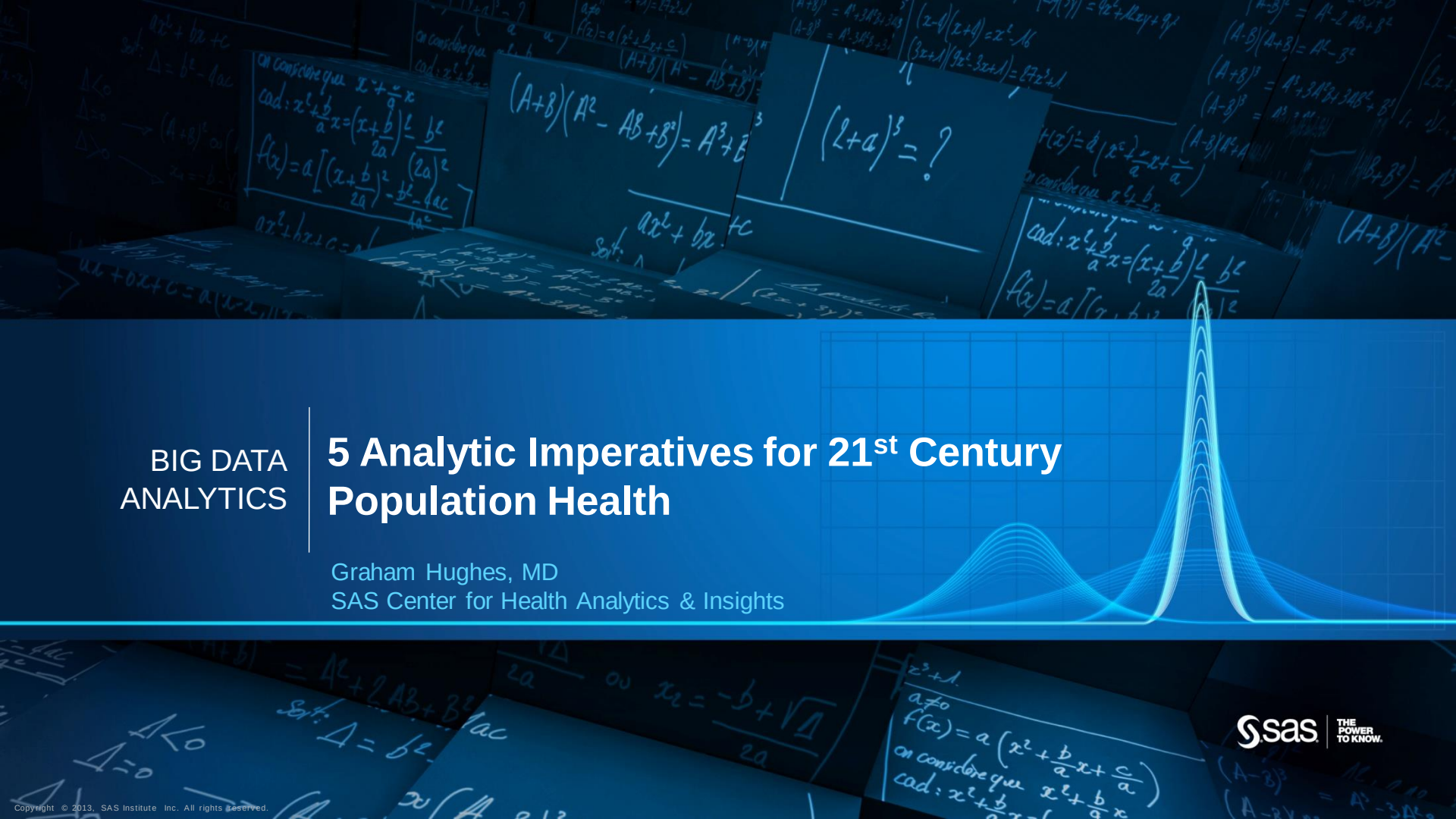

BIG DATA ANALYTICS

5 Analytic Imperatives for 21st Century Population Health

Graham Hughes, MD
SAS Center for Health Analytics & Insights

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LEARNING OBJECTIVES

Describe the difference between traditional healthcare business intelligence and a more comprehensive view of the spectrum of analytics

Discuss the importance of having an appreciation for how other industries leverage advanced analytics and how the same techniques can rapidly be applied to healthcare

Identify the 5 key analytic areas that healthcare organizations need to consider in their Population Health management initiatives

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TARGET STORES

NYT Feb 2012

Marketing analytics

Consumer Data

Pregnancy Likelihood Score

Identified Pregnant Teen

“YOU’RE PREGNANT?....”

TARGET

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ZULILY

Online Retailer

"Daily Deal"

Page Layout Optimization

Millions of Layout Combinations

Mass Personalization

"YOU HAVE NO SENSE OF FASHION…"

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FACEBOOK

“HERE’S LOOKING AT YOU KID….”

Analysis of Posts

Analysis of Likes

Predict IQ, Race, Political Leaning

Gender orientation

Influence emotion

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NOBEL LAUREATES "IT'S A CHOCOLATE RIVER…"

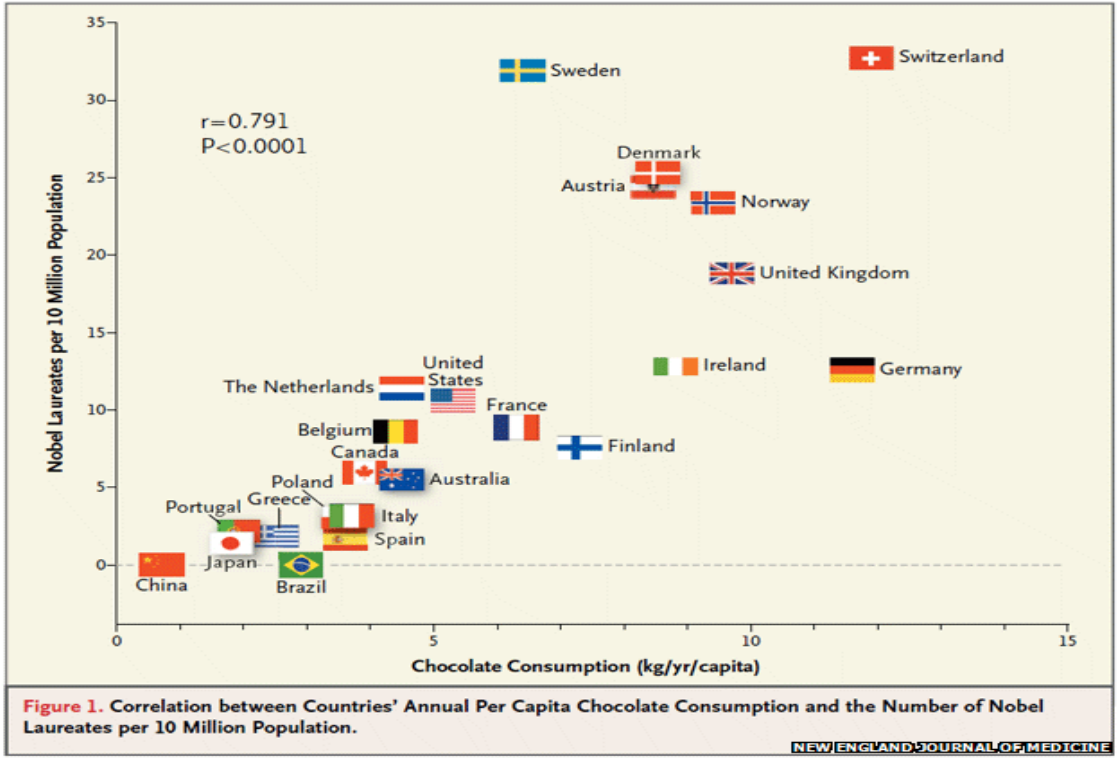
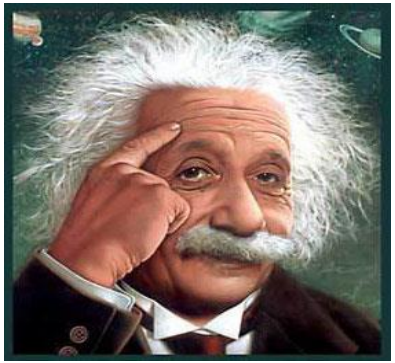


Figure 1. Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.

NEW ENGLAND JOURNAL OF MEDICINE



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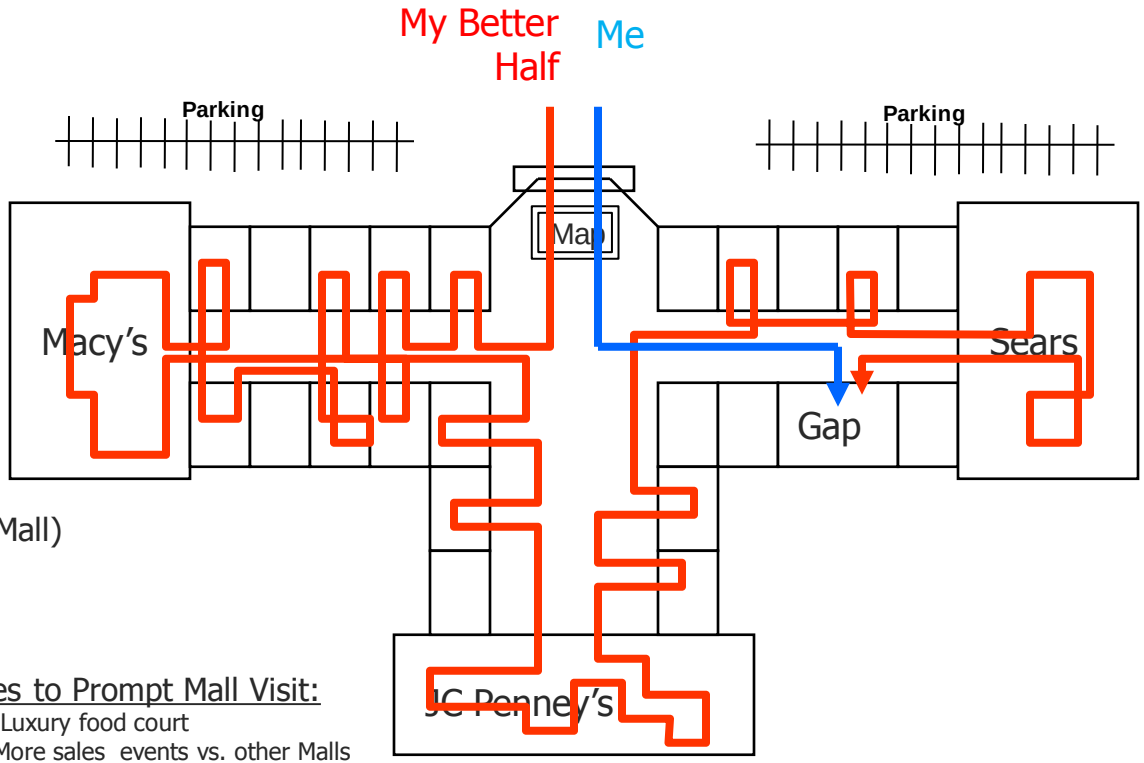
HORSES FOR COURSES

BEEN SHOPPING WITH DR. SEUSS?

Mission: Go to Gap, buy a pair of jeans



My Better Half
Time: 3 hrs. 26 min.
Spent: $676 (value to Mall)

Me
Time: 6 min.
Spent: $43 (value to Mall)

Messages to Prompt Mall Visit:
- Luxury food court
-More sales events vs. other Malls
- "Spend the Afternoon"

THE POWER TO KNOW.

THAT'S INTERESTING BUT WHY SHOULD I CARE?

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From Stan Huff, Intermountain Healthcare

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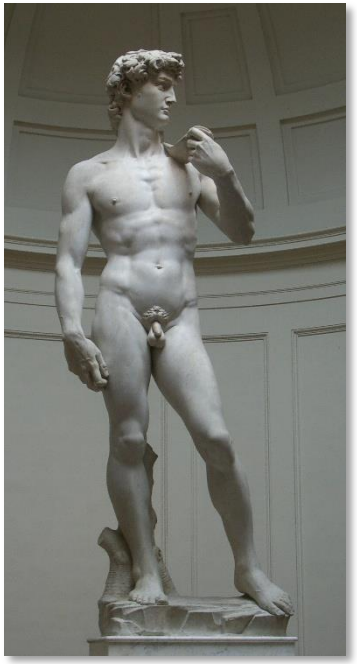
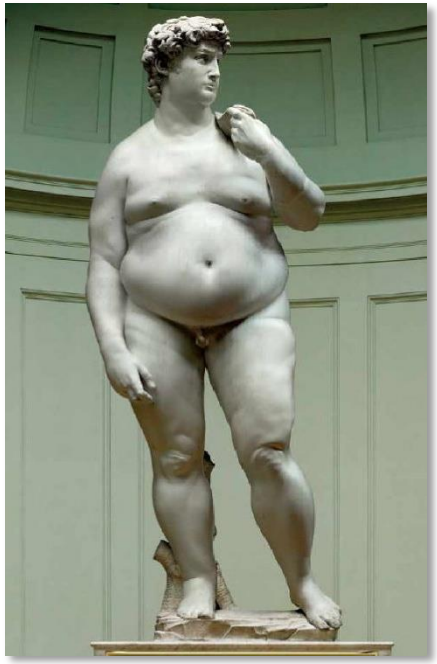
2014 ONE PERSPECTIVE ON HEALTHCARE "BIG" DATA…..



David

Moves to USA



HONDA

Hypertensive

Obese

Non-compliant

Diabetic &

Asthmatic

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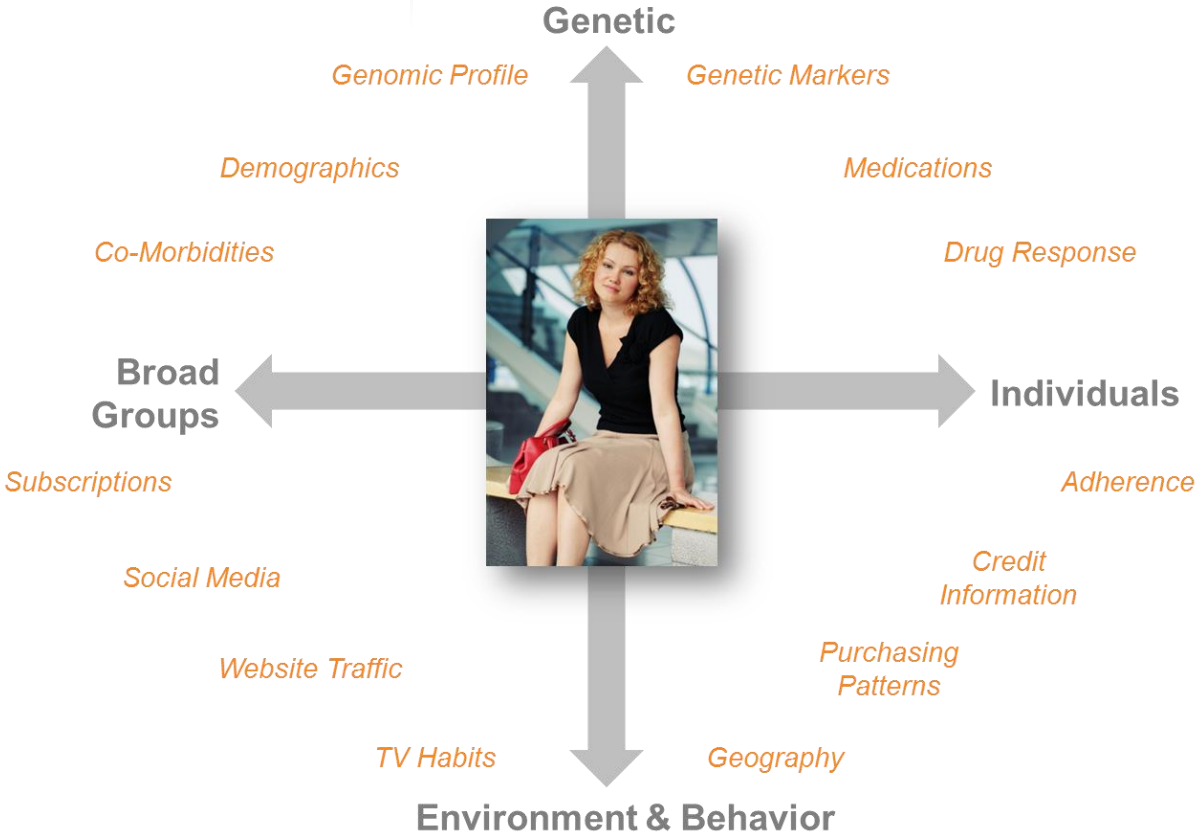
POPULATION HEALTH

STARTS WITH THE INDIVIDUAL



Precision Medicine

Every disease becomes a rare disease

Patient Engagement = next blockbuster?

Real World Data enables learnings from N=1

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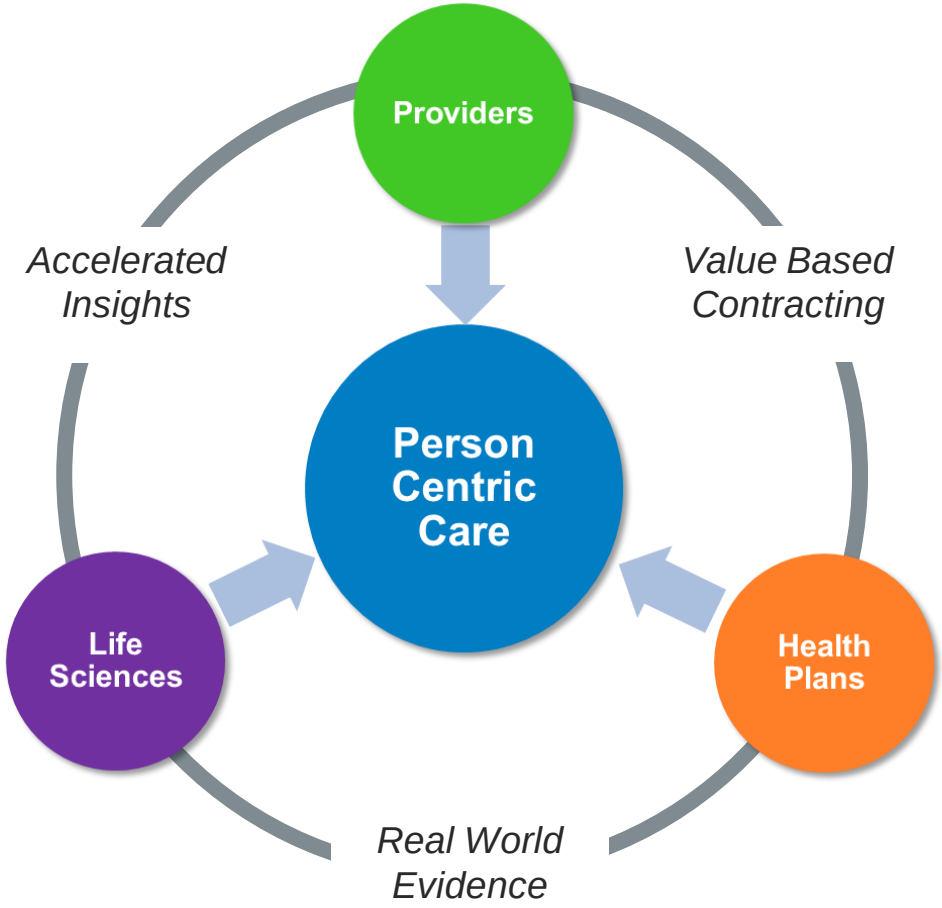
MARKET DYNAMICS

Shared Risk & Reward

Population Health

New Delivery Models



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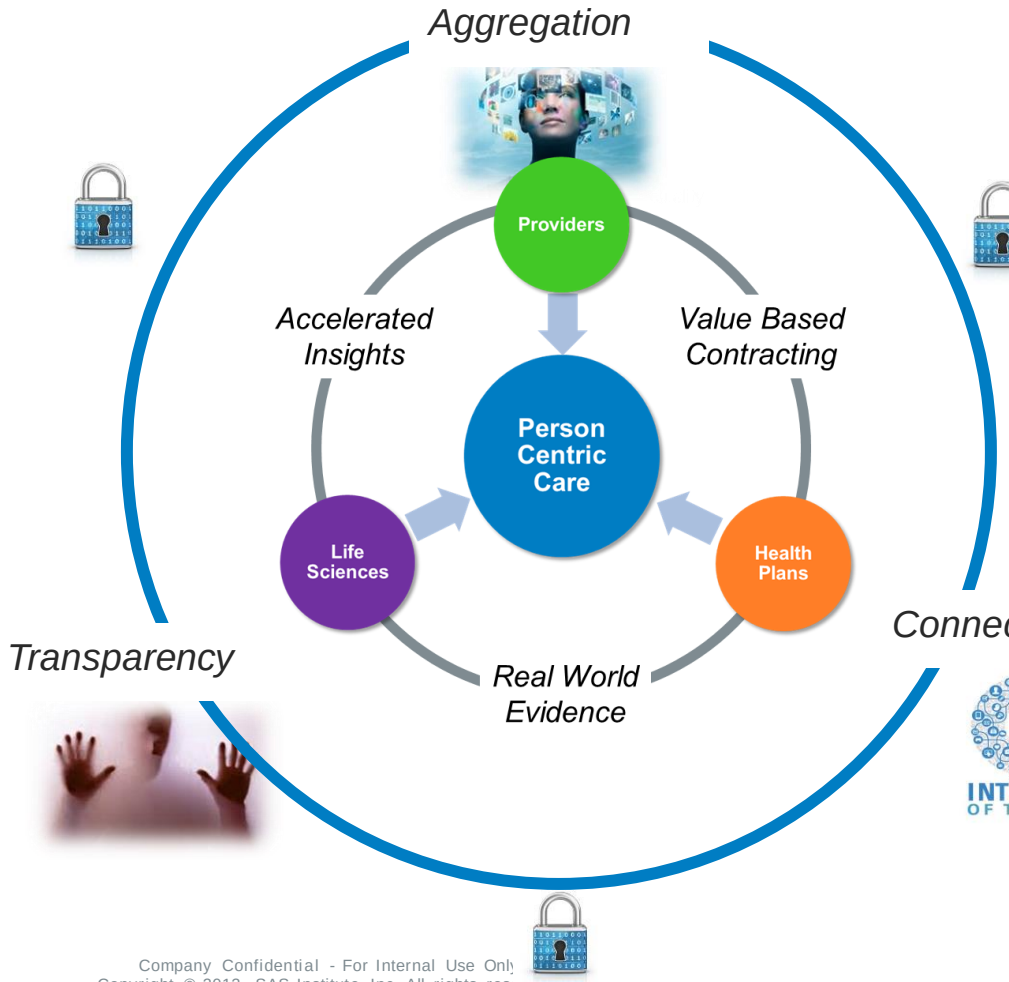
ENABLING ECOSYSTEM

Internet of Things

Secure Cloud

Analytics Everywhere

Knowledge



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Fee For Service
Value Based Payment Models!

HEALTHCARE ANALYTICS

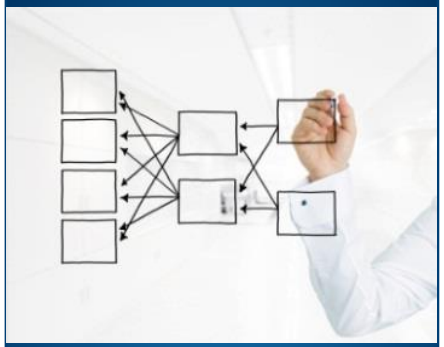
MOVING FROM REACTIVE TO PROACTIVE

Value Based Healthcare

New Business Opportunities / Growth

Manage Financial Risks and Incentives

Proactively Manage Quality and Outcomes



Improve Efficiency Of Care Delivery

Population Health and Engage Patients

Establish Robust Analytics Foundation

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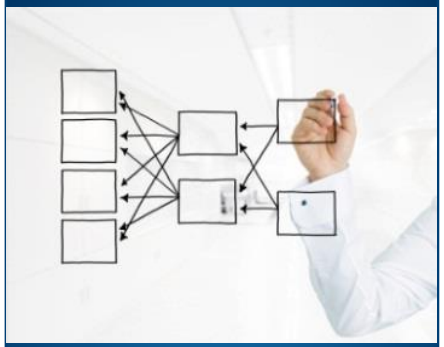

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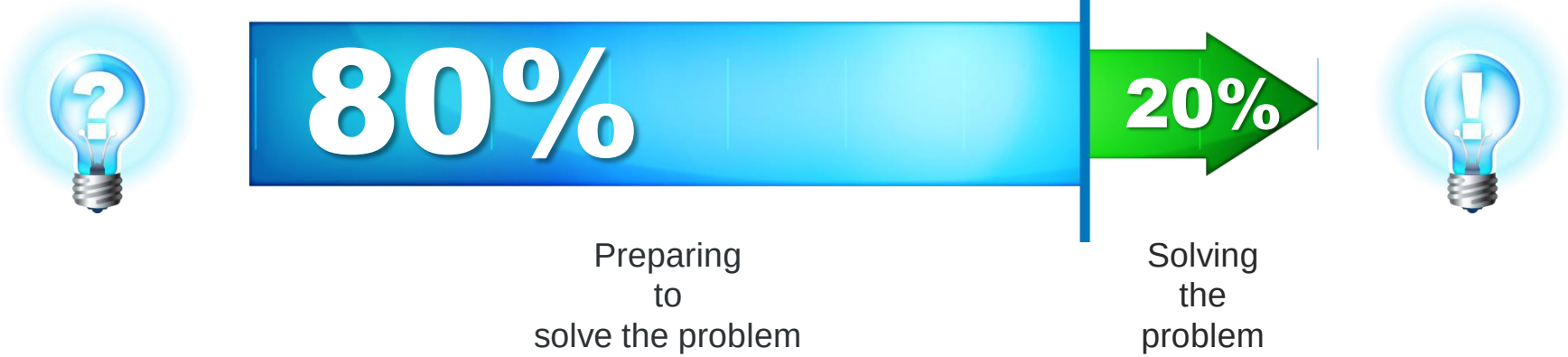
ENTERPRISE DATA | "ARE MY METHODS UNSOUND…."

BUSINESS PROBLEM

BUSINESS DECISION



20+% error rate in EHR coding – How much uncertainty can you tolerate?
80 % of EHR data in free text – NLP & Text Analytics Essential

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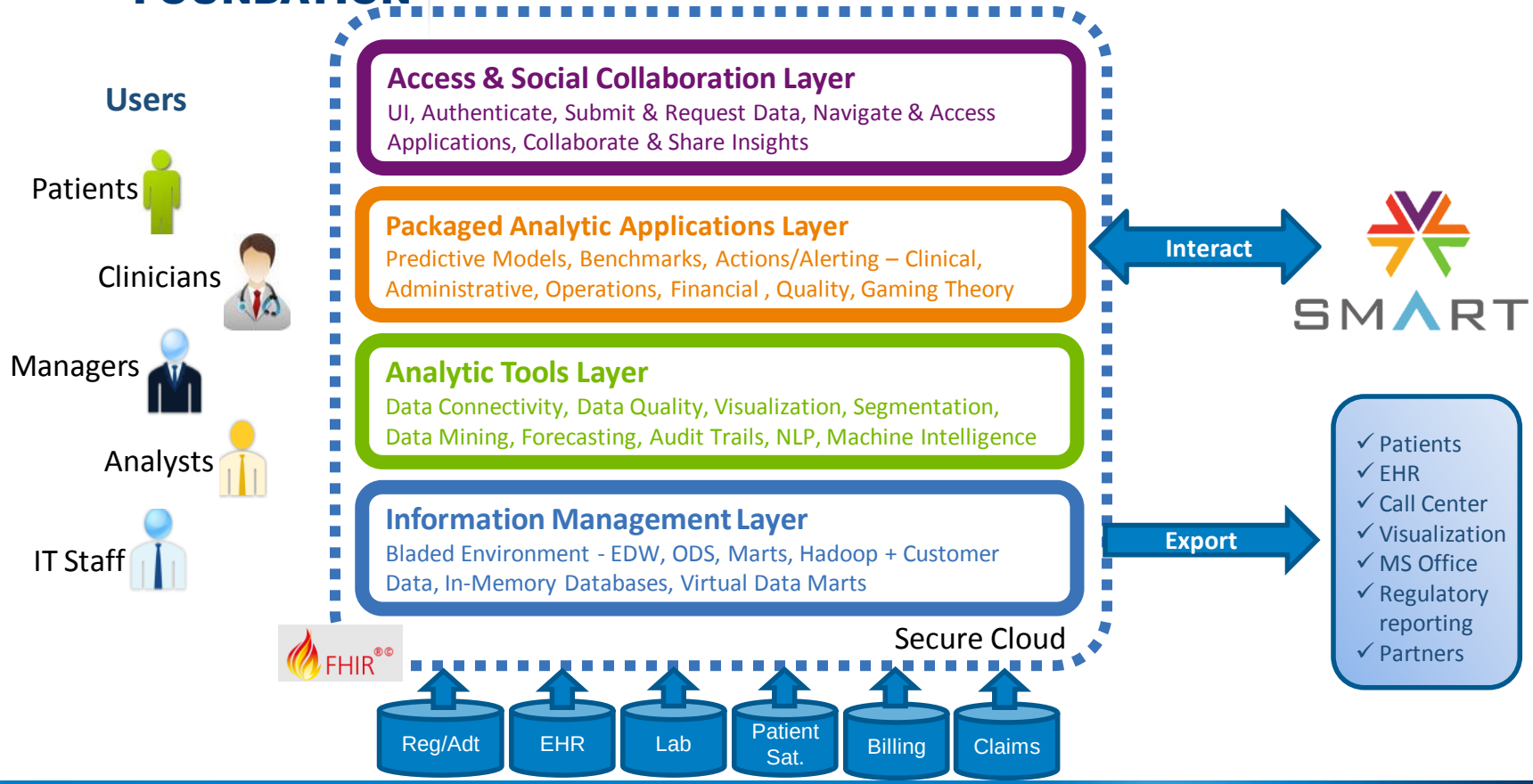
ANALYTIC FOUNDATION

"AH, MR. SPOCK – THE MIND OF THE ENTERPRISE…."



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MORE POWER

In Database

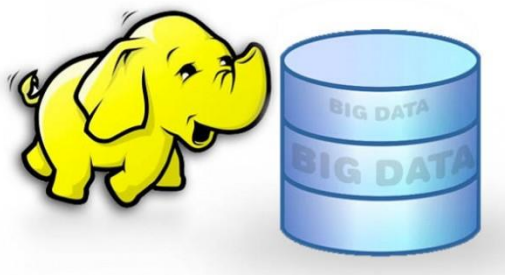
Streaming Data

In Memory

Massively Parallel

Hadoop

“I CANNAE CHANGE THE LAWS OF PHYSICS CAP’N……”



Increase Throughput ➡ Increased Insight

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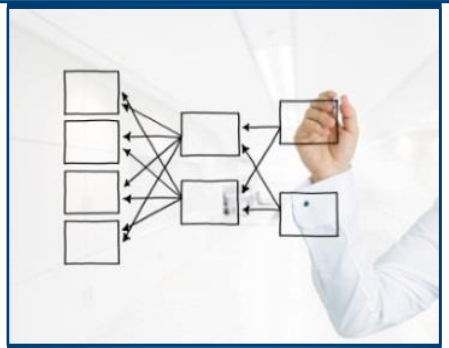

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EPISODE ANALYTICS

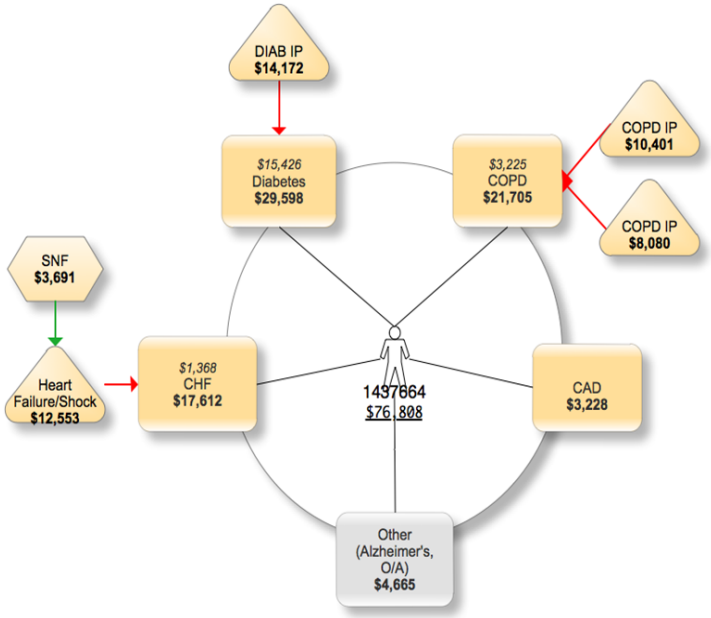
Evidence Informed Care Baselines

Flexible Triggers & Boundaries

Identify Variation

Predict Shared Savings

CREATING A PAYER-PROVIDER BRIDGE



Value Based Payment Analytics

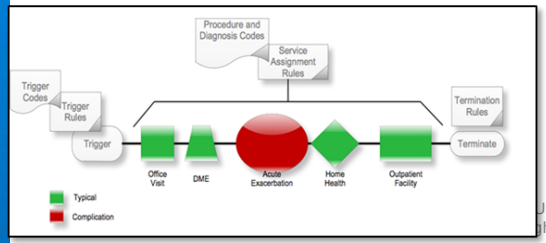
- Episode Based Payments
- Bundled Payment Pilots
- Shared Savings ACOs

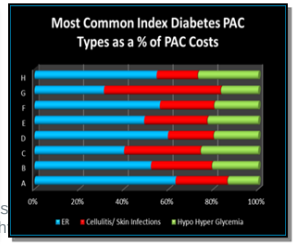
Analytics Solution:

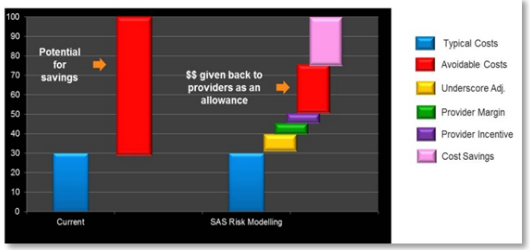
- Episode Grouper
- Assess performance
- Identify variance
- Prospectively model contracts

Markets

- Health Plans
- Healthcare Providers / ACOs







PORTFOLIO OPTIMIZATION

Predicted Revenues

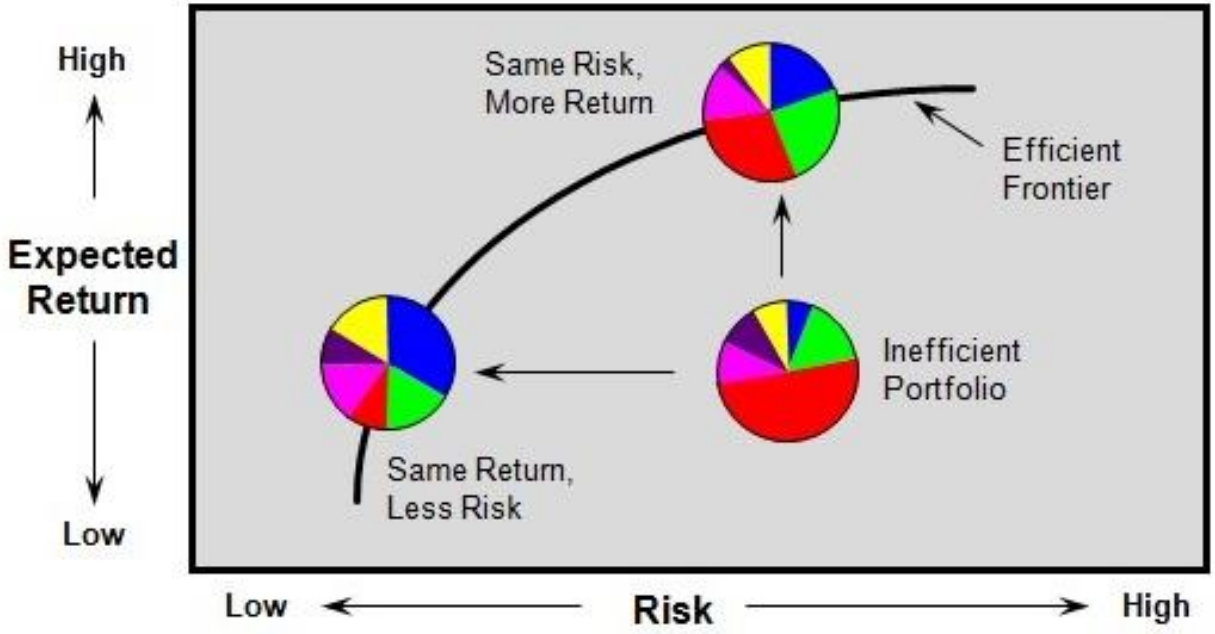
Predicted Costs

Margin Analysis

Balanced Portfolio

"SHOW ME THE MONEY…."

Fee for Service — Capitated



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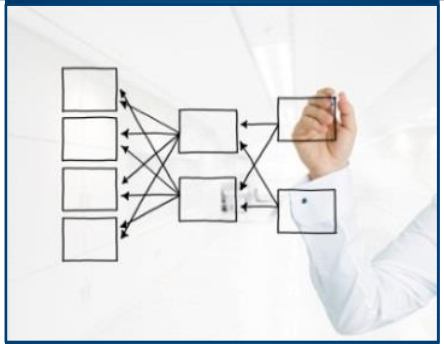

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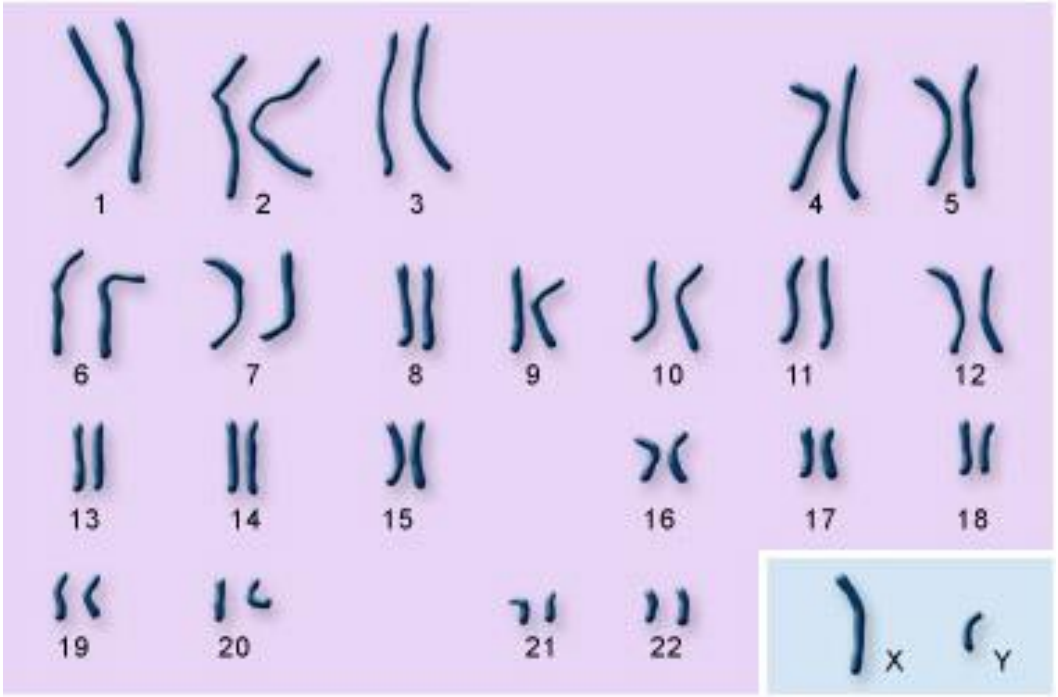
HUMAN GENOME

Predict

Prevent

Treat

WE ALL HAVE 23 PAIRS OF CHROMOSOMES



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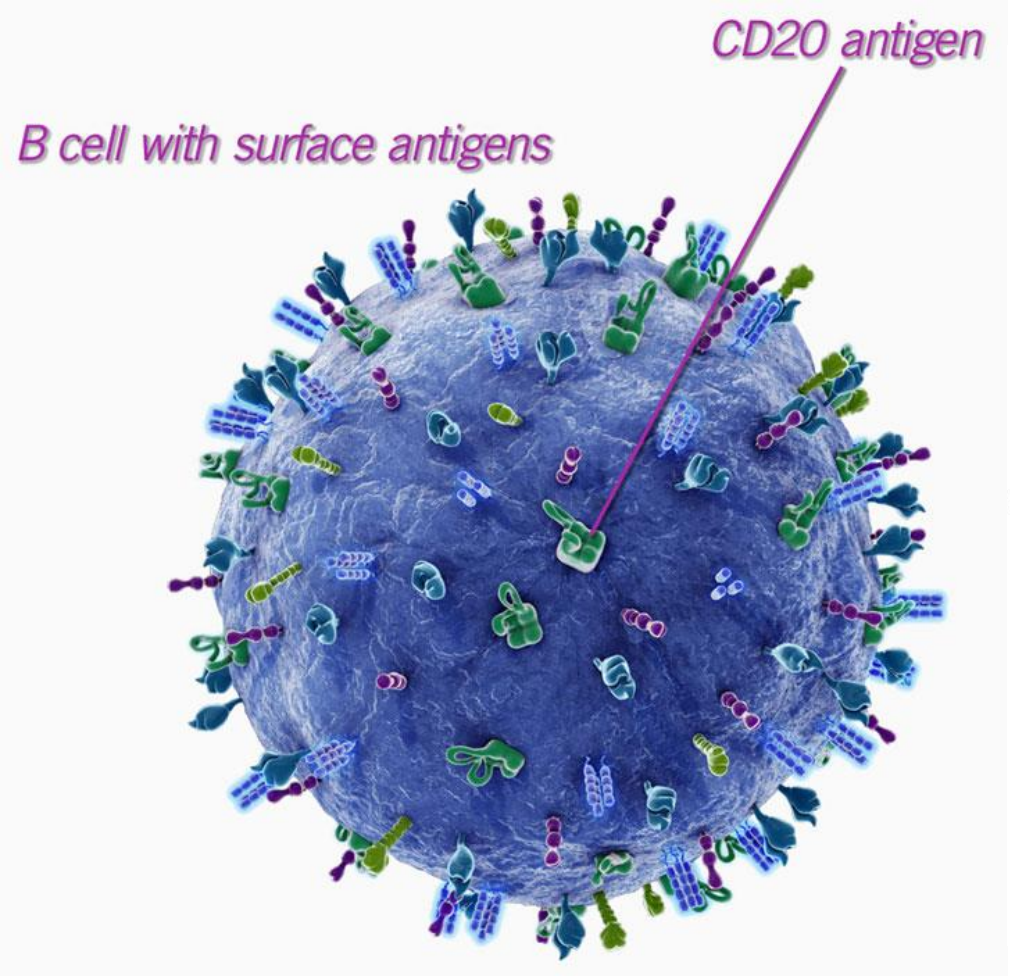

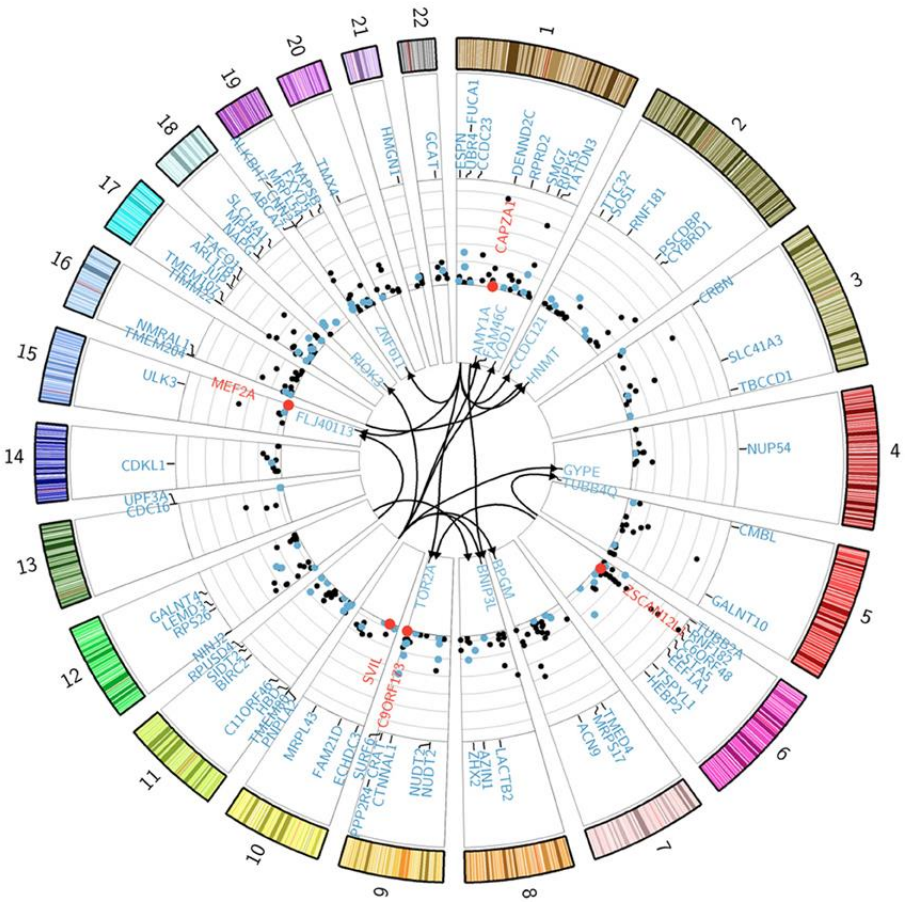

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Corey Wood

Dx: Stage 4 NSC Lung Cancer ROS1 Mutation)

Rx: Crizotinib (Xalkori) – ALK / ROS1 inhibitor

Emily Whitehead

Dx: Resistant ALL

Rx: CAR-T Immunotherapy

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Susanne Carlson

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OBSERVATIONAL RESEARCH

Time series analysis

Identify best outcomes

Real world evidence

Hypothesis Creation

“MY DENSITY BROUGHT ME TO YOU….”

Treatment Sequence Frequency
Surgery Only
Surgery - Radiation
Surgery - Chemo
Surgery - Hormone
Surgery – Radiation - Hormone
Surgery – Chemo - Radiation
Surgery – Chemo - Hormone
Surgery – Chemo – Radiation - Hormone
Surgery – Chemo – Hormone - Radiation
Other

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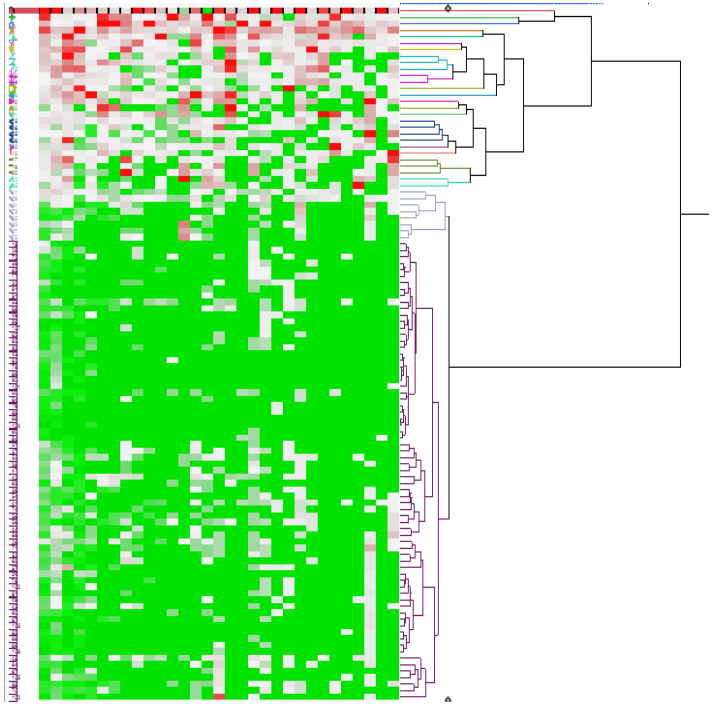
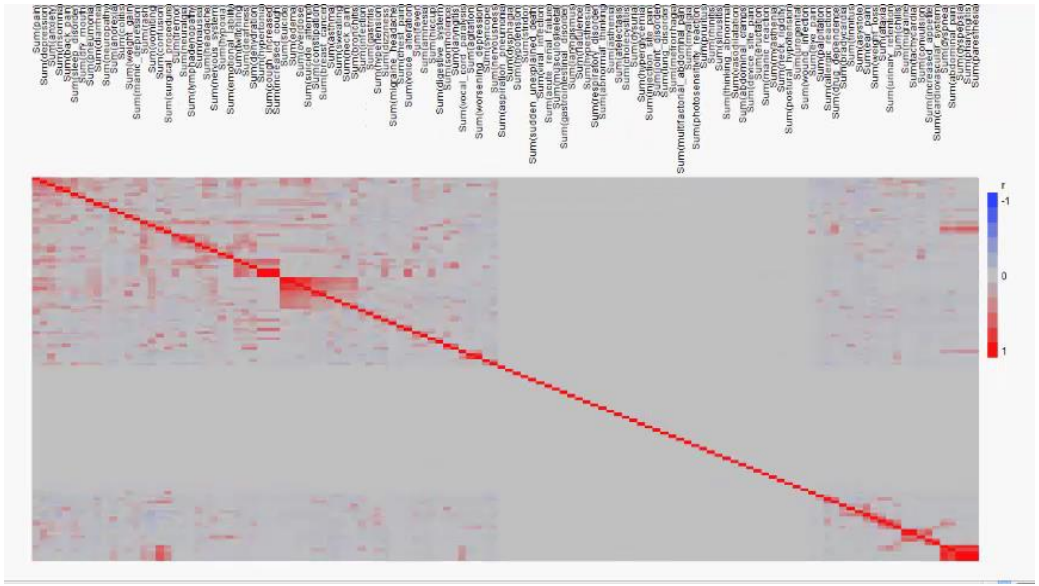
VISUALIZATION

FROM NARRATIVE TO COHORT TO INSIGHT
MULTIDIMENSIONAL TEMPORAL ANALYSIS





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OBESITY PATTERN ANALYSIS

Framingham Study

12,000 Patient

32 Years

BMI

Network Effects

57% Risk Increase

“GET BUSY LIVING OR GET BUSY DYING….”

Nicholas A. Christakis, M.D., Ph.D., M.P.H., and James H. Fowler, Ph.D.
N Engl J Med 2007; 357:370-379July 26, 2007DOI: 10.1056/NEJMsa066082

The NEW ENGLAND JOURNAL of MEDICINE

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HEALTHCARE ANALYTICS

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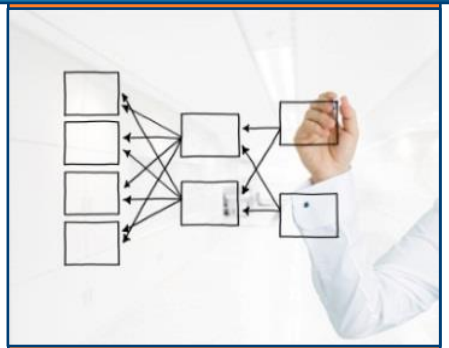

Improve Efficiency Of Care Delivery

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SIMULATION

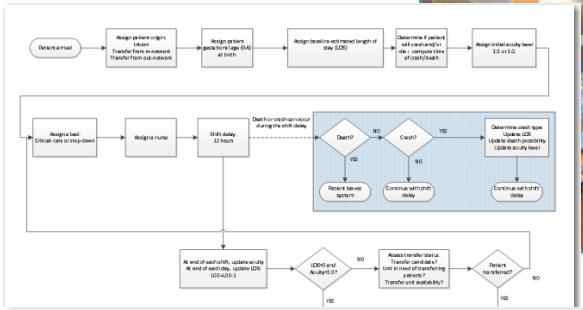
- 68 bed NICU
- Discrete event simulation model
- Probability of volume & acuity of patients
- Time based morbidity estimations by type (Sepsis, NEC, PDA,….)
- Simulation of flow / staffing needs
- “What If” Analyses

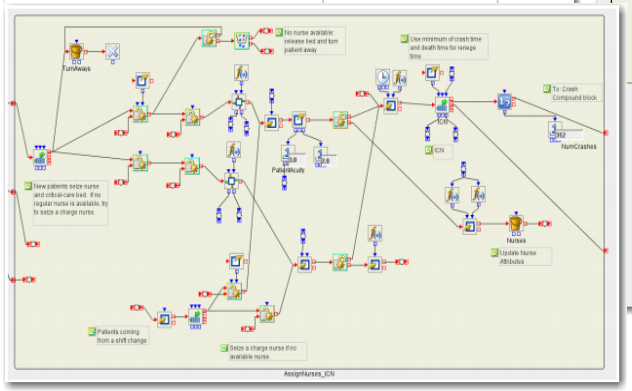
“THESE GO TO 11…”

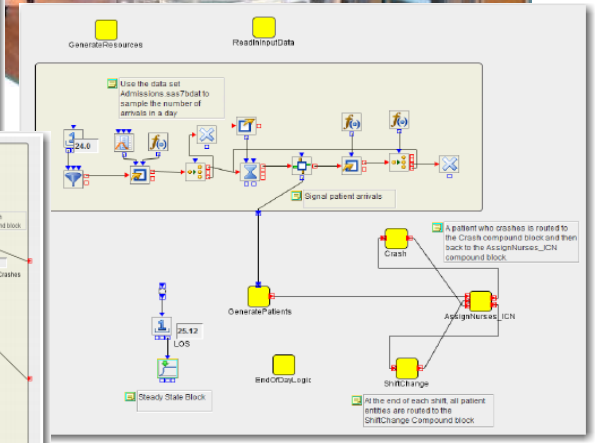
DUKE UNIVERSITY HEALTH SYSTEM

Dr Chris Rienzo, Dr David Tanaka

SimNICU







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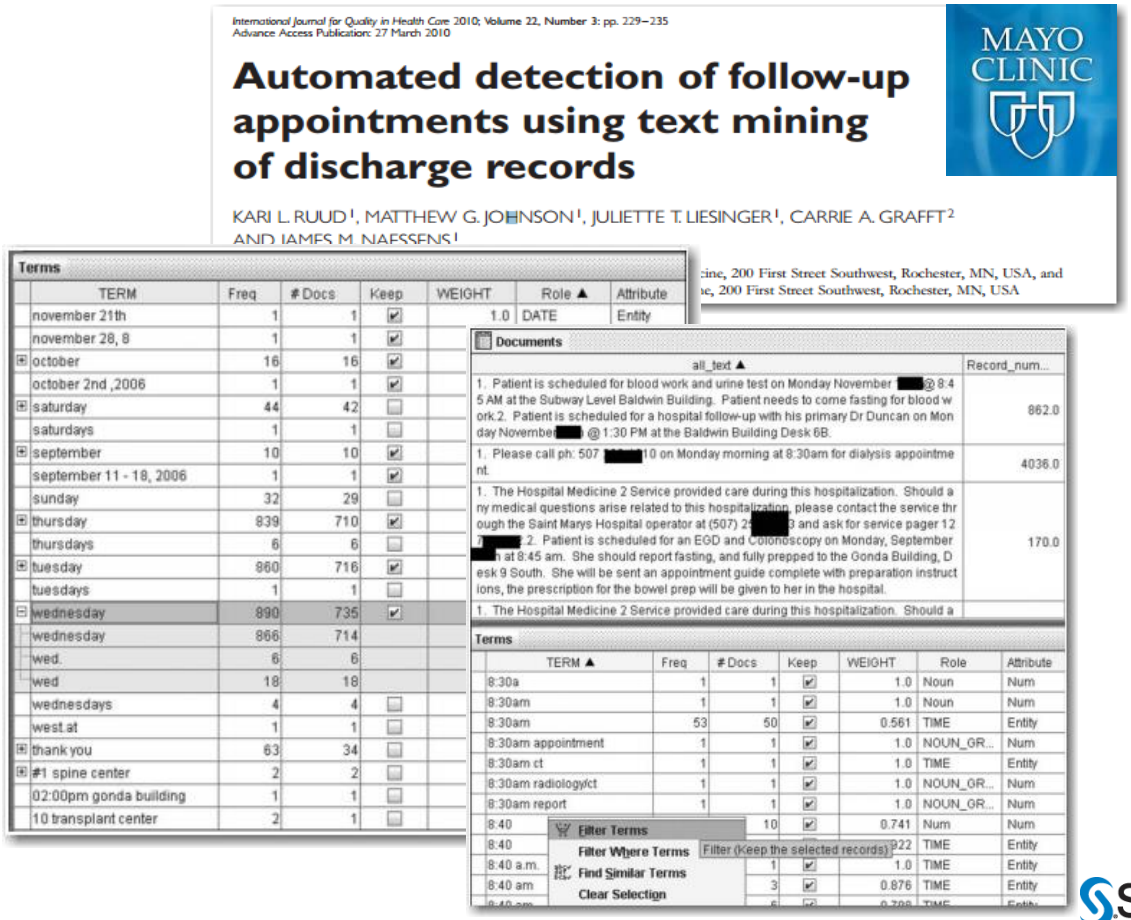
IMPROVING CARE TRANSITIONS

- 6481 Discharge Summaries
- Compare Manual to Automated
- Leverage Text Mining
- > 96% concurrence
- Sensitivity 96.8%
- Specificity 96.3%

"I'LL BE BACK…."



International Journal for Quality in Health Care 2010; Volume 22, Number 3: pp. 229–235
Advance Access Publication: 27 March 2010

Automated detection of follow-up appointments using text mining of discharge records

KARI L. RUUD[1], MATTHEW G. JOHNSON[1], JULIETTE T. LIESINGER[1], CARRIE A. GRAFFT[2] AND JAMES M. NAESSENS[1]

MAYO CLINIC

cine, 200 First Street Southwest, Rochester, MN, USA, and
e, 200 First Street Southwest, Rochester, MN, USA

Terms

TERM	Freq	# Docs	Keep	WEIGHT	Role ▲	Attribute
november 21th	1	1	☑	1.0	DATE	Entity
november 28, 8	1	1	☑			
⊞ october	16	16	☑			
october 2nd ,2006	1	1	☑			
⊞ saturday	44	42	☐			
saturdays	1	1	☐			
⊞ september	10	10	☑			
september 11 - 18, 2006	1	1	☑			
sunday	32	29	☐			
⊞ thursday	839	710	☑			
thursdays	6	6	☐			
⊞ tuesday	860	716	☑			
tuesdays	1	1	☐			
⊟ wednesday	890	735	☑			
wednesday	866	714				
wed.	6	6				
wed	18	18				
wednesdays	4	4	☐			
west at	1	1	☐			
⊞ thank you	63	34	☐			
⊞ #1 spine center	2	2	☐			
02:00pm gonda building	1	1	☐			
10 transplant center	2	1	☐			

Documents

all_text ▲	Record_num...
1. Patient is scheduled for blood work and urine test on Monday November [redacted]@ 8:45 AM at the Subway Level Baldwin Building. Patient needs to come fasting for blood work.2. Patient is scheduled for a hospital follow-up with his primary Dr Duncan on Monday Novembe[redacted] @ 1:30 PM at the Baldwin Building Desk 6B.	862.0
1. Please call ph: 507 [redacted]10 on Monday morning at 8:30am for dialysis appointment.	4036.0
1. The Hospital Medicine 2 Service provided care during this hospitalization. Should any medical questions arise related to this hospitalization, please contact the service through the Saint Marys Hospital operator at (507) 2[redacted]3 and ask for service pager 12 [redacted].2. Patient is scheduled for an EGD and Colonoscopy on Monday, September [redacted] at 8:45 am. She should report fasting, and fully prepped to the Gonda Building, Desk 9 South. She will be sent an appointment guide complete with preparation instructions, the prescription for the bowel prep will be given to her in the hospital.	170.0
1. The Hospital Medicine 2 Service provided care during this hospitalization. Should a	

Terms

TERM ▲	Freq	# Docs	Keep	WEIGHT	Role	Attribute
8:30a	1	1	☑	1.0	Noun	Num
8:30am	1	1	☑	1.0	Noun	Num
8:30am	53	50	☑	0.561	TIME	Entity
8:30am appointment	1	1	☑	1.0	NOUN_GR...	Num
8:30am ct	1	1	☑	1.0	TIME	Entity
8:30am radiology/ct	1	1	☑	1.0	NOUN_GR...	Num
8:30am report	1	1	☑	1.0	NOUN_GR...	Num
8:40		10	☑	0.741	Num	Num
8:40				922	TIME	Entity
8:40 a.m.		1	☑	1.0	TIME	Entity
8:40 am		3	☑	0.876	TIME	Entity

Filter Terms
Filter Where Terms — Filter (Keep the selected records)
Find Similar Terms
Clear Selection

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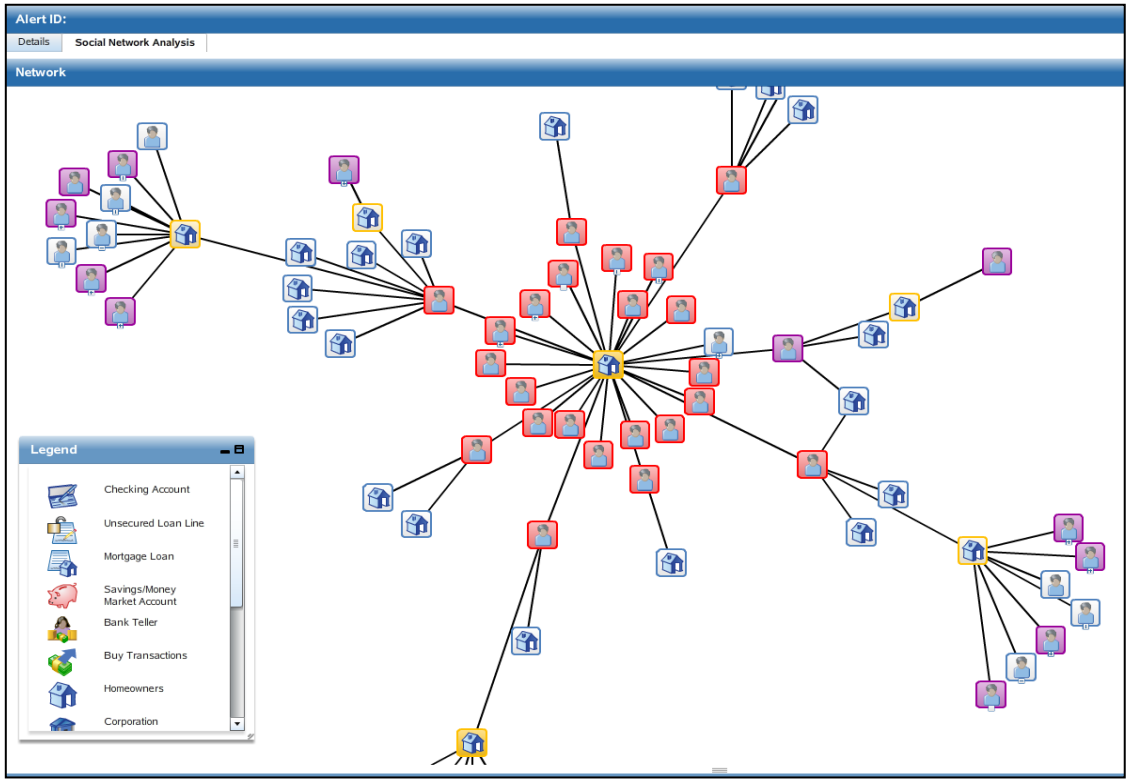
DETECTING FRAUD

Scoring is:

- Rule and analytic-based
- Top Down
- Bottom Up

- Identify relationships in fraud networks
- Track evolution over time
- Predict fraudulent activity

“DO YOU FEEL LUCKY, WELL DO YA?...”



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HEALTHCARE ANALYTICS

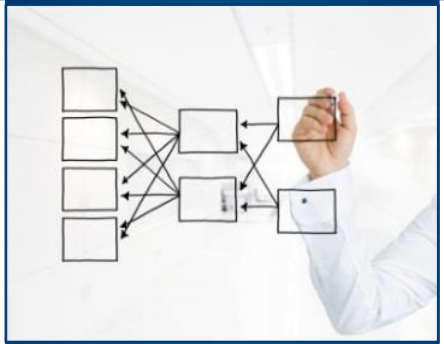
MOVING FROM REACTIVE TO PROACTIVE

Value Based Healthcare

New Business Opportunities / Growth

Manage Financial Risks and Incentives

Proactively Manage Quality and Outcomes



Improve Efficiency Of Care Delivery

Population Health and Engage Patients

Establish Robust Analytics Foundation

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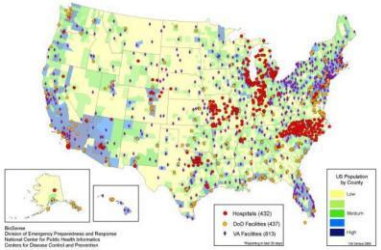
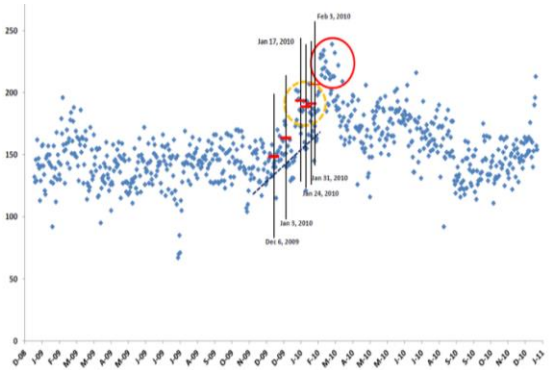
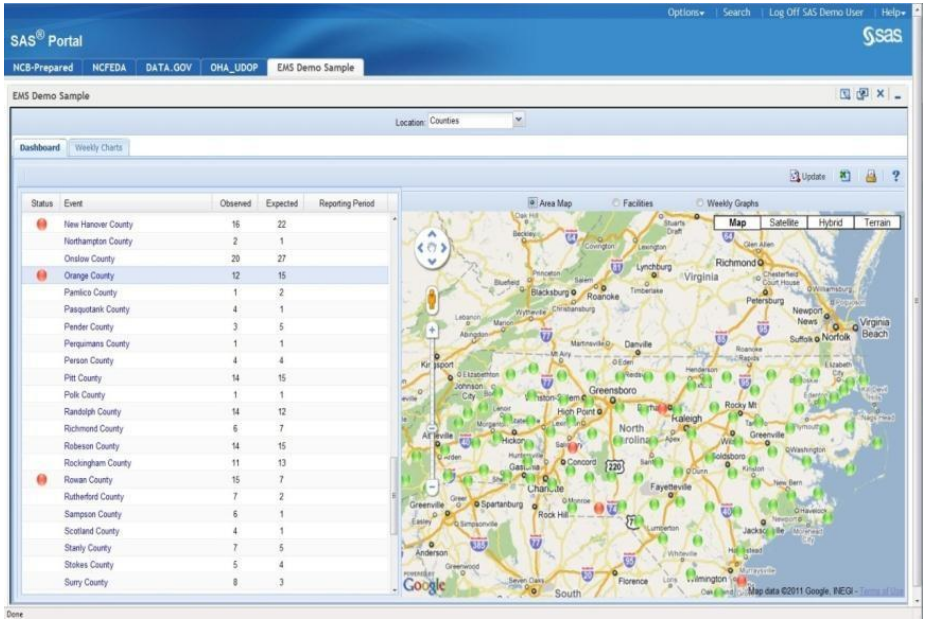
CHAI EXAMPLE:

NATIONAL COLLABORATIVE FOR BIO-PREPAREDNESS







Public / Private Partnership

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL | NC STATE UNIVERSITY | sas | Homeland Security

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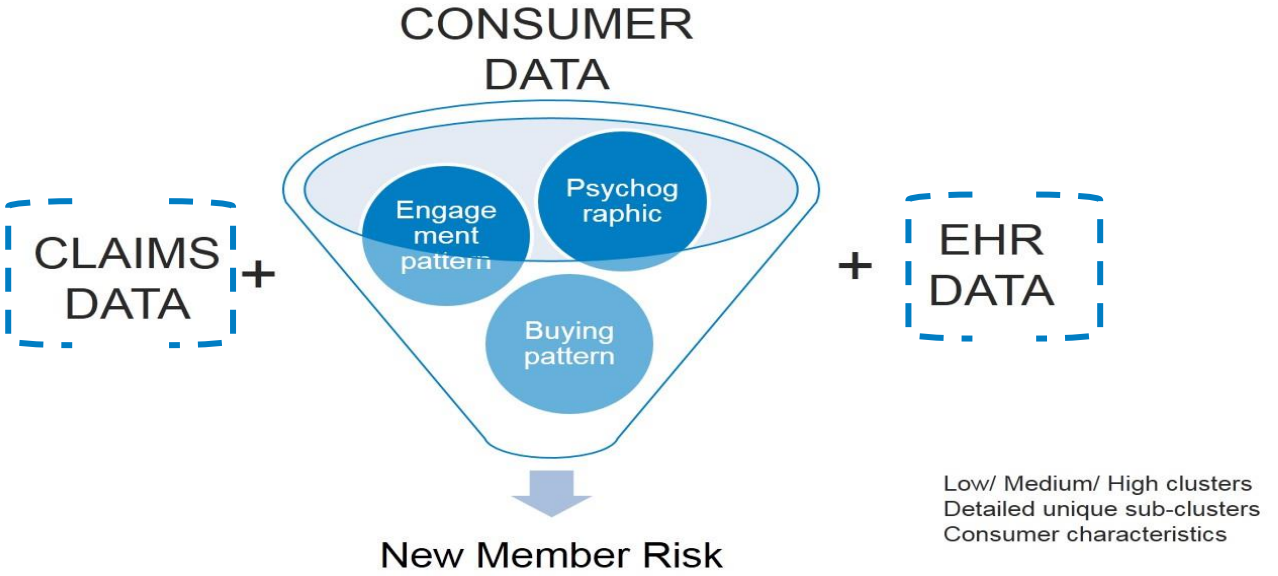
MEMBER RISK STRATIFICATION

RISK SCORING FOR NEWLY INSURED – NO CLAIMS DATA



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THE QUANTUM PATIENT

“While the individual man is an insoluble puzzle, in the aggregate he becomes a mathematical certainty”

Sherlock Holmes

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TRANSFORM | MOVE BEYOND YOUR COMFORT ZONE

Move from Piecemeal Analytics to Enterprise Analytics

Consider a mixed delivery approach – on premise & cloud

Think of CDSS as a continuum

Rethink the end to end process

Develop an analytics COE

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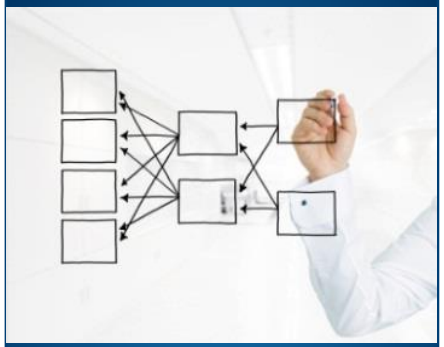

Improve Efficiency Of Care Delivery

Population Health and Engage Patients

Establish Robust Analytics Foundation

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THANK YOU

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