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The Healthcare Disruption is Underway

24 months
Frequency at which healthcare data doubles

150+ exabytes
Amount of healthcare data today\(^1\)

50%
Expected alternative payments from the Centers of Medicare and Medicaid by 2018\(^2\)

$47 trillion
Estimated global economic impact of chronic disease by 2030\(^3\)

Sources:
The Challenge

There’s a gap in the accuracy of treatment decisions. As many as 44% of all initial cancer treatments are modified on the second course of treatment.\(^1\) Less than 50% of medicine is evidence based.\(^2\) An epidemiologist would have to read 167 hours a week to keep up with new professional insight.\(^3\) Aging populations require more care. 20% of the United States’ population will be over 65 by 2050, growing from 12% in 2010.\(^4\)

Sources:
1. Journal of Clinical Oncology, Talk about Health Blog, Sept 2011
Multiple Dynamics Pressing on Providers

- **Payment Reform**: Reimbursement is no longer based on “how many” but on “how good” in terms of cost, quality and outcomes.
- **Consolidation**: Payers and delivery systems are consolidating to gain market share.
- **Care Coordination**: Integrated networks are required to deliver comprehensive care to populations under one payment umbrella.
Providers must close care gaps and coordinate care across the entire population

67% Catastrophic individuals this year that were not catastrophic last year

Source: Healthcare Risk Adjustment and Predictive Modeling by Ian Duncan, 2011
What do we mean by holistic care management?

0.4 Terabytes
Per lifetime

6 Terabytes
Per lifetime

1100 Terabytes
Generated per lifetime

Volume, Variety, Velocity, Veracity
Integrating healthcare and social care

Severity of need

Public Health

High-touch case management

Low-touch, service delivery & coordination

No-touch, automated benefits disbursement

Eligibility & entitlement

High-touch care

Low-touch, prevention / intervention

No-touch, automated patient outreach Enrollment

Cloud-based cognitive computing
Watson: A New Era of Cognitive Computing

Enhance, scale, and accelerate expertise across the domains of health and wellness, and facilitate collaboration across the communities of care.
Human+Cognitive = Augmented Intelligence

Humans excel at:

- Common Sense
- Dilemmas
- Morals
- Compassion
- Imagination
- Dreaming
- Abstraction
- Generalization

Cognitive systems excel at:

- Natural Language
- Pattern Identification
- Locating Knowledge
- Machine Learning
- Eliminate Bias
- Endless Capacity
“We will serve as a catalyst to improve and save lives of people around the world, and lower healthcare costs, through the power of cognitive insights”

Watson Health mission statement
Five pillars enabled through a platform that has data, knowledge, analytics and industry specific solutions supported on a secure cloud.
Use language, vision, speech and data insight APIs to add cognitive functionality to your application or service

The Watson that competed on Jeopardy! in 2011 comprised what is now a single API—Q&A—built on five underlying technologies.

Since then, Watson grew to a family of 28 APIs in 2015.

By the end of 2016, there will be over 50 Watson APIs—with more added every year.
Cognitive computing helps to support us in a number of ways:

- **Engagement**: Helps organizations build stronger relationships.
- **Discovery**: Helps people create new insights by synthesizing information.
- **Decision**: Helps users make more informed, evidence-based decisions.
- **Exploration**: Visually depict and analyze data in ways not before possible.

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Engagement: **SleepHealth – First Apple ResearchKit app supported by Watson Health Cloud**

- Research study to investigate how sleep is associated with general health and other medical conditions, alertness, productivity
- Help gain greater insight into sleep habits and sleep disorders
- Combines its data with HealthKit data
- Research led by American Sleep Apnea Association and UCSD

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Engagement: Partnership on Health and Wellness with American Heart Association

Employee Health and Wellness App

- Maximize health and wellness
- Prevent chronic diseases
- Reduce healthcare costs
- Increase engagement

Employee Health and Wellness App
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Advisor will anticipate
• Needs of people with different types of cancers, at different stages of disease, and at various points in treatment
• Become increasingly personalized as individuals engage – getting “smarter” each time used.

Will incorporate Watson’s voice recognition and natural language processing technology, enabling users to ask questions and receive audible responses.
Engagement: **Medtronic + Watson Health**

2 solutions that address the biggest needs in Diabetes Care

**Sugar.IQ™**

- Personalized diabetes mobile companion with real time glucose insights for individuals with diabetes to help make daily diabetes management easier and more effective.

**Medtronic Turning Point**

- Integrated & personalized diabetes care program with coaching services & risk stratification for healthcare systems to help high risk/at-risk individuals with diabetes improve their lives & reduce the cost of care.

- Bridging the gap in between doctor visits enabling Self-Management & Better Care.
Discovery: **Watson for Clinical Trial Matching**

**Business challenge:**
- Clinicians have **no easy way to search across eligibility criteria** of relevant clinical trials for their patient; affecting research advancement and patient care
- Less than 10% of clinical studies are completed on time
- 30% of sites for clinical trials fail in enrolling even a single patient

**Watson solution:**
- Use patient data to **instantly check eligibility** across all relevant clinical trials, which can improve research and treatment outcomes

**Two use cases:**
- **Point of care**: Cognitive Physician assistant to assess patient eligibility against all available trials
- **For Pharma**: Identify potentially productive sites (potentially eligible patients) help recruit patients for a specific trial
Discovery: **Watson for Drug Discovery**

*Cognitive computing helped accelerate cancer research to identify protein kinase activity on p53 through the understanding scientific language and the use of predictive analytics*

**Business Challenge**

- Data overload with 100,000 new cancer articles per year and 5,000 new P53 related articles per year

**Solution**

- In a retrospective analysis, correctly predicted 7 of 9 known p53 kinases; it took researchers worldwide 10 years to discover these 7 kinases while Watson identified and prioritized them in a matter of weeks
- Prospectively identified an additional 6 candidates for further research through the use of NLP and predictive analytics
- Demonstrated ability to extract and logically infer and reason over biological pathways and chemical / biological relationships

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Discovery: Accelerating academic research to help doctors develop novel treatments for cardiovascular disease

Hypothesizing novel targets for cardiovascular disease from relevant literature

IBM Watson for Drug Discovery

Research results will be expected in mid-2017

Objective:
— Accelerate identification of proteins associated with cardiovascular disease and cardiovascular disease outcomes
— Identify genes associated with certain cardiovascular disease subtypes

Business Problem:
— Cardiovascular diseases continue to be the leading cause of death in the US. About 1,400,000 people die from cardiovascular diseases annually
— Challenging to analyze the volumes of data in the context of all that is known about cardiovascular diseases
— Cardiovascular diseases treatments will require approaches adapted for each individual

Preliminary Findings:
— Evaluated over 1,000 candidate proteins to arrive at a ranked set of 1,200 proteins for further study as biomarkers for cardiovascular disease

Value of Watson:
— Demonstrated predictive capabilities; Watson successfully ranked “blinded” positive proteins (not in the training set) higher than others in the list of candidate proteins
— Watson proposed novel protein biomarkers associated with cardiovascular outcomes using semantic similarity analysis on known cardiovascular biomarkers
— This analysis will help to enable the development of more targeted treatments for cardiovascular disease
Explore: Real World Evidence Insights

Cognitive computing empowering treatment optimization for individuals and populations across the spectrum of acute and chronic conditions

Business challenge
► Care team uses anecdotal evidence, as opposed to a data driven approach, to identify patterns in similar patient profiles
► Care teams treat disease states similarly across various patient types and profiles

Solution
► Develop solutions designed to collect, understand and analyze real world evidence including patient attributes, environmental factors, and other exogenous health data
► Draw powerful insights and inform a variety of initiatives such as reducing drug misuse or increasing prescribed medication adherence
► Predict outcomes/disease progression based on similar clinical and behavioral patient profiles
Decision Support: Watson for Genomics
Analysis, Reports, & Visualizations

Molecular Profile Analysis

Pathway Analysis

Drug Analysis

Watson Genomics Content

- 20+ Content Sources Including:
  - Medical Articles
  - Drug Information
  - Clinical Trial Information
  - Genomic Information
Watson for Genomics: Sixteen Adopters and Partners

- Ann & Robert H Lurie Children’s Hospital of Chicago
- BC Cancer Agency
- City of Hope
- Cleveland Clinic
- Columbia University, Irving Cancer Center
- Duke Cancer Institute
- Fred & Pamela Buffett Cancer Center in Omaha, Nebraska
- McDonnell Genome Institute at Washington University in St. Louis
- New York Genome Center
- Sanford Health
- University of Kansas Cancer Center
- University of North Carolina Lineberger Cancer Center
- University of Southern California Center for Applied Molecular Medicine
- University of Washington Medical Center
- Yale Cancer Center
- University of Tokyo

Clinicians Tap Watson to Accelerate DNA Analysis and Inform Personalized Treatment Options for Patients
Fourteen Leading Cancer Institutes Collaborate with IBM to Advance Genomics as Part of Watson Health

"Determining the right drug combination for an advanced cancer patient is alarmingly difficult, requiring a complex analysis of different sources of big data that integrates rapidly emerging clinical trial information with personalized gene sequencing," said Norman Sharpless, MD, director, University of North Carolina Lineberger Comprehensive Cancer Center. "We are partnering with IBM in an effort to solve this decision problem with the help of cognitive technology and to improve the decisions we make with our patients to maximize their chance for cure."

"When you are dealing with cancer, it is always a race," said Lukas Wartman, MD, assistant director of cancer genomics at the McDonnell Genome Institute at Washington University in St. Louis. "As a cancer patient myself, I know how important genomic information can be. Unfortunately, translating cancer-sequencing results into potential treatment options often takes weeks with a team of experts to study just one patient's tumor and provide results to guide treatment decisions. Watson appears to help dramatically reduce that timeline."

"Watson will sift through the thousands, the tens of thousands, of genetic changes between a patient's tumor cells and normal cells. It will learn and start finding which genetic changes are important to the cancer," said KU Cancer Center deputy director Andrew Godwin. "The hope is this will be a tool in our everyday treatment of patients."

IBM has fed millions of research articles into the program, including biomedical research and clinical information," Dr. Guda said. "The cognitive computer can keep track of the complex relationships among gene mutations, drug treatments and treatment outcomes."
Decision Support: Watson for Oncology

Cognitive computing assisting health care providers to help them make smarter, evidence-based decisions when it comes to providing personalized care

Business Challenge
► Ability to identify treatments for an individual patient based on the latest evidence and clinical guidelines

Solution
► A tool to assist physicians in making personalized treatment decisions
► Analyzes patient data against thousands of historical cases and trained through thousands of Memorial Sloan Kettering MD and analyst hours
► Gain deeper insights into patient from both the structured and unstructured patient record utilizing natural language processing
► Offers suggestions to help inform oncologists’ decisions based on >300 medical journals, >250 textbooks, and 15M pages of text
Cognitive insights where care pathways and associated outcomes can be visualized

Enables effective care planning by visualizing which care or treatments are effective based on similarity analytics of patient population
The power of cognitive for precision medicine

Discovery:
- Draw rapid insights from case notes and big information sources

Client Experience:
- Intuitive phone and on-line support for questions
- Promote citizen engagement

Optimization:
- Share, scale expertise worldwide
- Focus resources on high-need populations with better precision

Outcomes:
- Inform choices of interventions most likely to succeed
In 10 years, cognitive systems will be to computing what transaction processing is today

• Amplify human creativity
  – Inspiring us to new alternatives to decision options
  – Bringing the breadth of all human knowledge to the tip of our tongue
• Learn their behavior through formal and informal training processes
• Interact with humans on our terms – in the language of humans
• Demonstrate their expertise through trust and depth of character
• Evolve strategies of success – adapting to ever changing knowledge and understanding
• Establish transformative relationships between humans and machines