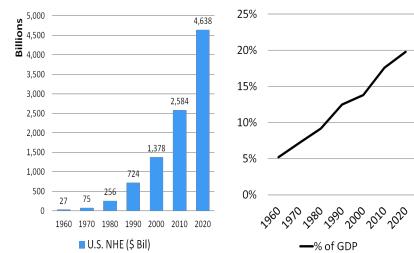
Steven Shapiro, Chief Medical and Scientific Officer, UPMC

Is This Really an Opportunity?

*“Before The Beginning of Great Brilliance ...
There Must Be Chaos”*

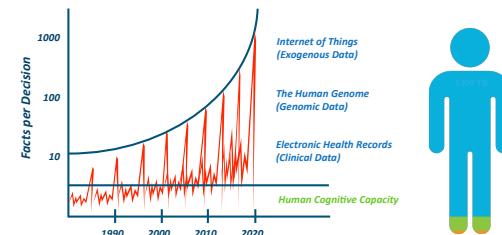


Unsustainable Operating Models



The Need for Better Outcomes

Unfathomable Information Volumes



An Ocean of Unused Data

Topics

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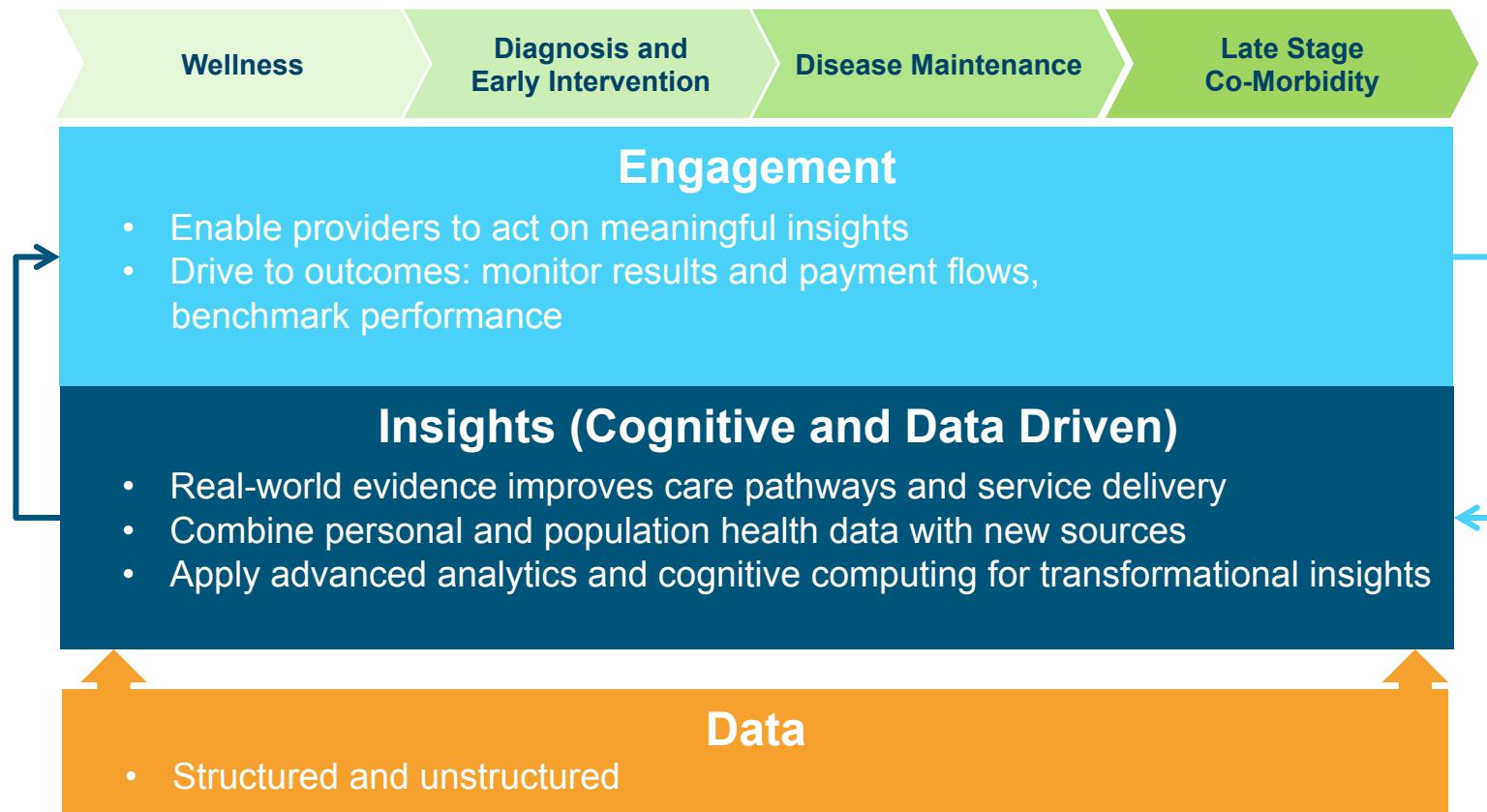
Healthcare Industry Taps Into the Power of Watson

New York Genomics
Center and IBM Watson

IBM



Big Data Analytics and Cognitive Computing Enable New Insights and Engagement

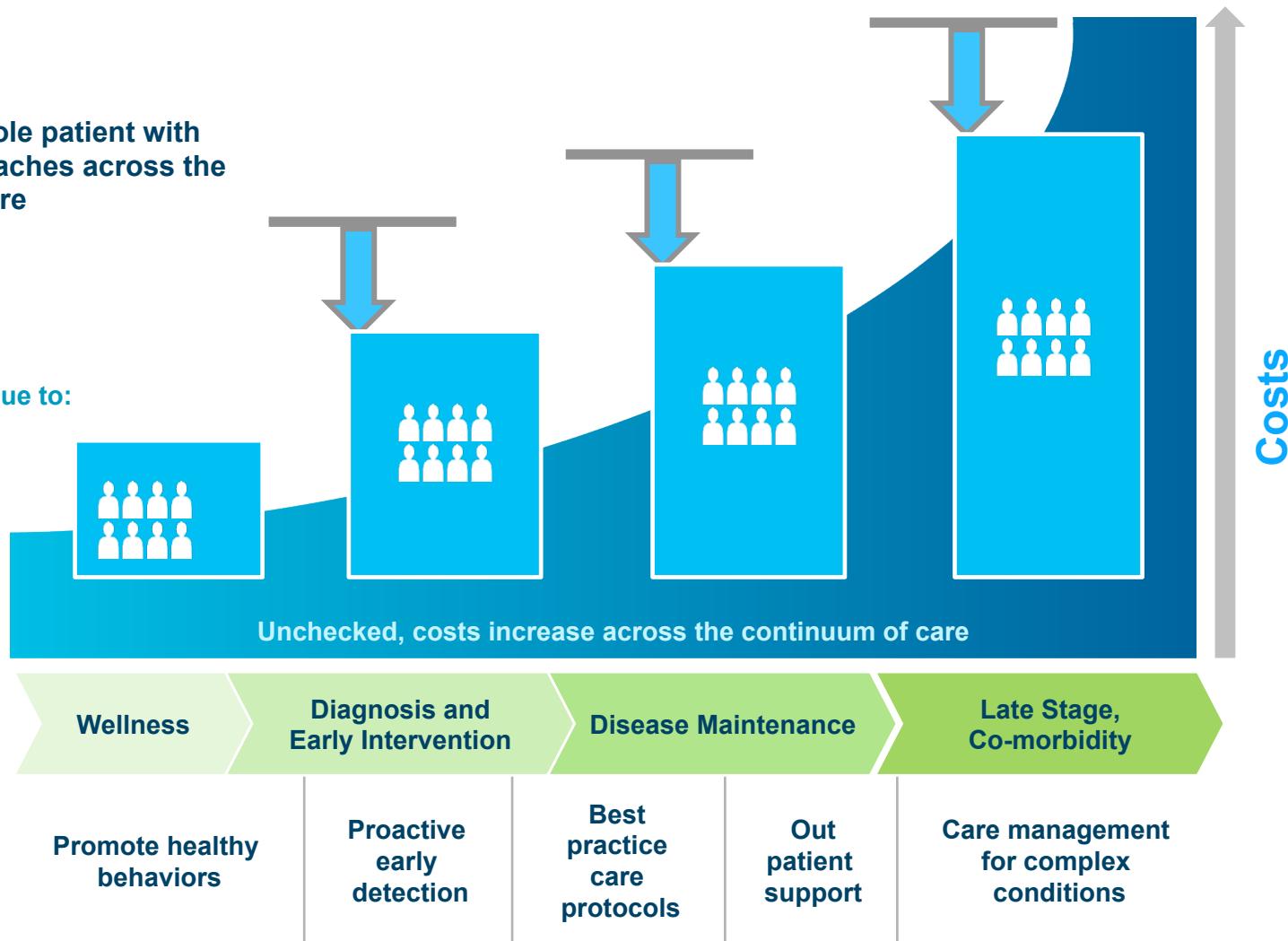


Integrated Care Approaches Improve Health and Reduce Costs

Address the whole patient with proactive approaches across the continuum of care

Costs increase due to:

- Aging populations
- Chronic disease
- Complex conditions



What Is IBM Doing in Healthcare?

- Long history of selling to Information Technology infrastructure (systems, software and service) to Healthcare, Life Sciences and Government customers
- IBM Research focuses on “Healthcare Informatics” (2010) to develop next generation healthcare analytics such as “Patient Similarity Analytics”
- IBM forms IBM Watson Group (post-Jeopardy 2011) to commercialize Watson – Healthcare is first industry chosen to focus on for suite of new solutions
- IBM makes acquisitions (2011) specific to support specific Healthcare and Government solutions

Initiate™ Master Patient Index

**CURAM®
SOFTWARE** Social Program and Care Management

- IBM forms Watson Health Group with multiple acquisitions, partnerships and new health cloud capabilities and offerings:



Patient Engagement
PCMH Focus, 40M Lives



explorys

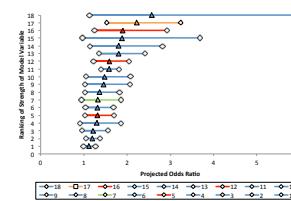
Big Data Analytics,
Applications, 50M Lives



Value of Unstructured Data and Social Determinants

The Data We Thought Would Be Useful ... Wasn't

- Structured data not available, not accurate, without the unstructured data - which was more trustworthy



What We Thought Was Causing 30 Day Readmissions ... Wasn't

- 113 possible candidate predictors expanded and changed after mining the data for hidden insights

New Hidden Indicators Emerged ... Social Determinants Were Essential

- Social indicators were important to identifying patients most at risk (most came from unstructured data)

1. Jugular Venous Distention Indicator
2. **Paid by Medicaid Indicator**
3. Immunity Disorder Disease Indicator
4. Cardiac Rehab Admit Diagnosis with CHF Indicator
5. **Lack of Emotion Support Indicator**
6. Self COPD Moderate Limit Health History Indicator
7. With Genitourinary System and Endocrine Disorders
8. Heart Failure History
9. High BNP Indicator
10. Low Hemoglobin Indicator
11. Low Sodium Level Indicator
12. **Assisted Living**
13. High Cholesterol History
14. Presence of Blood Diseases in Diagnosis History
15. High Blood Pressure Health History
16. **Self Alcohol / Drug Use Indicator**
17. Heart Attack History
18. Heart Disease History

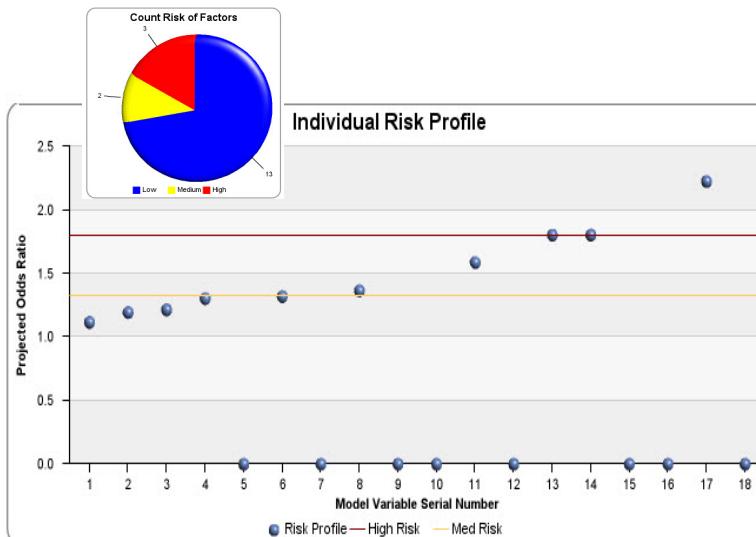
Predictor Analysis	% Encounters Structured Data	% Encounters Unstructured Data
Ejection Fraction (LVEF)	2%	74%
Smoking Indicator	35% (65% Accurate)	81% (95% Accurate)
Living Arrangements	<1%	73% (100% Accurate)
Drug and Alcohol Abuse	16%	81%
Assisted Living	0%	13%

The Impact – What Happened to Patient X?

Patient X was hospitalized **6 times** over an **8 month period**. The same basic information was available at each encounter and Patient X's readmission prediction score never dropped below **95%** (out of possible 100%)



Individual Patient Data at Each Encounter (Patient X @ Dec 20, 2009)



Description of Model Serial Number

- 18. Jugular Venous Distention Indicator
- 17. Paid by Medicaid Indicator
- 16. Immunity Disorder Disease Indicator
- 15. Cardiac Rehab Admit Diagnosis with CHF Indicator
- 14. Lack of Emotion Support Indicator
- 13. Self COPD Moderate Limit Health History Indicator
- 12. With genitourinary system & Endocrine disorders
- 11. Heart Failure History
- 10. High BNP Indicator
- 9. Low Hemoglobin Indicator
- 8. Low Sodium Level Indicator
- 7. Assisted Living from ICA Extract
- 6. High Cholesterol History
- 5. Presence of diseases of the blood in diagnosis history
- 4. High Blood Pressure Health History
- 3. Self Alcohol/Drug Use Indicator (Cerner + ICA)
- 2. Heart Attack History
- 1. Heart Disease History

Patient Population Monitoring Clinical and Operational Data



- Admit / Readmission
- 30-Day Readmission

IBM Watson Health

**MD Anderson Cancer
Moonshot**

IBM



Thank You

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