



Predictive Modeling: Advancing the Frontiers

The Predictive Modeling Summit
Washington, DC
December 4, 2013



Vipin Gopal, PhD

Vice President,
Clinical Analytics

Humana[®]

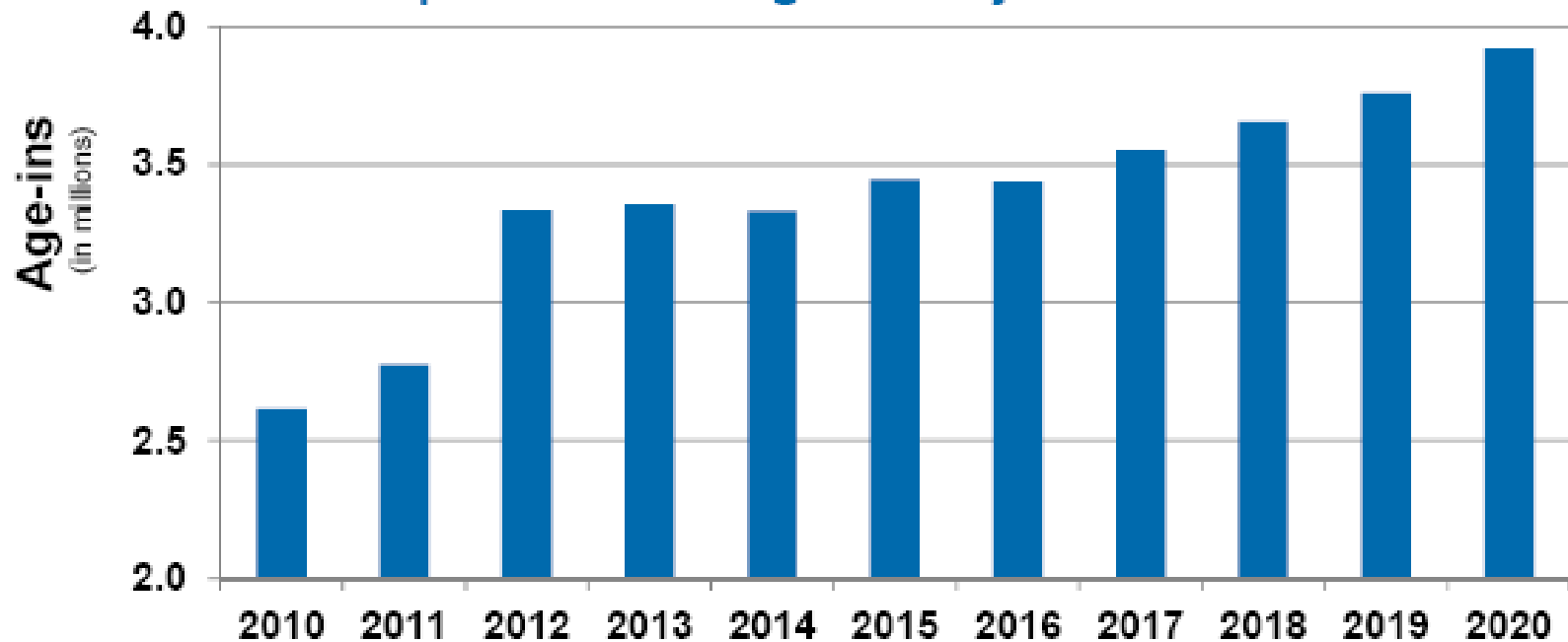


Macro Trends in Healthcare

Age-In Population

An Estimated 7,600 People Turn 65 Daily

Population Turning 65: Projected 2010 – 2020



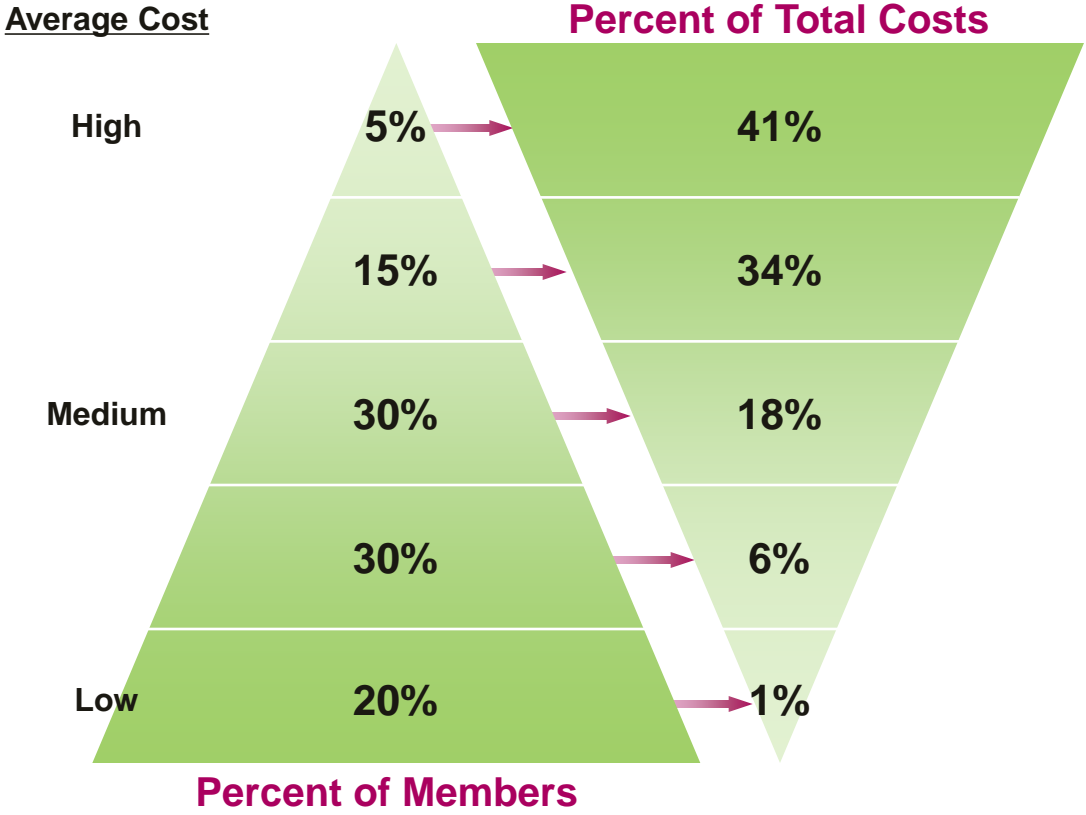
Source: The U.S. Census Bureau, Population Projections

(http://www.census.gov/population/www/projections/files/nation/download/NP2008_D1.xls)

File 1. Projected Population by Single Year of Age, Sex, Race, and Hispanic Origin for the United States: July 1, 2000 to July 1, 2050

Macro Trends in Healthcare

Cost Distribution

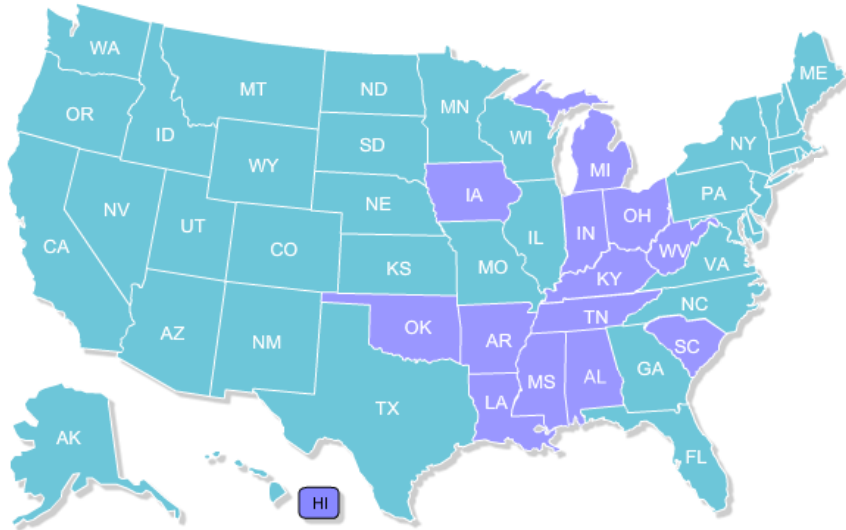


The 80/20 rule broadly applies in healthcare

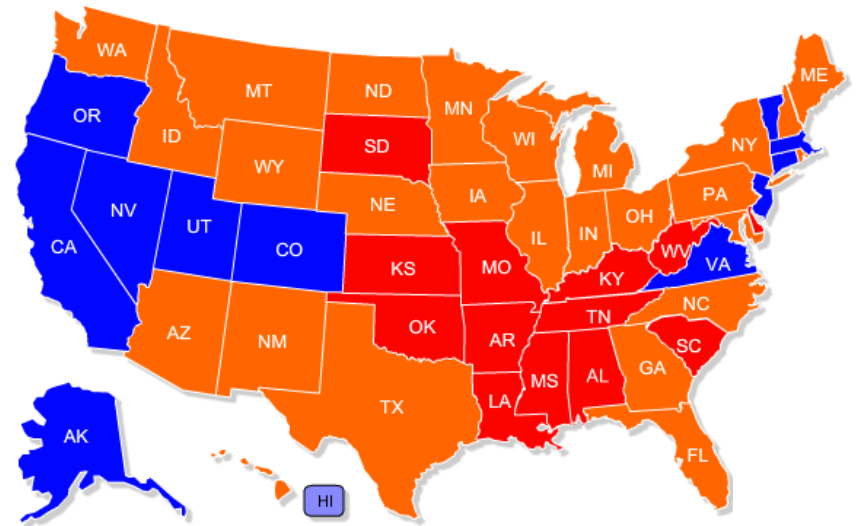
Macro Trends in Healthcare

The Obesity Epidemic

2012



2030 (Projected)



In 1980, no state was above 15%
In 1991, no state was above 20%



Humana

- Leading health care company that offers a wide range of insurance products and health and wellness services; founded in 1961; headquartered in Louisville, KY
- 2012 revenues of \$39.1 billion
- Total assets of approximately \$20.9 billion
- Over 25 years of experience in the Medicare program
- One of the nation's top providers of Medicare Advantage benefits with approximately 2.5 million members
- Approximately 12.4 million medical members nationwide
- Approximately 8.2 million members in specialty products
- Operates more than 400 medical centers and 270 worksite medical facilities

Predictive Modeling in Healthcare

The Broad Context

- Evolved as a visible domain in the past decade
 - Predictive Modeling not much of a discussion topic 10 years ago
- Confluence of significant enablers helped accelerate such evolution
 - Business Drivers – Recognition that analytics can be a differentiating competency in driving positive clinical results
 - Software – Availability of tools with suite of algorithms and features
 - Hardware – Rapid increase in computing power and data infrastructure
 - Data – Explosion in the availability of relevant data
 - Talent – Academic programs in various disciplines have graduated skilled modelers with a lot of depth

Predictive Modeling As a Key Impact Area

From Humana Q1 2013 Earnings Call

Clinical Infrastructure Investments Progress

- ❖ Care management professionals at 7,600 versus 4,400 a year ago
- ❖ Improvement in new member predictive models and clinical assessment processes
- ❖ 31,000 of new members in chronic programs versus 4,000 a year ago
- ❖ Increase in care management professionals and early identification of prospective members
- ❖ 180,000 seniors in chronic care programs versus 125,000 a year ago; expect that to reach 275,000 by December 2013
- ❖ Continuing to accelerate relationships with risk providers
- ❖ Employ, have strategic relationships or contracts with 6,200 providers covering over 530,000 of our Medicare members

Classic Problems - Readmissions

2009 NEJM Article

SPECIAL ARTICLE

Rehospitalizations among Patients in the Medicare Fee-for-Service Program

Stephen F. Jencks, M.D., M.P.H., Mark V. Williams, M.D.,
and Eric A. Coleman, M.D., M.P.H.

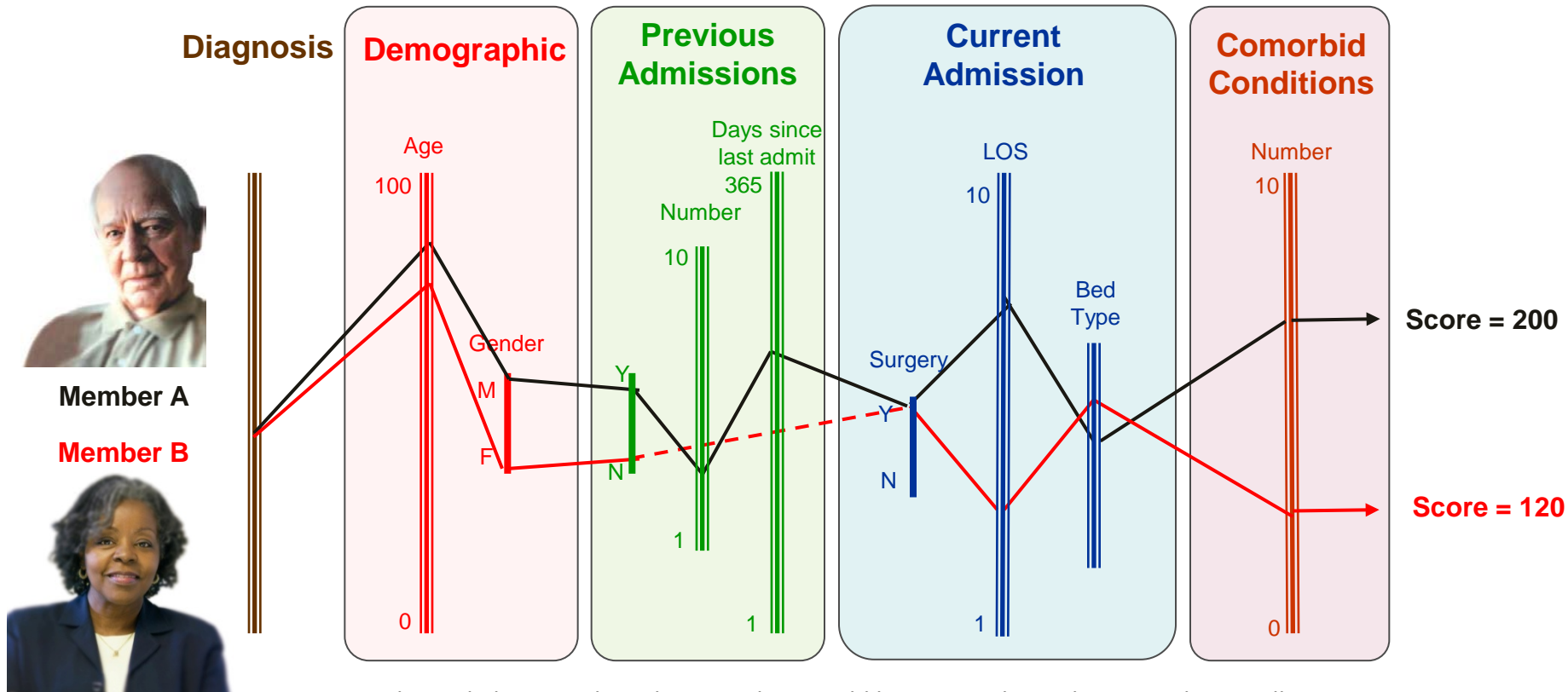
N ENGL J MED 360;14 NEJM.ORG APRIL 2, 2009

- 1 in 5 patients rehospitalized in 30 days
- Half never see an outpatient doctor prior to rehospitalization
- 70% of surgical readmissions are for chronic medical conditions
- Costs \$17.4 billion annually

Classic Problems - Readmissions

Predictive Model

How can we identify members at most risk for readmission?

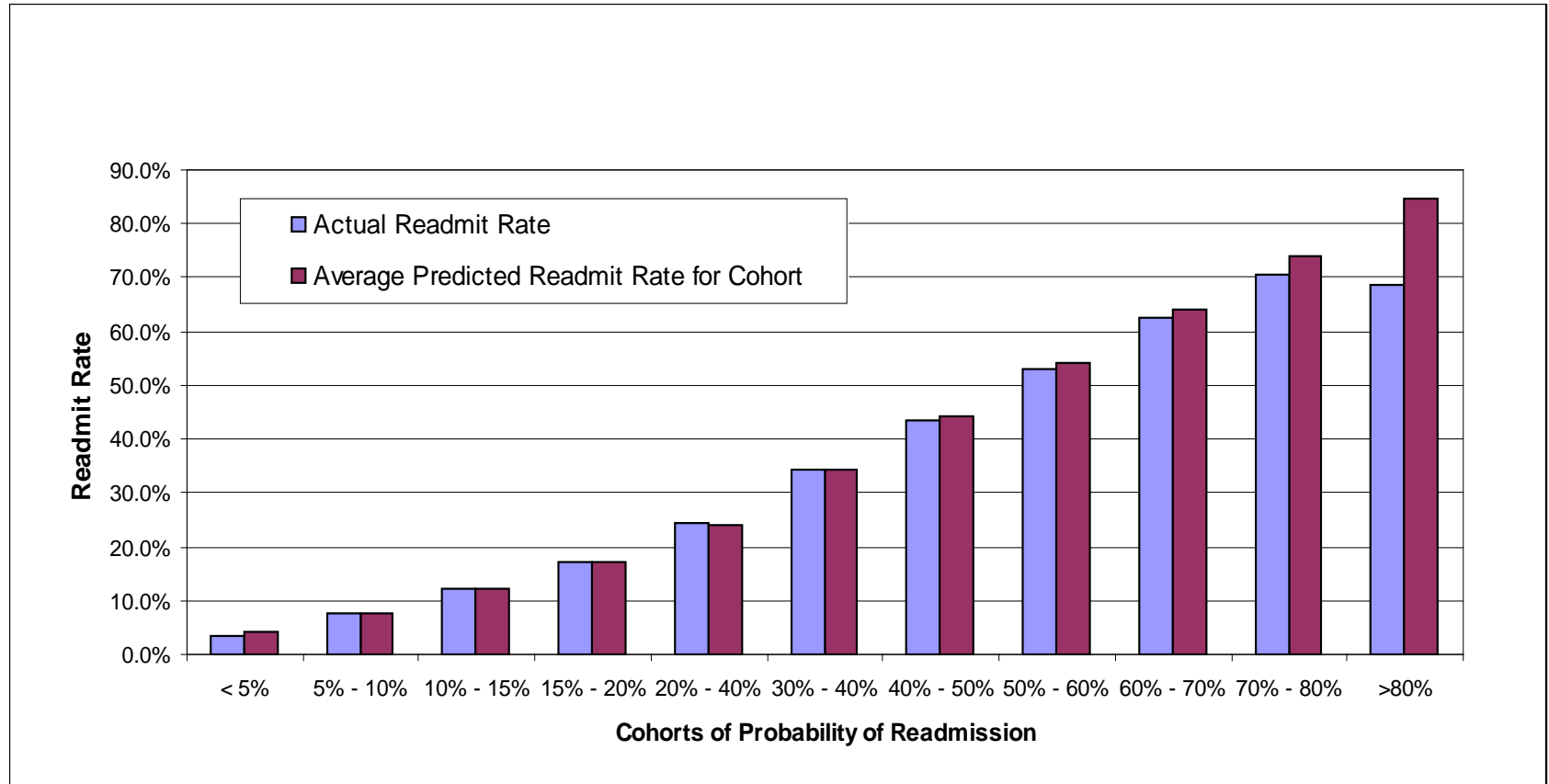


Traditional, diagnosis based approaches would have scored members A and B equally

The bottom line: Humana's readmission predictive modeling approach, built on a database of half a million admissions, allows *stratification* and *prioritization* to those members in the most need.

Classic Problems - Readmissions

Predictive Model Performance

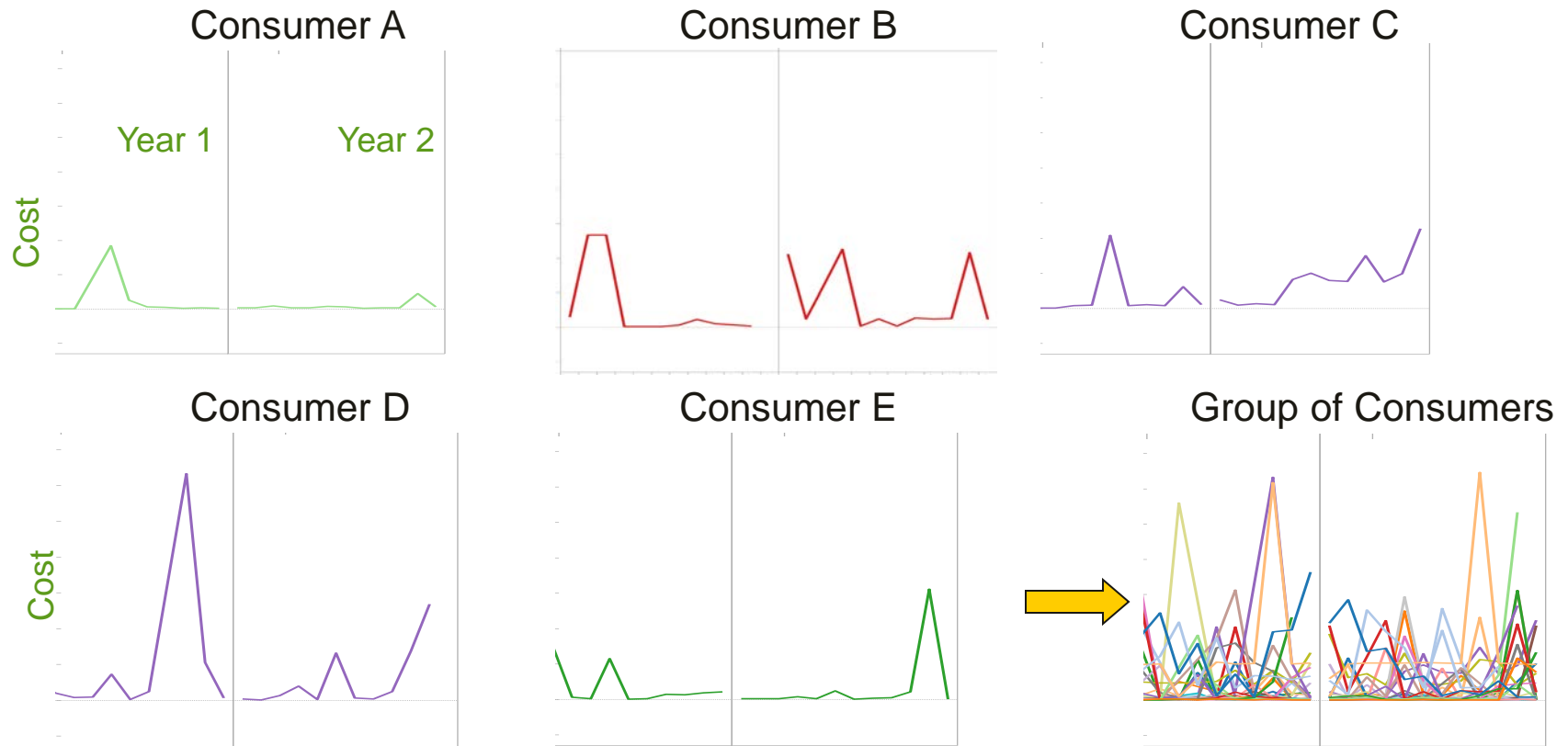


Classic Problems – Severity Predictions

Challenge

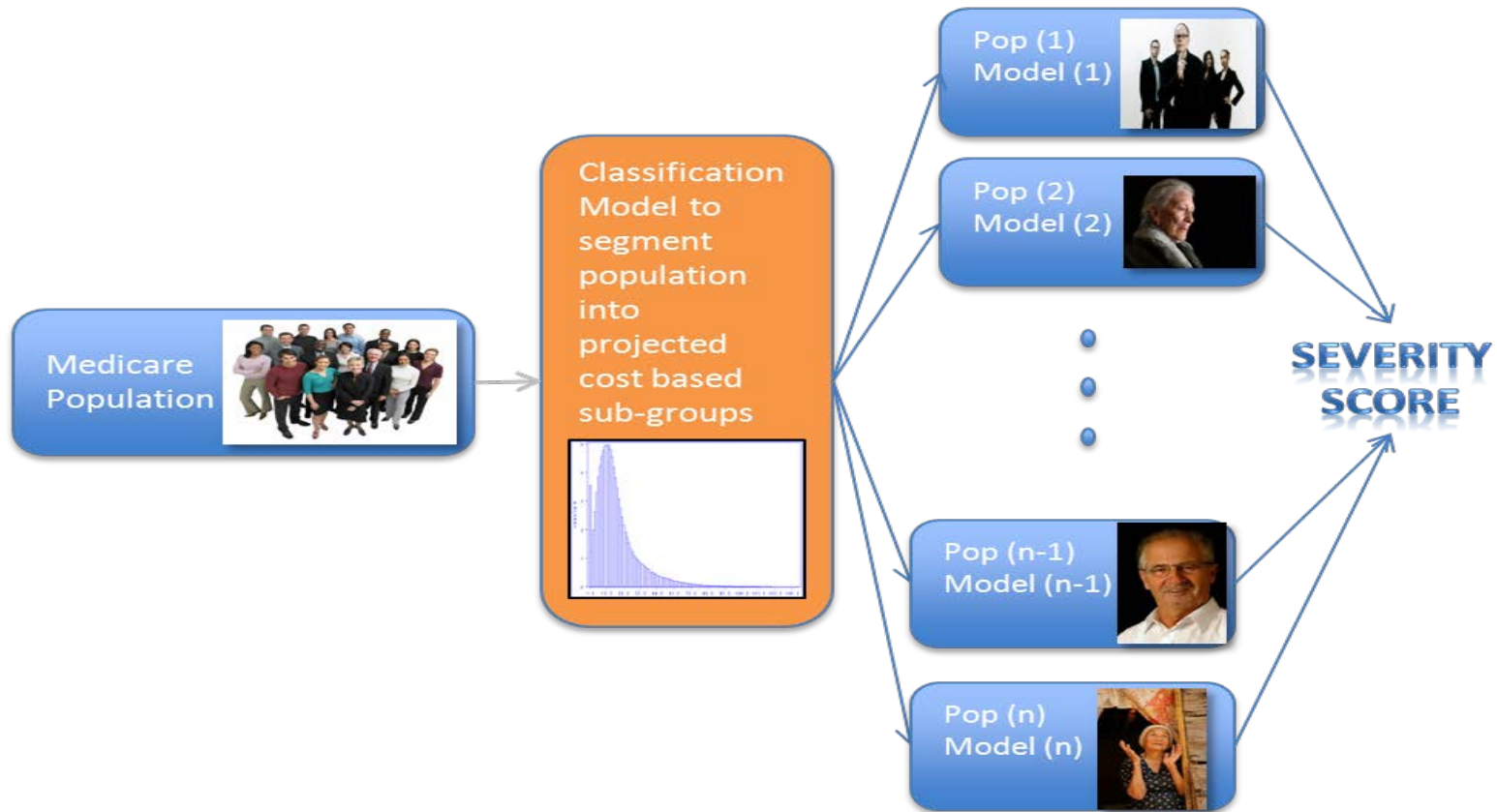
Objective: Predict a measure of severity, say costs over the next 12 months. Stratify a population.

Observed utilization patterns - examples



Classic Problems – Severity Predictions

Approach



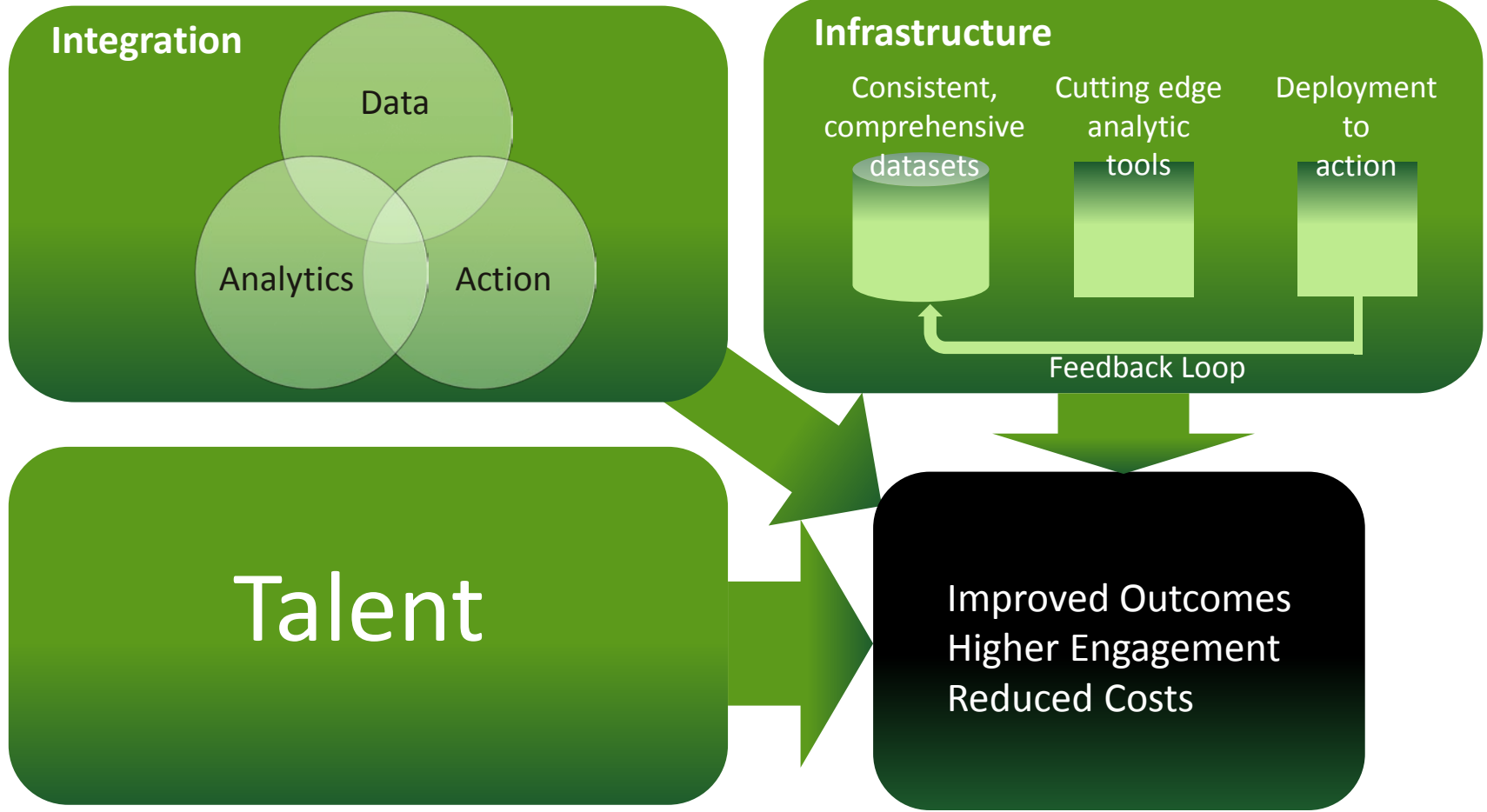
Predictive Modeling in Healthcare

Where are we headed?

- Broad range of applications
 - Clinical
 - Marketing
 - Financial
 - Fraud Detection
- Deeper Data Sources
- Need to Know our Consumers Better
- Efficient Delivery Mechanisms
 - Real-time Alerts
 - Mobile devices

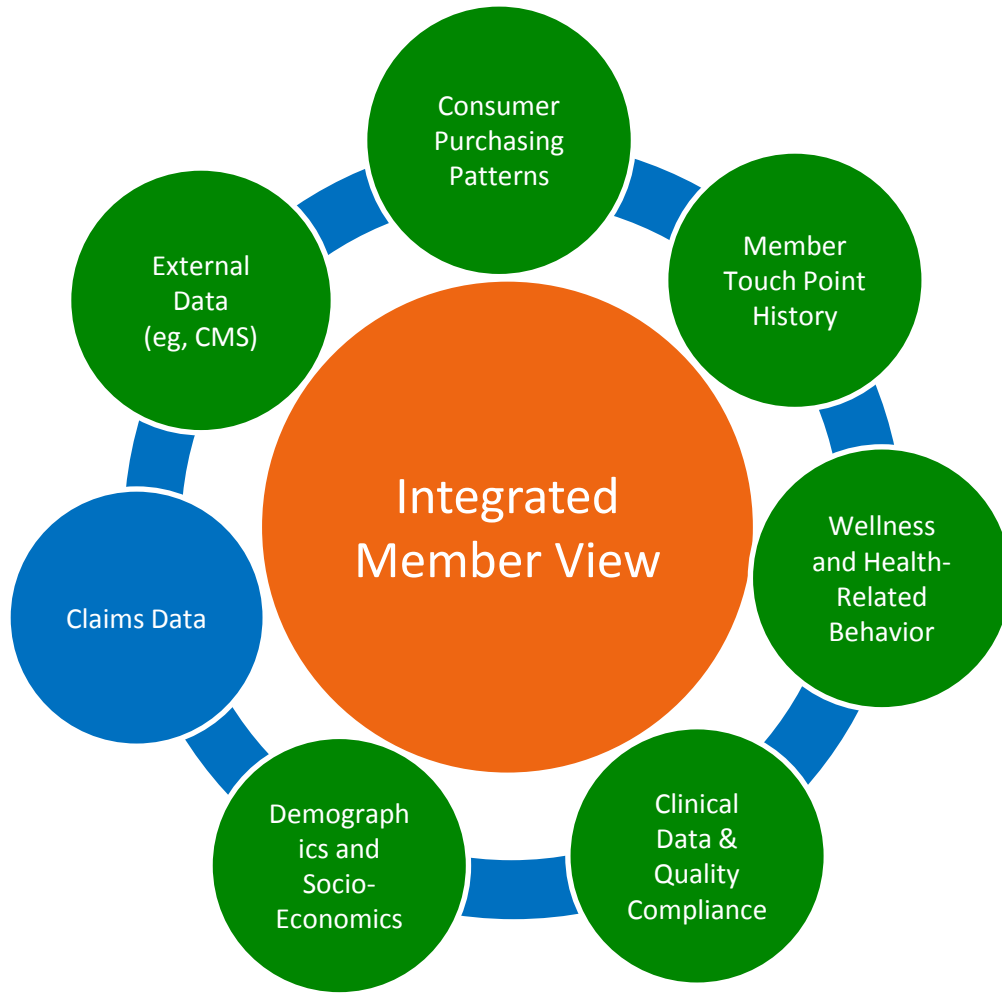
Predictive Modeling in Healthcare

Key Components



Data Sources

What do we know about our consumers?



Past modeling work primarily relied on claims data

Current work aggregates multiple data sources to create an integrated view of the member for consistent and rapid analytics

Next-Gen Data Sources

Text Based

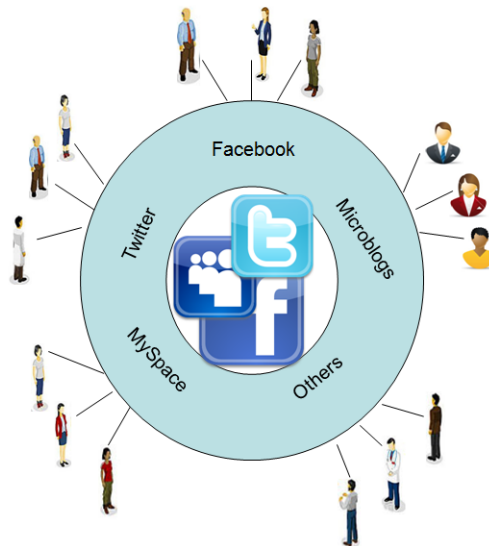
**EMR
Nurses' Notes
Call Center Transcripts**

Devices

**Remote monitoring
Smart Phones**

Online Data

**Social Media Data
Web Footprint**



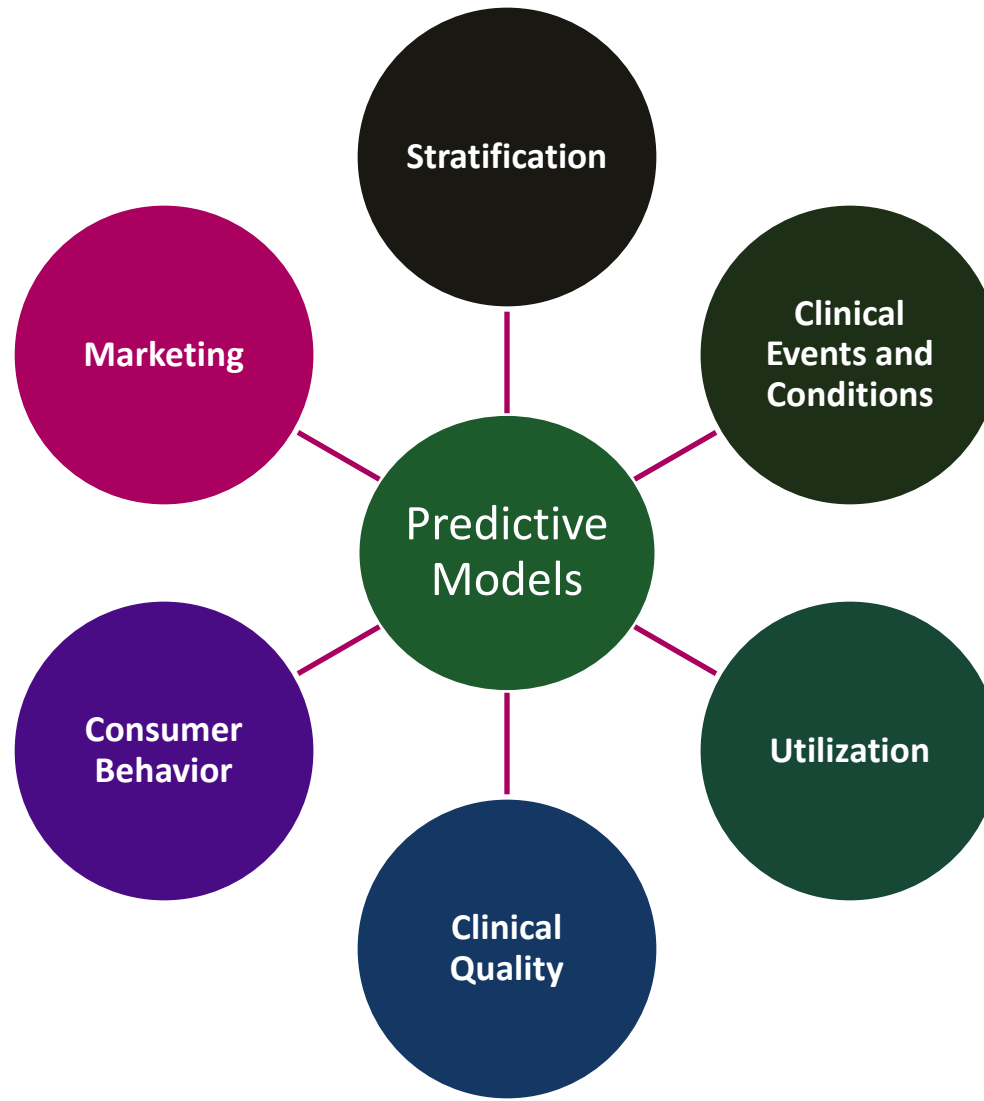
Analytics



**Text mining
Sentiment analysis**

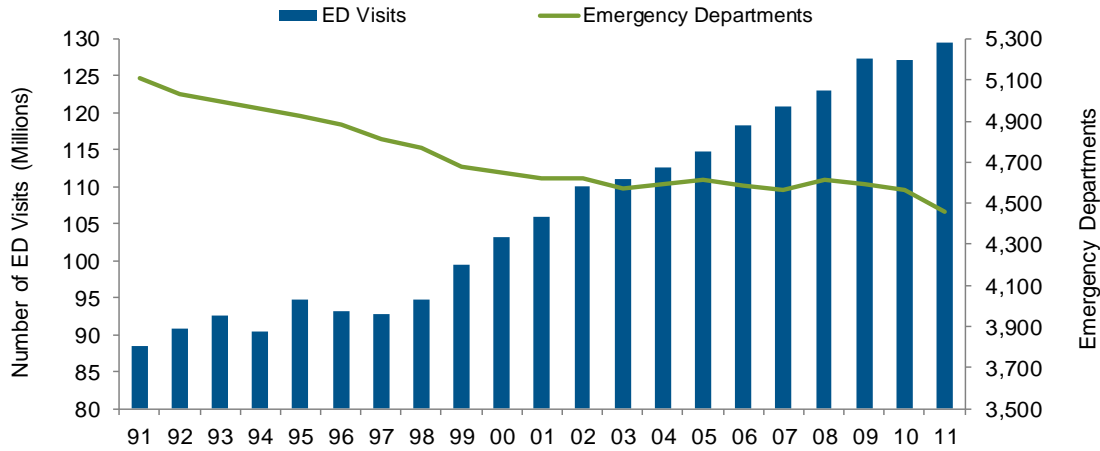
Predictive Modeling in Healthcare

Application Areas



Utilization - ER

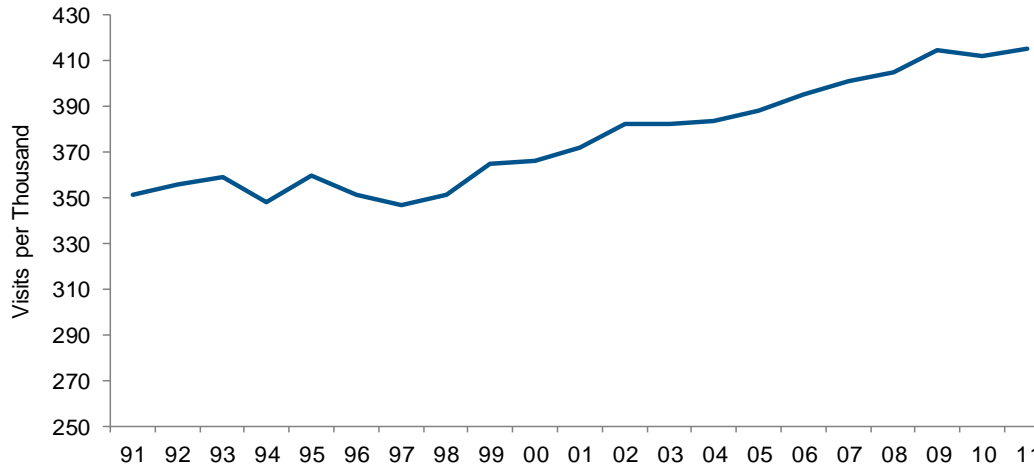
How can analytics help?



Emergency Department Visits and Emergency Departments⁽¹⁾
in Community Hospitals, 1991 – 2011

Over a decade*

- 20% increase in the number of ER visits
- 13% increase in ER visits/1000
- 3% decrease in the number of ER facilities



Hospital ER Visits/1000 persons , 1991 – 2011

* Numbers over two decades are 48%, 19%, and 12% respectively

Clinical Events - Falls

Prediction enables prevention

US Statistics

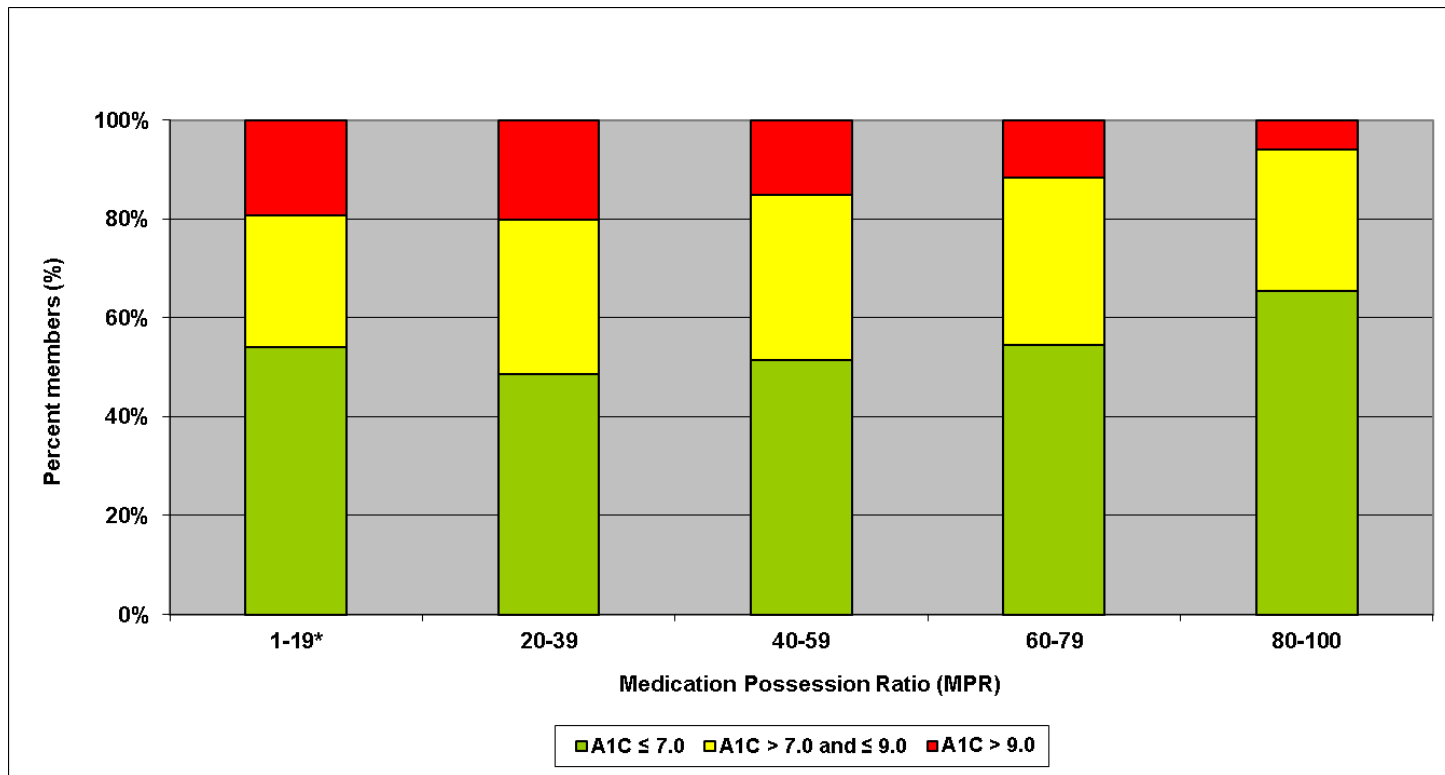
- 1 out of 3 adults aged 65+ fall each year
- Older adults five time more likely to be hospitalized because of falls than any other cause
- Cost of hospital care following an injurious fall among elderly totaled \$6.5 billion in 2006
- 18,000 older adults died from falls in 2007
- 2.2 million nonfatal fall related injuries among older adults in 2009 (581,000 were hospitalized)
- Annual direct and indirect cost of fall injuries is expected to reach \$54.9 billion by 2020

If we can predict risk of falling for any given individual, we can initiate proactive steps to potentially prevent a fall

Consumer Behavior

Medication Non Adherence - Predicting Before it Actually Happens

Higher medication adherence leads to better clinical outcomes

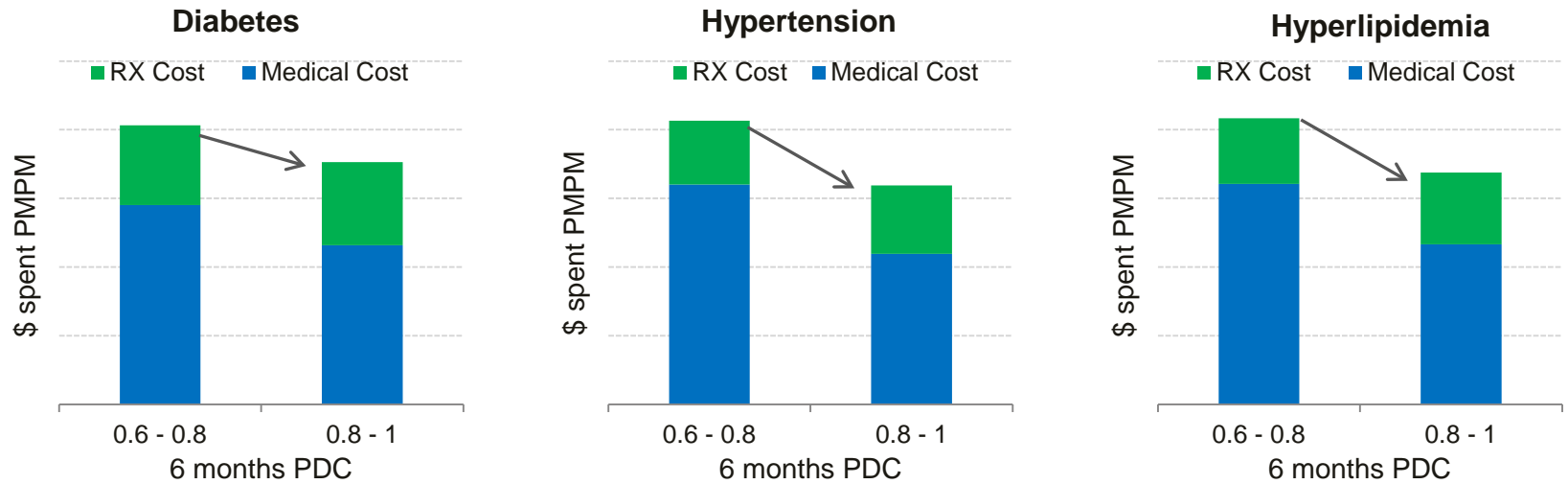


Consumer Behavior

Medication Non Adherence - Predicting Before it Actually Happens

Higher medication adherence leads to lower costs

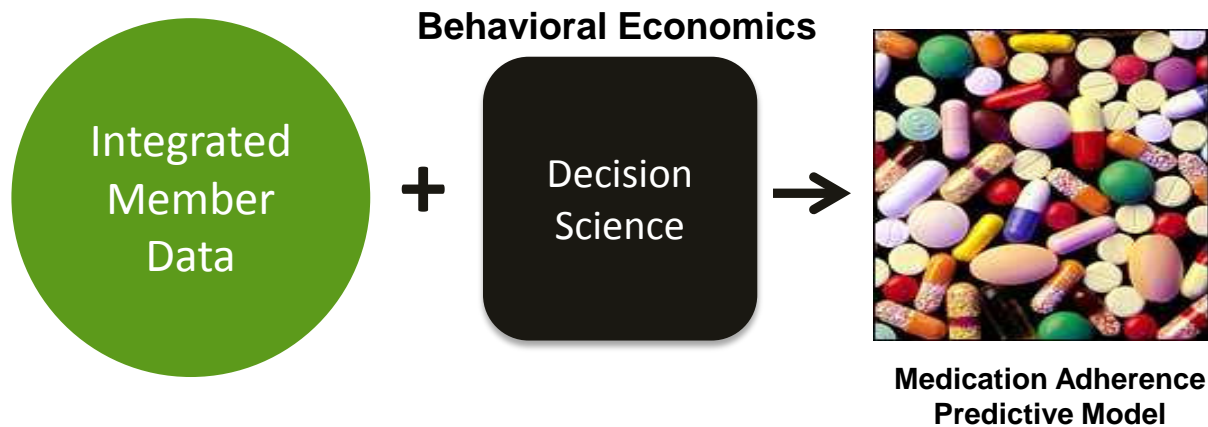
Medical Costs and RX Costs by Adherence



Consumer Behavior

Medication Non Adherence - Predicting Before it Actually Happens

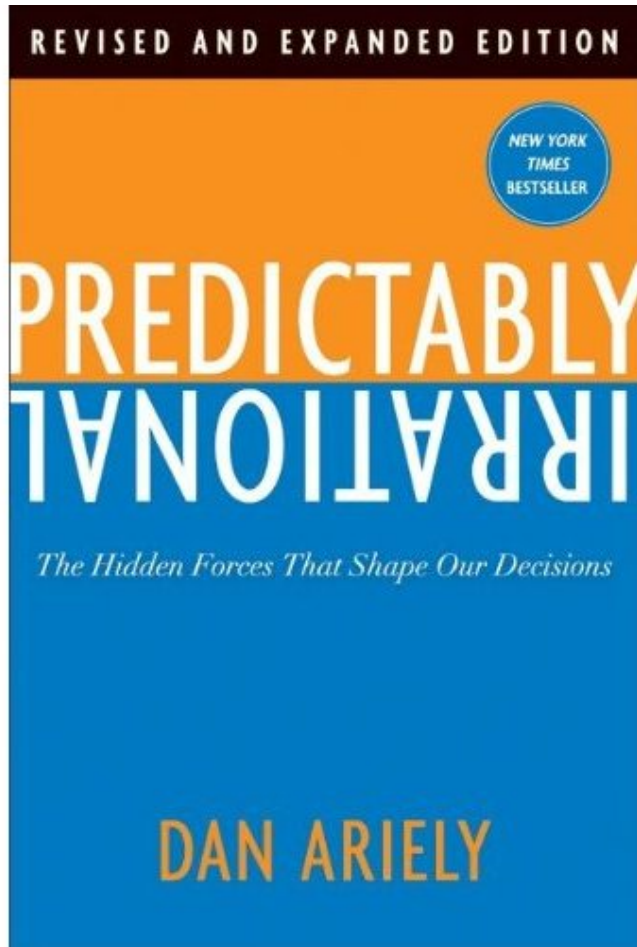
- Non-adherence is often detected after the fact.
- Traditional rules of thumb relies on 'past adherence is indicative of future adherence'



- Proactive identification of non adherers can enable better interventions and more effective campaigns. Result in increased adherence.
- Significant lift seen on all segments, particularly recently diagnosed and recently enrolled.

Predicting and Influencing Consumer Behavior

Irrationality

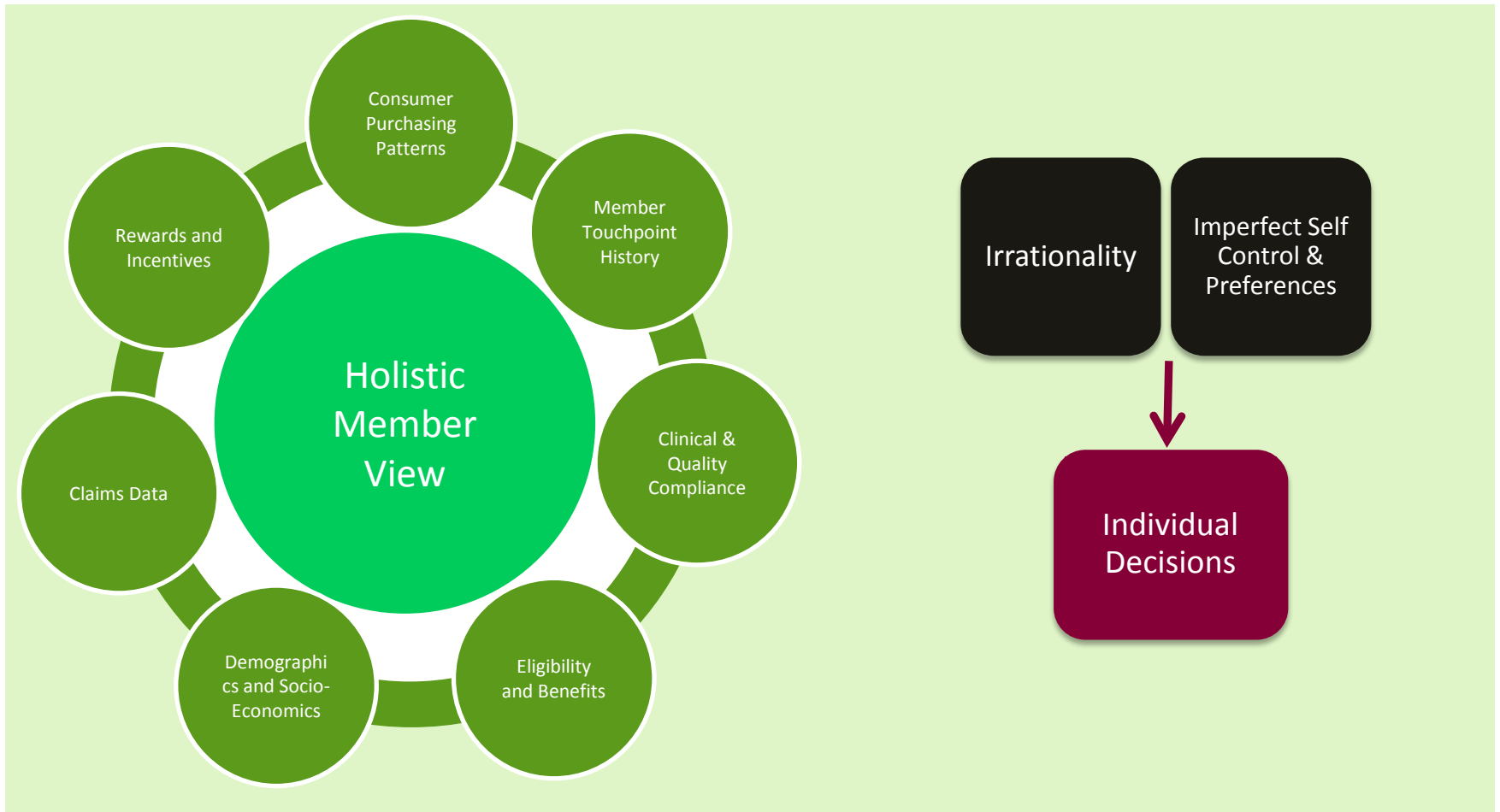


Irrationality is apparently predictable!

Can we model irrationality?

Predicting and Influencing Consumer Behavior

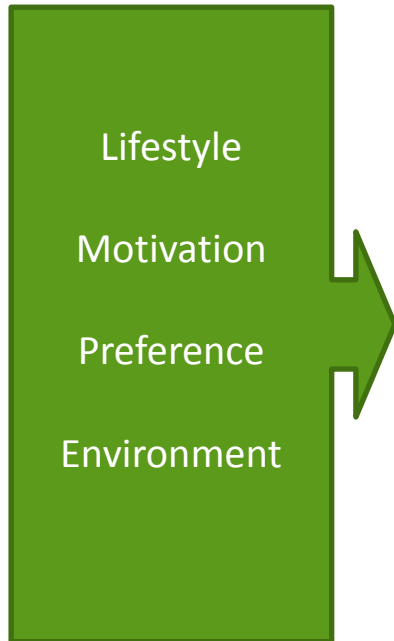
"The Holy Grail"



Influencing health related behaviors is a fundamental code to better health

Sales and Marketing

A broad spectrum of topics



Personalized Business Solutions

Member Acquisition

- Find group influencers and member network
- Identify prospects and their needs
- Insights on likes and lifestyle



..

..

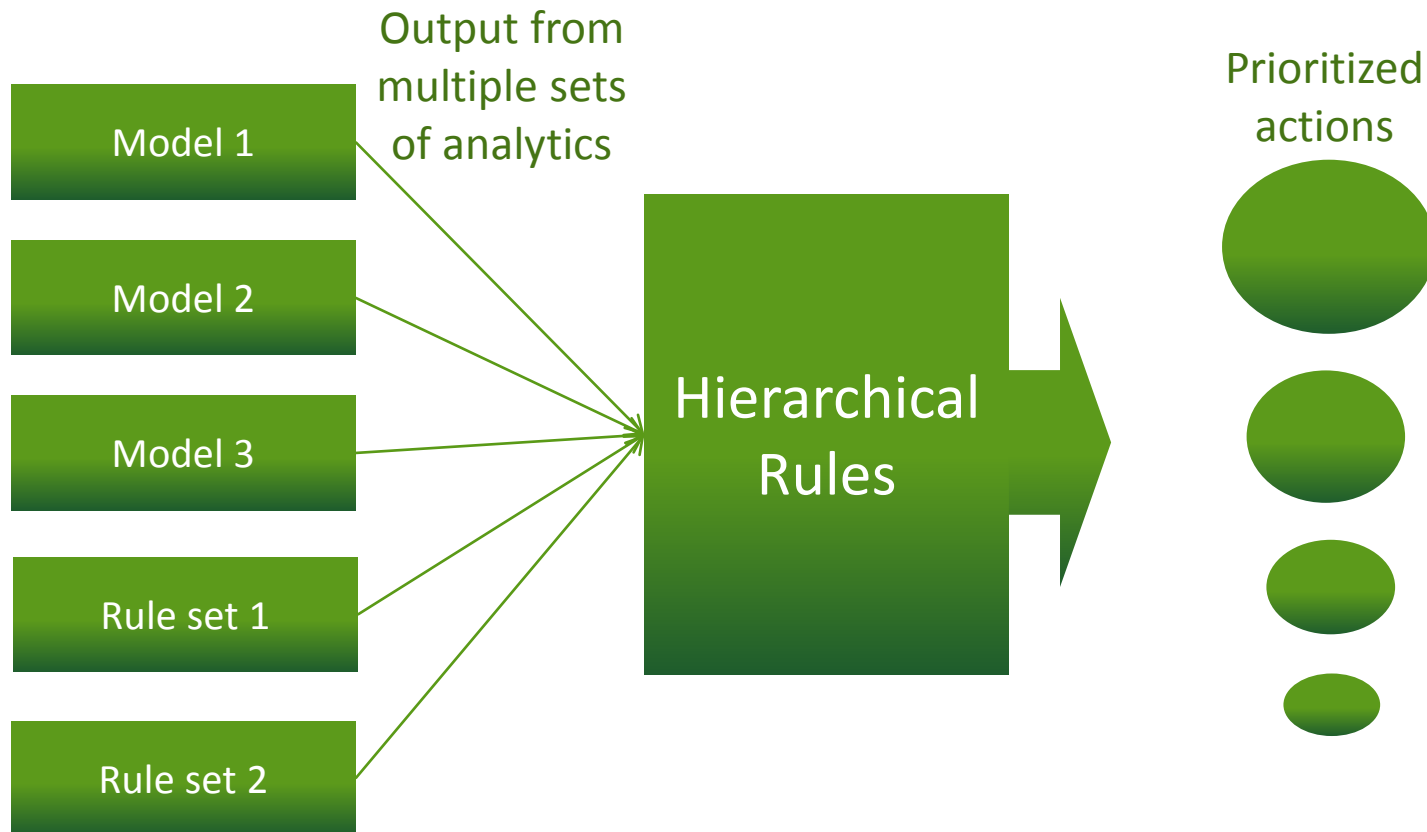
Member Retention and Cross-Sell

- Identify members likely to dis-enroll
- Segment based on reason
- Insights to design tailored marketing campaigns



Integration: Analytics and Action

Proliferation of models should simultaneously see efforts to have them work in unison



Predictive Modeling

Guiding Principles in an Industrial Setting

- Establish a set of "quick wins" to drive early results and build momentum
 - Show results to bolster the business case behind making further investments
- Focus on the issues that have the most direct impact on the business
 - Ensure that effort is placed on key strategic issues and pressing challenges
- Address challenges with underlying data
 - Clean and streamlined data is an enabler for the creation of more effective and comprehensive analytical models

Leading-Edge Analytics

Themes

- **Focus:** Are we solving the right problems?
- **Nimble:** Rapid analytics to respond to business needs
- **Cutting-edge Methods:** State-of-the-art problem solving
- **Tools:** Leverage advancements in the analytics marketplace
- **Optimize:** Maximize output of analytic resources
- **Integrate:** Systems approach to data, analytics and action
- **Real-time:** Closing the feedback loop with the most recent data

Predictive Modeling Frontiers

Recap

- We have seen rapid evolution as a discipline over the past decade
- Newer and better software, data sources, hardware
- Lot more applications
- Deeper understanding of our members
- More efficient and effective delivery mechanisms for model output
- Broader and deeper impact for predictive modelers in the coming years

Predictive Modeling



**“ Predictions are hard,
especially about the future.”**

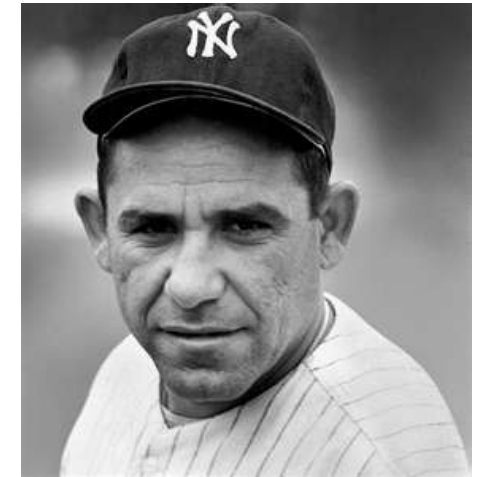
Niels Bohr
Nobel Laureate in Physics

Not quite!

Future is a bit more
predictable?

**“Future is not what
it used to be”**

Yogi Berra
Baseball player



Questions?