Population Health Management: Innovations in Risk Adjustment & Predictive Modeling with EHRs and new HIT Sources

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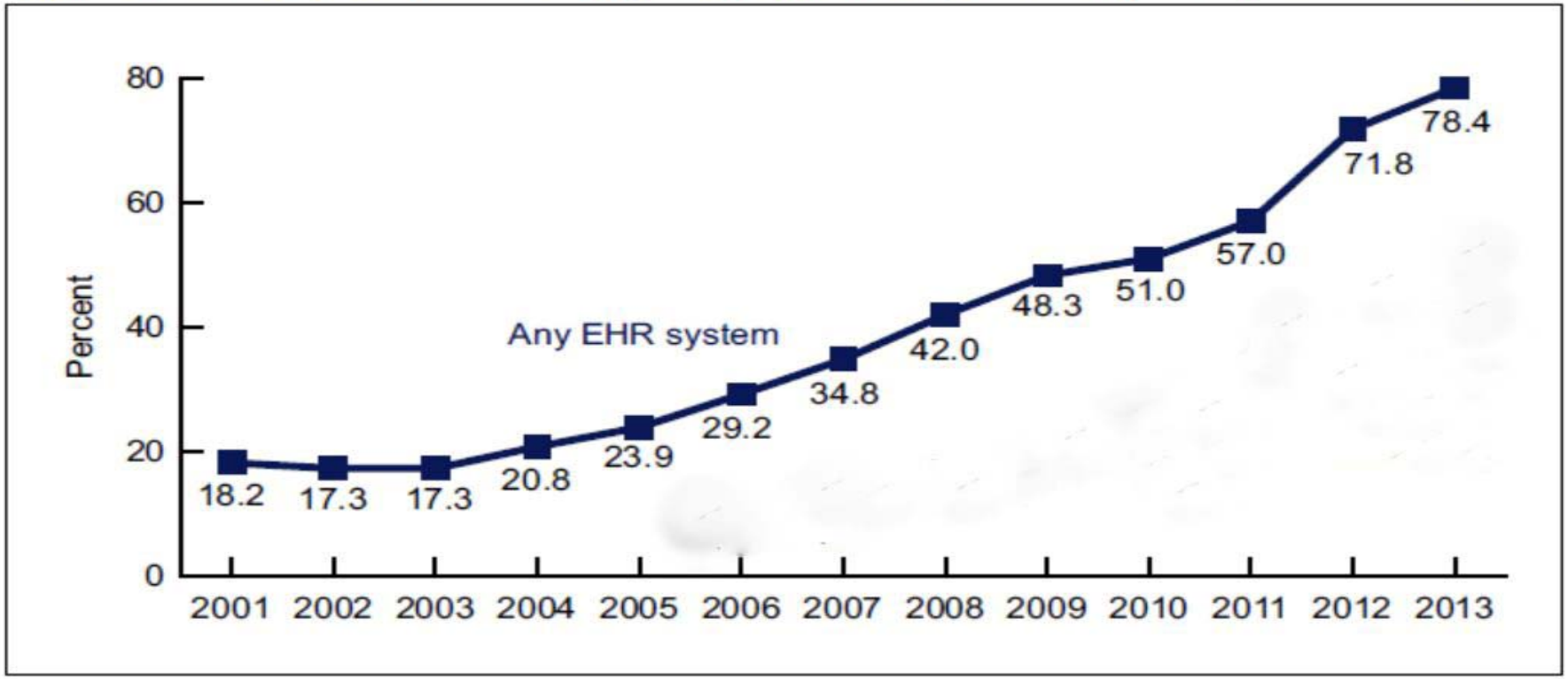
Electronic health record use has reached a "tipping point." The impact on predictive modeling (PM) and risk adjustment (RA) for population health management will be profound !

Figure 1. Percentage of office-based physicians with EHR systems: United States, 2001–2013



Source: USDHHS, CDC-National Center for Health Statistics - 2014

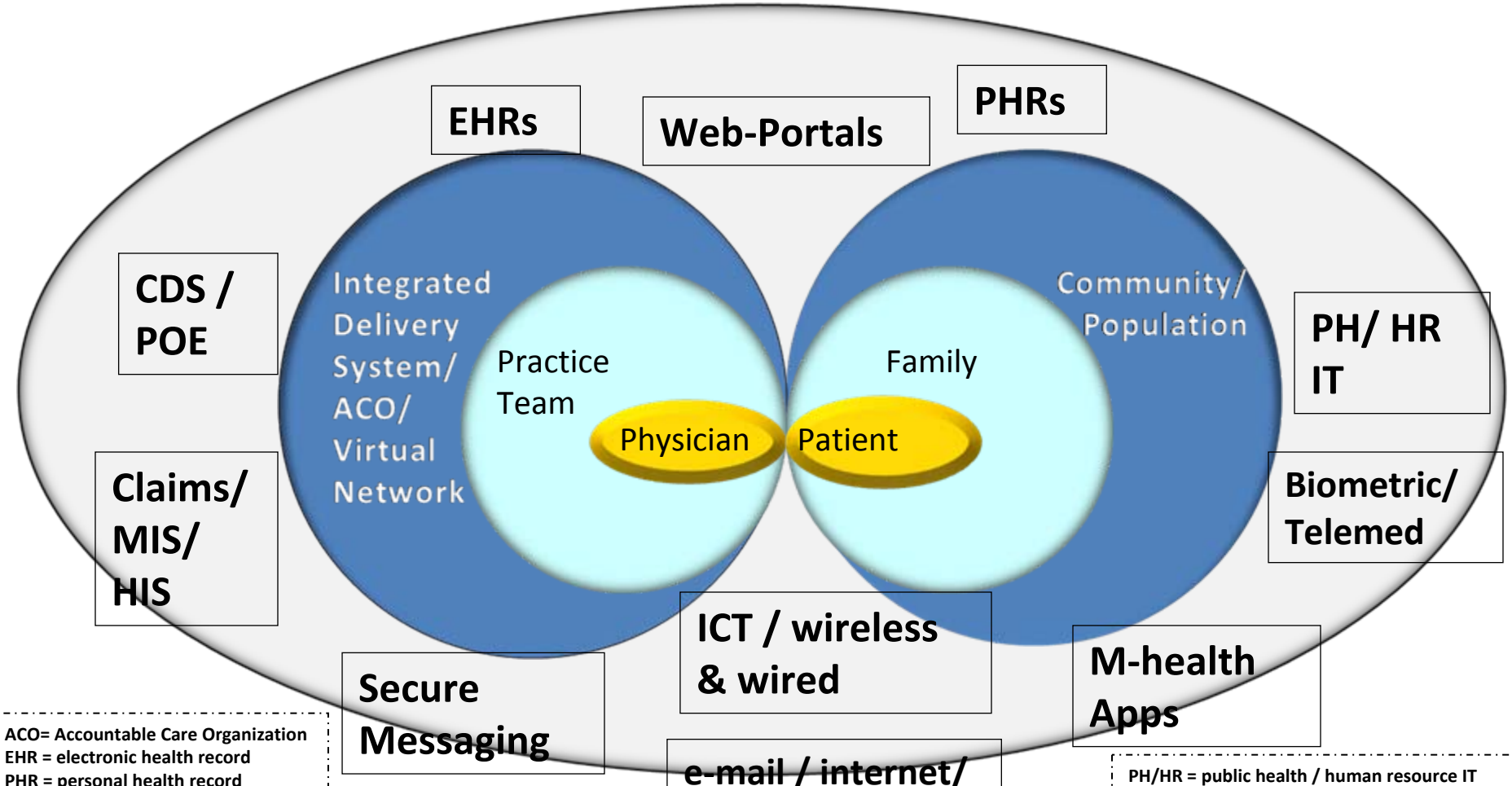
I WILL DISCUSS THE IMPACT OF THE FOLLOWING HEALTH IT (HIT) TRENDS ON FUTURE INNOVATIONS IN PREDICTIVE MODELING AND RISK ADJUSTMENT

- **The evolving *digital health milieu***
- **The *health data-economy* shift**
- **HIT mediated care - the new *e-patient / e-clinician***
- **Opportunities -- and hype – of *BIG data***
- ***e-Measures* *of risk and health as a new focal point***
- **HIT as a new enabler for *population health***

THE DIE IS CAST

HEALTH IT AND E-HEALTH WILL SOON INTERMEDIATE AND DOCUMENT ALL ASPECTS OF HEALTH AND HEALTH CARE

The new "digital health milieu"

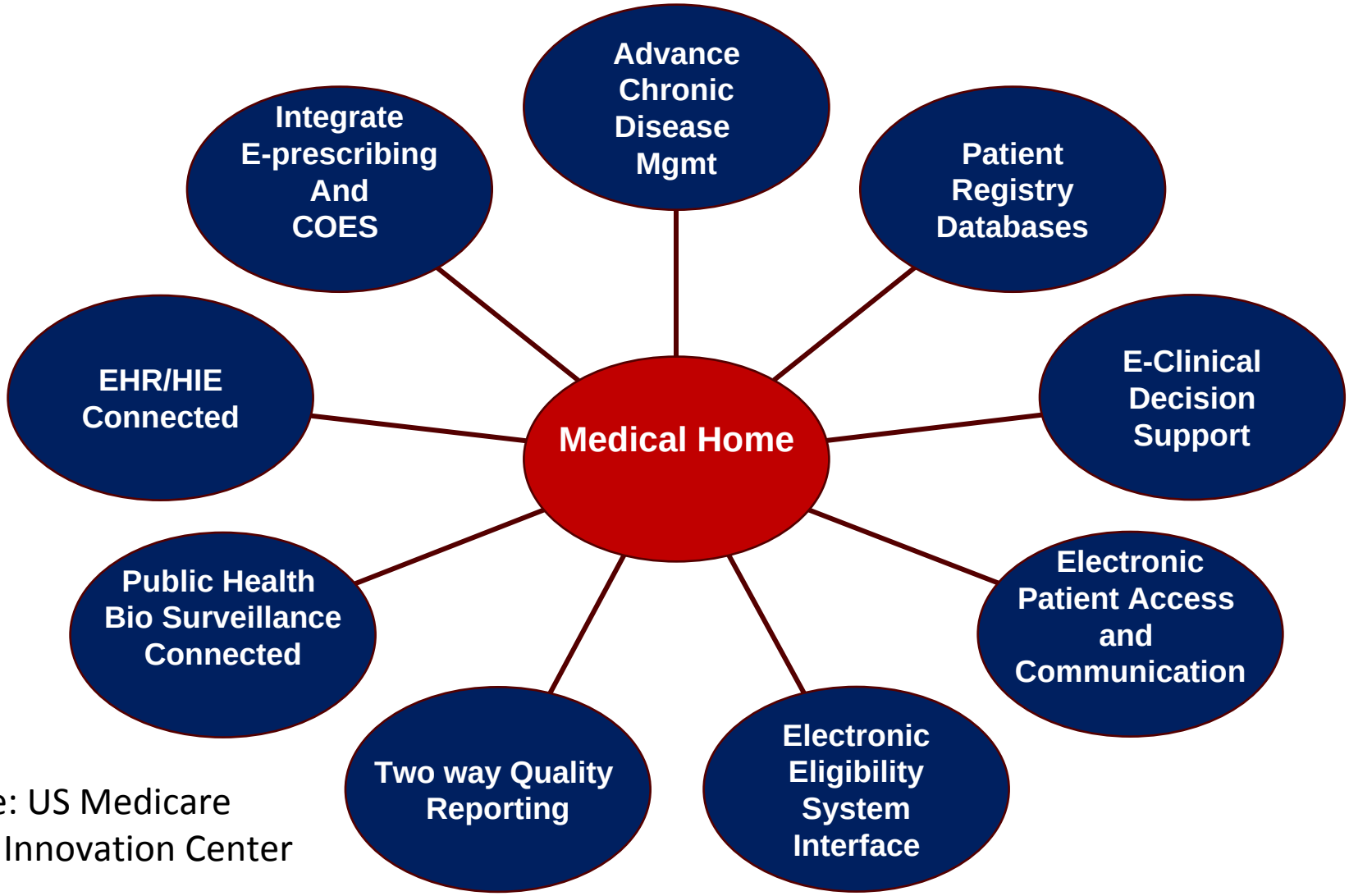


ACO= Accountable Care Organization
EHR = electronic health record
PHR = personal health record
CDS = clinical decision support IT systems
MIS/HIS = Management/Health IT systems
POE = provider order entry IT systems

PH/HR = public health / human resource IT systems
Telemed = telemedicine/ remote patient monitoring-M-health = mobile health applications
ICT = information / communication technology

Source: Weiner, 2012 http://www.ijhpr.org/content/1/1/33

HIT is the core of the Patient Centered Medical Home (PCMH)



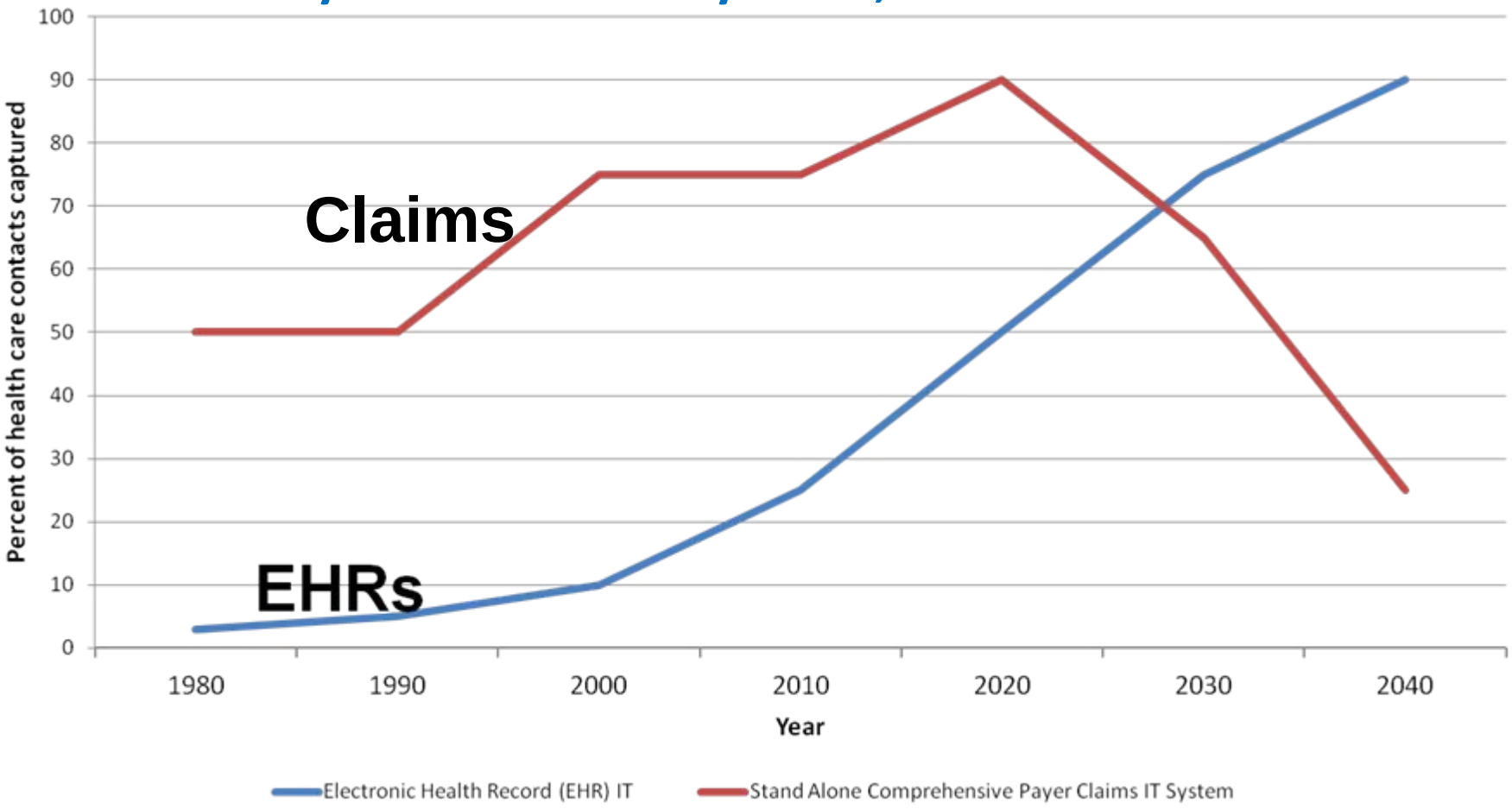
Source: US Medicare (CMS) Innovation Center

FOR 5 DECADES, GETTING PAID HAS BEEN THE MOTIVATION FOR MOST HIT AND THE MAIN SOURCE OF PM / RA DATA

FROM HERE ON, DATA WILL BE DERIVED FROM HIT INTENDED TO SUPPORTING THE CLINICAL CARE PROCESS

The shifting US "data economy" – the transition from claims to EHR systems

Estimated % of health care contact information captured primarily by claims vs. EHR systems, US 1980-2040



Source: Weiner and Salzberg JHU – Work in Progress

The Changing Axiom of the US Health Care "Data Economy"

	CLAIMS/ ADMIN DATA	EHR/HIT/E-HEALTH
MOTIVATOR	•REIMBURSEMENT •MANAGEMENT •P4P/QI/REPORTING	•CARING FOR ONE PT • CARE WORKFLOW • P4P/QI/REPORTING
ADVANTAGES	• UBIQUITOUS • INTEROPERABLE • ACCURATE IF RELATED TO $$ •STANDARDIZED	• CLINICALLY RICH DATA USEFUL FOR PM/RA
DISADVANTAGES	• LIMITED CLINICALLY • INACCURACY RELATED TO $ • DATA HOLES EXIST	• POOR INTEROPERABILITY • ACCURACY INCENTIVES ? • STANDARDS IN FLUX • DATA UNSTRUCTURED

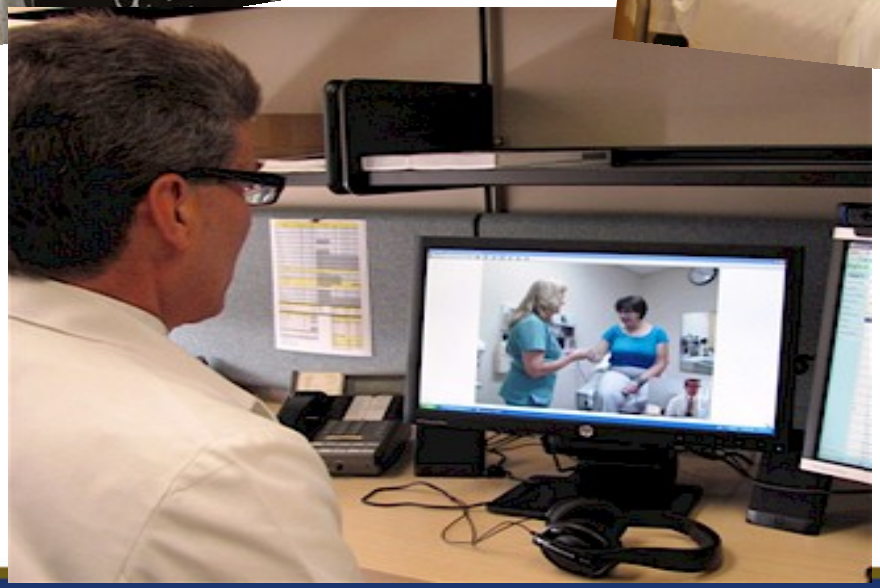
Source: Weiner and Salzberg JHU – Work in Progress

AS THE HIT / E-HEALTH SUPPORTED INFRASTRUCTURE BECOMES THE NORM

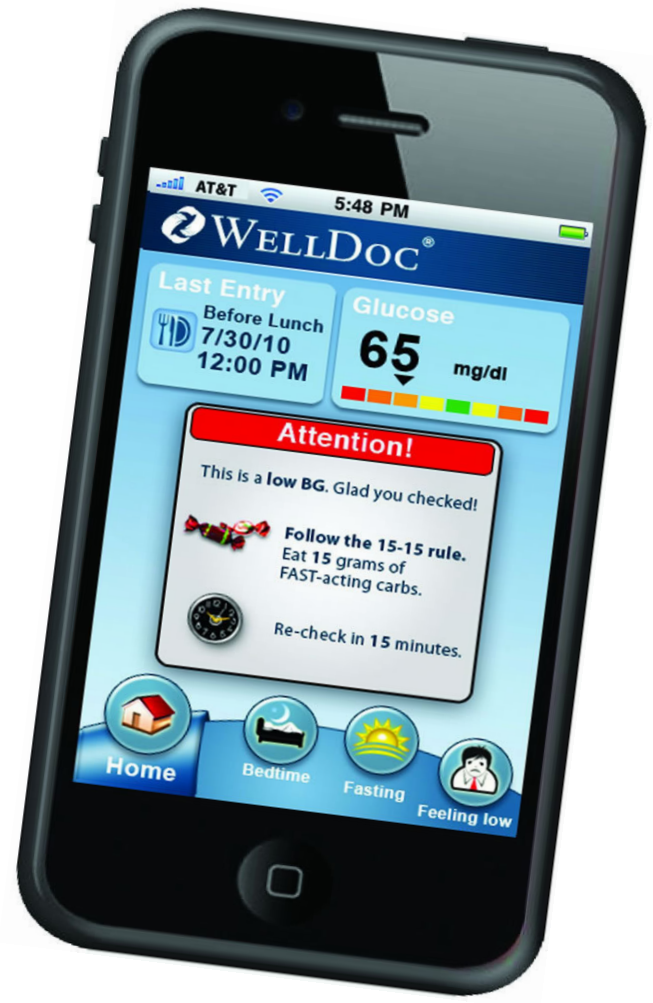
REAL-TIME IN-PERSON PATIENT / DOCTOR INTERACTIONS WILL DECREASE SUBSTANTIALLY

PM WILL BECOME INTEGRATED INTO THIS PROCESS

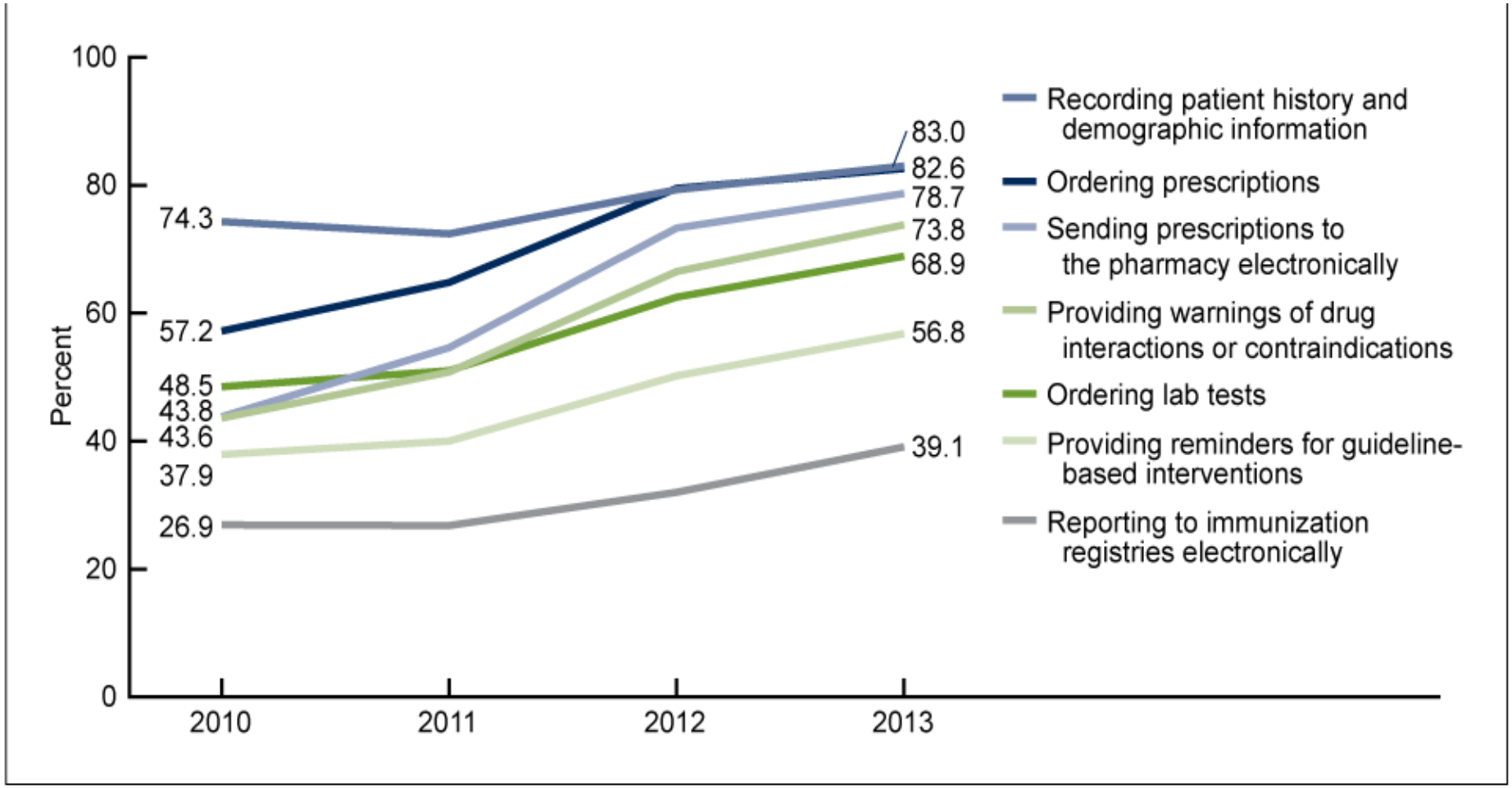
15% or more of care will soon be real-time but “remote”, using telemedicine and “e-referrals”



Mobile health apps and biometric devices will increase exponentially as care alternative / adjunct

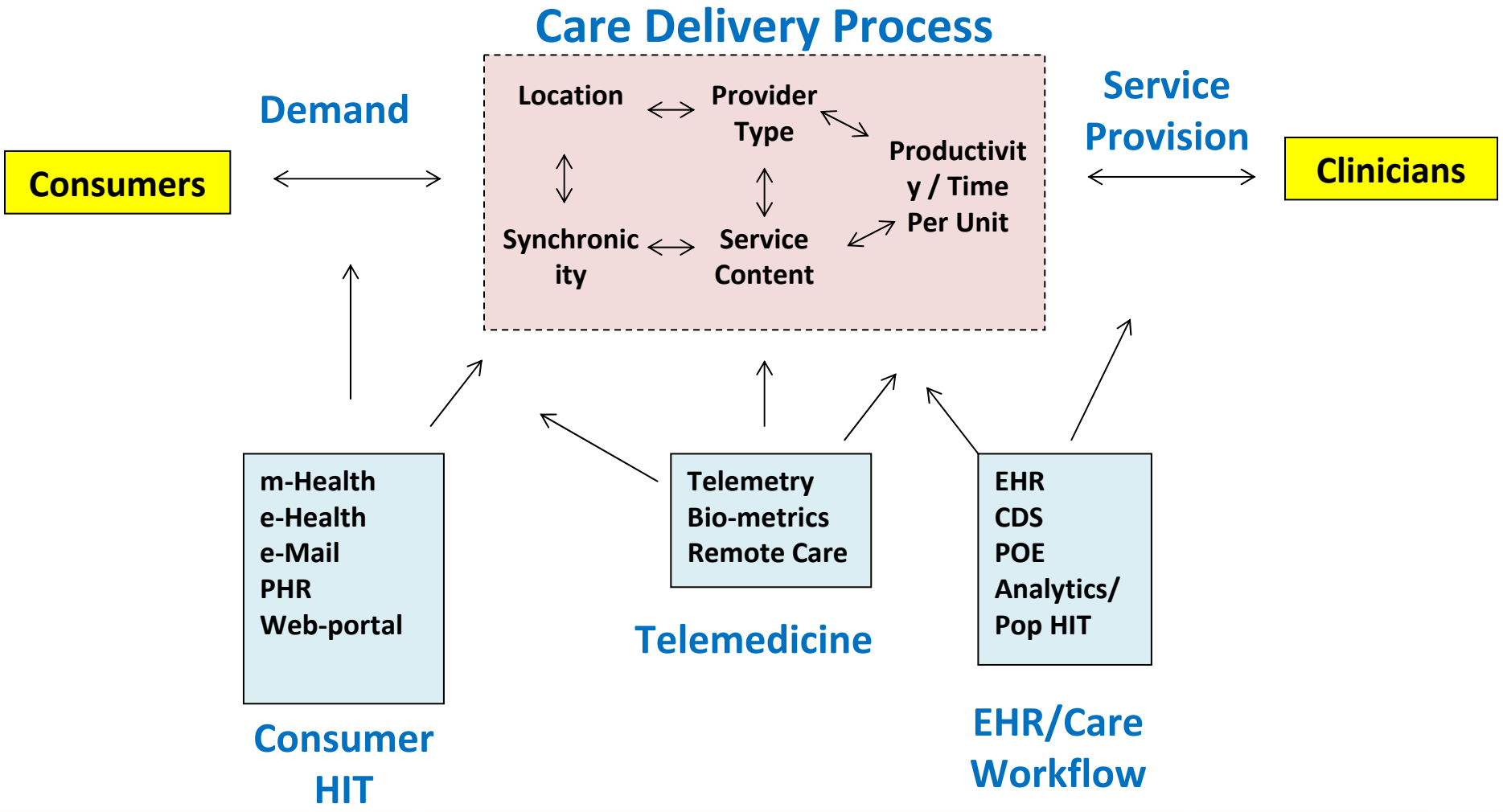


The new electronic EHR workflow will lead to profound changes in clinical practice



NOTES: All trends were significant ($p < 0.05$). See the Table for the 17 Stage 2 Core Set objectives.
SOURCE: CDC/NCHS, National Ambulatory Medical Care Survey, Electronic Health Records Survey.

The new e-Health Mediated Patient / Clinician Interaction: A Conceptual Model

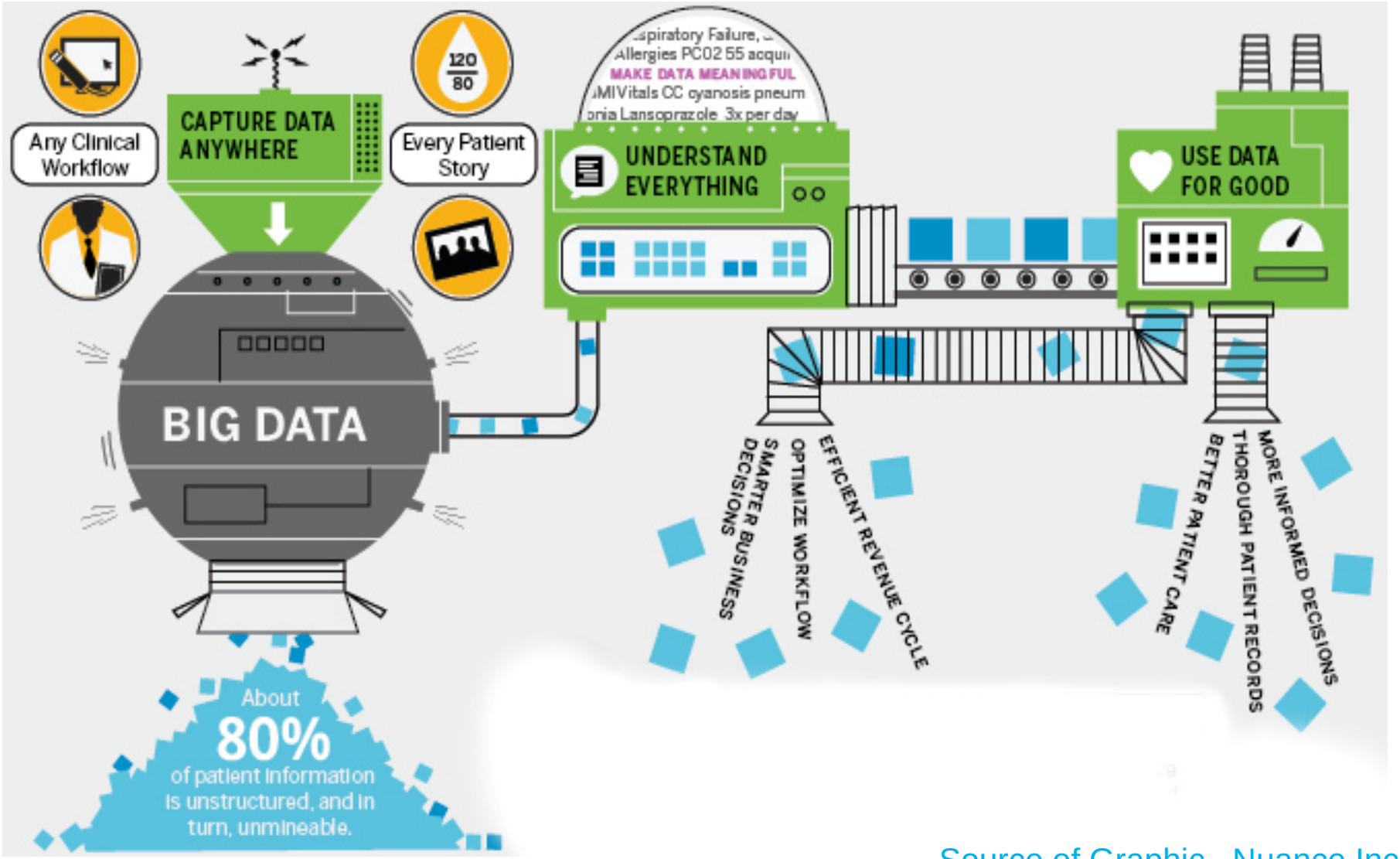


SOURCE: Weiner, Yeh, Blumenthal, Health Affairs Nov 2013: http://www.ncbi.nlm.nih.gov/pubmed/24191092

DATA…DATA EVERYWHERE… BUT NOT A DROP TO DRINK

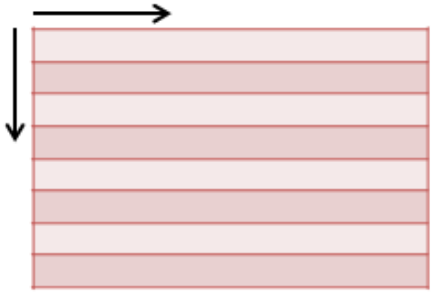
THE OPPORTUNITY AND HYPE OF “BIG DATA” AND “BIG ANALYTICS” IN HEALTH CARE PREDICTIVE MODELING

“BIG DATA” in Health Care



Source of Graphic –Nuance Inc

The Four "Vs" of Big Data in Health Care

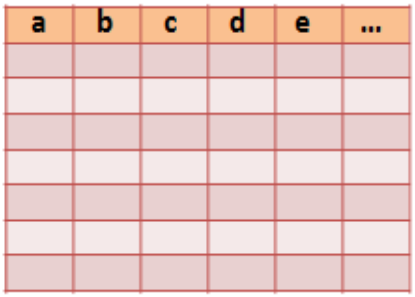


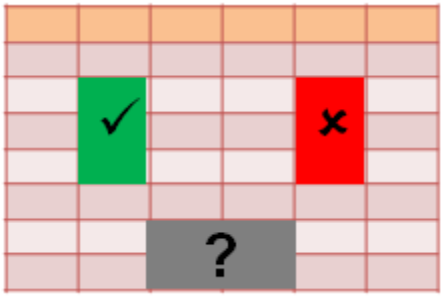
Volume

Velocity

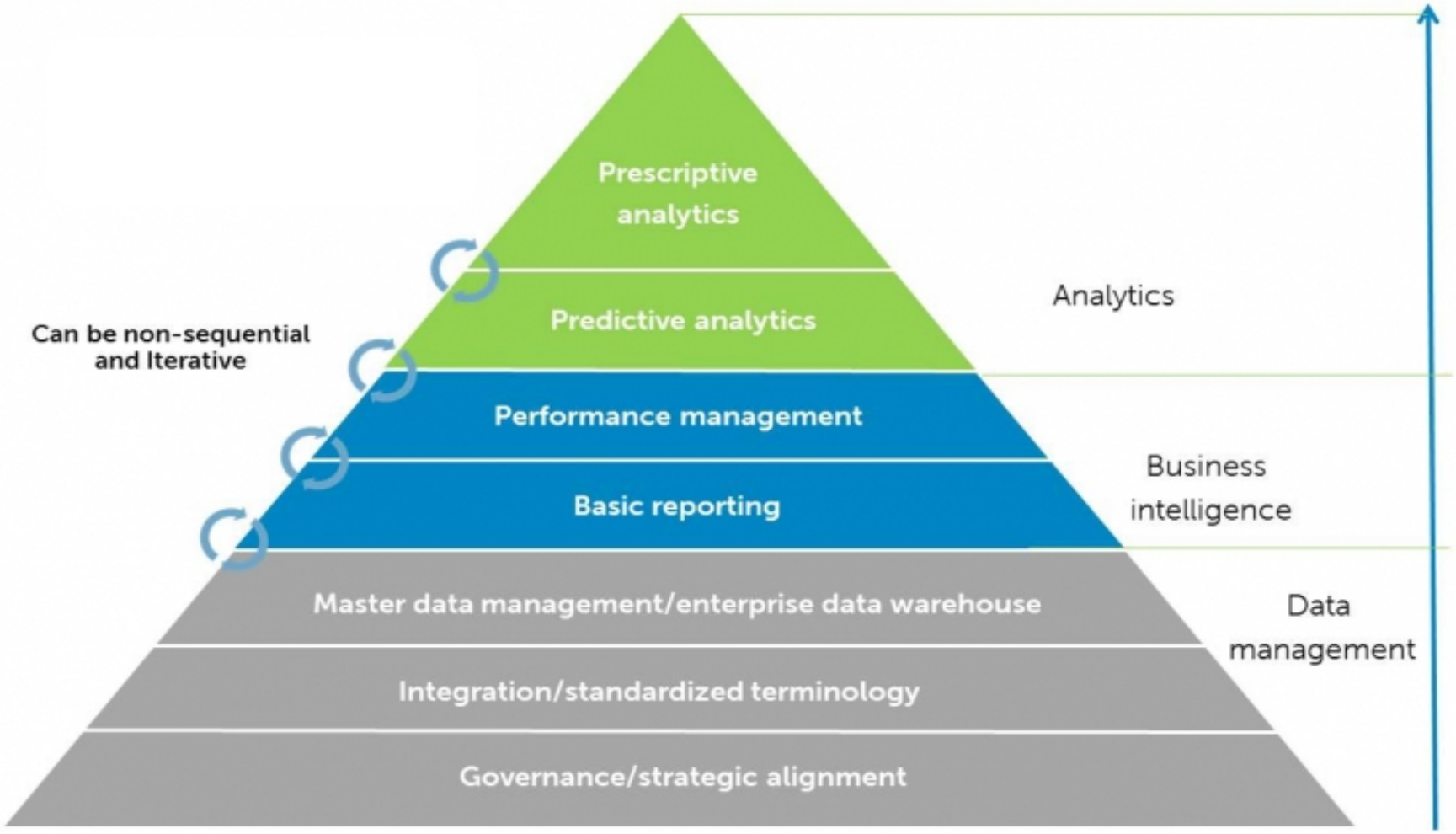
Variety

Veracity





Big Data, Big Analytics, Big Predictions???



Source: Dell

CHALLENGES AND HYPE OF BIG DATA: THIS WILL ALL IMPACT PREDICTIVE MODELING

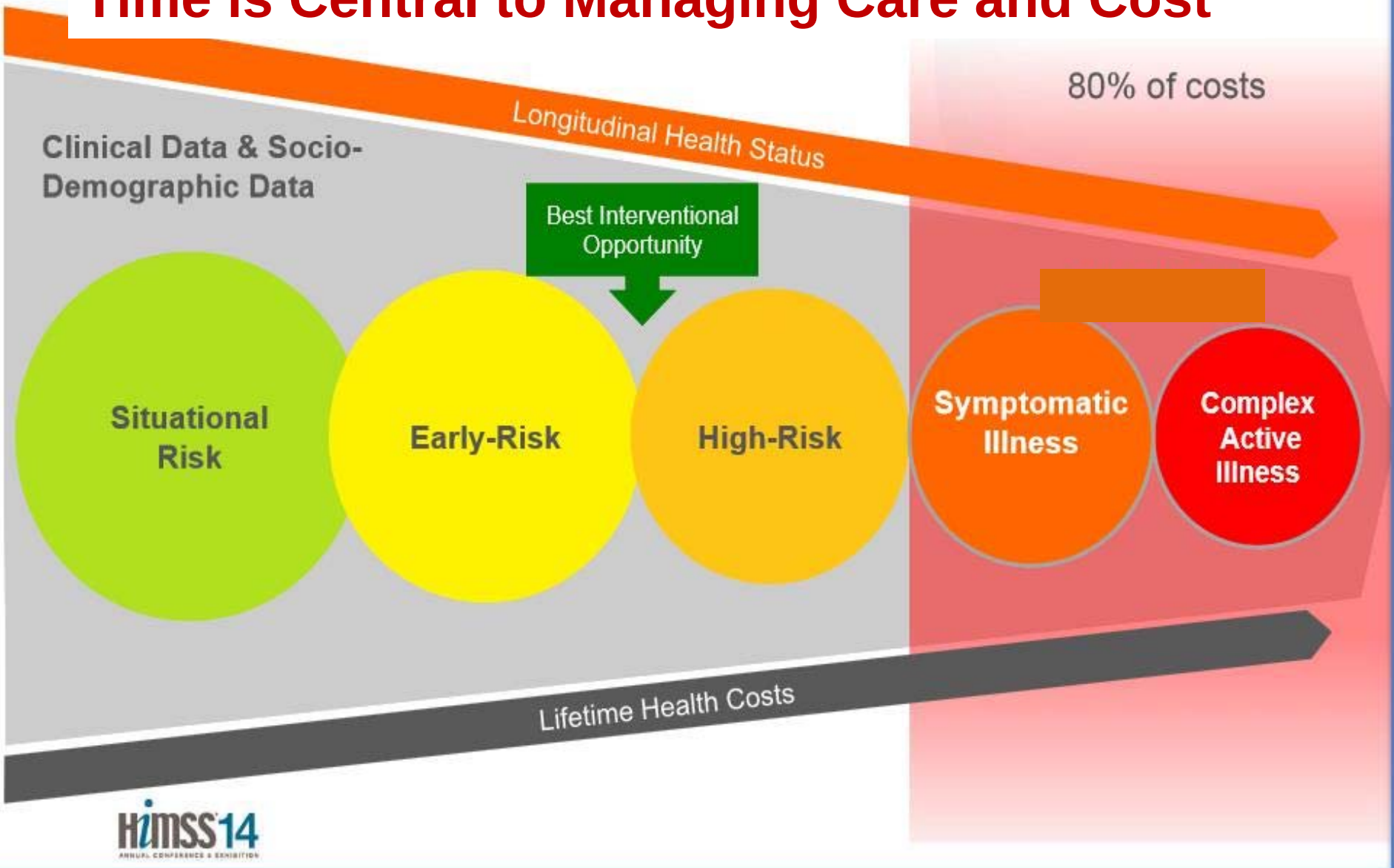
- **Some - though not all - data are unstructured and messy (e.g., clinicians notes and social networks)**
- **Some data streams (imaging, sensors, genomics) are huge, others are not (by today's tech standards)**
- **Until interoperability is surmounted, much data will be missing and difficult to link**
- **Observational "machine learning" is only a small part of the equation. Logic, evidence and "domain experts" are essential for useful analytics**
- **Tools to share practical information with humans is key (e.g., decision support)**
- **The lines between big data / big analytics / predictive modeling are blurry**
- **Caveat emptor, everyone is hyping to sell something.**

THE DIGITAL MEASUREMENT OF HEALTH STATUS AND RISK WILL BECOME CENTRAL TO MOST EVERYTHING

"E-ACG" RESEARCH FRONTIERS AT JOHNS HOPKINS

www.acg.jhsph.edu

Measuring and Understanding Risk Over Time is Central to Managing Care and Cost



HIMSS14

EHR and other HIT data offer profound opportunities to measure risk beyond current claims based models

Clinical Domain
Symptoms/Physical Status
Diagnostics
Therapeutics
Medical History
Genomics

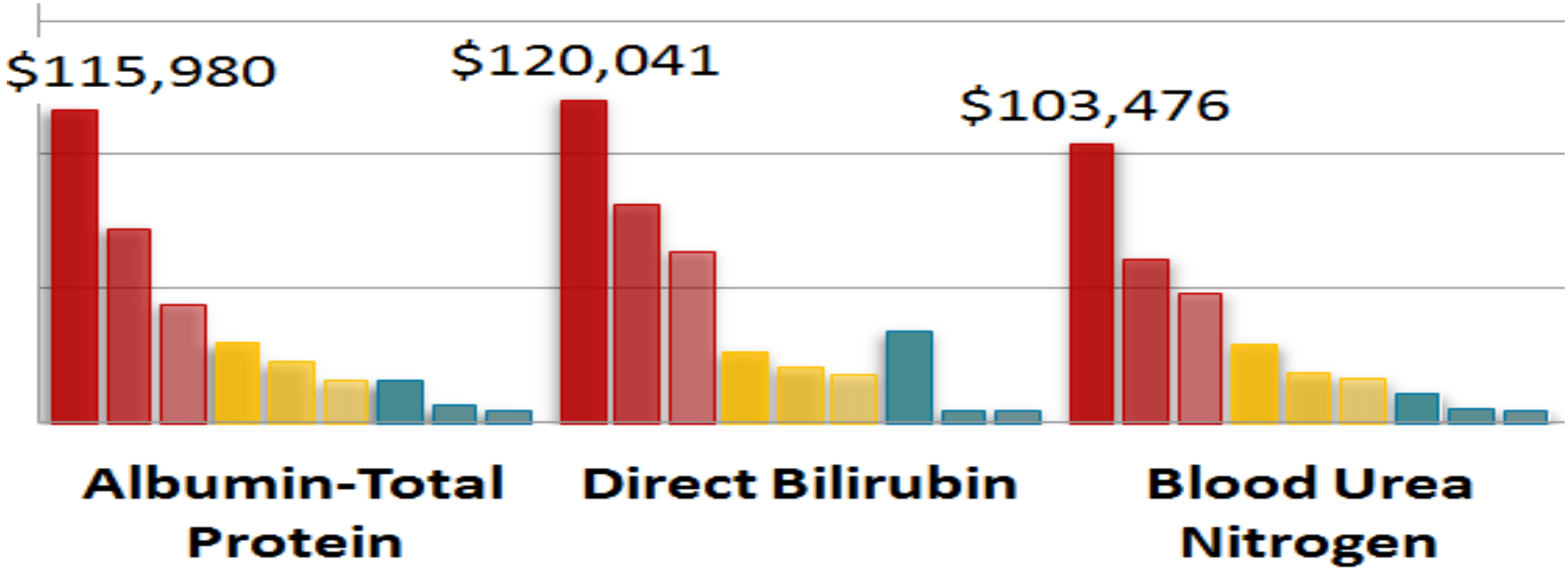
Consumer Domain
Socio-economic
Functional Status
Behavioral/Lifestyle
Family
Preferences
Knowledge/Attitudes
Community / Environmental

The new electronic sources of risk factor / health status input data include:

- EHR “charting” (clinical findings, history, biometrics)
- EHR workflow (decision support-CDS, time stamps)
- “Order entry” (POE)” (e-prescribing, test-ordering)
- “Investigation “results” (lab, image, EKG/cardio)
- Home devices / sensors / m-health
- PHRs / Pt. portal / m-health (consumer preferences, actions and functions)
- Social networks / e-interactions (Dr/Pt, Pt/Pt, Dr/Dr)
- Community surveillance / public health networks

Electronic ambulatory lab results add significant risk prediction ability to claims-based information

Figures represent est. additional annual $ associated with "risk" information from lab data. Each bar represents pt. cohort stratified by lab value (H,M,L) for each test noted, for three claims-based morbidity levels (ACG RUBs).



Source: Preliminary JHU analysis based on approx 60,000 persons with claims data and in-scope digital lab results. Will likely be part of JHU ACG Version 12.0

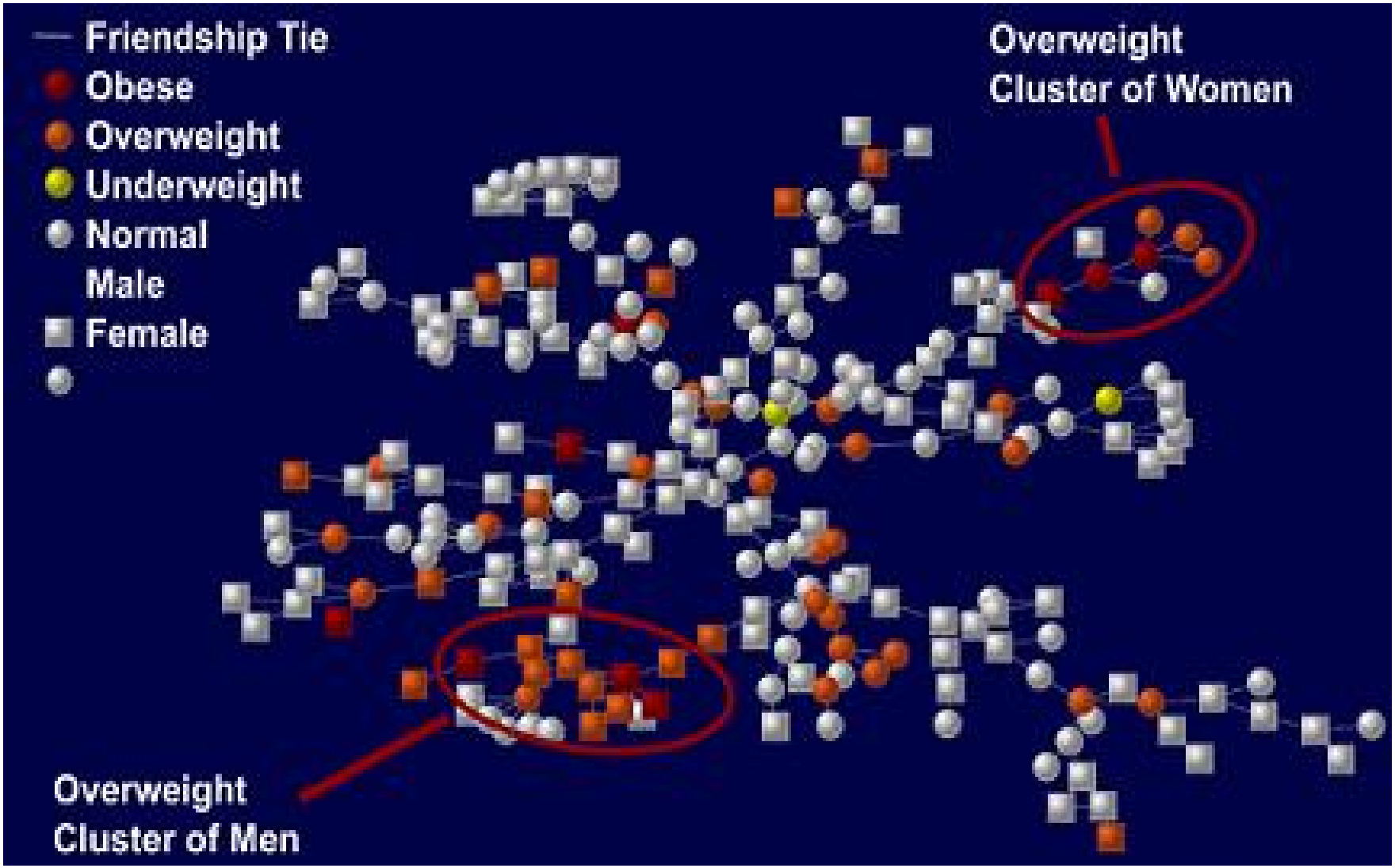
Moving beyond cost and utilization: Some new targeted end-points / outcomes of EHR- based predictive modeling

- "Morbidity trajectories" over time
- Real time population health / community surveillance
- Real time clinical action for individual consumer
- Functional Status / Frailty
- Biometric attributes
- Cardiovascular and other physical function
- Social needs / challenges
- Consumer health related behaviors
- Mortality / Longevity

Consumer based “health risk appraisals” can be integrated into EHRs and the care workflow

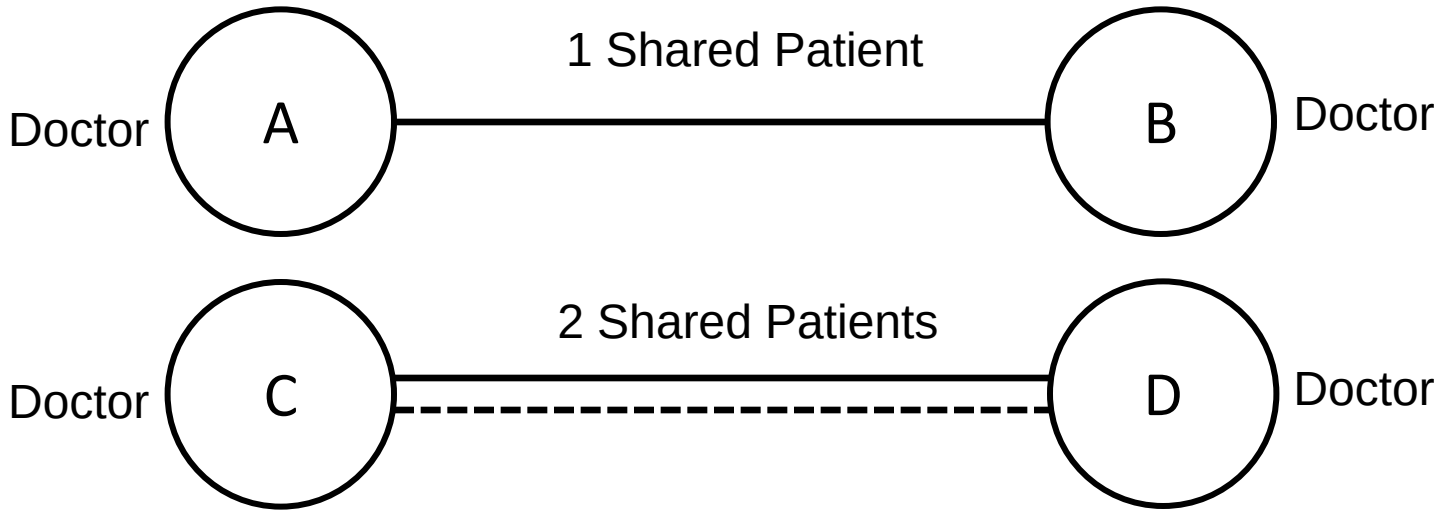
Source: Cerner

Consumer Social Network Data and Risk Prediction

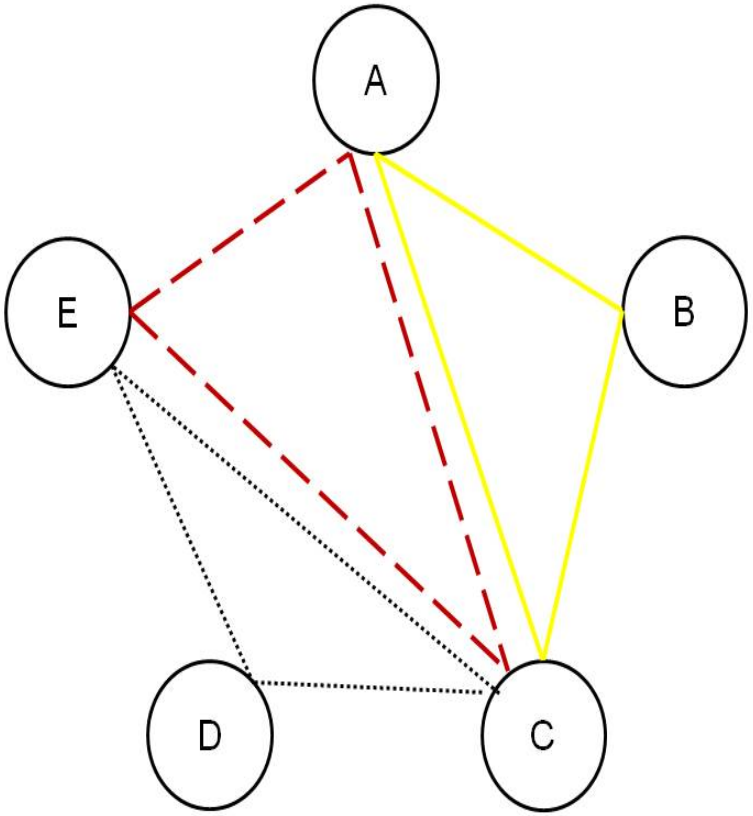


Source: Yale Univ. Prof. Christakis

Physician “social networks” and risk prediction



Constructing a "Care Density" Shared Care Network Measure



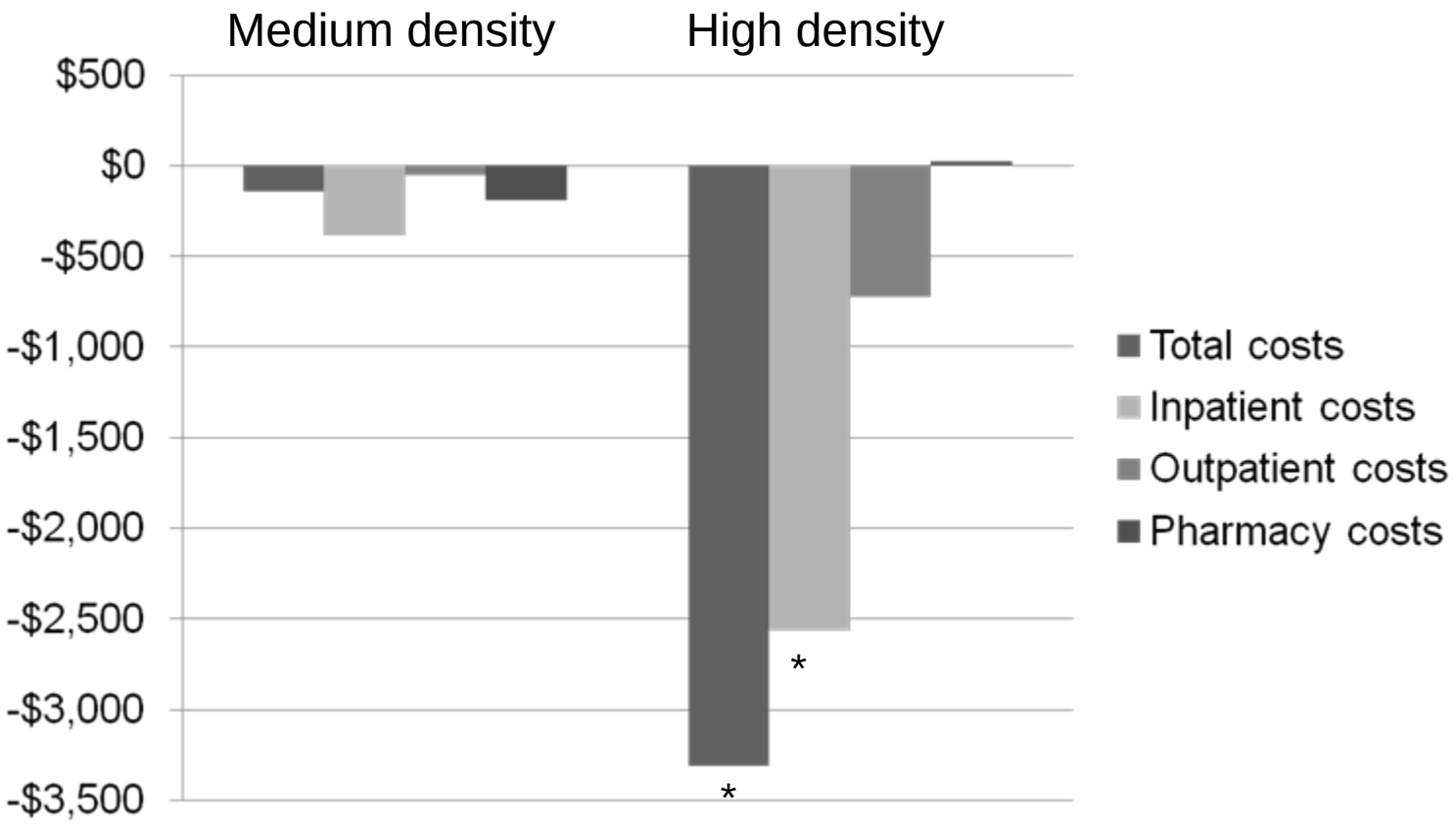
5 doctors represented by circles

3 patients represented by different lines

<u>Total number of shared patients</u>
total number of pairs of doctors

A new methodology now integrated into Johns Hopkins ACG System Version 11.0

Impact of Care Density on costs of for CHF Pts.



$0 represents the average costs for the patients in the low care density group. All models are adjusted for insurance plans, payer type, product type, age, gender, number of ADGs, having seen a PCP, and providers.

Source: Pollack CE, Weissman GE, Lemke KW, Hussey PS, Weiner JP. JGIM. March 2013
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3579968/

MAXIMIZING HEALTH (AND VALUE) FOR POPULATIONS

HIT AND RELATED "RISK" MEASUREMENT AND PREDICTIONS WILL MAKE COMMUNITY TARGETED POPULATION HEALTH MANAGEMENT FEASIBLE… AND INEVITABLE

Working Definitions

Population Health

"Population health comprises organized activities for assessing and improving the health and well-being of a defined population."

Population Health Informatics (PHIT):

"Population health informatics is the systematic application of information technologies and electronic information to the improvement of the health and well-being of a defined community or other target population."

HIT WILL ALLOW GREAT ADVANCES IN POPULATION HEALTH AND THESE WILL HAVE IMPACT ON FUTURE PM

- Ways to integrate disparate “numerators” & “denominators” to define true populations and communities.
- Ways to identify those “at-risk” both at the community and patient-panel level.
- Advanced tools for extracting and analyzing unstructured data from many sources.
- Models and tools to help medical care systems move towards “population value” perspectives.
- Integration of pop health analytics and decision support.

Hot-Spotting Baltimore Hospitalizations Using HIE Data

Source: CMS Innovation Planning Grant Received by the Maryland Department of Health

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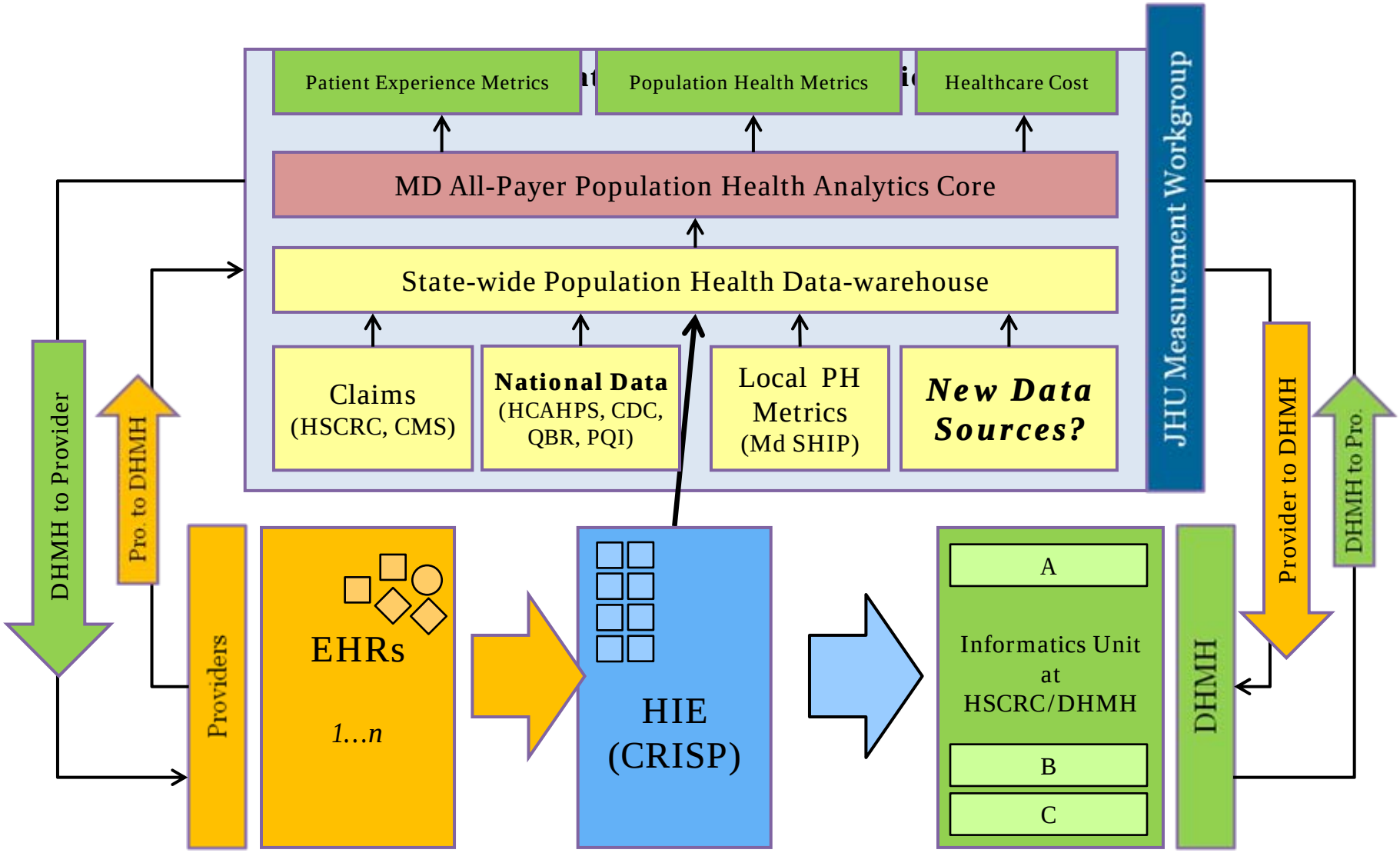
Conceptual model for the "Maryland Population Health Information Network" (M-PHIN) in Support of the new "All Payer" Population-Based Global Budget Hospital Payment System



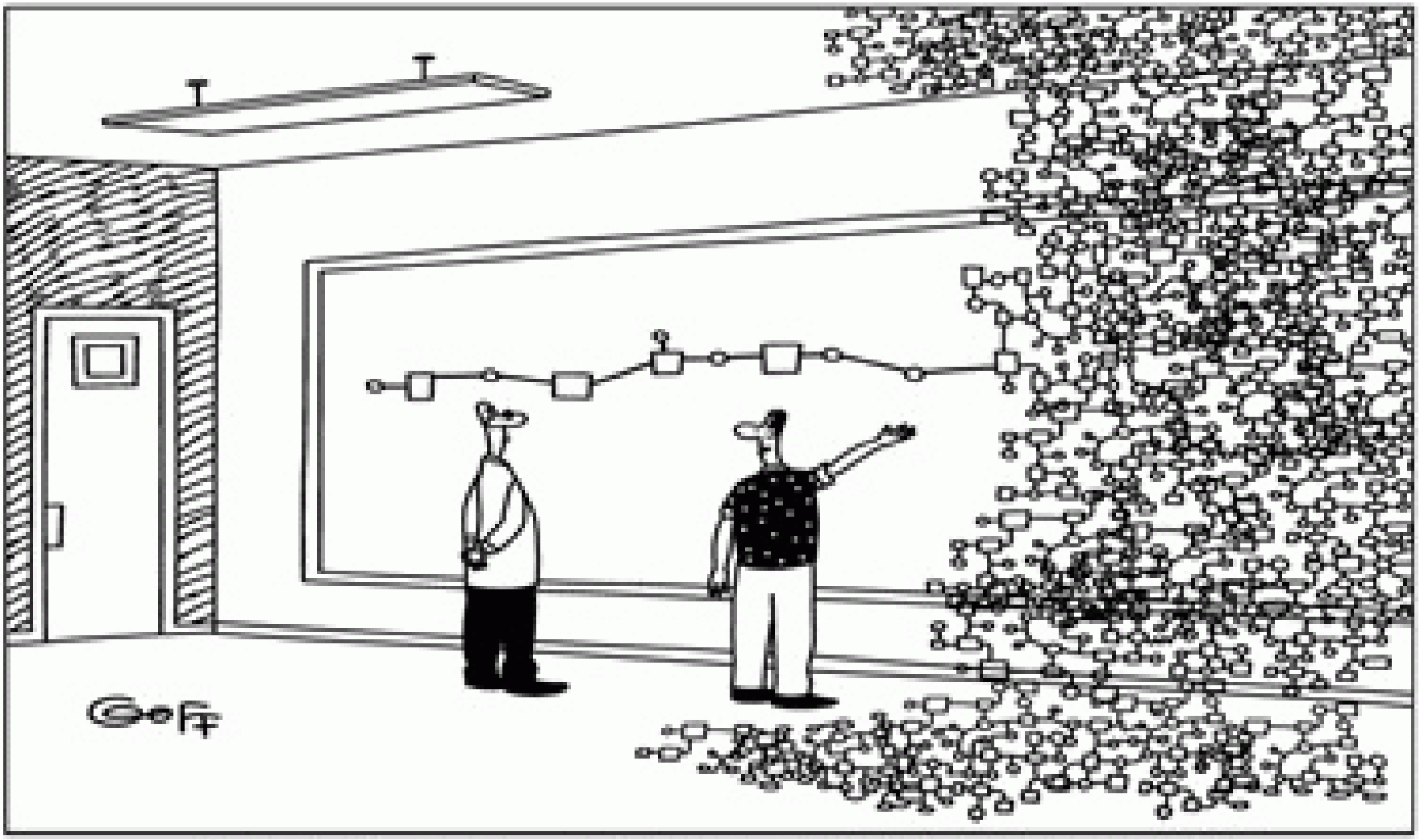
IN CONCLUSION

THE NEXT DECADE OR TWO WILL BE THE MOST DYNAMIC AND EXCITING TIME EVER IN THE FIELD OF PREDICTIVE MODELING IN HEALTH CARE

Likely future predictive modeling innovations for population health management

- Integration into the electronic health care workflow
- Be more finely tuned to specific individuals and populations
- Predict health outcomes beyond cost
- Target broader timeframes
- Be more accurate
- Involve more complex modeling
- Become more transparent and less hyped
- Be applied by a wider array of end-users
- Keep all of busy for the rest of our careers!!

But the journey may hold some surprises



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