



PRECISION MEDICINE
SUMMIT
A HIMSS EVENT

JUNE 12-13, 2017
BOSTON, MA



Overcoming Obstacles, Seizing Opportunities, Curing Cancer

www.ThePrecisionMedicineSummit.com/Boston/2017 | #PrecisionHIT

Realizing the Promise of Precision Medicine, in press (Academic Press)

Lots of skeptics, lots of criticism

- 1. “Physicians already practice personalized/precision medicine”**
- 2. Cost is too high**
- 3. MD workload would increase exponentially**
- 4. Lack of interoperability**
- 5. No clinical benefits in the real world**



Mono-therapy

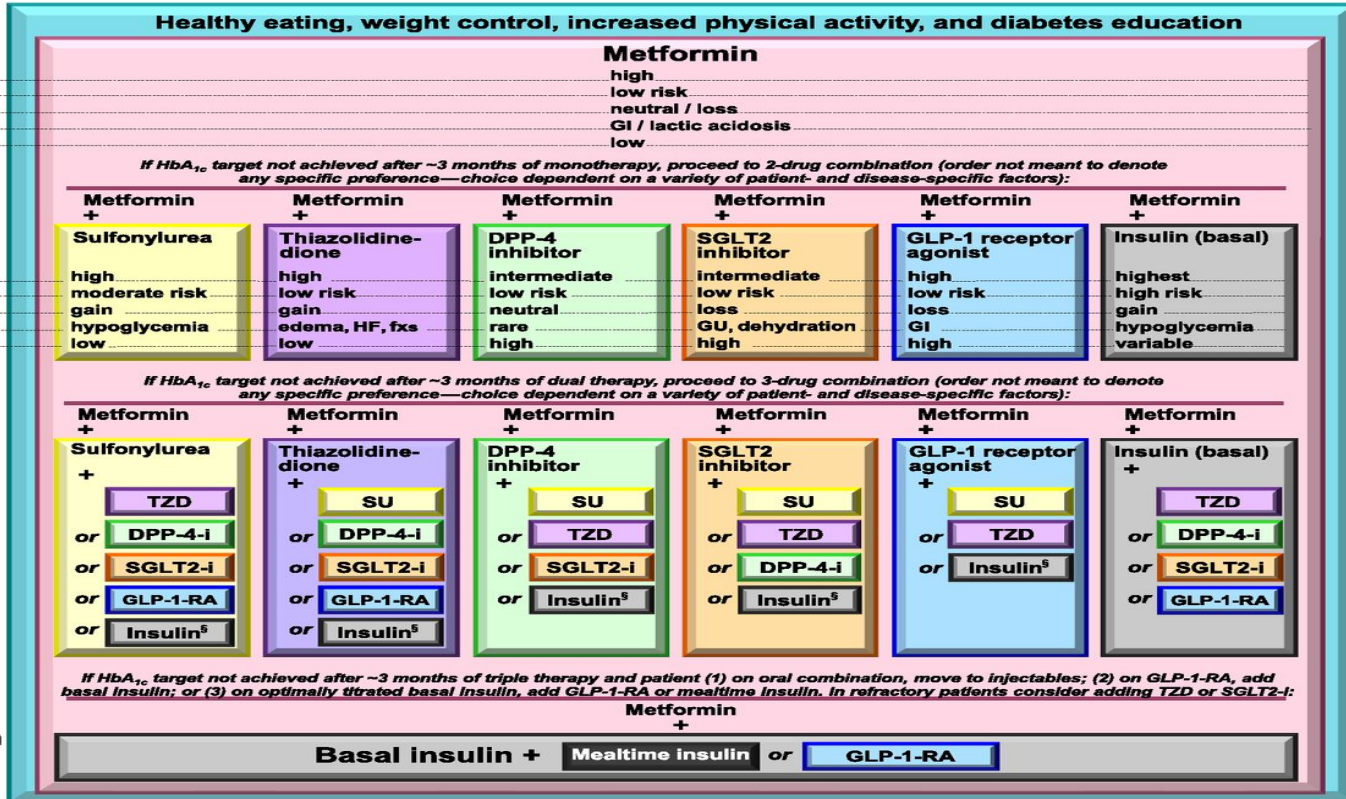
Efficacy*
Hypo risk
Weight
Side effects
Costs*

Dual therapy[†]

Efficacy*
Hypo risk
Weight
Side effects
Costs*

Triple therapy

Combination injectable therapy[‡]





Objection 1: personalized medicine vs **P**ersonalized **M**edicine

- Old-time p.m: Switching antibiotics, choosing the best diabetes drug based on protocols—**Trial and Error Medicine**
- P.M. with capital P addresses numerous interlocking contributing causes/risk factors, how they apply to individual patients
- Imprecise medicine: Looks at large groups in RCT, often addresses **intermediate** steps in pathogenesis.
- Precision Medicine looks for exact causes--**root** causes of disease
- Examples: RA typifies imprecise; Fe deficit precision medicine.

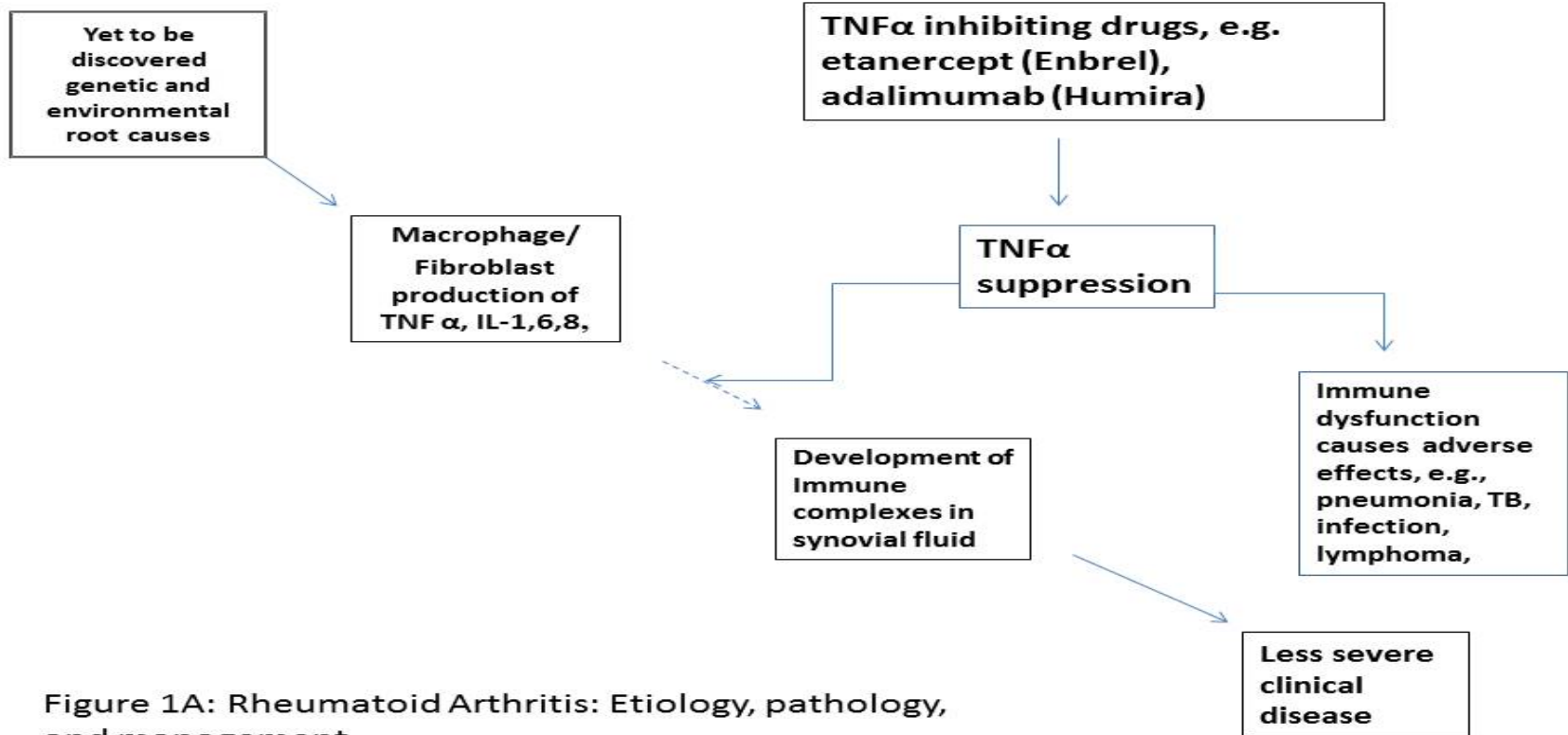


Figure 1A: Rheumatoid Arthritis: Etiology, pathology, and management

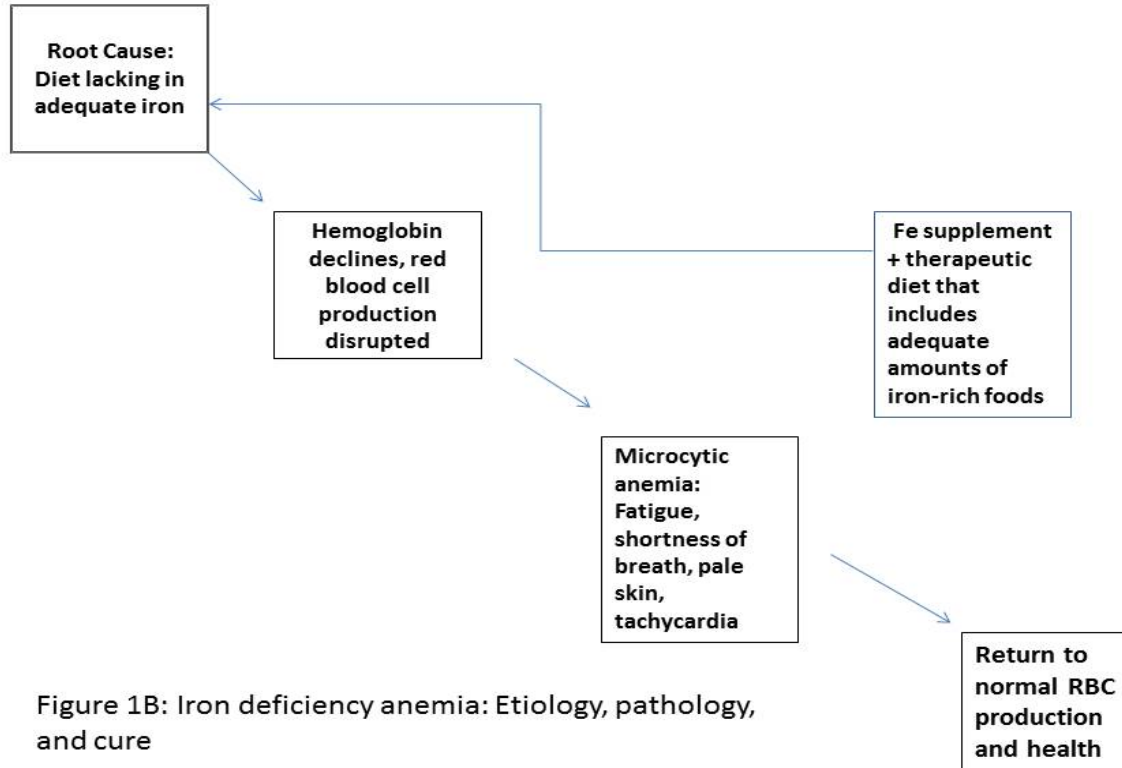


Figure 1B: Iron deficiency anemia: Etiology, pathology, and cure

PMI project: 1 million person cohort-- “All of Us Research Program”
Designed to detect multiple, interacting risk factors –Identify ROOT CAUSES

- **Genomic data**
- **Diet**
- **Physical activity level**
- **Heart rate, respirations via mobile apps and remote sensors**
- **Medication lists**
- **Psychosocial stress**
- **Local weather and air quality**
- **OTC medication purchases**
- **Infectious exposure**
- **Medical history and more**

Applying precision medicine requires finding which risk factors affect each patient, *and to what degree*

Each patient has unique % of risk factors

John Patrick

- **10% genetics**
- **50% chronic stress—Stress responders: stress management, cognitive behavioral therapy**
- **40% diet—Sodium sensitive hypertension**

Mary Smith w/coronary heart disease

- **70% genetic predisposition—Familial hypercholesterolemia**
- **10% poor diet,**
- **10% chronic stress**
- **10% Sedentary lifestyle**

To Sum up: We need

A) to determine the best Tx for each contributing cause

B) assessment tools to detect how these contributing risk factors affect each patient

Here's what being done by innovative thinkers using data analytics:



Diabetes risk prediction tool

IMPORTANT NOTE: This is not a diagnostic tool. Talk to your doctor about your results.

INSTRUCTIONS

Measure or look up your value for each item below.

Put your cursor or finger over your value on the number line for the first item.

Then move your cursor or finger straight up to the Points line.

Write down the number of points you earned for that item.

Repeat for each of the seven items. Then, total up your score.

Points

What's your fasting blood sugar (in mg/dL)?

What's your long-term blood sugar, or A1C (in %)?

Family history of high blood sugar? (0 for no, 1 for yes)

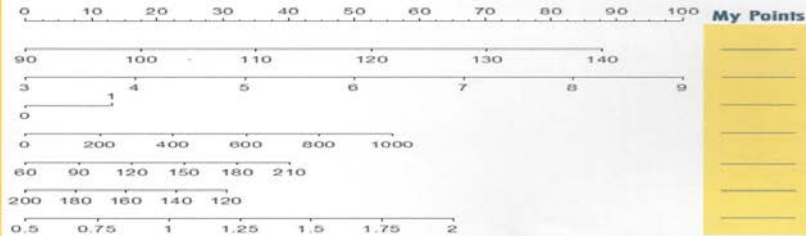
What's your blood triglyceride level (in mg/dL)?

What's your waist measurement, in centimeters?
(multiply inches by 2.54)

How tall are you, in centimeters?
(multiply inches by 2.54)

What's your waist to hip ratio?

(take your waist measurement of smallest point, and hip measurement at widest point. Divide the first number by the second.)



Total score of 146 or above: Talk to your doctor soon about your risk of diabetes, and what preventive steps you should take.

Lower scores: At your next checkup, discuss with your doctor how you can keep your risk of diabetes from increasing.

If you haven't had a blood sugar test and you're over age 45 or you have a high body mass index (over 25), talk to your doctor about being tested. Also talk to your doctor if you haven't had your triglyceride levels measured in the last five years.

Model based on data from adults over age 25 who took part in the Diabetes Prevention Program.

More information about the research behind this model: <http://umhealth.me/diabpre>

Sussman JB, Kent DM, Nelson JP et al. BMJ. 2015; 350:h454. <http://www.bmj.com/content/350/bmj.h454>

COPYRIGHT: University of Michigan {Caveat: Retrospective vs prospective analysis}

New research is pointing way to more personalized care

- **Jeremy Sussman et al U of Michigan**
- **Reanalyzed Diabetes Prevention Program, RCT 3,000+ patients at risk of Type 2 diabetes (Risks: Overweight, GTT, and fasting BG)**
 - **Intensive Lifestyle modification**
 - **Metformin**
 - **Controls**

RESULTS:

- **Intensive Lifestyle mod: Reduced DM incidence by 58% . So 42% did not.**
- **Metformin: Reduced incidence of DM by 31% (69% didn't). There was no way to separate responders from non-responders**
- **DPP researchers suggested applying results to millions of at-risk patients would be a good thing.... REALLY ?**

Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. N Engl J Med 2002;346:393-403.



- **Sussman used predictive analytics to reanalyze raw data and individualize Tx**
- **Identified 7 key risk factors (out of 17 considered)**
 - **fasting blood glucose**
 - **hemoglobin A1c**
 - **family history of elevated blood glucose**
 - **blood triglyceride level**
 - **waist measurement in centimeters**
 - **waist-to-hip ratio.**
 - **Height**



- **Results: “Average reported benefit for metformin was distributed very unevenly across the study population, with the quarter of patients at the highest risk for developing diabetes receiving a dramatic benefit (21.5% absolute reduction in diabetes over three years of treatment) but the remainder of the study population receiving modest or no benefit.”**
- **Take home message: Using this more detailed set of risk factors enabled Sussman to ID individuals more likely to benefit from Tx and those who would not.**

Objection 2: Will Precision medicine overwhelm docs with too much data?

That's Wrong Q: How can the workflow of the average clinician be *redesigned* to accommodate the introduction of precision medicine.

- **Seize the opportunity: Redesign for health promotion, comprehensive disease prevention—Ralph Snyderman et al Duke.** To Adopt Precision Medicine, Redesign Clinical Care. *NEJM Catalyst*. Feb 5, 2017.
<http://catalyst.nejm.org/adopt-precision-medicine-personalized-health/>
- **Move away from episodic care addressing acute symptoms**



- **Embrace predictive tools (eg. Sussman)**
- **Lengthen the duration of office visit; 10 -15 min not enough!**
- **Give patients more responsibility for their own care (via mobile apps)— J Am Med Inform Assoc (2017) 24 (3): 619-632.**
 - **Imedicalapps.com—reliable source of clinician-facing and patient facing medical apps.**
 - **Iprescribeapps.com**
 - **Iltifat Husain, MD, Editor in chief, Assistant Prof at Wake Forest School of Medicine**

Objection 3: The High Cost of Precision Medicine

- **Less encouraging scenario**
- **J Econ Perspectives reviewed 58 cancer drugs, many precision med drugs**
 - **1995: additional year of life cost \$54,000**
 - **2005: \$139,000**
 - **2013: \$207,000**
 - **ROI: Survival improved by only a few months**

- **More positive statistics; Cost effective therapy**
- **Gleevec (imatinib) for chronic myeloid leukemia**
 - **Precision approach: addresses key chromosomal translocation—close to a root cause**
 - **1980 Life expectancy for CML patient: 3.5 yr**
 - **2010: 27.3 years**
- **Similar success story for Herceptin (trastuzumab) for HER2 positive breast cancer**



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Realizing the Promise of Precision Medicine

The role of patient data, mobile technology,
and consumer engagement



Paul Cerrato and John Halamka



Where we are

- **EHR - 80% adoption of EHRs but with 453 clicks to admit a patient , 140 structured data elements per encounter to support clinical quality measures, 40% of clinicians feel burned out (C+)**
- **Interoperability - we've made reasonable gains with pushing payloads from place to place, but have not built the enabling infrastructure to support pull (C+)**
- **Patient/family engagement - we're making reasonable progress with portals but we need an app that enables true patient stewardship of data (B)**
- **Big Data analytics - many products exist only in Powerpoint (B)**
- **Cloud/mobile - we need to accept that risk can never be zero (B)**

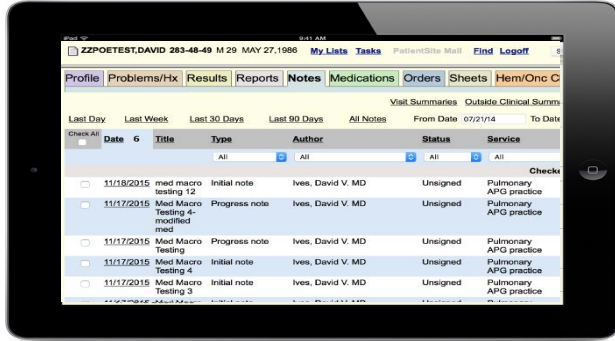


Where we need to go

- **EHR - my wife's thyroid issues and the need for "social" precision medicine**
- **Patient/Family engagement - my recent hypertension diagnosis and "internet of things" precision medicine**
- **Big Data Analytics - my wife's cancer experience and "clinical trial of one" precision medicine**

Patient and Provider Mobile Apps

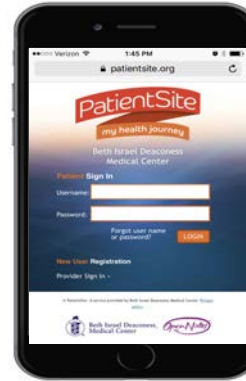
Clinician Apps



Inpatient Med Lists



PatientSite



Patient Questionnaires



Dragon

Medical Recorder



LifelImage Mobile



eyeRad

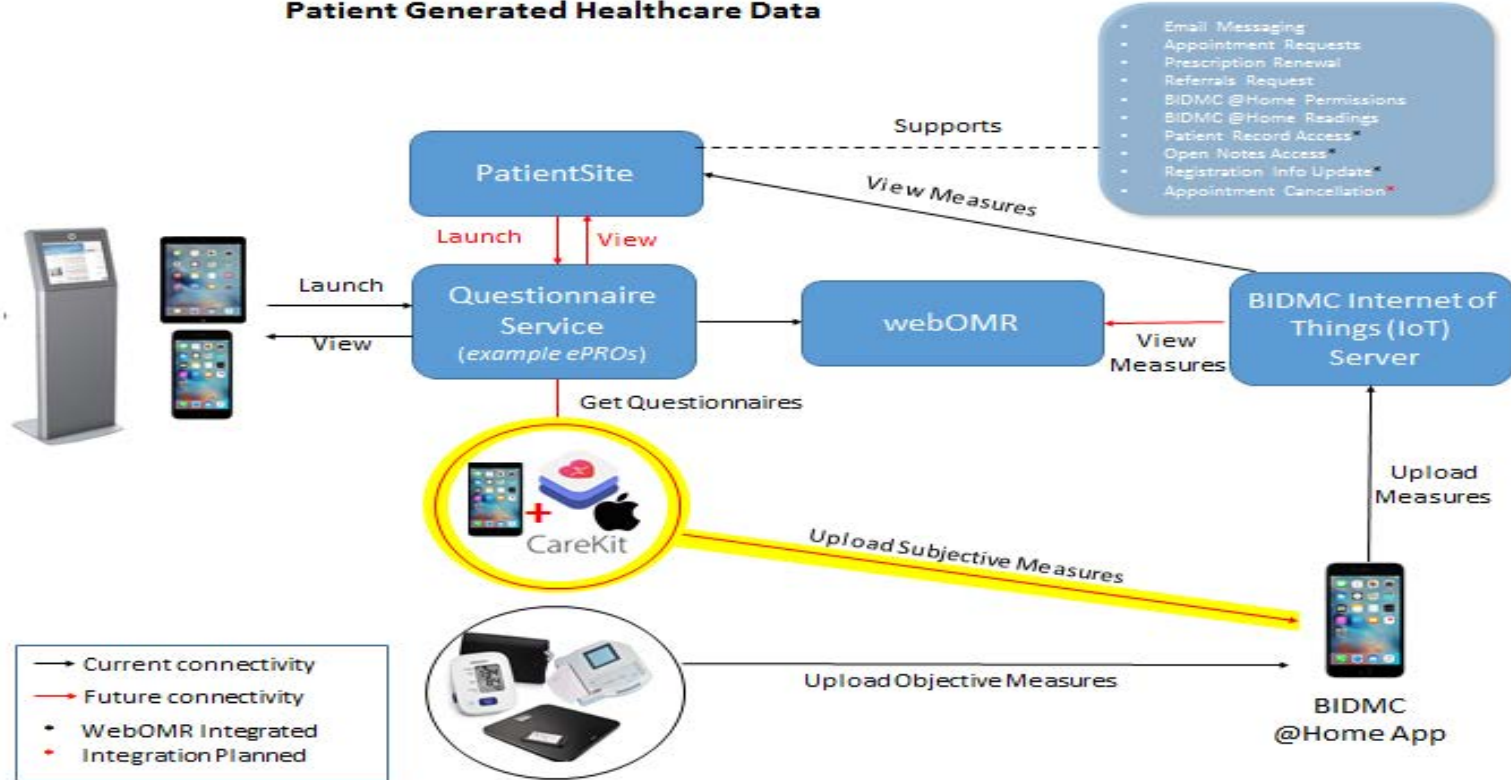


MyICU



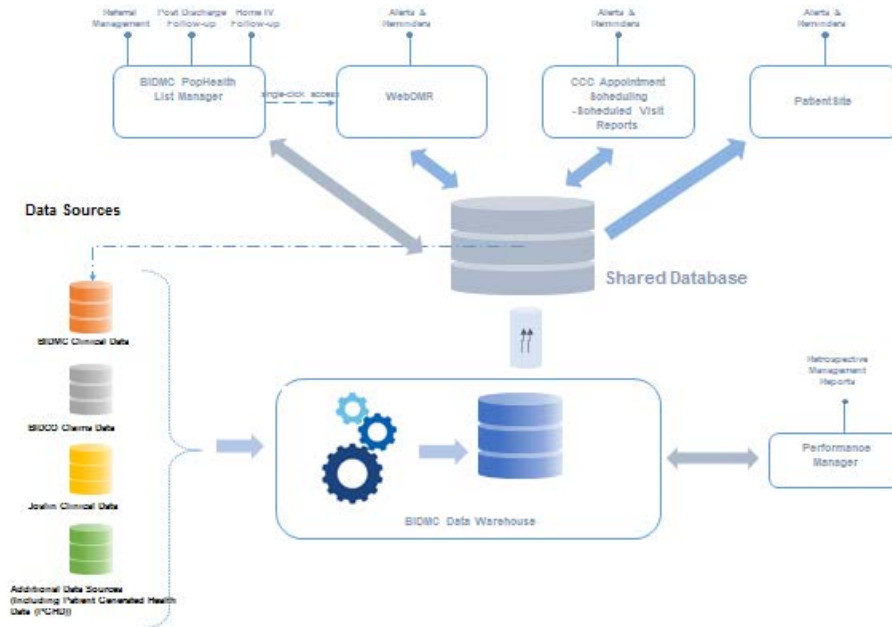


Patient Generated Healthcare Data





Population Health and Care Management





John Halamka, MD and Paul Cerrato, MA

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