Rlab #5: Personalized medicine with R

Our R-driven journey in the medical domain

R.L.Rossi – Milano 16/1/2018

P4 Medicine

PREDICT • PREVENT • PERSONALIZE • PARTICIPATE

Leroy Hood & Institute of Systems Biology, Seattle

Personalized medicine

(2005 - 2016)

Precision medicine

(2015 - today)

Hi-definition medicine

(today)

Digital health

Quantified self

PLOS | BIOLOGY

RESEARCH ARTICLE

Digital Health: Tracking Physiomes and Activity Using Wearable Biosensors Reveals Useful Health-Related Information

Xiao Li[1☯], Jessilyn Dunn[1,2☯], Denis Salins[1☯], Gao Zhou[1], Wenyu Zhou[1], Sophia Miryam Schüssler-Fiorenza Rose[3,4], Dalia Perelman[5], Elizabeth Colbert[3], Ryan Runge[1], Shannon Rego[3], Ria Sonecha[1], Somalee Datta[1], Tracey McLaughlin[5], Michael P. Snyder[1]*

1 Department of Genetics, Stanford University School of Medicine, Stanford, California, United States of America, **2** Mobilize Center, Stanford University, Palo Alto, California, United States of America, **3** Spinal Cord Injury Service, Veterans Affairs Palo Alto Health Care System, Palo Alto, California, United States of America, **4** Department of Neurosurgery, Stanford University School of Medicine, Stanford, California, United States of America, **5** Division of Endocrinology, Stanford University School of Medicine, Stanford, California, United States of America

☯ These authors contributed equally to this work.
* mpsnyder@stanford.edu

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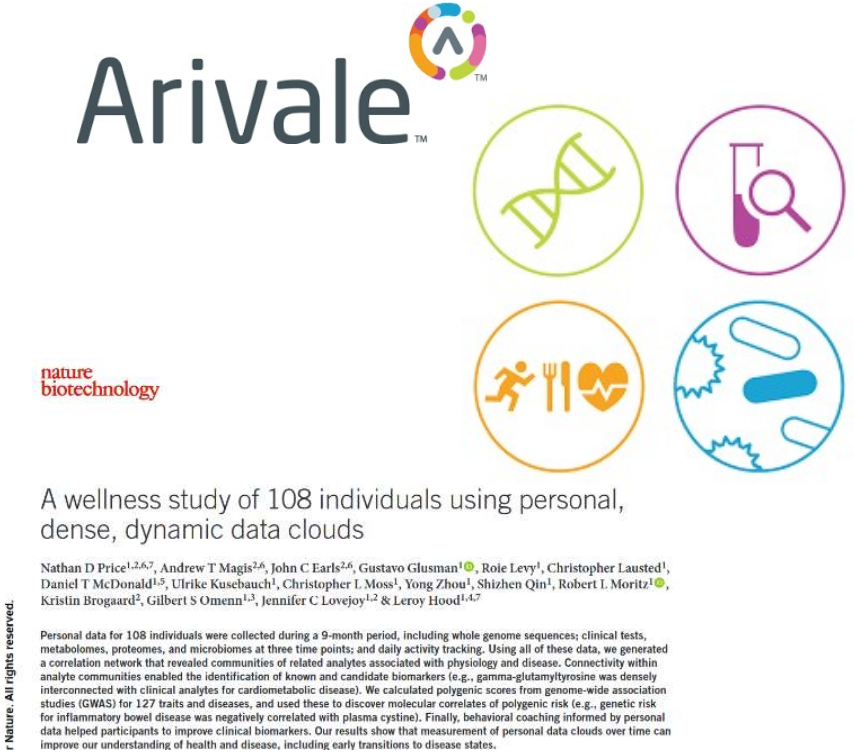
Abstract

A new wave of portable biosensors allows frequent measurement of health-related physiology. We investigated the use of these devices to monitor human physiological changes during various activities and their role in managing health and diagnosing and analyzing disease. By recording over 250,000 daily measurements for up to 43 individuals, we found

2 billion measurements from 60 people, including continuous data from each participant's wearable biosensor devices and periodic data from laboratory tests of their blood chemistry, gene expression and other measures. Participants wore between one and seven commercially available activity monitors and other monitors that collected more than 250,000 measurements a day.

The actors today



Disclaimers

Take it all with a grain of salt

We will not use such fancy data

- Sorry to inform you that we will actually deal with **“population” medicine**.
  i.e. all reference values and evaluations are made relative to the mean population risk values

- Genetics (DNA) is where the story gets **really personal**.
  Do you think your DNA impact on those risks?

→ *feel free to give your opinion*

Use it at your own risk

- Even if the science behind all this is sound, we are just making a R-related **coding exercise**.
  Please do not be scared by your numbers (well, obviously enough you just need to be a *smoker* to have high risks, so beware of this first).

- I am a **molecular biologist**, *NOT* a physician or a clinician or a dietician or a …
  (do not expect, and please don't ask, a diet or diagnosis from me)

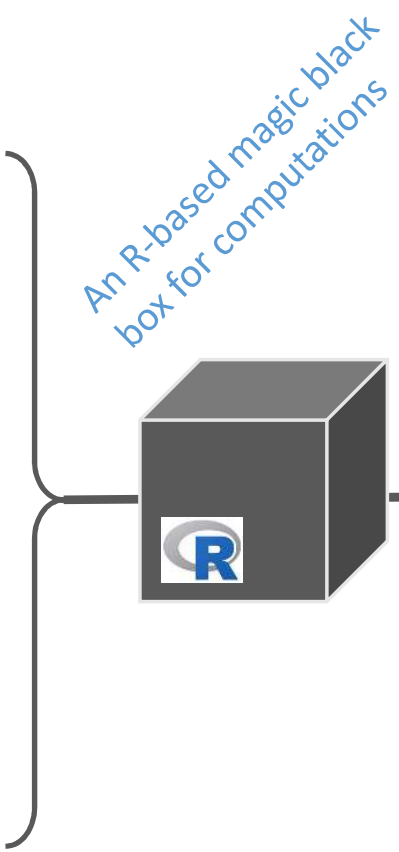
Rlab #5 goals

What we would like to make

A GUI to input the followings:

QUANTITATIVE INPUTS:
Gender, Age, BMI (height, weight),
Waist,
Blood pressure max & min,
Total cholesterol,
HDL ("good" cholesterol)

CLOSE QUESTIONS (yes/no) INPUTS:
Smoker; Daily motion; Daily veggies;
hypertension drug treatment;
High blood glucose;
Parents or siblings with T2D;
Relatives with T2D;
Parents or relatives with hypertension;
Self affected by T2D



The individual Relative Risks (RR) as outputs

$RR_{overweight}$

$RR_{obesity}$

RR_{t2d}

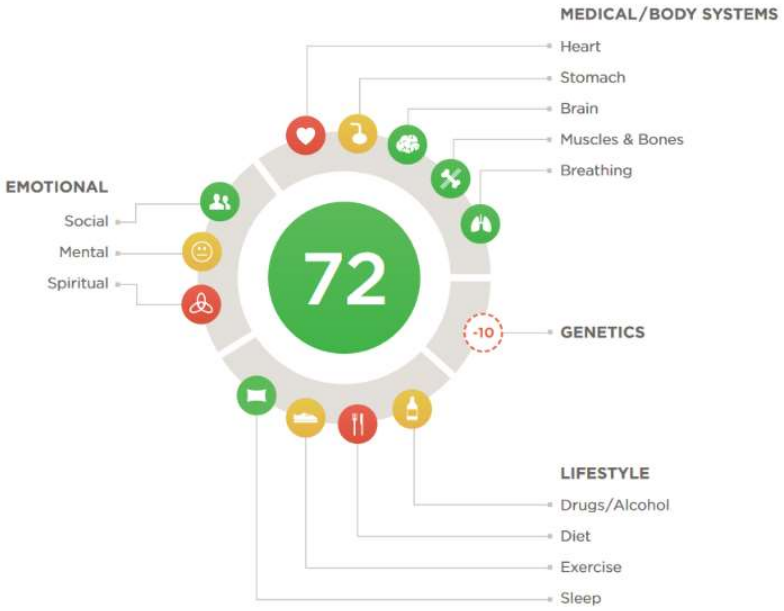
$RR_{hypertension}$

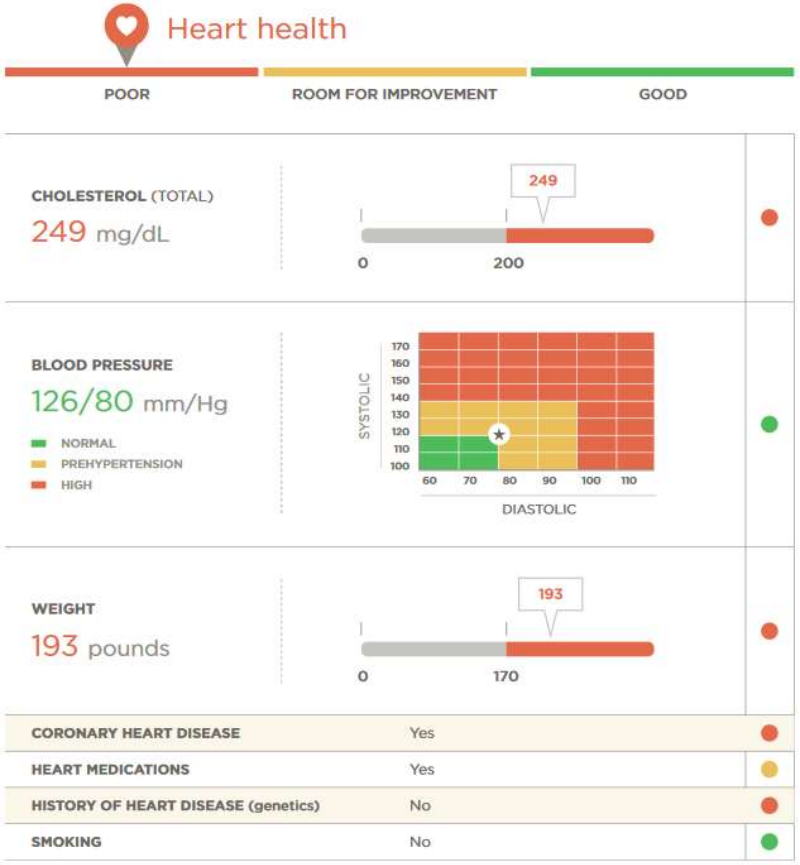
RR_{cvd}

A visualization dashboard of individual rel. risks

How do we communicate risk?

Comparables (a bunch of designs out there we can be inspired from)
and thoughts on risks communication





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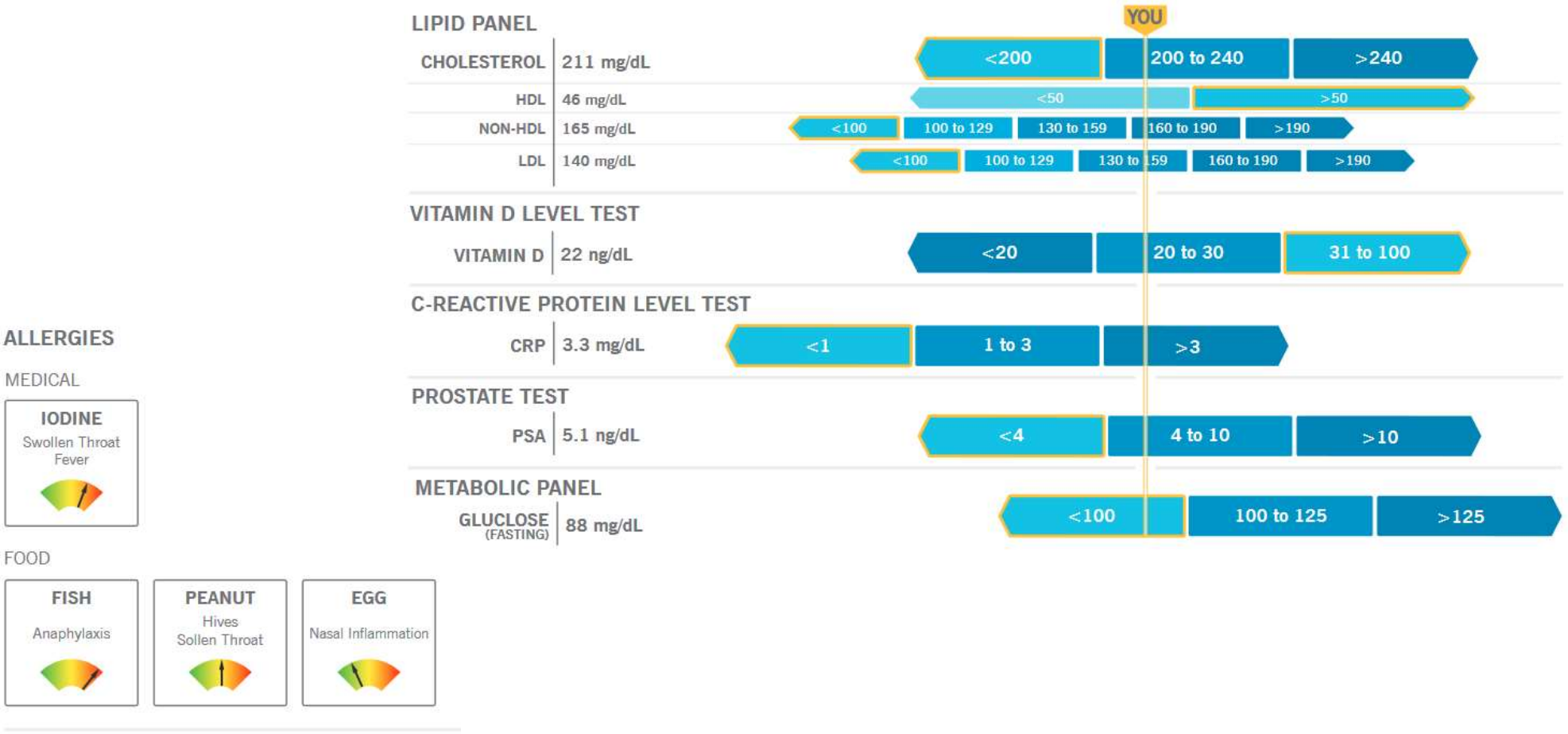

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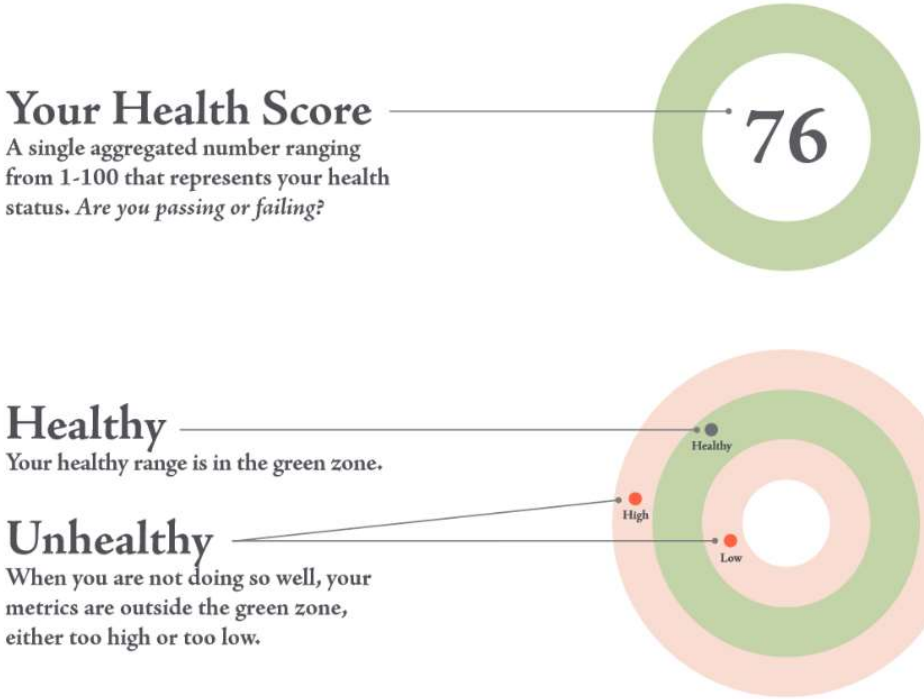
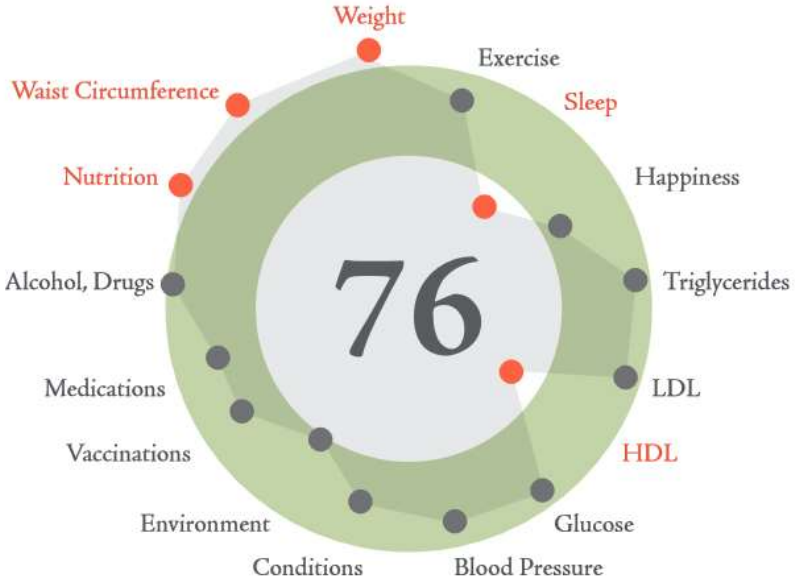




healthdesignchallenge.com
https://s3.amazonaws.com/challengepost/zip_files/production/4940/zip_files/hgraph_goinvo_healthdesignchallenge.pdf?1354248603

BODY WEIGHT TREND GRAPH

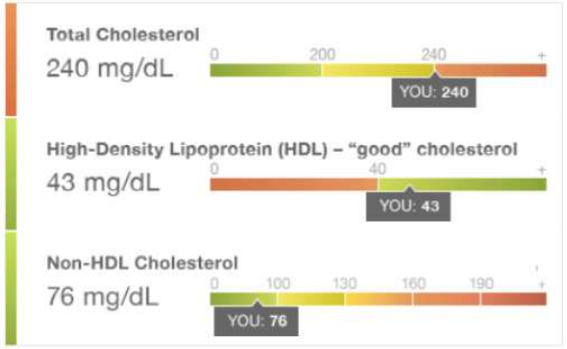
BODY MASS INDEX RESULTS

What does this mean?

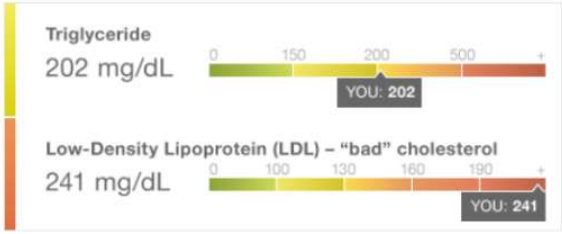
Your body mass index (BMI) calculation is a measure of body fat based on height and weight, which is a reliable indicator fo obesity. Check out the National Heart Lung and Blood Institute BMI calculator to see where this number came from and what steps you can take to improve your BMI

Lipid Panel (11/20/2012 11:15 am)

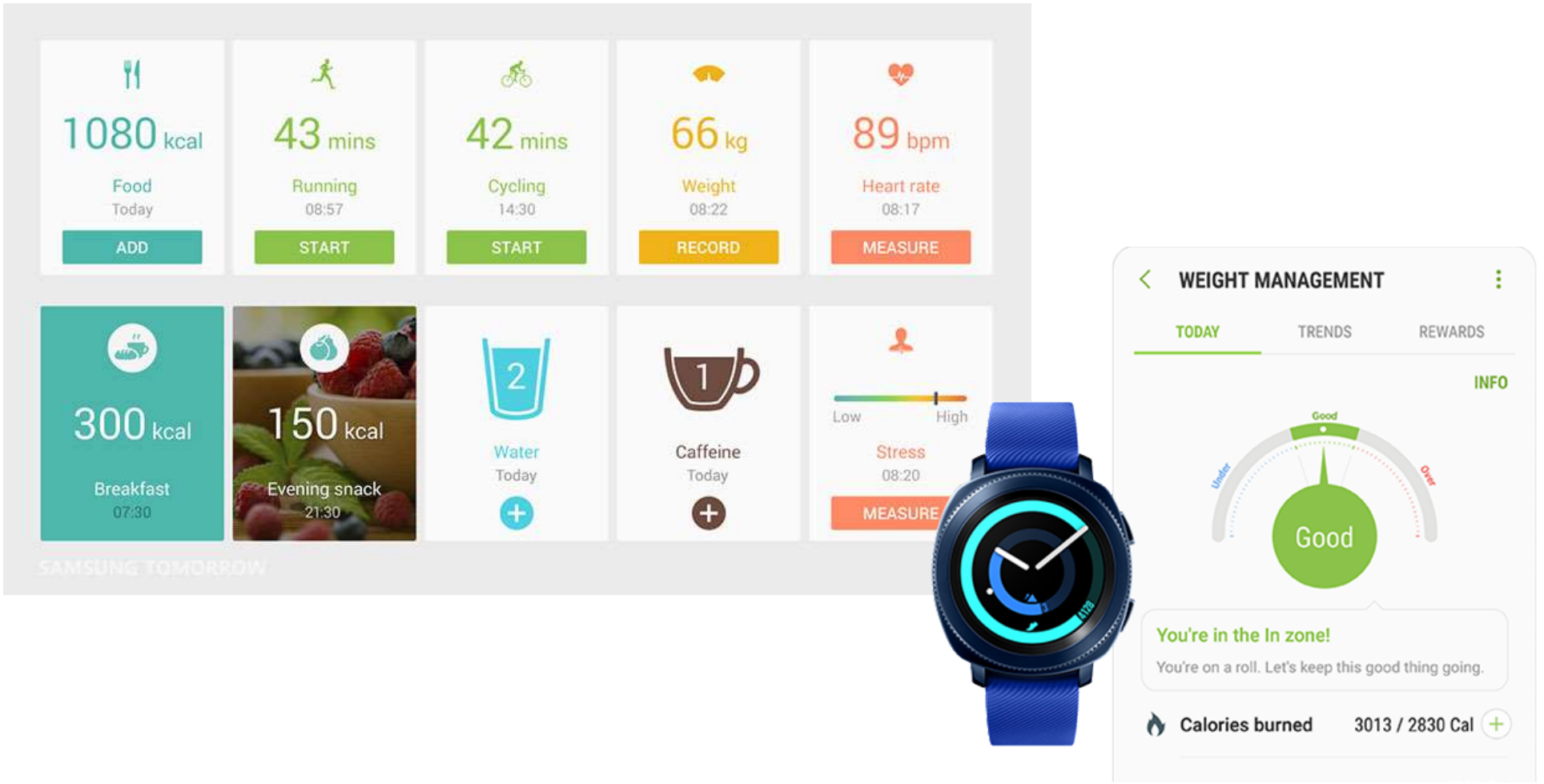
LIPID PANEL LAB RESULTS (1 OF 2)



LIPID PANEL LAB RESULTS (2 OF 2)



http://hdc.socialhealthinsights.com/bluebutton



Samsung Health app

Just show numbers or graph them? Change in perception

Framingham Risk Score - RESULTS[1,4]

Your patient's Framingham Risk Score is < 1%

2009 CCS Canadian Cholesterol Guidelines Recommendation[1]

Risk Level	Initiate/consider treatment if any of the following:	Primary LDL-C targets
Low (FRS < 10%)	• LDL-C ≥ 5.0 mmol/L	≥ 50% reduction

Adapted from Genest et al. *Can J Cardiol.* 2009.[1]

Clinical judgment should be used regarding the timing of pharmacological therapy in low risk patients. Please consult guidelines for complete recommendations.

Clinicians should exercise judgment when implementing lipid-lowering therapy; lifestyle modifications will have an important long-term impact on health and the long-term effects of pharmacotherapy must be weighed against potential side-effects.

Print results

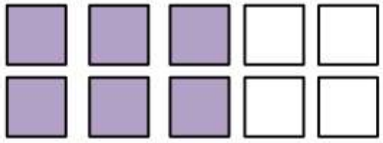
(difficult to understand)

Probability < Frequency < Visualization

(easier to understand)

60%

6 in 10



http://www.vizhealth.org/