Using Analytics to Improve Population Health

Nav Ranajee
IBM
Healthcare Marketing Leader
Big Data and Analytics
IBM Healthcare Market Presence

- Healthcare point of view and IBV studies
- Over 8,000 employees work in healthcare
- Leadership as a best practice employer and promoter of open collaboration
- Smart Value Perspective

Smarter Healthcare

- Patient-Centered Primary Care Collaborative
- Continua Health Alliance
- HL7, COCIR and epSOS

Anchor clients

Thought Leadership

Coalitions/Standards

Policy

Partners

Industry Frameworks/Solutions

R&D

- IBM Health Integration Framework: 28 software assets and a global partner ecosystem program
- Integrated Big Data/Analytics stack
- Cloud EHR and Desktop Services
- Global solution centers: Hawthorne, La Gaude, Dallas, Berlin, Austin, Beijing

- 600 patents
- $100M Research Initiative (56 MD’s)
- Apple Partnership to develop Healthcare Apps

Global solution partners: Cerner, Siemens, McKesson, Trizetto, EPIC, SAP

Policy advisor to 10 US state Medical Home initiatives
- eHealth, privacy/security
- World Community Grid
The Healthcare Landscape
The Healthcare Industry is Undergoing a Significant Transformation

- Escalating incidence and cost of chronic disease
- Advances in technologies/mobile health/EHR/Analytics
- New Value Based Payment Models
- Consumer Driven Healthcare
- Industry challenges and opportunities
- Expectations for better quality, outcomes and value
- Affordable Care Act/Meaningful Use
- Globalization of health care

Source: IBM HCLS, IBM GBS Institute for Business Value

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Ultimately Demographics drives the need for change

**Economic Forces**

Buyers of care (including governments, private insurers, employers and individuals) expect greater value, improved quality and better outcomes – at a more affordable cost

- 17.6% of U.S. GDP consumed by healthcare spending
- 90% of the population of OECD countries has health insurance

**Demographic Forces**

The changing face of the population and their illnesses will continue to shape the healthcare transformation.

- 80 years: Life expectancy at birth exceeds 80 years across majority of OECD countries
- 30%: 10 year improvement rate for heart attack survival

**Technological Forces**

Increasing demand for healthcare and social services is driving the creation of new technologies

- 247 million: The number of mHealth users (those who download a smartphone mHealth app)
- 1 billion: Projected annual health-related apps downloaded by year 2016

Disease and cost of care progression

- Early intervention
  - Opportunities identification

Health status

- Healthy
  - Low risk
- At risk
- High risk
- Early clinical symptoms
- Active disease

Healthcare spending

- Time
- Early intervention
  - Opportunities identification

20% of people generate 80% of costs

70% of US deaths are from chronic diseases
Healthcare is moving to a system focused on value, coordinated around the patient and integrated into our communities.

### Core Principles of Current System

- **Over-emphasis** on expensive treatments and incremental improvement
- Myopic focus on *capacity for acute care*
- Use of *volume-based reimbursement models*
- **Patients** are responsible for coordinating their own care
- Care varies by venue and clinician
- Quality is determined *by the provider*

### Tomorrow’s Healthcare System

- Focus is on **value, coordinated** around the patient and integrated into communities
- Emphasis is on *proactive care* to meet health needs
- Payment is based upon **value** and **outcomes**
- Primary care teams provide **comprehensive care** throughout patient life
- Care is *standardized* according to **evidence-based** guidelines
- **Empowered consumers** determine market

*The market is rejecting the major structural deficiencies that have resulted in the industry's systemic challenges*
Transforming Healthcare via Population Health Management and Value Based Care

- Definition: “the health outcomes of a group of individuals including the distribution of such outcomes within the group”

- Volume to Value Based Care

- Triple Aim: Improved Health, Improved Care, Reduced Cost

- Steps to Population Health Management
  - Define Population
  - Stratify Risks
  - Identify Care Gaps
  - Manage Care
  - Engage Patients
  - Measure Outcomes

“There is nothing more important [in healthcare] than the transition from traditional medicine to population health and the implications that will have. No Outcome No Income.”

Dr. David Nash
Founding Dean, Jefferson School of Population Health
Population Health Management Priorities

- **Information-powered clinical decision making**
  - Right Data at the Right Point of Care at the Right Time
  - Requires integrated data network
  - Requires new leadership focused on population health

- **Primary Care-led Clinical Work Teams**
  - Comprehensive care management outside of 4 walls
  - Individualized care plans based on social/clinical data
  - Technology enables extension and knowledge of PCP teams

- **Patient Engagement**
  - Use data to understand non-clinical barriers to care
  - Use data to activate personal health and wellness
  - Use data to map services to population need
  - Use data to identify high risk patients
Big Data and Analytics
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.
Healthcare leaders face an intensifying mission for transformation …That lead directly to requirements for Big Data & Analytics

**BUILD SUSTAINABLE HEALTHCARE SYSTEMS**
- Understand total cost of care & areas for efficiencies and process changes
- Provide cost transparency and superior care to an ever more demanding public

**COLLABORATE TO IMPROVE CARE AND OUTCOMES**
- Recognize patterns of disease progression and take targeted action
- Understand effects of treatments on the broader population and individual patients

**INCREASE ACCESS TO HEALTHCARE**
- Predict future resource demands and requirements to serve your patient population
- Optimize care and service to the citizen, consumer and patient at any point of contact

**Wellness**
Locating the data and having the right resources to turn it into insights are obstacles widespread adoption of analytics.

**Primary obstacles* to widespread analytics adoption**

- Ability to get the data: 37%
- Culture does not encourage sharing information*: 35%
- Lack of understanding how to use analytics to improve the business: 34%
- Lack of management bandwidth due to competing priorities: 25%
- Lack of executive sponsorship: 24%
- Lack of skills internally in the line of business: 23%
- No case for change: 19%
- Don't know where to start: 17%
- Ownership of the data is unclear or governance is ineffective: 17%
- Perceived costs outweigh the projected benefits: 9%
- Concerns with the data: 3%

*An obstacle is anything of that impedes and/or deters the healthy application of analytics*

Explosive growth of patient data creates opportunity for Healthcare Transformation

### Issues Impacting Patient Data Management

- Growth driven by increased EMR and HIT application adoption
- Increased data sharing with patients (e.g. MU Stage 2 requirements)
- M&A creating convergence of multiple systems
- ACO movement demanding deeper mining and analysis of data
- Tighter mandates for data security

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**EXPLOSIVE GROWTH**

The healthcare industry is experiencing explosive growth in data—from 500 petabytes (PBs) in 2013 to 25,000 PBs by 2020.¹

The Broad Institute uses 10 PetaBytes of STORAGE to perform gene sequencing.²

ONE 3D CT SCAN CONSUMES 1GB of STORAGE³

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By 2015, the average hospital could generate 665TB of data.⁴

THE AVERAGE HOSPITAL HAS 800,000 TOTAL RECORDS.

64,000–96,000 ARE DUPLICATES.

THE AVERAGE COST OF A DUPLICATED MEDICAL RECORD IS $50. IF THE RECORDS AREN’T RECONCiled, THE COSTS ARE EVEN HIGHER.⁵

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Sources: CDW Healthcare Industry View, Desperately Seeking Data Storage, November 2013; IBM Smarter Care

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80% unstructured data in EMRs, devices, publications, drug structures…
How are you measuring and reducing preventative readmissions?

How are you providing clinicians with targeted diagnostic assistance?

Which patients are following discharge instructions?

How are you using data to predict intervention program candidates?

Would revealing insights trapped in unstructured information facilitate more informed decision making?

Does unlocking the unstructured data help accelerate your transformation?

- Physician notes and discharge summaries
- Patient history, symptoms and non-symptoms
- Pathology reports
- Tweets, text messages and online forums
- Satisfaction surveys
- Claims and case management data
- Forms based data and comments
- Emails and correspondence
- Trusted reference journals including portals
- Paper based records and documents

Over 80% of stored health information is unstructured*

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Healthcare analytics is a journey

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

- What will happen?
- What will be the impact?

Foundational
- Dashboards
- Clinical data repositories
- Departmental data marts
- Enterprise data warehouse

Advanced, Predictive
- Enterprise analytics
- Unstructured content analytics
- Outcomes analytics
- Evidence-based medicine

Cognitive, Prescriptive
- Streaming analytics
- Similarity analytics
- Personalized healthcare
- Consumer engagement

BI Reporting
- Care Optimization

Population Analytics
- What are potential scenarios?
- What is the best course?
- How can we pre-empt and mitigate the crisis?
Types of Analytics in Healthcare

**PHM/Clinical Analytics**
- Predictive
- Prescriptive
- Disease management

**Financial Analytics**
- Revenue Cycle
- Budgeting/Forecasting
- Resource costs

**Consumer Analytics**
- Patient Satisfaction
- Behavioral
- Wellness

**Comparative Analytics**
- Clinical benchmarks
- Peer comparisons

**Regulatory Reporting**
- Compliance
- PQRS/Meaningful Use

**Performance Measurement**
- Outcomes measures
- Process measures
- Pay for performance

**Pharma Analytics**
- Drug discovery
- Quality assurance
- Marketing/Sales

**Genomic Analytics**
- Medical research
- Clinical trials

**Location Analytics**
- Geospatial
- Identify market place

**Streaming Analytics**
- Medical Devices
- TeleHealth
- Fitness devices

**Risk/Fraud Analytics**
- Claims/Billing
- HIPAA monitoring

**Social Media Analytics**
- Patient portal activity
- Facebook/Twitter/LinkedIn

**Public Health**
- Disease Registries
- Surveillance
- Global Data tracking

**Operational Analytics**
- Clinical Decision Support
- Bedside monitoring
- Staffing
- Supply chain

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## Primary Use Case: Measure & Act on Population Health

**Target Segment:** Providers

### Description
Gain insights into a population of patients and take action by identifying gaps in care, re-admission risk, disease progression and performance against quality measures.

### Data Types: Structured & Unstructured

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EMR</strong></td>
<td>Clinical data, notes, dictation</td>
</tr>
<tr>
<td><strong>Events</strong></td>
<td>Weather, local events, disease outbreaks</td>
</tr>
<tr>
<td><strong>Insurance</strong></td>
<td>Claims, DRG, eligibility</td>
</tr>
<tr>
<td><strong>Genomics</strong></td>
<td>bio-markers, phenotype</td>
</tr>
<tr>
<td><strong>Government</strong></td>
<td>Social services, demographics</td>
</tr>
<tr>
<td><strong>Pharmacy</strong></td>
<td>Prescriptions, OTC drugs</td>
</tr>
<tr>
<td><strong>Mobile Health</strong></td>
<td>Email, Apps</td>
</tr>
<tr>
<td><strong>Social/Communities</strong></td>
<td>Wellness, Patients Like Me</td>
</tr>
</tbody>
</table>

### Capabilities
- Predict patients at risk for readmission and intervene
- Identify gaps in care by disease
- Anticipate and take pre-emptive action during disease outbreaks
- Understand clinical performance against targets and take specific action

### Outcomes
- Preventative care
- Optimize outcomes and costs
- Risk stratify population
- Provide evidence-based care per national guidelines
Apply new insights from **social and clinical analysis** to inform care protocols and drive better outcomes

**Segment populations by risk profiles**

- Healthy low risk
- At risk
- High risk
- Early clinical symptoms
- Active disease

**Inform care approaches with evidence**

**Prevention**

**Educate and engage** to change attitudes and behaviors to prevent the onset of health issues

- Plan evidence-based wellness and vaccination programs
- Fix inadequate housing to prevent asthma

**Early intervention**

**Promote** routine screening and healthy lifestyles to defer disease onset and manage risk

- Predict disease onset to intervene earlier
- Enroll individuals and families at high risk for diabetes in lifestyle programs

**Care Management**

**Deliver** the right care services to support the individual with the right programs and treatments to improve quality of life and optimize resource use

- Prevent admissions and readmissions through alternative care environments
- Provide proactive support for return to work programs

**Examples**

Apply new insights from **social and clinical analysis** to inform care protocols and drive better outcomes
Applying Big Data & Analytics to *Population Health Management*

**Population Health Management**

Improve outcomes on chronically ill populations of patients

- Reduce treatment variability and gaps in care
- Reduce hospital readmissions
- Improve patient compliance
- Improve quality performance
- Coordinate care across providers

50% improvement choosing correct treatment, reducing side effect complications

Reduced preventable hospital acquired conditions by 40% over 3 years

Improved quality scores from 92% to 99%

Estimated $8-12 M savings per year through efficiencies and readmission avoidance

$9.1B reduction in costs over 5 year time frame across the collaborative

Reduced re-admissions by 20% in accordance with quality requirements
## Population Health Analytics Requirements

<table>
<thead>
<tr>
<th>Understand / Reduce Total Cost of Care</th>
<th>Stratify Populations According to Program Objectives</th>
<th>Understand / Improve Quality of Care &amp; Patient Experience</th>
<th>Measure Program Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Comparison to market performance</td>
<td>• High Risk for Future Cost</td>
<td>• Comparison to market performance</td>
<td>• Performance of Intervention population vs. Control</td>
</tr>
<tr>
<td>• Distribution of costs within clinically equivalent episodes</td>
<td>• High Risk for Future Event</td>
<td>• Provider / Care Team performance variation</td>
<td>• Cost of Intervention vs. Benefit to Population</td>
</tr>
<tr>
<td>• Provider practice pattern variation</td>
<td>• High Risk for Future Adverse Outcome</td>
<td>• Identify areas of opportunity</td>
<td>• Impact of Intervention on Patient Outcome</td>
</tr>
<tr>
<td>• Identify areas of opportunity that cross continuum of care</td>
<td>• Readmission Prevention</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• High Frequency ED Users</td>
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</tbody>
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Business problem:
➢ Need better individualized cancer treatment plans

Solution:
➢ Suggestions to help inform oncologists’ decisions based on 600K+ pieces of evidence and 2M pages of text from 42 publications
➢ Analyzes patient data against thousands of historical cases and trained through 5000+ Memorial Sloan-Kettering MD and analyst hours
➢ Evolves with the fast-changing field

IBM WatsonOncology
Developed with Memorial Sloan Kettering
Watson facilitating medical school problem-based learning methods

Business problem:
- Give medical students and doctors easier insight into data to inform their diagnoses and decisions

Solution:
- Intuitive, new user interface to Watson’s power revealing chains of evidence to support clinical reasoning
- Analysis of whole EMRs to extract and visually present summarized knowledge with semantic understanding of context
- Cognitive systems in a classroom-based setting
- Watson facilitating medical school problem-based learning methods
THR - 2014 Davies Award Winner projects 6X return for Clinical BI

$12M investment $73M ROI 5 years

Four use cases:
- Population Health: ACO-33 and P4P
- Heart & Vascular (H&V) Procedures
- H&V Care Redesign
- Referral Management Analysis

Capabilities:
- Single data repository, unique patient identifier, data model, self-service reporting

Results:
- Quality scores improved from <92% 99%
- Expected 10% recovery ($3.4M/yr) on referral leakage
- Save $8-12M/yr through efficiencies & readmission avoidance
Seton Healthcare Family reduces CHF readmission to improve care

**Reduce re-admission**
of CHF patient by proactively targeting care management

**Identify**
patients likely for readmission

**Reduce costs**
mortality rates, and improved patient quality of life

**Business Challenge:** Seton Healthcare strives to reduce the occurrence of high cost Congestive Heart Failure (CHF) readmissions by proactively identifying patients likely to be readmitted on an emergent basis.

**The Solution:** IBM Content and Predictive Analytics for Healthcare solution will help to better target and understand high-risk CHF patients for care management programs by Utilizing natural language processing to extract key elements from unstructured History and Physical, Discharge Summaries, Echocardiogram Reports, and Consult Notes, leveraging predictive models that have demonstrated high positive predictive value against extracted elements of structured and unstructured data, and providing an interface through which providers can intuitively navigate, interpret and take action.

“IBM Content and Predictive Analytics for Healthcare uses the same type of natural language processing as IBM Watson, enabling us to leverage information in new ways not possible before. We can access an integrated view of relevant clinical and operational information to drive more informed decision making and optimize patient and operational outcomes.” - Charles J. Barnett, FACHE, President/Chief Executive Officer, Seton Healthcare Family

**Solution Components**
- IBM® Content and Predictive Analytics for Healthcare
- IBM Cognos Business Intelligence
- IBM BAÖ solution services
What Really Causes Readmissions at Seton

Key Findings

The Data We Thought Would Be Useful … Wasn’t
• 113 candidate predictors from structured and unstructured data sources
• Structured data was less reliable than unstructured data – increased the reliance on unstructured data

New Unexpected Indicators Emerged … Highly Predictive Model
• 18 accurate indicators or predictors (see next slide)

Predictor Analysis

<table>
<thead>
<tr>
<th>Predictor</th>
<th>% Encounters Structured Data</th>
<th>% Encounters Unstructured Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ejection Fraction (LVEF)</td>
<td>2%</td>
<td>74%</td>
</tr>
<tr>
<td>Living Arrangements</td>
<td>&lt;1%</td>
<td>73% (100% Accurate)</td>
</tr>
</tbody>
</table>
Data that is ACTIONABLE

Population Management
We identified & recommended vaccination for patients at risk for meningitis within hours of the outbreak.

Intervention
The patient's BP and sugar levels spiked, I need to communicate with her and direct her to treatment.

Health Economics
I have evidence that demonstrates a lower total cost of care and better outcomes with a seemingly more expensive drug or treatment.

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

Consumer Engagement
My reports show a decline in satisfaction based on sentiments expressed on our member portals and social networking sites.
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