

# Population Based, Precision Medicine

*A strategy to optimize employer  
population health & wellbeing*

Presented by: Quest Diagnostics and Guest

18<sup>th</sup> Population Health Colloquium  
Philadelphia, PA  
March 20, 2018



# Personalized Medicine, Machine Learning, and Genomics - A strategy to optimize employer population health & wellbeing

---

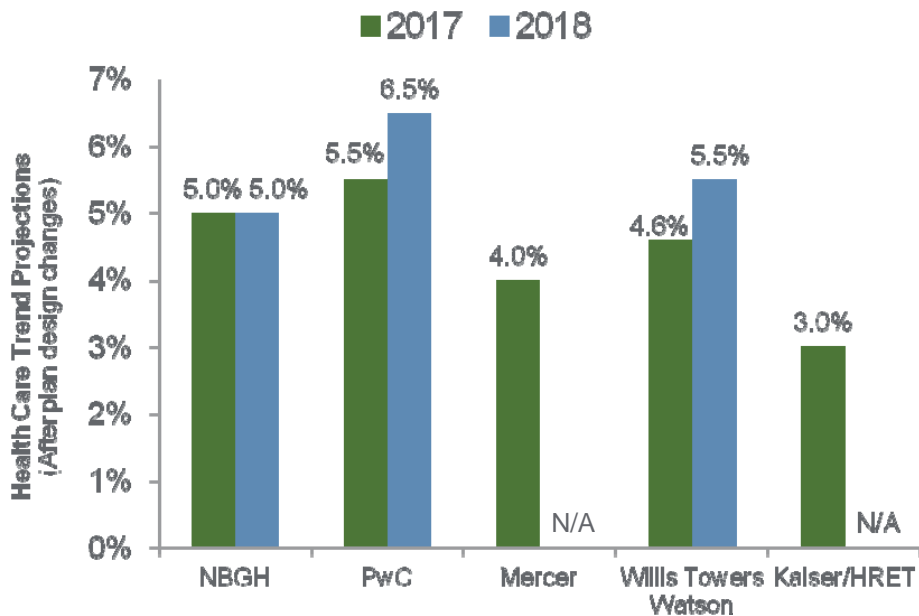
## Session Agenda

- 1. Workplace Screening as a Population Health Strategy to Identify and Engage High Cost Conditions** (30 min)  
Steven Goldberg, MD, MBA, VP, Chief Health Officer, Health & Wellness, Quest Diagnostics  
Maren Fragala, PhD, Director, HealthyQuest, Quest Diagnostics
- 2. Similarity analysis in population data to provide predictive power in patient-centered outcomes** (30 min)  
Wendi Mader, Director, Marketing and Strategy – Health & Wellness, Quest Diagnostics  
Stewart Sill, Senior Health Advisor, Consumer Health Strategy, IBM Watson Health
- 3. Population Based Precision Medicine: Delivering the Right treatment for the Right patient at the Right time across a population** (30 min)  
Jay Wohlgemuth, MD, SVP and Chief Medical Officer, Research & Development, Medical and Employee Health, Quest Diagnostics
- 4. Panel Discussion-All** (30 min)

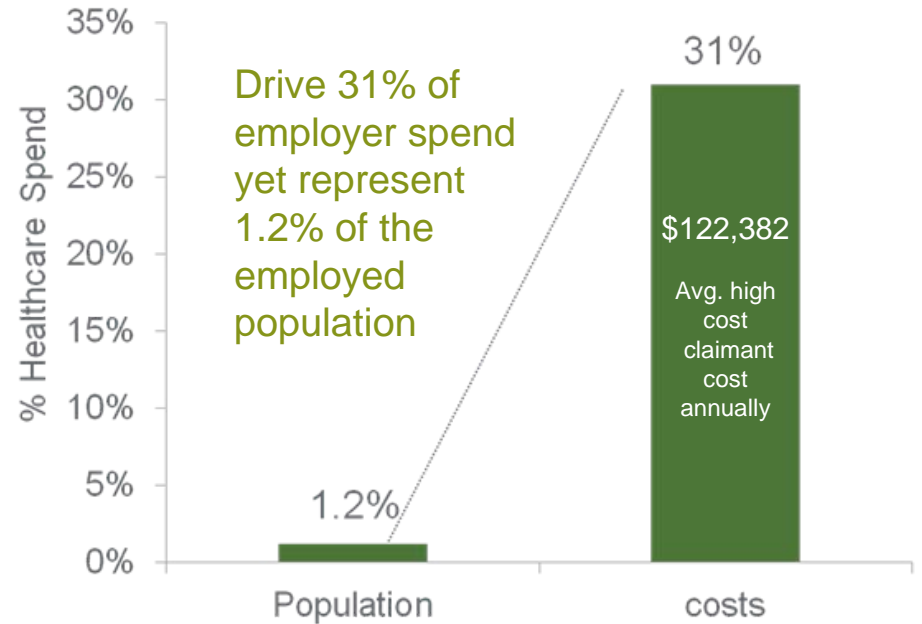
# Setting the stage: Health Care Costs

Employers continue to confront annual increases in the cost of health benefits.

**Current estimates have health care costs increasing by between 5.0% and 6.5% in 2018<sup>1,2</sup>**



**High Cost Conditions<sup>3</sup>**

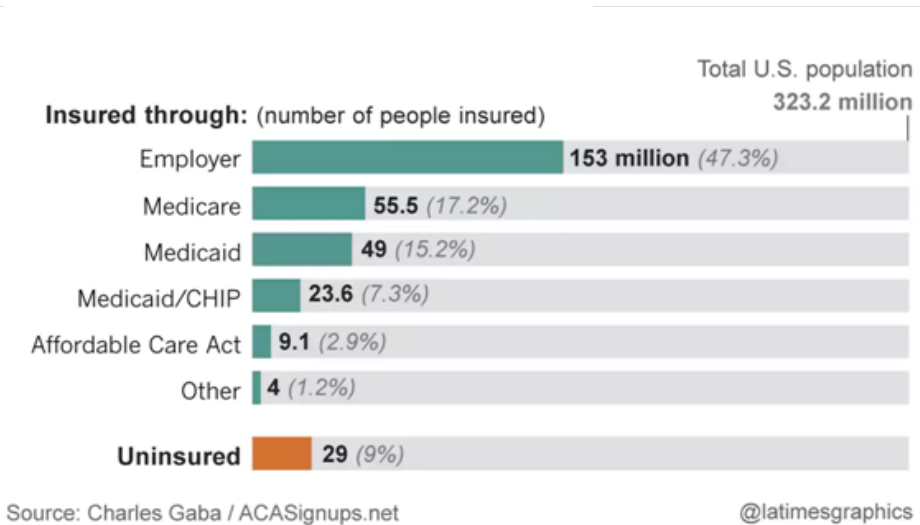


1. National Business Group on Health, Large Employers' 2018 Health Care Strategy and Plan Design Survey, 2017.2. NBGH. Numbers You Need. Infographic. U.S. Health Care Costs.3. American Health Policy Institute (AHPI) survey of 26 large employers

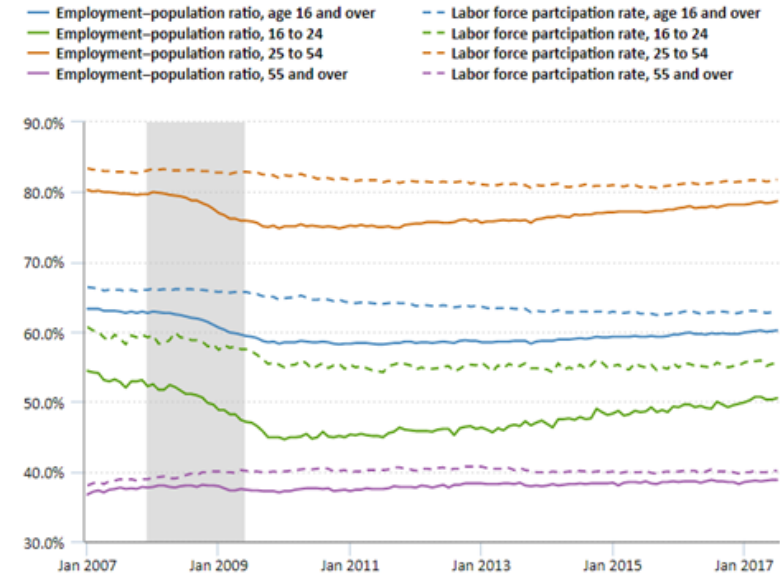
# Setting the stage: American Workforce Demographics

More Americans (153M) receive health benefits through an employer than any other source of coverage

## Healthcare coverage in U.S.



## Employment Population



Shaded area represents a recession as determined by the National Bureau of Economic Research. Click legend items to change data display. Hover over chart to view data. Source: U.S. Bureau of Labor Statistics.



# 1

VISION

Empowering  
**better health** with  
**diagnostic insights**

# 2

2-POINT STRATEGY

**Accelerate** growth

- Grow General Diagnostics
- Expand Advanced Diagnostics
- Extend Diagnostic Services

**Drive** operational excellence

- Enhance the Quest customer experience
- Deliver Invigorate operational efficiencies

# 3

GOALS

-  **Promote** a healthier world
-  **Build** value
-  **Create** an inspiring workplace

## HOW WE OPERATE



### Our principles

- Focus on diagnostic information services
- Strengthen organizational capabilities
- Deliver disciplined capital deployment



### Our behaviors

- Agile
- Customer Focused
- Transparent
- United as One Team
- Performance Oriented



### Our values

- Quality
- Integrity
- Innovation
- Accountability
- Collaboration
- Leadership

# Quest is part of the healthcare infrastructure...

Serves **50%**  
of hospitals



**470,000**  
Physicians  
connected to  
Care360 portal



**675+**  
EMR interfaces

Expanding retail  
presence



Access to  
**~80%** of U.S.  
insured lives




Serves **1/3** of the  
U.S. adult population



Q<sup>2</sup> Solutions helped  
develop **50%** of all  
FDA-approved Oncology Precision  
Medicine drugs since 2014


# Quest has a distinctive set of capabilities in our base business that we leverage to serve population health and extended care

**10,000**   
Mobile Nurses

 **3** Large Scale  
Call Centers

 **3,500**   
Logistics vehicles  
and 25+ aircraft



Connectivity with  
**470,000**   
physicians

**5,000**  
Mobile examiners  
and phlebotomists

**2,200**  
Patient Service  
Centers

# Workplace Screening as a Population Health Strategy to Identify and Engage High Cost Conditions

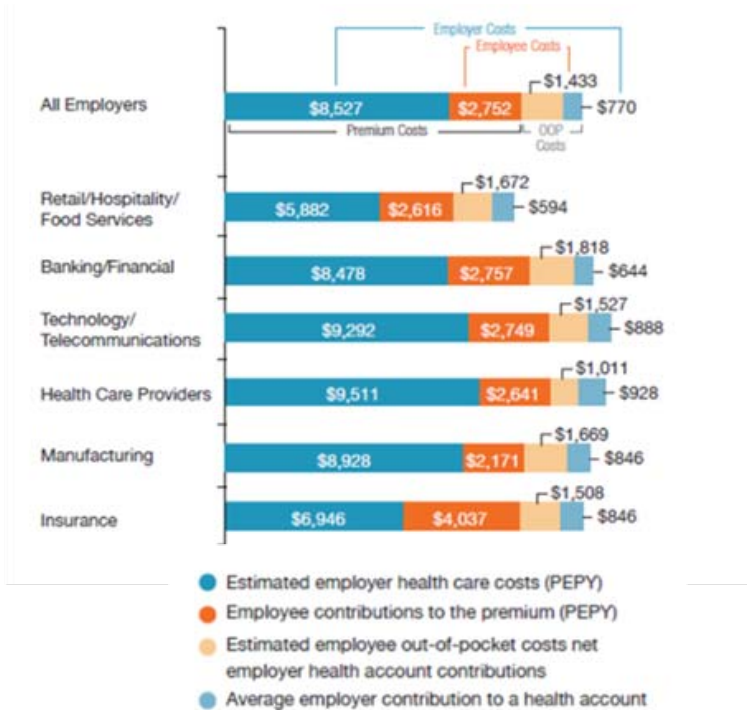
Steven Goldberg, MD, MBA, VP, Chief Health Officer  
Maren Fragala, PhD, CSCS\*D, Director, HealthyQuest



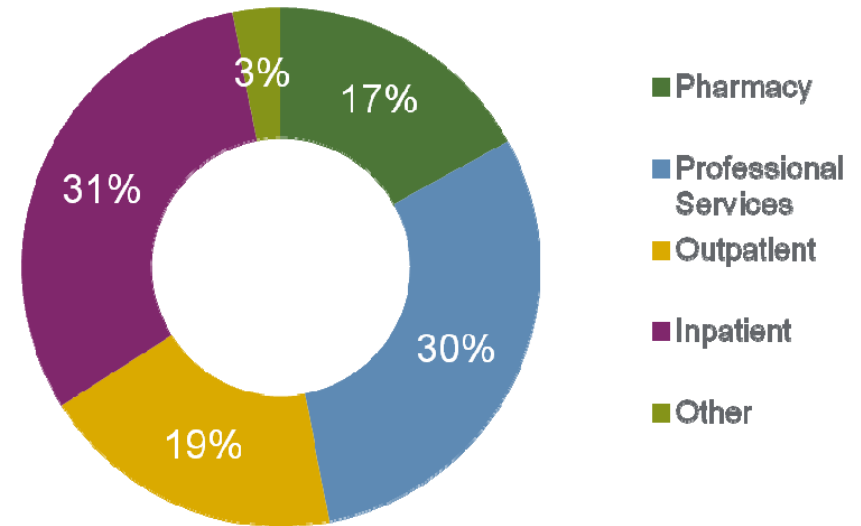
# Average Health Care Cost in 2017 was \$13,482 per employee\*

Employers paid \$9,297 (69%) and employees were responsible for \$4,185 (31%)<sup>1</sup>

## Health Care Costs by Industry<sup>1</sup>



## Components of Health Care Spending<sup>1</sup>



1. National Business Group on Health, Large Employers' 2018 Health Care Strategy and Plan Design Survey, 2017.

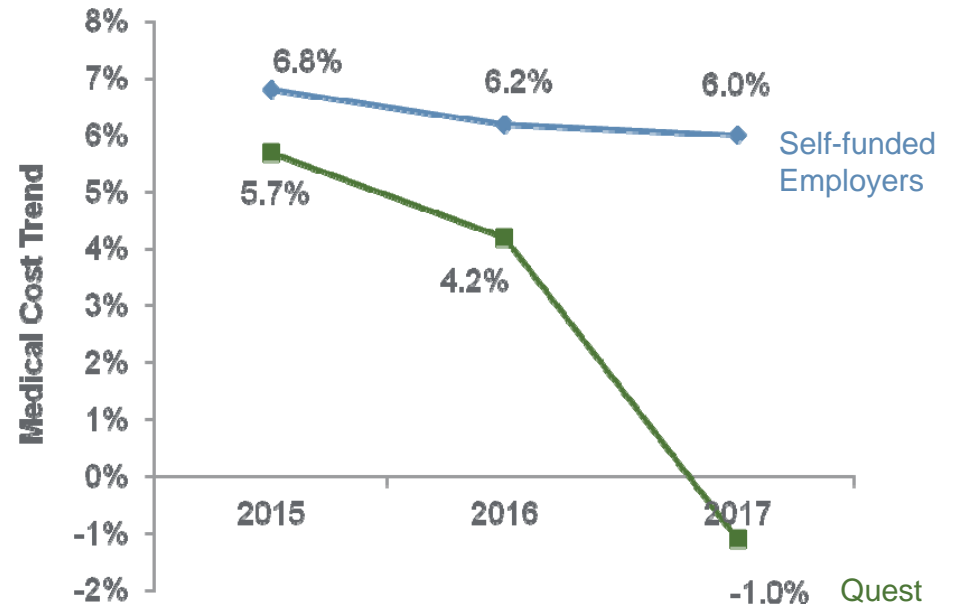
\* Includes out of pocket costs and contributions.

# 3 tier approach to controlling costs and improving care: plan design, health plan partner oversight, and population health

Population Health – Improved care and lower costs

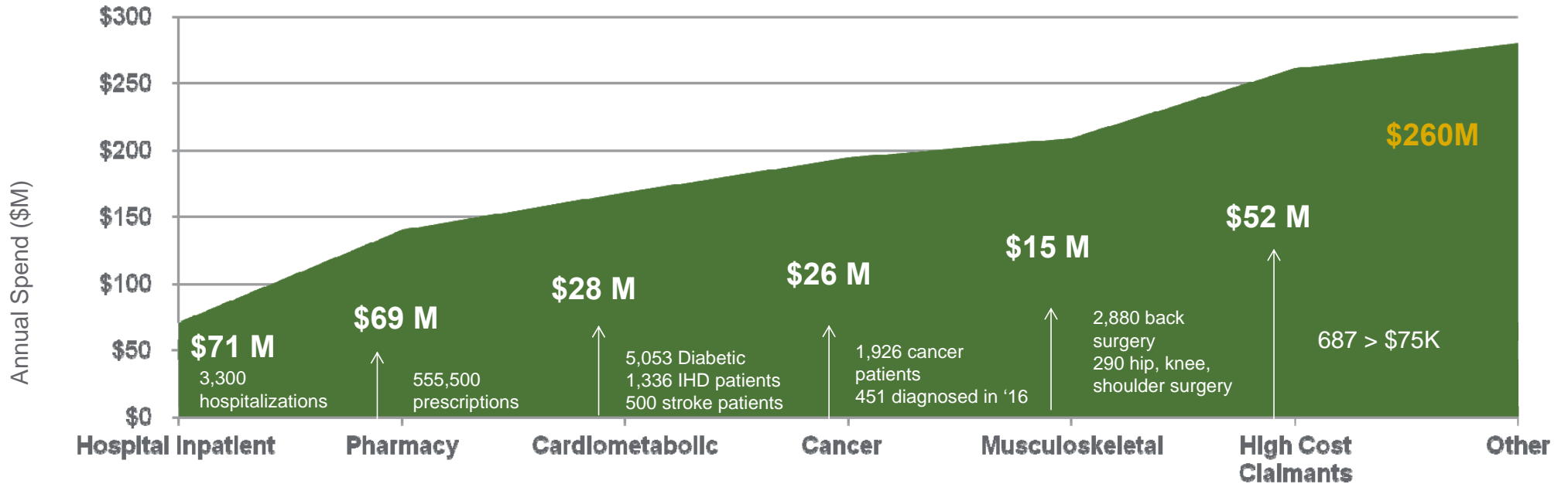


Annual self-funded employer claims trend vs. Quest



Source for Trend: PwC Health Research Institute medical cost trends 2007-2018. HRI recalibrated its trend estimates down for 2016 and 2017.

# Key spend categories Quest employee population



# Quest employee offered population health programs target clinical benefit and ROI

Comprehensive health screenings allows us to identify likely high-cost claimants.

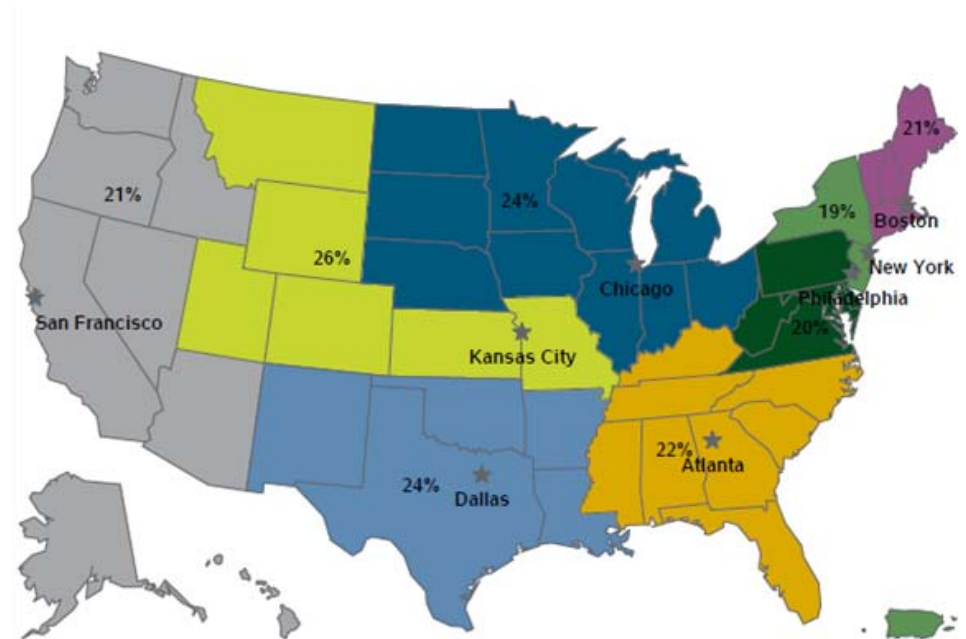
## Basic

- Obesity
- Metabolic Syndrome
- Blood pressure
- Cholesterol

## Comprehensive

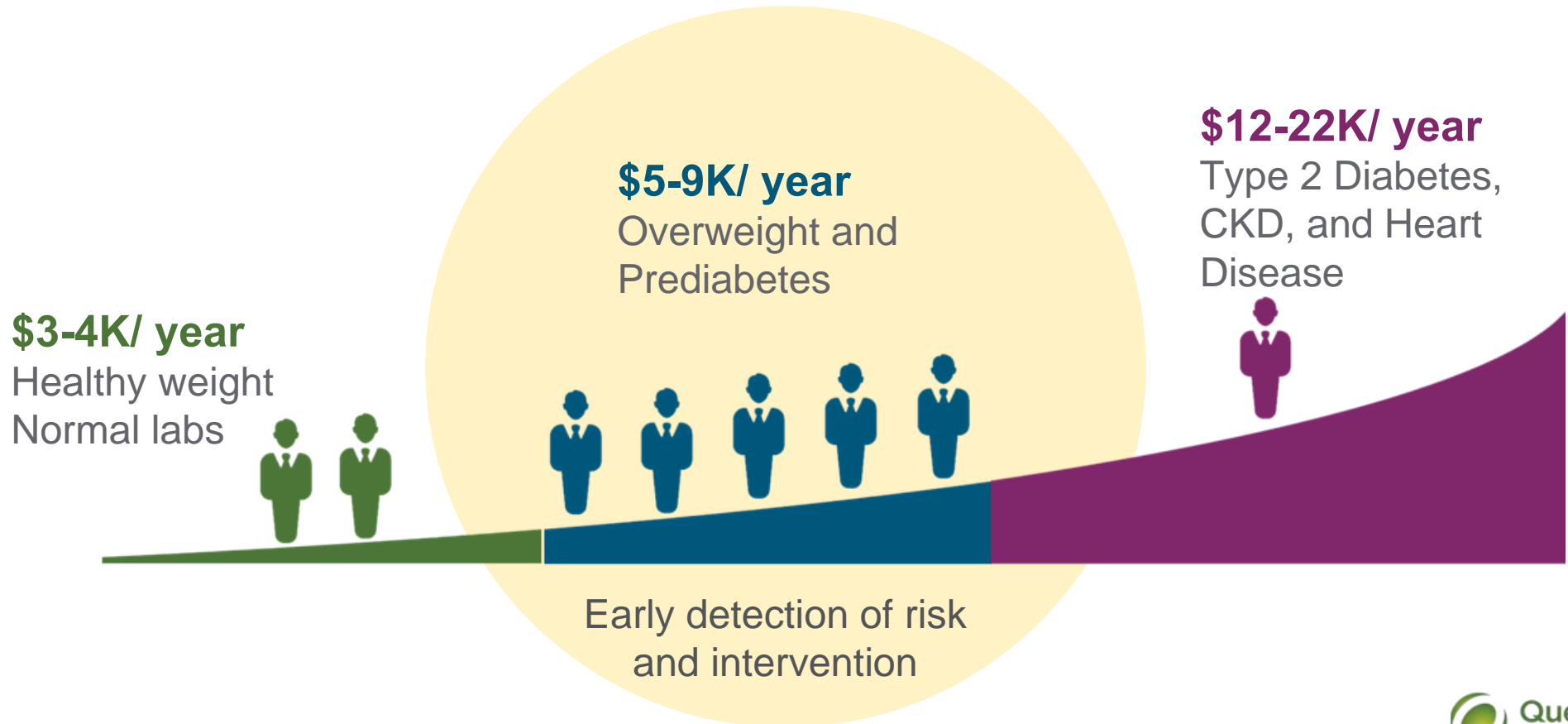
- Diabetes
- Prediabetes
- Chronic kidney disease
- Tobacco use
- Colon cancer
- Cardiovascular disease
- Liver disorders
- Thyroid issues
- Sleep apnea

## Prevalence of Metabolic Syndrome



# Need to identify and prevent potential high cost claimants

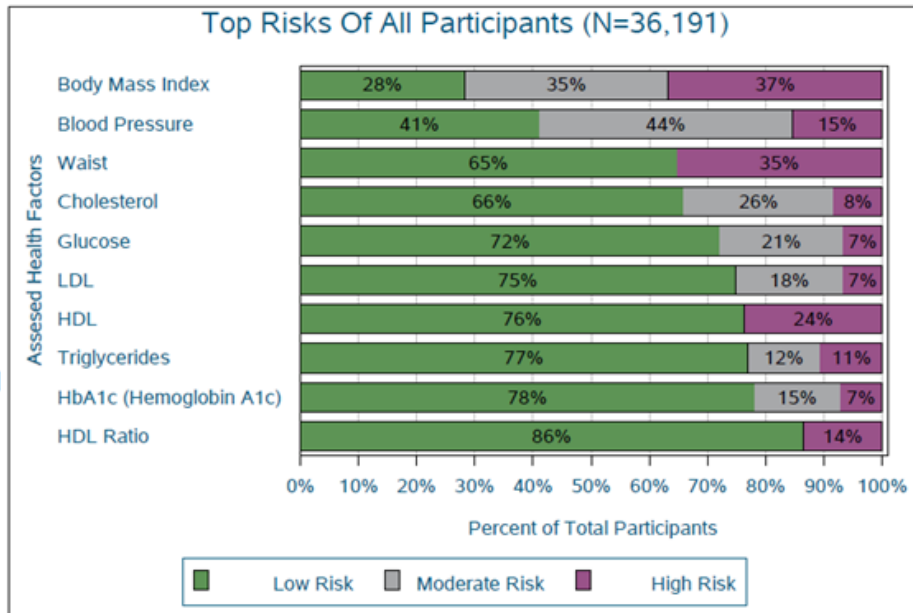
Comprehensive health screenings allow early detection of risk and intervention.



# State of *Our* Employee Health

We carry a high health risk burden for chronic disease.

## Blueprint for Wellness | 2017 Company Profile



## Health Burden

- **Health Risk Score** 18% higher than benchmark
  - Employees = 1.34 vs. Benchmark = 1.16
- **Risk factors in employee population** (mod. or high):
  - 72% at risk for BMI
  - 59% at risk for Blood Pressure
  - 22% at risk for HbA1c
- **Modifiable lifestyle & behavioral factors**  
Opportunities for intervention to reduce health risk:
  - Exercise – 86%
  - Nutrition – 67%
  - Stress - 27%
  - Tobacco – 11.5%



## Focus on 3 conditions for health impact and value

### Prediabetes:

**84.1 million**  
Americans have  
prediabetes <sup>1</sup>

**\$510**  
annual costs  
per case <sup>2</sup>

**90%**  
are not aware they  
have the condition<sup>1</sup>

### Diabetes

**1 in 10**  
Americans have  
diabetes<sup>3</sup>  
(diagnosed or undiagnosed)

**\$10,970**  
annual costs  
per case <sup>2</sup>

↓ **58%**  
in 3-yr risk with diabetes  
prevention program & 5%-  
7% sustained weight loss <sup>4</sup>

### Chronic Kidney disease (CKD)

**1 in 7**  
U.S. adults  
have CKD <sup>5</sup>

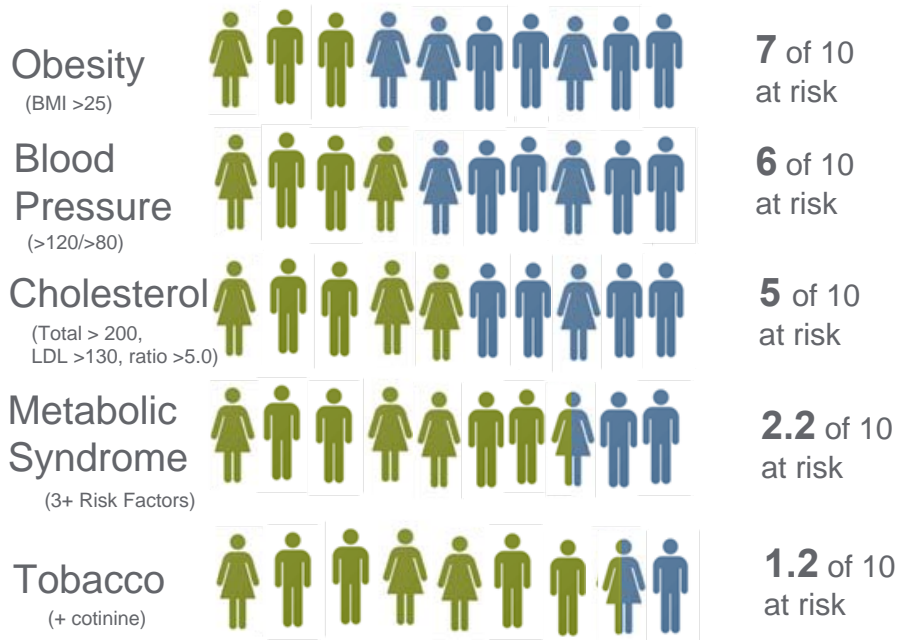
**\$12,700**  
annual costs per  
case (stage 4) <sup>7</sup>

↓ **68%**  
in risk of adverse events  
with healthy lifestyle<sup>6</sup>  
(BMI, PA, not smoking, diet)

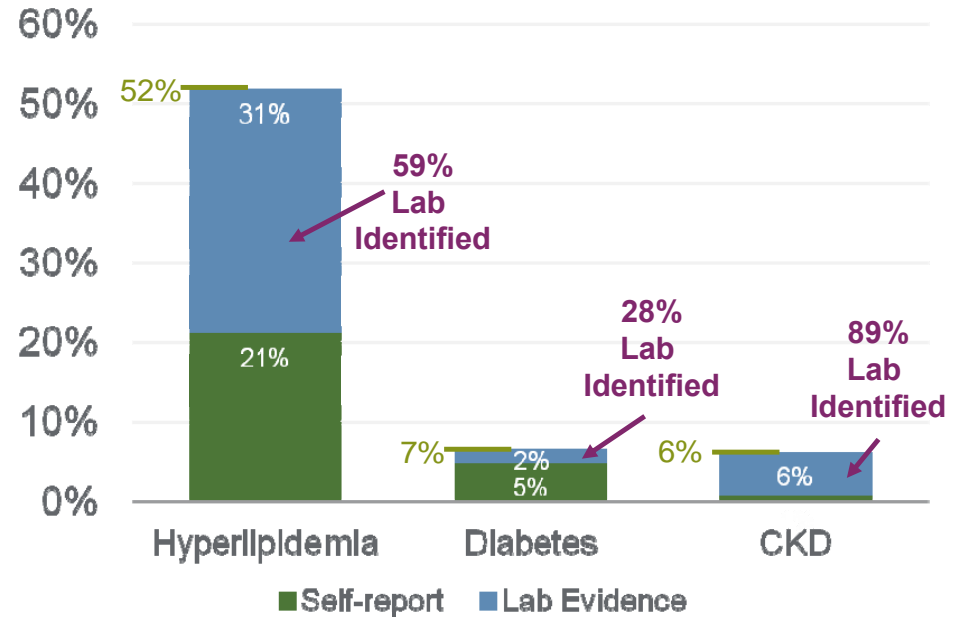
# Employees underestimate their illness burden

89% with High Risk for Chronic Kidney Disease, 59 % for High Cholesterol, and 28% for Diabetes first learned of health condition through lab-based wellness program

## Prevalence of chronic disease risk factors



## Newly identified health conditions

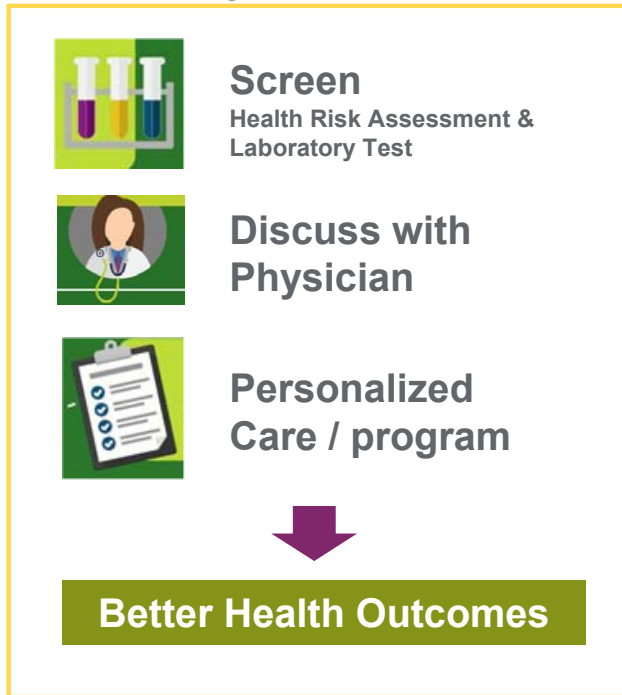




# Sustainability requires population health interventions

HealthyQuest bridges gaps in care to facilitate healthy living and reduce progression of chronic disease

## Care Pathway



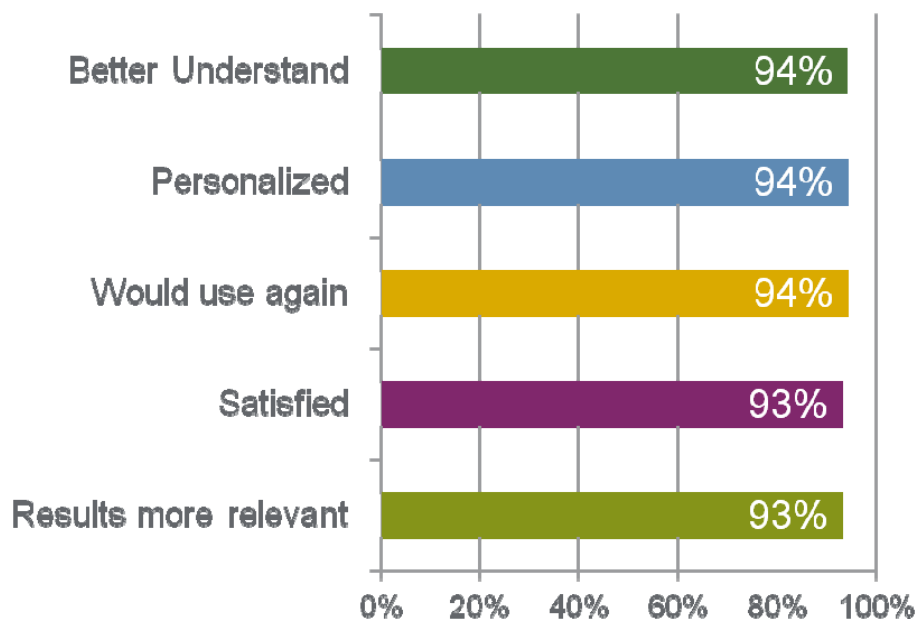
## Population Health



# Physician Health Information Sessions

Empowering better health through personal *understanding* diagnostic insights

## Member experience



## Frequently discussed Tests

1. Cholesterols (total, HDL, LDL, ratio) (29-44%)
2. Vitamin D (38%)
3. hs-CRP(34%)
4. Glucose (23%) & HbA1c (15%)
5. Iron (16%) & Ferritin (8%)

- 88% discussed behavior change diet (82%), physical activity (56%), meds (20%)
- 19% recommended physician follow-up in 1-4 weeks (80% in 1-3 mos.; 1% in 6 mos.)
- 9% transferred to GrandRounds

# Chronic Kidney Disease

## Screening and physician follow-up to prevent progression of chronic kidney disease and associated adverse health consequences



Having kidney disease increases the chances of also having heart disease and stroke <sup>1</sup>

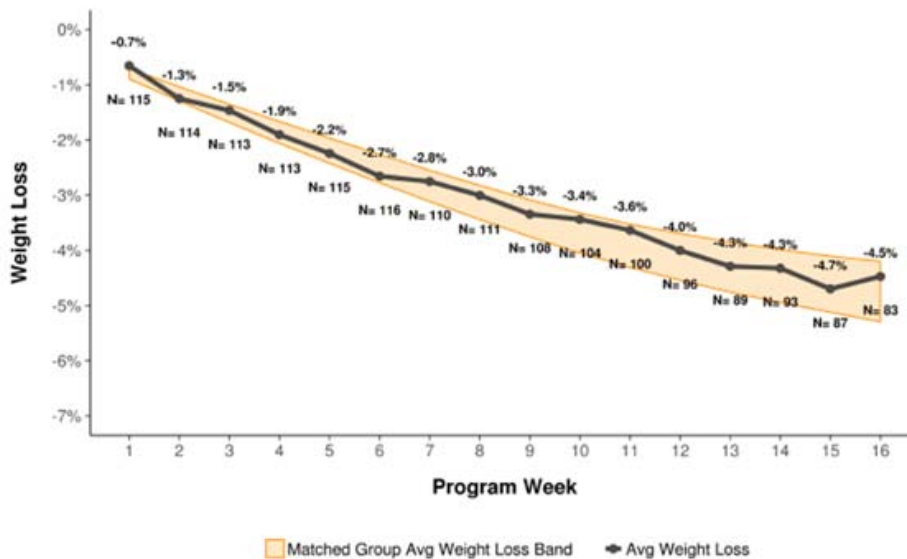


73% of end stage renal disease is attributable to modifiable risk factors, blood sugar, and blood pressure management <sup>1</sup>



1. CDC. National Chronic Kidney Disease Fact Sheet, 2017

# Screening + Care drives measurable outcomes with our 16-week Diabetes Prevention Program



- **Participants lost 4.5% bodyweight over 16 weeks<sup>1</sup>**
- **38% reduction in 3-yr diabetes risk<sup>2</sup>**

<sup>1</sup>140 enrolled; 110 completed 4-8 sessions; 83 completed 9+ sessions.

# Similarity analysis (Machine Learning) in population data to provide predictive power in patient- centered outcomes

Wendi Mader, Director, Marketing and Senior Health &  
Wellbeing Strategist

Stewart Sill, Senior Health Advisor, IBM Watson Health

# Patient centered outcomes

“Given my personal characteristics, conditions, and preferences, what should I expect will happen to me?”  
“What are my options, and what are the benefits and harms of those options?”

## Factors relating to the burden of chronic disease

- Conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks
- Factors related to urban design, school physical education, diminishing screen time, and workplace programs all stimulate physical activity
- Menu labeling, changes in food portion sizes, and increasing the availability of affordable, fresh produce can stimulate healthy diets
- Similarity analysis in population data by characteristics, conditions, and preferences can enable better health outcomes

...

## Social Determinants of Health



# Three key problems with current approaches to population health management



1

Screening is seen as an end point  
–not as a **starting point**

2

Basic screening **does not reveal**  
potential high cost claimants

3

High-cost claimants **are not** being  
provided convenient, rapid and simple  
access to care.

# Patient centered, Value-based care

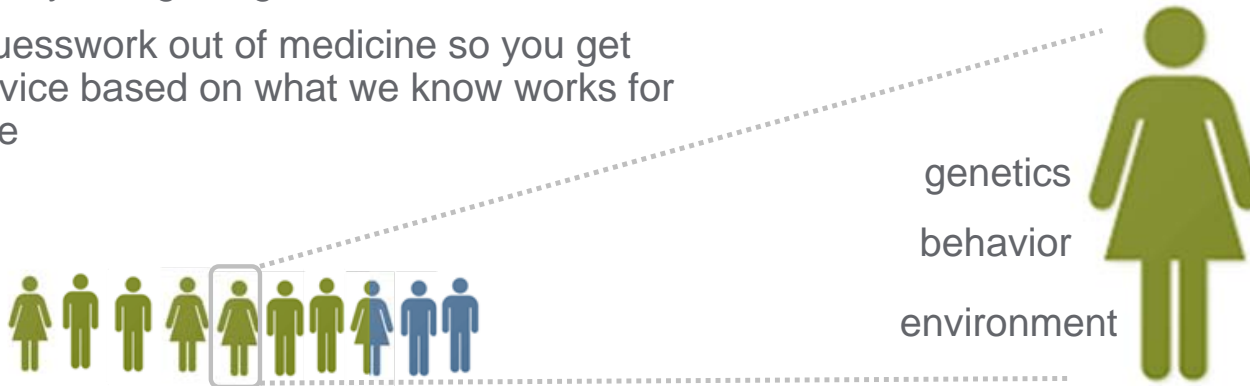
Effective population health management cannot be achieved without personalized medicine

## Population Health

- Evaluate big datasets to discover patterns in the diseases and health of large populations
- Goal is to give each person the best chance of staying healthy and getting well
- Take the guesswork out of medicine so you get the best advice based on what we know works for most people

## Patient-centered Personalized Medicine

- Individualizes care based on patients' characteristics such as their genetics, behavior, and environment.





# Population Health to Systems Approach

---

Population health screenings can reduce future morbidity and mortality when it identifies an actionable disease or pre-diseased state in asymptomatic people

## Population Health

- Seeks the most precise treatments for individuals with the goal of achieving the best health for everyone.
- Data on large groups allows us to do subgroup analyses.
- How age, sex, and other factors affect disease, diagnosis, and treatment to achieve more specific health guidance.
- Population health allows us to draw the most individualized conclusions.
- Many approaches to wellness and prevention occur outside the context of clinical practice. (Frieden , 2010).

## Systems approaches to biology and medicine

- Emerging model of medicine that focuses on maximizing wellness for each individual, rather than merely treating disease (Wood, 2004)
- Includes predictive, personalized, preventive, and participatory aspects.
- Extends beyond genomic medicine because “genes and their products almost never act alone, but in networks with other genes and proteins and in context of the environment” (Chakravarti, 2011)
- Provides opportunities to study and measure the effects of environmental exposures; (Gohlke JM, 2011 )

Fielding JE, Teutsch SM. An opportunity map for societal investment in health. *JAMA*. 2011 May 25; 305(20):2110-1. Systems biology, proteomics, and the future of health care: toward predictive, preventative, and personalized medicine. Weston AD, Hood L *J Proteome Res*. 2004 Mar-Apr; 3(2):179-96.

Chakravarti A. Genomics is not enough. *Science*. 2011;334:14–15. Gohlke JM, Thomas R, Zhang Y, et al. Genetic and environmental pathways to complex diseases. *BMC Syst Biol*. 2011 May 5;46 PMID 19416532

Frieden TR. A framework for public health action: the health impact pyramid. *Am J Publ Health*. 2010;98(9):1543–1544.

# Merging data sources for similarity analysis and predictive outcomes

## A variety of factors predict health outcomes in obesity



Endogenous factors: genes and gene expression;

Individual factors: dietary intake, exercise habits, TV-viewing patterns, and income;

Neighborhood factors, such as availability of grocery stores, walking environment, and food advertising;

School-related factors: availability of sugary beverages and school health education;

Industry factors: portion-size norms in restaurants and packaged foods;

State policies and regulation of food marketing; national food distribution programs and support for various agricultural products;

Life-course factors: history of breastfeeding, maternal health, and parental obesity.

# Leveraging data integration to manage employee health



## Blueprint for Wellness<sup>®</sup>

- Highly personalized reporting
- Specific key areas of focus with integrated programs to support change
- Predictive risk calculations providing deeper insights about the 'path a participant is on'
- Similarity analysis including age, gender, and geographic comparisons

# Personalized results that inspire change

Relevant comparisons

Prior year results

Coordinated care

Interactive online reporting

“The way the screening results were presented was truly extraordinary.”

**Your Health Quotient**

Your health quotient score is **75** out of 100.

Your past results:

- Aug. 2012: 88
- Jan. 2014: 46
- July 2010: 72
- Apr. 2009: 40

Choose a health factor to see your results and what they mean for your overall health.

**Key Areas of Focus**

- Metabolic Syndrome**  
Definition: A combination of five factors that you combine you can be defined as having metabolic syndrome, but not all are necessary for diagnosis.
- Blood Pressure**  
Definition: Pressure of your blood as it moves through your body.
- Triglycerides**  
Definition: Type of fat in your blood.

**Hemoglobin A1c**

Your result is in the high range. This means you have a higher risk of developing and you should discuss the value of this result with your doctor. Hemoglobin A1c is a measure of your average blood sugar levels over the past 2-3 months. It is a good indicator of how well your diabetes is managed. If you have already been told that you have diabetes, this is a good sign that you are doing well.

**Body Mass Index (BMI)**

The quantity of being in a body is measured.

**Quest Diagnostics**

# Blueprint for Wellness – opportunities for additional value

---



## Identification/Awareness

- Personalized offers for screening based on demographics, health, and consumer profile
- More targeted risk feedback and predictive insights/modeling from integration of multiple data sources
- Deeper risk alerts related to specific conditions



## Education/Activation

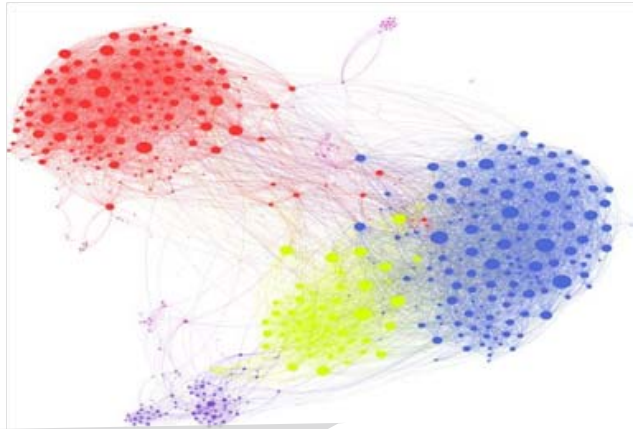
- Prioritized action list based on guidelines/research (eg, behaviors, preventive care)
- What works best for people like them



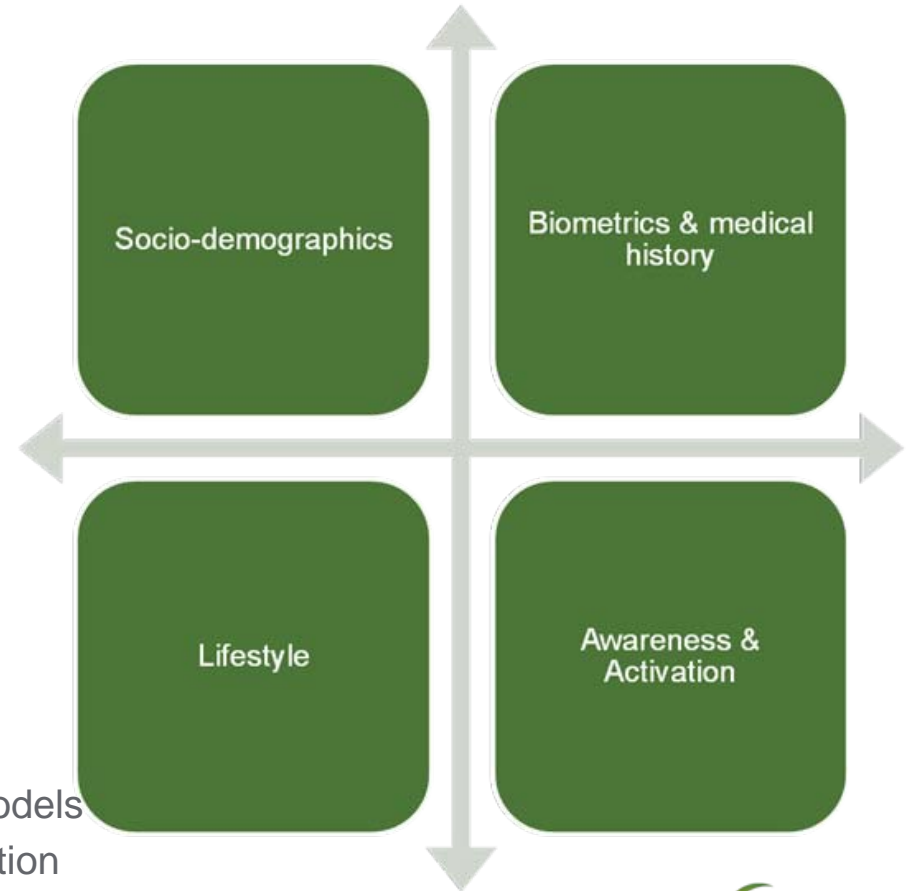
## Referral/Follow-up

- Easy pass into personally relevant follow-up care/support/tools
- Follow-up alerts/monitoring to prompt actions at the right times

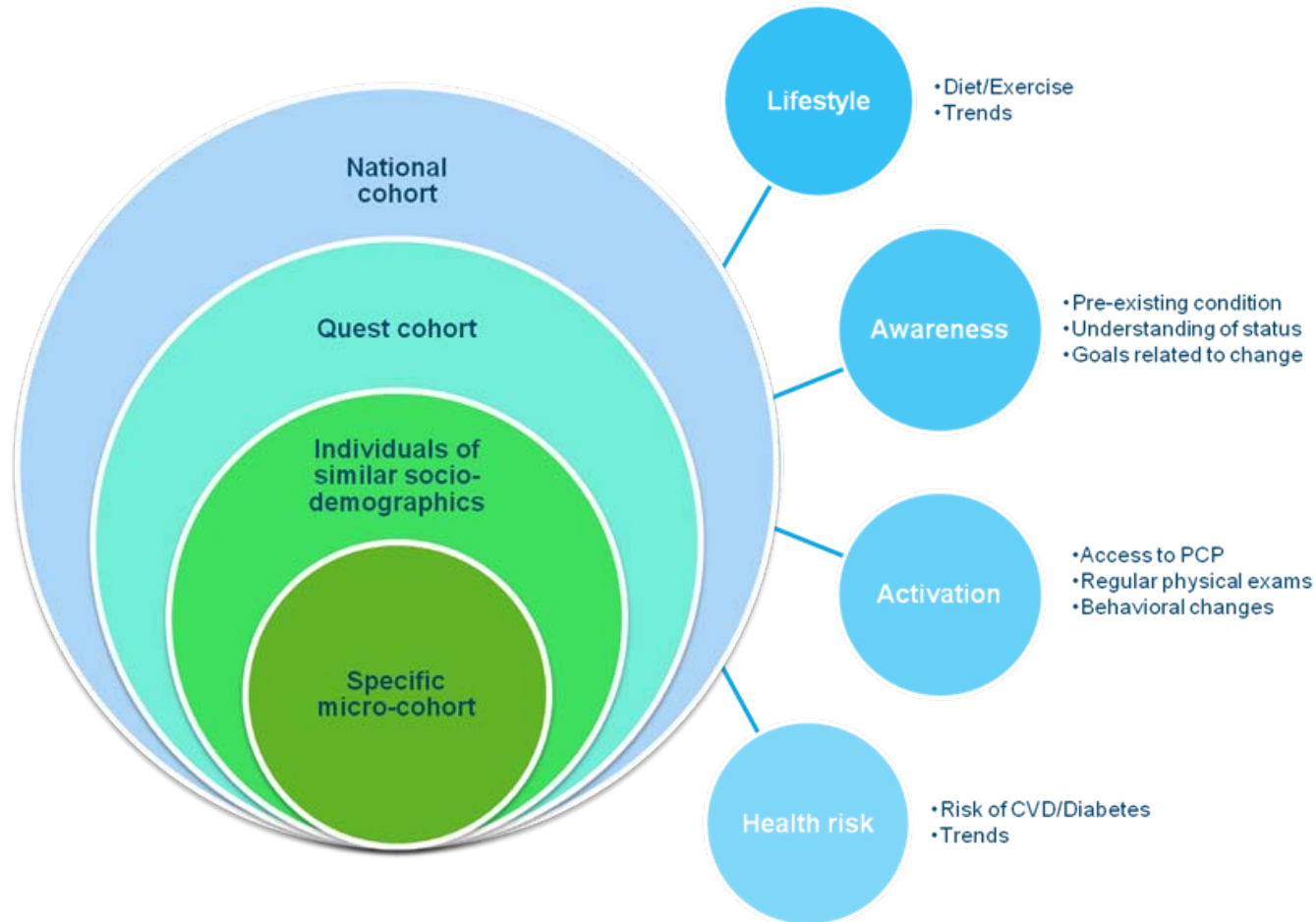
# Data and knowledge driven approach



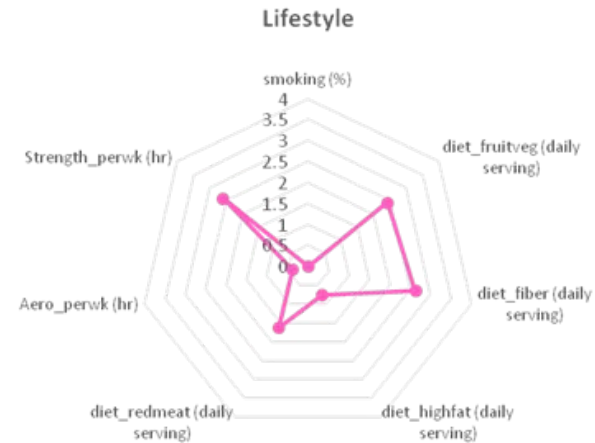
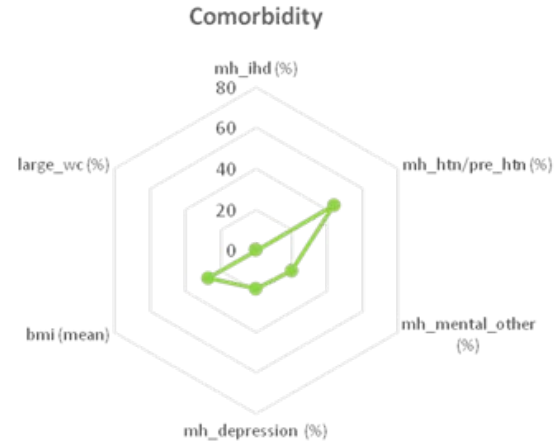
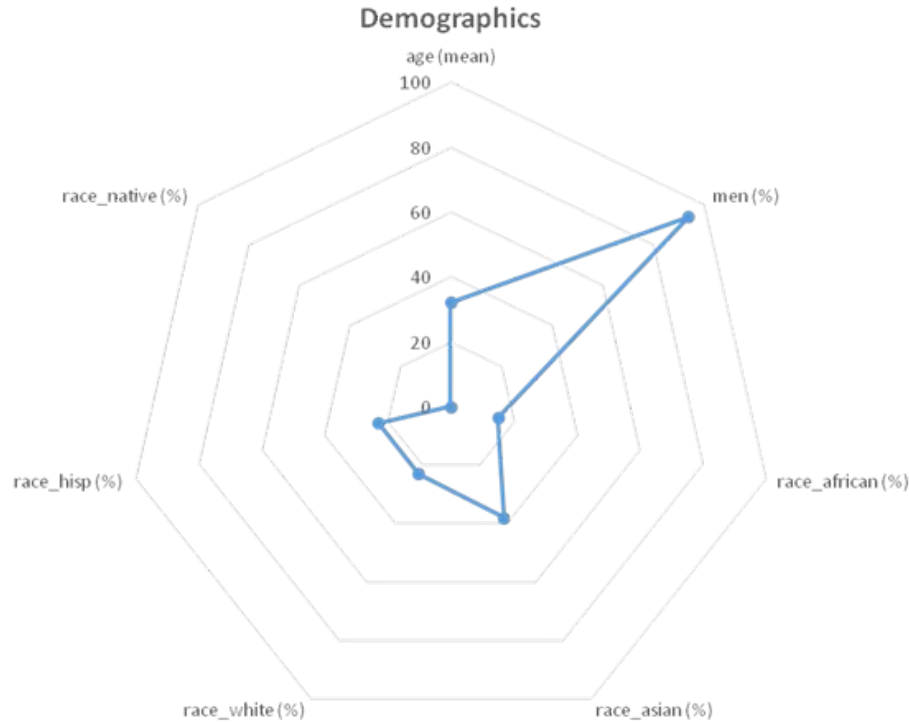
- Integrated participant record
- Longitudinal trend analyses
- “People like me” clustering
- Risk assessment and predictive models
- Guidelines extraction and prioritization
- Context personalization



# Machine Learning Clustering Revealed 23 Unique Personas

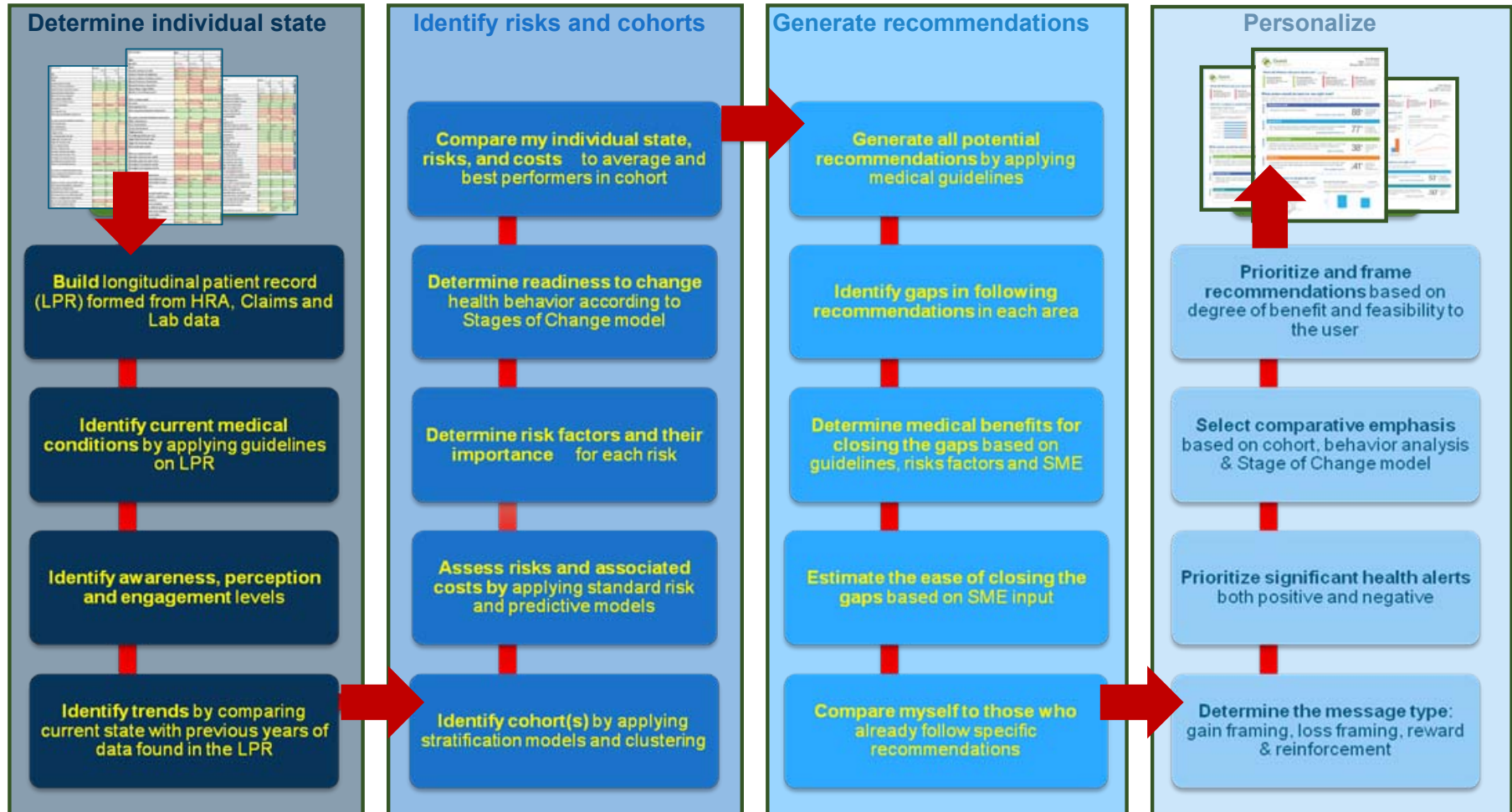


# Example Persona – The Macho Men





# Report Generation Process Overview



What did Watson discover about me? [Learn More...](#)

<p><b>Opportunity:</b> Your health measures related to Metabolic Syndrome are higher than other people like you. <a href="#">Learn more below.</a></p>	<p><b>Opportunity:</b> Your blood pressure, cholesterol, and weight have continued to increase each year. <a href="#">See trends</a></p>	<p><b>Opportunity:</b> Your blood sugar had previously decreased, but has returned to an elevated level.</p>	<p><b>Congratulations!</b> Your strength training exercise, not smoking, and stress management are providing benefits.</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------

How do I compare to people like me? [Learn More...](#)

**Health Profile is below Peers** [Learn More...](#)

Your risk of heart disease is 3 times higher than peers of the same age, gender, and race but whose health measures are in the target range.

**Comparison to people of same age, gender, and race**

■ Peers better than you ■ Peers worse than you

**Beware of Financial Impact** [Learn More...](#)

Based on the experience of others, if your health status continues to worsen, you will likely require more healthcare services and your out of pocket costs could increase by 50% per year.

**Change in healthcare costs if health status:**  
■ worsens, ■ improves, ■ remains the same

What action would be best for me right now?

Based on Watson's analysis of options, the actions below would be mostly likely to help improve your health, reduce risk of disease, prolong your life, and increase your energy and well-being now.

<p><b>ACTIVITY &amp; EXERCISE</b></p> <p>Starting an exercise routine is the hardest part. You're already there with strength training. Now begin to add 10 minutes of aerobic exercise each day (for example, walking or swimming) with a long-term goal of 2.5 hours per week. <a href="#">Tips and Tools</a></p>	<p><b>43%</b> Of your peers do aerobic exercise 3+ days per week</p>
<p><b>PREVENTIVE CARE</b></p> <p>Health improvement is a team sport. You don't need to do it alone. Establish a relationship with a primary healthcare provider you trust to guide and support you along the way. <a href="#">Find a provider in your network</a></p>	<p><b>68%</b> Of your peers have a primary care provider</p>
<p><b>FOOD &amp; DIET</b></p> <p>A healthy eating pattern goes hand in hand with exercise when managing weight. Consider making small changes to your eating habits with the initial goal of reducing your body weight by 5%. <a href="#">Get a personalized plan and support</a></p>	<p><b>33%</b> Lower risk of diabetes for you at healthy weight</p>

George and Ann have nearly **identical biometric profiles** (Metabolic Syndrome) but differ on other factors like trends, risk, awareness, behaviors, motivation, and comparison to peers, therefore have **different report features.**

What did Watson discover about me? [Learn More...](#)

<p><b>Congratulations!</b> Your blood pressure, cholesterol, and blood sugar have improved.</p>	<p><b>Congratulations!</b> Your improved nutrition and physical activity have contributed to your health improvements.</p>	<p><b>Opportunity:</b> Continued improvements are needed to address your Metabolic Syndrome and reduce disease risk. <a href="#">Learn more</a></p>	<p><b>Opportunity:</b> You appear to be overdue for a breast cancer screening, which is important based on your age and family history.</p>
-----------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------

What action would be best for me right now?

Based on Watson's analysis of options, the actions below would be mostly likely to help improve your health, reduce risk of disease, prolong your life, and increase your energy and well-being now.

<p><b>PREVENTIVE CARE</b></p> <p>Complete your breast cancer screening. <a href="#">Find a provider in your network</a></p>	<p><b>88%</b> Of your peers are up to date with breast cancer screening</p>
<p><b>MEDICATION</b></p> <p>Visit your primary care provider to discuss if medication would be useful in managing your cholesterol and blood pressure in addition to your lifestyle changes. <a href="#">Schedule an appointment now</a></p>	<p><b>77%</b> Of your peers on cholesterol medications are now under control</p>
<p><b>ACTIVITY &amp; EXERCISE</b></p> <p>Starting an exercise routine is the hardest part. You've already begun, so now just add one more day of aerobic exercise to your weekly routine to amplify the benefits, with a long-term goal of 2.5 hours per week. <a href="#">Ways to increase...</a></p>	<p><b>38%</b> Of your peers do aerobic exercise 3+ days per week</p>
<p><b>TOBACCO</b></p> <p>Continuing to smoke takes away from the accomplishments you've already made in diet and exercise. Take advantage of quit smoking resources which might be effective for you. <a href="#">View available options</a></p>	<p><b>41%</b> Lower risk of heart disease for you by stopping smoking</p>

How do I compare to people like me?

<p><b>Your Habits are Better than Average</b> <a href="#">Learn More...</a></p> <p>Comparing with other people of similar age, gender, and race, your nutrition and physical activity habits are above average, but still opportunity for improvement.</p> <p><b>Lifestyle habits compared to your peers</b></p>	<p><b>See the Positive Impact</b> <a href="#">Learn More...</a></p> <p>Your healthy lifestyle changes and health status improvements are decreasing your risk for heart disease, based on evidence from similar populations.</p> <p><b>Changes in your risk of developing heart disease</b></p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

What did Watson discover about me? [Learn More...](#)

**Opportunity:**  
It is important to prioritize your weight and blood sugar, which have increased and are becoming high risk.

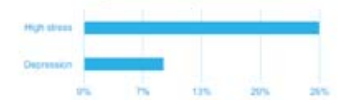
**Opportunity:**  
Your data indicates you may be affected by depression and high stress which can make healthy lifestyle habits more difficult. Thankfully, there are strategies to help. See below.

**Congratulations!**  
Since you have had success with healthy habits in the past, it should be easier to pick them up again.

How do I compare to people like me? [Learn More...](#)

**You're Not Alone** [Learn More...](#)  
Among women your age and race, many others also have depression and report high stress. You can learn what your peers are doing to stay healthy.

Peers also dealing with stress and depression



**Benefit from Healthier Habits** [Learn More...](#)  
Comparing with others, your nutrition and physical activity habits fall below average. Improvements could quickly improve your energy and well-being.

Lifestyle habits compared to your peers



What action would be best for me right now?

Based on Watson's analysis of options, the actions below would be most likely to help improve your health, reduce risk of disease, prolong your life, and increase your energy and well-being now.

**MENTAL HEALTH**

Take advantage of the Employee Assistance Program (EAP) to support your depression and stress. This service has greatly benefited many of your colleagues. [Get started easily now](#)

64% Of peers with depression report that their personal productivity is negatively impacted

You can also talk with a primary healthcare provider about what strategies might be helpful for you. Establishing a relationship with a regular healthcare provider you trust provides a key resource. [Find a primary care provider in your network](#)

---

**WEIGHT MANAGEMENT**

Re-commit to managing your weight and reaping the benefits. Re-establish a healthy eating pattern through small changes each week. Re-engage in regular physical activity, starting with 20-30 minutes twice per week, with a long-term goal of reaching 2.5 hours per week. [Find tools and support](#)

↓ 45% Lower risk of diabetes for you at a healthy weight

---

**TOBACCO**

Smoking can undermine your efforts with diet and exercise. But since you recently started smoking, it will likely be easier to stop now vs. waiting until later. Take advantage of quit smoking resources which might be effective for you. [View available options](#)

↓ 42% Lower risk of heart disease for you by stopping smoking

Example Report Features for Persona Pairs

Alice and Sofia have nearly identical biometric profiles (Pre-Diabetes) but differ on other factors like trends, risk, awareness, behaviors, motivation, and comparison to peers, therefore have different report features.

What did Watson discover about me? [Learn More...](#)

**Congratulations!**  
It is great that you have a regular primary healthcare provider to support you.

**Opportunity:**  
Your body weight has increased to a higher level of obesity (called Class II Obesity), which further increases disease risk.

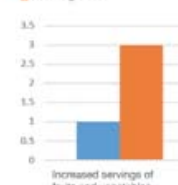
**Opportunity:**  
You should pay extra attention to your increasing blood sugar levels because of your family history of diabetes.

**Opportunity:**  
It appears you have been prescribed medication for your blood sugar but may not be taking it.

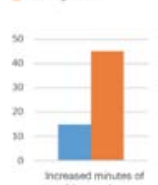
How do I compare to people like me? [Learn More...](#)

**Learn from Others** [Learn More...](#)  
Other people like you who have been successful at losing weight have made changes to their eating and exercise habits.

Increase in fruits and vegetables among those who successfully lose weight

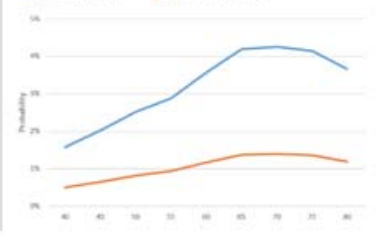


Increase in aerobic exercise among those who successfully lose weight



**Lower Your Risk** [Learn More...](#)  
Currently your risk of developing diabetes is 3 times higher compared to others like you, but this can be changed through healthier lifestyle habits.

Your risk of diabetes over the course of your life



What action would be best for me right now?

Based on Watson's analysis of options, the actions below would be most likely to help improve your health, reduce risk of disease, prolong your life, and increase your energy and well-being now.

**MEDICATION**

You should take medications as prescribed or discuss barriers and possible alternatives with your primary care provider. [Learn more about your medication](#)

53% Of your peers on medications for blood sugar are now under control

---

**FOOD & DIET**

A Registered Dietician would be another key player in your healthcare team. Meet with one soon for personalized meal planning guidance, which can help decrease your weight and prevent diabetes. [Schedule an appointment](#)

↓ 50% Lower risk of diabetes for you at a healthy weight

# Population Based Precision Medicine: Delivering the Right treatment for the Right patient at the Right time - across a population

Jay Wohlgemuth, MD, SVP and Chief Medical Officer

# Population based precision medicine

---

- Aggressive population health implementation programs improve health and lower costs of care for employers and employees
- Use of population data drives programs to connect individuals to the precision care they need – right intervention, right cost, right provider
- Technologies are transforming the care we can deliver to consumers in their homes / communities
- ALL healthcare is consumer healthcare – reduction in complexity and increased convenience for consumers is a critical enabler of population health strategies

# Unhealthy employees are hurting your bottom line.

1.2%  
of your  
employees  
are high cost  
claimants

*Each of them  
cost*

**\$122k**

*on average  
annually.<sup>1</sup>*

Also— health-related issues are costing you in lost work and medical copays.<sup>2</sup>

1. American Health Policy Institute. 2016. **High Cost Claimants: Private vs. Public Sector Approaches**

2. CDC. 2017. **Business Pulse**



# We innovate across healthcare disease areas and technologies

> 650 MDs and PhDs with broad-ranging expertise



General Diagnostics



Advanced Diagnostics



Diagnostic Services

Cardiometabolic &  
Endocrine



Cancer  
Diagnostics



Lab  
Services



Employer  
and Consumer



Prescription  
Drug  
Monitoring



Infectious  
Diseases &  
Immunology



Women's  
Health



Neurology

Clinical Trials /  
Q2 Solutions



Sports  
Diagnostics

# Quest Diagnostics has transformed to the leader in Diagnostic Information Services (more than a lab)

---

Partnerships with leaders in healthcare

Enabling consumers to access care

Big data to improve population health

**Empowering better health with diagnostic insights**

Smart use of IT tools and integrated solutions

Delivering advanced diagnostics to the community

Hospital to Home: right care, right cost, in a convenient way



# Quest Quantum™ - A critical enabler of solutions for populations, providers, and patients



Analyze

## Analytics Suite

- Data Diagnostics
- Lab Utilization
- On Demand Informatics
- Clinical Pathways



Connect

## Clinical & Financial Suite

- eLabs
- ePrescribing
- Interactive Insights
- IBM Watson Genomics
- EHR
- Practice Management
- Revenue Cycle Management

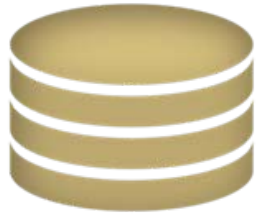


Engage

## Digital Experiences

- MyQuest™
- Healthcare Provider Portal
- Quantum Analytics Portal
- BluePrint for Athletes™

# Our Health Trends database —driving value for our customers and country



>20B



HCV screening and treatment with CDC and Rx partners

Closing gaps in care with Data Diagnostics®

Diabetes prevention with AMA and CDC

Improving mutation analysis actionability

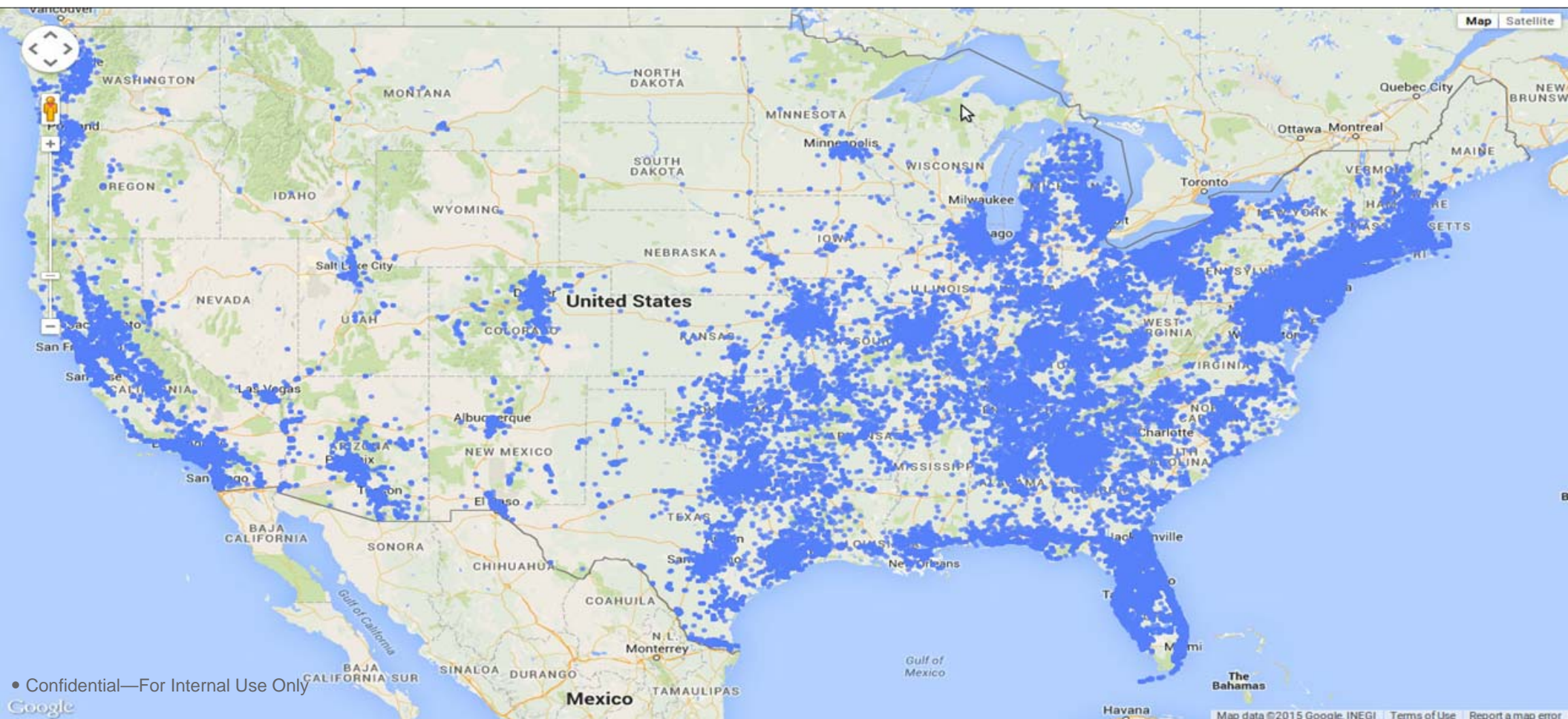
Annual Prescription Drug Monitoring Health Trends™ report

Providing access to cancer precision medicine with IBM Watson and MSKCC

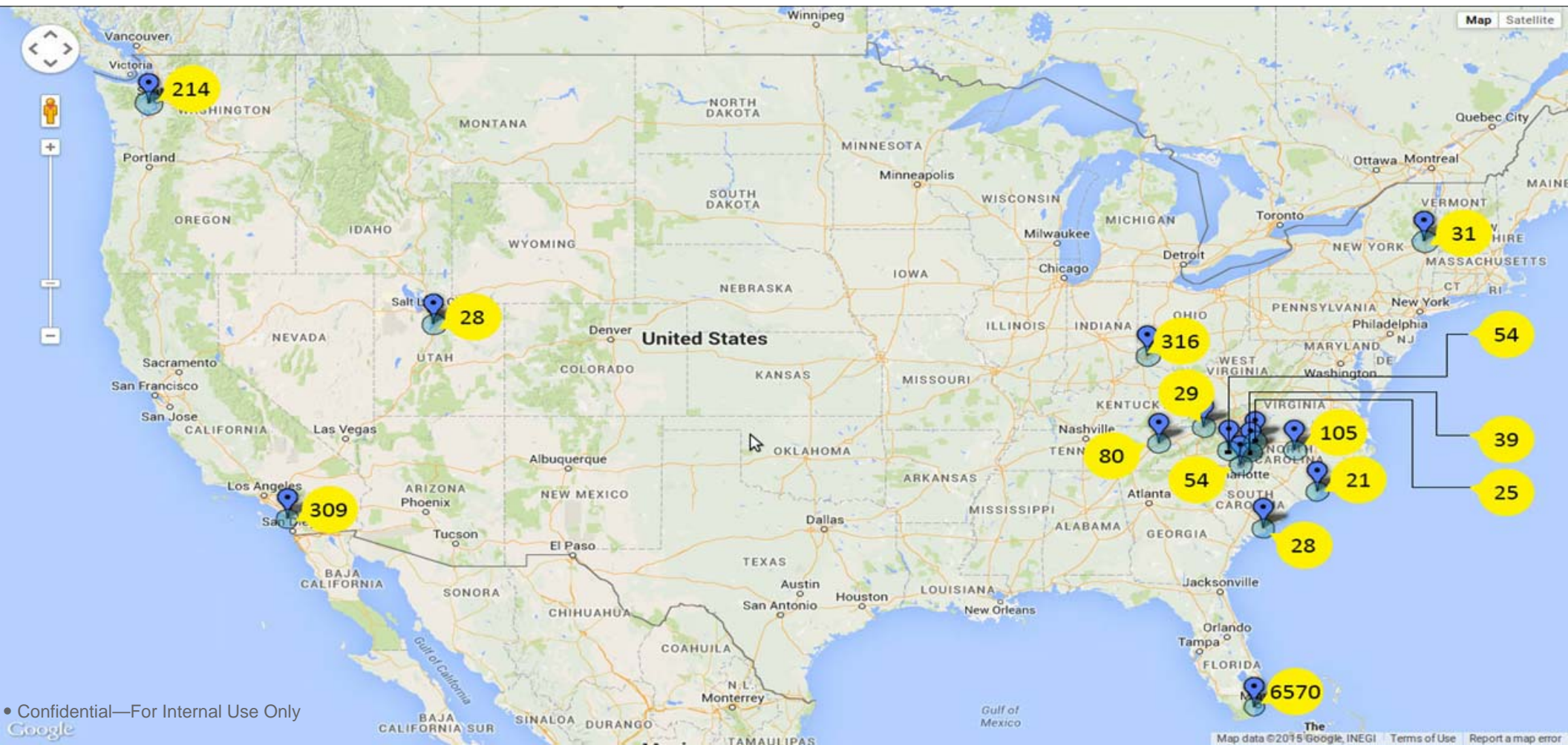
Improving clinical trials enrollment and CDx development and commercialization



# The Quest universe of patients in the US that potentially qualify for a clinical trial: 180,000



For the same trial, using traditional clinical trial units, 8000 people are identified



# National population data enables treatments for “rare” diseases with targeted therapies

**In A First, Pfizer Spins Out Biotech Firm With \$103 Million In Funding**  
September 25, 2017, **Ellie Kincaid**, FORBES STAFF



- Hereditary Xerocytosis (HX) genetic disease causing hemolytic anemia
- Mutations in ion-channel proteins in RBC membrane, targeted therapy inhibits PIEZO1 is mutated in the majority of cases
- 48,404,254 patients representing ~20% of US population across all 50 states characterized for Hemoglobin and MCHC suggest US prevalence of HX is higher than thought – estimate 34,249 ~1:1400 US adults aged 18-99
- Unexplained anemia or elevated MCHC, as well as -> potential HX -> enrollment in pivotal trials (2019)

## Prevalence Estimate of Possible Hereditary Xerocytosis as Derived from a Large Laboratory Database

Harvey W. Kaufman<sup>1</sup>, Justin K. Niles<sup>1</sup>, Denis R. Gallagher<sup>1</sup>, Alicia Rivera<sup>2</sup>, Seth L. Alper<sup>2</sup>, Carlo Brugnara<sup>3</sup>, L. Michael Snyder<sup>1</sup>.

1. Quest Diagnostics, Marlborough, MA 01752

2. Division of Nephrology and Vascular Biology Research Center, Beth Israel Deaconess Medical Center, and Department of Medicine, Harvard Medical School, Boston, MA 02215

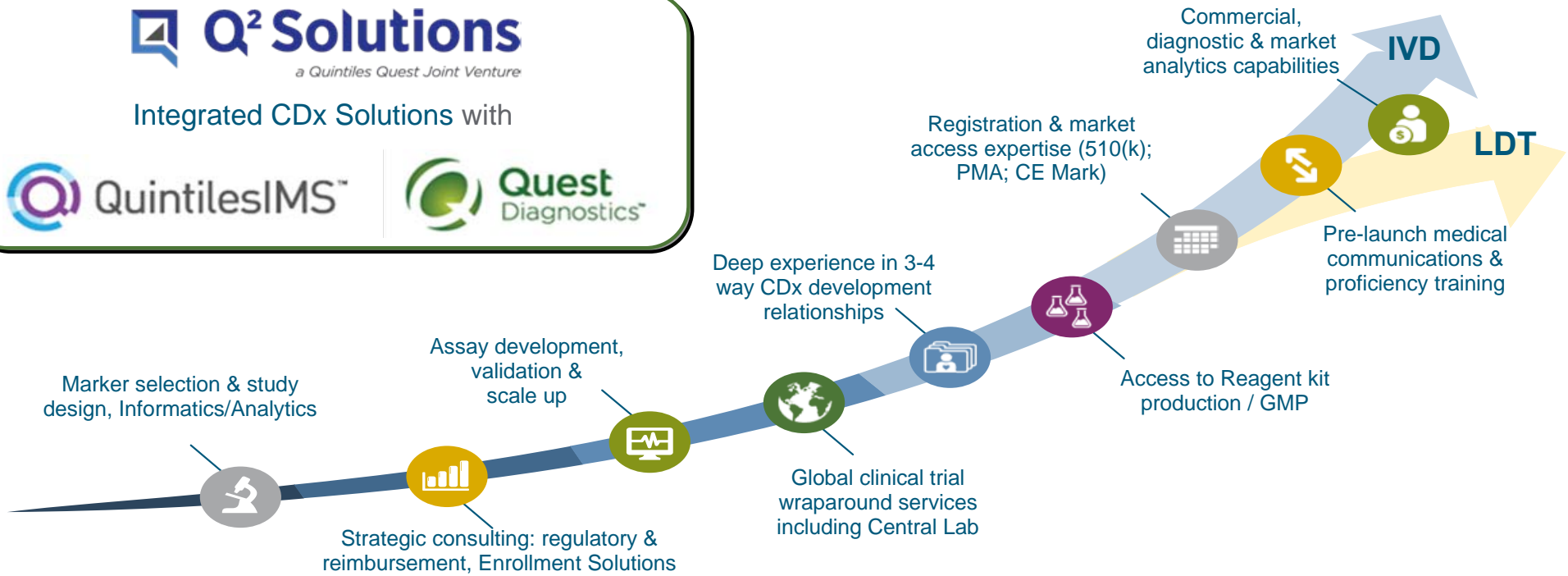
3. Department of Laboratory Medicine, Boston Children's Hospital and Department of Pathology, Harvard Medical School, Boston, MA 02115

# Quest and Q<sup>2</sup> Solutions are enabling all aspects of drug and companion development

**Q<sup>2</sup> Solutions**  
*a Quintiles Quest Joint Venture*

Integrated CDx Solutions with

**QuintilesIMS™** | **Quest Diagnostics™**



# We are delivering healthcare at the right time, in the right place, at the right cost, in a more convenient way

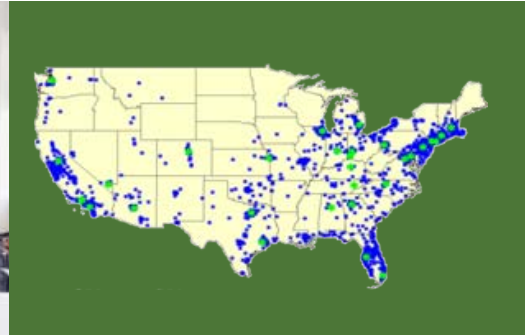
## Hospital to Home: Quest Extended Care Services



Home



Work



Quest PSC



Hospital



7000 mobile phlebotomists and NPs

Self-collection / minimally invasive technology



Telemedicine enabled referral into appropriate care



Quest Hospital services – service 50% and run 140+ hospital labs





**Six sites open in  
Texas and Florida**

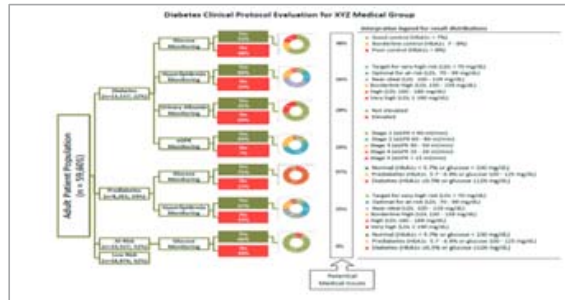


# Population health: an integrated solution to identifying and closing gaps in care can help effectively deliver solutions to those in need

Identification of gaps in care

Support through provider workflow

Extend care: PSC, retail, mobile nursing, home care



MyQuest



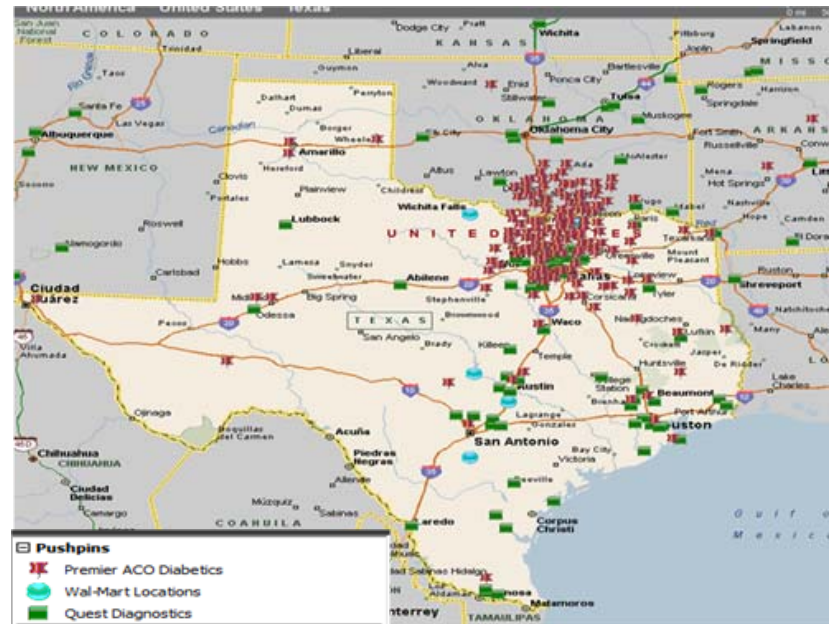
# Closing gaps in care in the community

## Example: Premier ACO Diabetes Gaps


- Premier ACO has ~10,000 diabetics in DFW and Southern OK with MANY gaps in care

Diabetics	HbA1c gaps	Retinal exam gaps
10,371	5,500	6,118


- Given revenues associated with gap closure, and the difficulty in closing gaps, a shared savings ACO model is appropriate
- Significant focus on rural areas where patients can be harder to engage
- Quest is helping Premier close these gaps through
  - Use of our PSCs, Walmart sites, Visiting nurses,
  - EMR data exchange services,
  - Home based self-collection kits,
  - Chronic care management, program enrollment and
  - Deployment of medical diagnostics in the field





➤   
Identify eligible participants

➤   
Conduct AWW & schedule appointment

➤   
Patient obtains services from Physicians and Partners

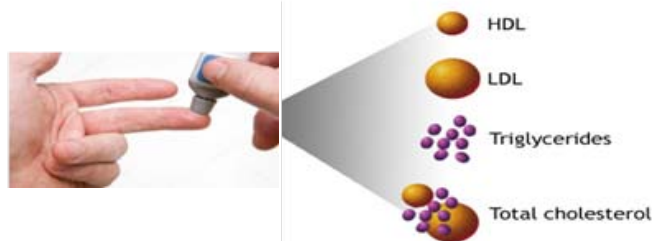
➤   
Documented in EMR, Care360, Partner Rad System (Mammography)

➤   
Interventions & Resources team available to patients for follow up

➤   
Patient, physicians, ACO, Care Managers provide results

# Together with our partners, we will address major gaps in medical care through population based precision medicine

28M+ Lipid panels



Gaps in Care

FH Genetic Testing and Care

Cholesterol lowering therapy initiation

Cholesterol lowering therapy under treated

- ✓ 73.5M in the US have high LDL
- ✓ 1 out of every 3 with high LDL are treated to guidelines

834,500 of U.S. adults have FH



Geisinger  
Health Plan

AMGEN

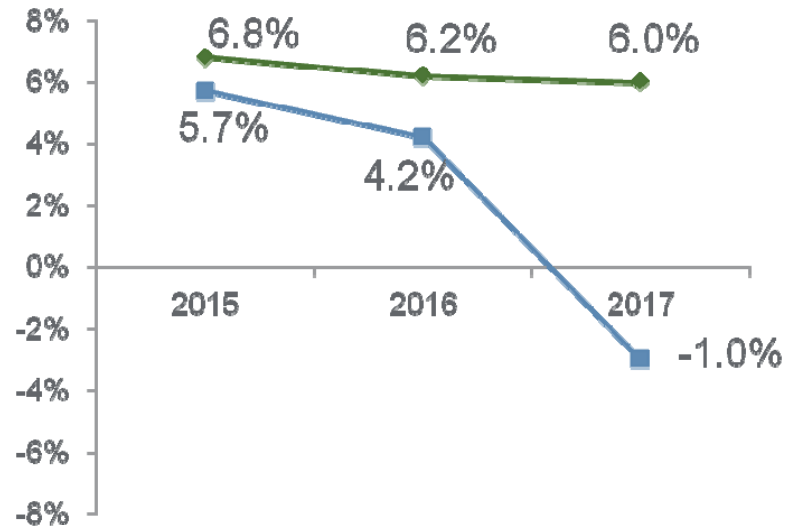
Walmart

LEMONAID



# At Quest we are improving care and lowering costs through population health

Annual self-funded employer trend vs. Quest (blue line)



Lowering costs for Quest

Improving care and costs for employees

Our formula for effective population health depends on our Blueprint for Wellness



Engage  
Screen  
Identify



Interpret  
Connect to Care



Intervene  
Prevent  
Save

# Connect Members to Care: Physician Health Information Sessions

Immediate access to a board-certified physician

Referral / enrollment in population health solutions (pre-diabetes, diabetes, smoking cessation, renal care, home sleep study)

Referral to in-network providers based on needs

Secure follow-up report



 pwnhealth

 Quest  
Diagnostics™  
Health & Wellness

Questions  
about your  
screening  
results?

Get the answers you need from a **board-certified physician**

- Over the **phone**
- When it's **convenient**
- At **no cost** to you

To schedule your **free physician consultation**:

- Go to [TH.PWNHealth.com/PHIS/CompanyABC](https://www.th.pwnhealth.com/PHIS/CompanyABC)  
or
- Call **1.844.659.3998**.



# Focus on 3 conditions for health impact and value

## Prediabetes:

**84.1 million**  
Americans have  
prediabetes <sup>1</sup>

**\$510**  
annual costs  
per case <sup>2</sup>

**90%**  
are not aware they  
have the condition<sup>1</sup>

## Diabetes

**1 in 10**  
Americans have  
diabetes<sup>3</sup>  
(diagnosed or undiagnosed)

**\$10,970**  
annual costs  
per case <sup>2</sup>

↓ **58%**  
in 3-yr risk with diabetes  
prevention program & 5%-  
7% sustained weight loss <sup>4</sup>

## Chronic Kidney disease (CKD)

**1 in 7**  
U.S. adults  
have CKD <sup>5</sup>

**\$12,700**  
annual costs per  
case (stage 4) <sup>7</sup>

↓ **68%**  
in risk of adverse events  
with healthy lifestyle<sup>6</sup>  
(BMI, PA, not smoking, diet)

# Blueprint for Wellness<sup>®</sup> powered population health programs: Medical and health economic yield

BFW Solution	Medical and Financial ROI
<b>Diabetes prevention – testing and care</b>	<ul style="list-style-type: none"> <li>✓ Quest target 2,279 enrolled in 2018</li> <li>✓ 26% risk reduction for progression to diabetes</li> </ul>
<b>Chronic renal disease prevention and care</b>	<ul style="list-style-type: none"> <li>✓ 30M in US have CKD, 85% are unaware</li> <li>✓ Quest 2017: 800 invited to program, Including 14 at stage IV or V and many more potential stage I-III</li> <li>✓ 70% of those contacted agreed to participate</li> <li>✓ \$0.5M per year saved by preventing 4 patients from reaching ESRD</li> </ul>
<b>Colorectal cancer early detection and prevention</b>	<ul style="list-style-type: none"> <li>✓ 4,500 engage in screening (FIT)</li> <li>✓ 315 (7%) positive; 17 (5.4%) with cancer</li> <li>✓ Early detection reduces 5 year death rate by 33%</li> <li>✓ Extends life of 2 members 5 years</li> </ul>
<b>Home based sleep diagnosis and care</b>	<ul style="list-style-type: none"> <li>✓ Rapid and cost-effective home based diagnosis of OSA</li> <li>✓ Avoidance of very costly office based sleep diagnosis</li> <li>✓ Appropriate and high quality care for underlying cause</li> </ul>

# Chronic Kidney Disease | Program example

We can estimate the clinical benefit and economic return

## Chronic kidney disease (CKD) in the U.S.:



30M have CKD, and 85% are unaware of their disease



~\$100B annual healthcare costs for advanced stage CKD



Blood test identifies those with CKD—glomerular filtration rate (eGFR)

Company population(US) = 13,811

average age = 40

66% female



**Employees at risk**



**Confirm CKD by retesting**

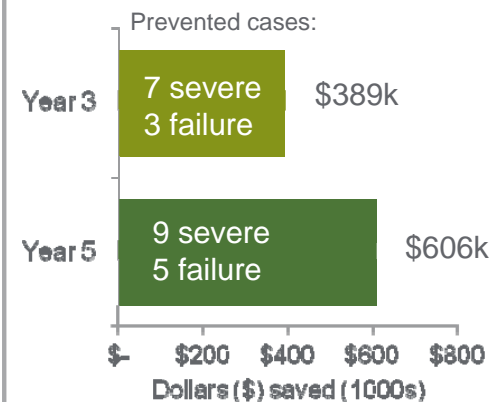


**Telemedicine consult with M.D.**



**Referral to PCP or nephrologist**

## Health & Financial Benefit



Progression rates based on: Sud et al., 2016; Sud et al., 2014; Chiu et al., 2008



# Blueprint for Wellness: improving care and lowering costs through population health

---



## Engage Screen Identify

- BFW
- PSCs
- Worksite programs
- Our examiners
- Retail
- Wellness engine



## Interpret Connect to Care

- BFW - MyGuide
- PHIS (Physician Health Information Sessions)
- BFW results to PCP
- Grand Rounds – 2<sup>nd</sup> opinion and physician referrals



## Intervene Prevent Save

- Care from appropriate PCP or Specialist
- Omada program
- Renal care program
- Home sleep assessment
- Employer sponsored programs (e.g., Diabetes)

# Pharmacogenomics can be effectively implemented in an employer sponsored health plan

- Genetic testing to determine risk of drug reaction and likelihood that a drug will work
- 50% of patients are on a prescription drug that fails to be effective or incur side effects
- Quest plan members are offered PGx testing across relevant mutations
- Integration with pharmacy benefit for healthplan
- Decision support for prescribing physician with pharmacist support



## 1-Year ROI (Rx Savings)

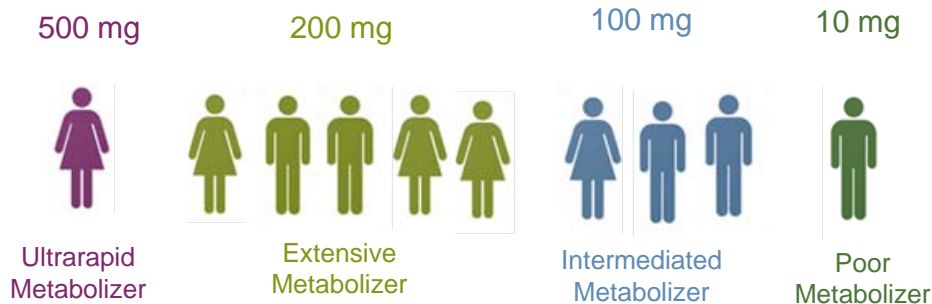
+ 0.6M Medication Savings
+ 0.7M Clinical Savings
- 0.3M Testing (n=1050)
<hr/>
+1.0M Potential In Year 1

## Est. Reduction in ADEs

warfarin	9*** (+3)
clopidogrel	6*** (+2)
carbamazepine	1*** (+1)
ivacaftor	0
phenytoin	1*** (+1)
abacavir	1*** (+1)

Top meds 17 ADE

(\*\*\* Probable hospitalization)



# Population Based Precision Medicine

---

- Aggressive population health implementation programs improve health and lower costs of care for employers and employees
- Use of population data can drive programs to connect individuals to the precision care they need – right intervention, right cost, right provider
- Technologies are transforming the care we can deliver to consumers in their homes / communities
- ALL healthcare is consumer healthcare – reduction in complexity and increased convenience for consumers is a critical enabler of population health strategies