Big Data and Analytics In Healthcare Overview
Fueling the Journey Toward Better Outcomes

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Market forces Changing Care Delivery

Care delivery evolution
Buyers of care expect greater value, improved quality and better outcomes – at a more affordable cost

- 17.6% of U.S. GDP consumed by healthcare spending
- 4X more people over 60 will be unable to care for themselves by 2050

Focus on the individual
Access to unprecedented amounts of data creates an opportunity for deeper insight, earlier intervention and engagement

- 50 million individuals entering health insurance market by 2017
- 1 billion health-related apps will be downloaded by the year 2016

Business model convergence
Increasing demand to connect healthcare and social services is driving formation of new partnerships

- 1/2 trillion $ avoidable costs with medication adherence
- 9 million of 36 million deaths attributed to preventable NCDs*

*non-communicable disease
IBM’s involvement in Healthcare

**Buyer/Consumer of Healthcare**
- 450,000 lives; $1.8B in investment
- Partner to promote innovation and value

**Change agent**
- Advocate for medical homes and founder of Patient Centered Primary Care Collaboration
- Healthcare standards leadership and participation in HL7 / IHE, Continua, CDISC, DICOM, ISO, OHT, OASIS, and CAQH-CORE
- Influencer to national level reform and eHealth
- IBM Research -- 600+ patents, systems thinking, Watson in Healthcare

**Solution provider across the continuum**
- Intersection of business and technology for Payers / Providers / Life Sciences / Devices
- Business services, process and workflow integration
- Big Data, information management and analytics
- Security, Mobility and Cloud
- Infrastructure build and optimization
Using analytics to drive consumer-centric value-based care

Healthcare Transformation

Disconnected services
- Ineffective outcomes

Coordinated care
- Improved health

Disconnected communication among providers fuels uncertainty and imprudent behavior

A patient-centric experience drives an improved outlook and adherence to treatment
Big Data Phenomenon in Healthcare

**Transactional & Application Data**
- EMRs
- PACS
- Labs

**Device/App Data**
- Remote Patient Monitoring
- Telemedicine
- eICU
- Quantified Self

**Social Data**
- Patient/Member conversations
- Health Community Blogs
- Social Media

**Publications and Research**
- Research Papers
- Omics analysis
Big Data offers great opportunity to better insights

With Big Data...

**Hospitals**
We identified & vaccinated patients at risk for meningitis within hours of the outbreak.

**Doctors and patients**
My patient’s BP and sugar levels spiked, I need to get her in as soon as possible.

**Finance**
We reduced readmission rates by assigning a care manager to heart patients with no emergency contact on file.

**Hospitals & Payers**
My reports show a decline in satisfaction based on sentiments expressed on our member portals. I need to maintain a balanced member portfolio as I attract, retain and lose members over time.
IBM Smarter Care uncovers valuable insights into **lifestyle choices, social determinants, clinical and financial factors** that effect the overall health of an individual ...

**Lifestyle**

Choices have direct impact on an individual’s mental and physical wellness.

**Social**

Demographic determinants such as where one is born, grows, lives, works and ages have direct impact on an individual’s overall health, mental health and well-being.

**Clinical**

Factors such as specific medical symptoms, history, medications, diagnoses, etc are indicators of an individual’s health.

**Financial**

Costs, insurance, reimbursement, incentive to modify behavior, new payment models, co-pays, etc. will pay a significant role.
IBM Smarter Care - Integrated portfolio of capabilities

**Coordination**
- Care identification
- Care planning
- Care collaboration
- Outcome evaluation

**Analytics and Cognitive Computing**
- Population analytics
- Diagnostic support
- Care pathways
- Operational reporting

**Cognitive computing**

**Foundation**
- Data warehouse, data models, and BI platform (report & predictive)
- “Single view” customer EMPI (MDM)
- Translational Medicine
- Portals, mobile and collaboration
- Remote monitoring and medical device connectivity
- Paper and Fax capture, conversion and extraction

Comprehensive global consulting, technology, infrastructure and managed services
Big Data & Analytics capabilities required to address the challenges and opportunities

Big Data & Analytics Strategy, Integration & Managed Services

Big Data & Analytics Platform

Real-time Data Processing & Analytics

Operational data zone

Landing, Exploration and Archive data zone

Deep Analytics data zone

EDW and data mart zone

Information Integration & Governance

Big Data & Analytics Infrastructure

What is happening?
Discovery and exploration

What action should I take?
Decision management

What did I learn, what's best?
Cognitive

Why did it happen?
Reporting and analysis

What could happen?
Predictive analytics and modeling

All Data

New/Enhanced Applications
Big data creates a challenge – and an opportunity

The bigger the haystack, the clearer the needle

**Look At All The Data**

**Look At Even Dirty Data**

**Let Data Lead the Way**

**Leverage Data as it is Captured**

- Analyze small subsets of information (Traditional Approach)
- Analyze all information (Big Data Approach)

- Carefully cleanse information before any analysis (Traditional Approach)
- Analyze information as is, cleanse as needed (Big Data Approach)

- Start with hypothesis and test against selected data (Traditional Approach)
- Explore all data and identify correlations (Big Data Approach)

- Analyze data after it’s been processed and landed in a warehouse or mart (Traditional Approach)
- Analyze data in motion as it’s generated, in real-time (Big Data Approach)
Typical Analytic Journey

Foundational
- What happened?
- When and where?
- How much?

Advanced, Predictive
- What will happen?
- What will be the impact?

BI Reporting
- Dashboards
- Clinical data repositories
- Departmental data marts
- Enterprise data warehouse

Population Analytics
- Enterprise analytics
- Unstructured content analytics
- Outcomes analytics
- Evidence-based medicine

Care Optimization
- Streaming analytics
- Similarity analytics
- Personalized healthcare
- Consumer engagement
- Cognitive Computing

Prescriptive
- What are potential scenarios?
- What is the best course?
- How can we pre-empt and mitigate the crisis?
Big Data Meets Big Math

Analytics without constraint
Advanced Analytics – the Traditional Way

- SAS
- Data Warehouse
- Analytics Grid
- Data
- SQL
- ETL
- C/C++, Java, Python, Fortran, ...
- Demand Forecasting
- Fraud Detection
IBM PureData For Analytics – Simplifying Serious Analytics

- **Analytic Tools**
- **Data Warehouse**
- **Analytics Grid**
  - C/C++, Java, Python, Fortran, ...
- **ETL**
- **SQL**
- **Demand Forecasting**
- **Fraud Detection**
Key healthcare use cases for Big Data & Analytics

Health Monitoring & Intervention
How can I monitor vital changes and raise alerts for proactive intervention at the bedside and at home?

Population Health Management
How can I make targeted decisions to improve care and outcomes on my chronically ill patient population?

Consumer Insight & Engagement
How can I create a customer-focused view to enable personalized marketing and engagement strategies?

Translational Research
How can I identify the genetic basis for diseases to help clinicians provide personalized medicine?

Analytics for Care Mgmt & Transitions
How can I improve transitions of care by identifying high-risk patients and informing an alternative care plan?

Biomedical Insights, Search & Discovery
How can I accelerate data sharing in support of research, new product development and clinical trials?
A national health insurer gives providers insight on the natural history of disease and intervention

Need

• Identify pre-diabetics and “hidden diabetics” and enable wellness companies to intervene in early stages

Benefits

• Set the standard for comprehensive disease modeling

• Identify patients 6 months to 2 years earlier by understanding physiological changes in gastrin and C-reactive proteins

• Enable targeted, early intervention programs and develop evidence-based care pathways
The State University of New York (SUNY) at Buffalo gains insights from big data to slow progression of multiple sclerosis

**Need**

- Researchers needed to quickly build models using a range of variable types and run them on a high-performing environment on huge data sets spanning more than 2,000 genetic and environmental factors that may contribute to multiple sclerosis (MS) symptoms

**Benefits**

- Able to reduce the time required to conduct analysis from 27.2 hours to 11.7 minutes
- Researchers are empowered to look for potential factors contributing to the risk of developing MS
- Read Forbes Article on this. Click [here](#)
Medical research hospital discovering connections between drugs, disease, and genetics to provide better care

Need

• Analytics platform to accelerate breakthrough translational discoveries
• Get beyond simple correlations based on diagnosis codes and SNPs
• Analytics platform to analyze large data sets of concepts vs. concepts, such as lab results, genotypes, medications, diagnosis codes, phenotypes

Benefits

• Connect genetic and phenotypic markers to health outcomes
• Understand genetic basis for disease and drug response to prevent adverse effects
• Query clinical and DNA data from 2.2M patients over 30 years from a single system
University of Ontario Institute of Technology (UOIT) uses big data to improve quality of care for neonatal babies

Need
- Performing real-time analytics using physiological data from neonatal babies
- Continuously correlates data from medical monitors to detect subtle changes and alert hospital staff sooner
- Early warning gives caregivers the ability to proactively deal with complications

Benefits
- Detecting life threatening conditions 24 hours sooner than symptoms exhibited
- Lower morbidity and improved patient care
Emory University Center for Critical Care gains early insight into heart failure in critical care patients

**Need**

- Provide clinic-wide situational awareness to allow prioritization of treatment based on real-time analysis of physiologic data streams

**Benefits**

- Early warning system detects subtle signs of Atrial Fibrillation in patients in the Intensive Care Unit
- Enables early detection and intervention to mitigate deterioration in the patient’s condition
Healthcare provider uses PureData System for Analytics and IBM Healthcare Provider Data Model to identify gaps in care with population care management

Need

• Risk stratify patients utilizing financial (claims), clinical (Epic and other) and other domain data to address gaps in patient care and move from fee-for-service to value based outcomes

Benefits

• Provide analytics and reporting data for at-risk populations with clinical decision in batch (retrospective) and real time
• Perform predictive modeling to enable proactive interventions.
• Provide a secure, encrypted data connection to accept the minimum data transmission necessary to accomplish the request
NLP enhancing Risk Adjusted Scoring for Medicare Advantage

Icd9: 272.4  Hcc: HCC024
Icd9: 414.00  Hcc: HCC084
Icd9: 244.9  Hcc: HCC022
Icd9: 780.79  Hcc: HCC166
Icd9: 780.79  Hcc: HCC166
Icd9: 455.3  Hcc: HCC166
Icd9: 562.10  Hcc: HCC036
Icd9: 401.9  Hcc: HCC091
Icd9: 787.03  Hcc: HCC166
Icd9: 784.0  Hcc: HCC166
Icd9: 780.79  Hcc: HCC166
Icd9: 300.00  Hcc: HCC059
Icd9: 787.03  Hcc: HCC166
Icd9: 780.79  Hcc: HCC166
Icd9: 780.79  Hcc: HCC166
Icd9: 780.79  Hcc: HCC166
A university medical center in the U.S. detects severe complications in brain injured patients

Capabilities Utilized
Stream Computing, IBM Research

• Collecting and analyzing more than 200 structured and unstructured data variables including EEG, blood pressure, temperature readings as well as persistent data such as lab results and patient histories

• Uncovering hidden patterns in test results that are difficult to correlate without analytics

Results

• Expects to help medical professionals detect symptoms of
Improving Cost Of Care

Goal
Proactive care-gap identification and risk stratifying population to enable providers to intervene

Challenge
- Disconnected data silos, growing data volumes
- Increasingly complex business rules making timely analysis impossible
- Time-to-action w/ 20-30 day lag delivering insights to downstream care decision support systems

Solution
- Integrated and Established unified analytic platform optimized for hypothesis driven data analytics and mixed workload
- Embedded all business rules 5K ~ 20K within big data platform as in-database routines to prevent data copying & movement (20% rules integrated in 2 weeks)
- Shifted many of the data processing steps to run within the platform including SAS data preparation steps

Benefits
- Dynamic rescoring of member population based of varying conditions and co-morbidities.
- Helping identifying and running various models for optimal “care steps” at the right price point
- MHA member search, member treatment history analysis - 500X faster
- Summarizing claims at member visit level and all claims categories – 16 hours to 2 minutes - 480X faster
- SAS process 1 hour then takes 3m23seconds - 20X faster
- Projected Claim volumes 30X scanning 11M records - 170X faster
Thank You!
For more information:
www.ibm.com/big-data/healthcare

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