

Precision Health Using Big Data

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Conflicts: Personalis, Genapsys, SensOmics, **Qbio**, **January AI**, Filtricine, Mirvie, Protos

Health Is a Product of Genome, Exposome & Lifestyle

Genome



Exercise



Pathogens



Environmental Exposures



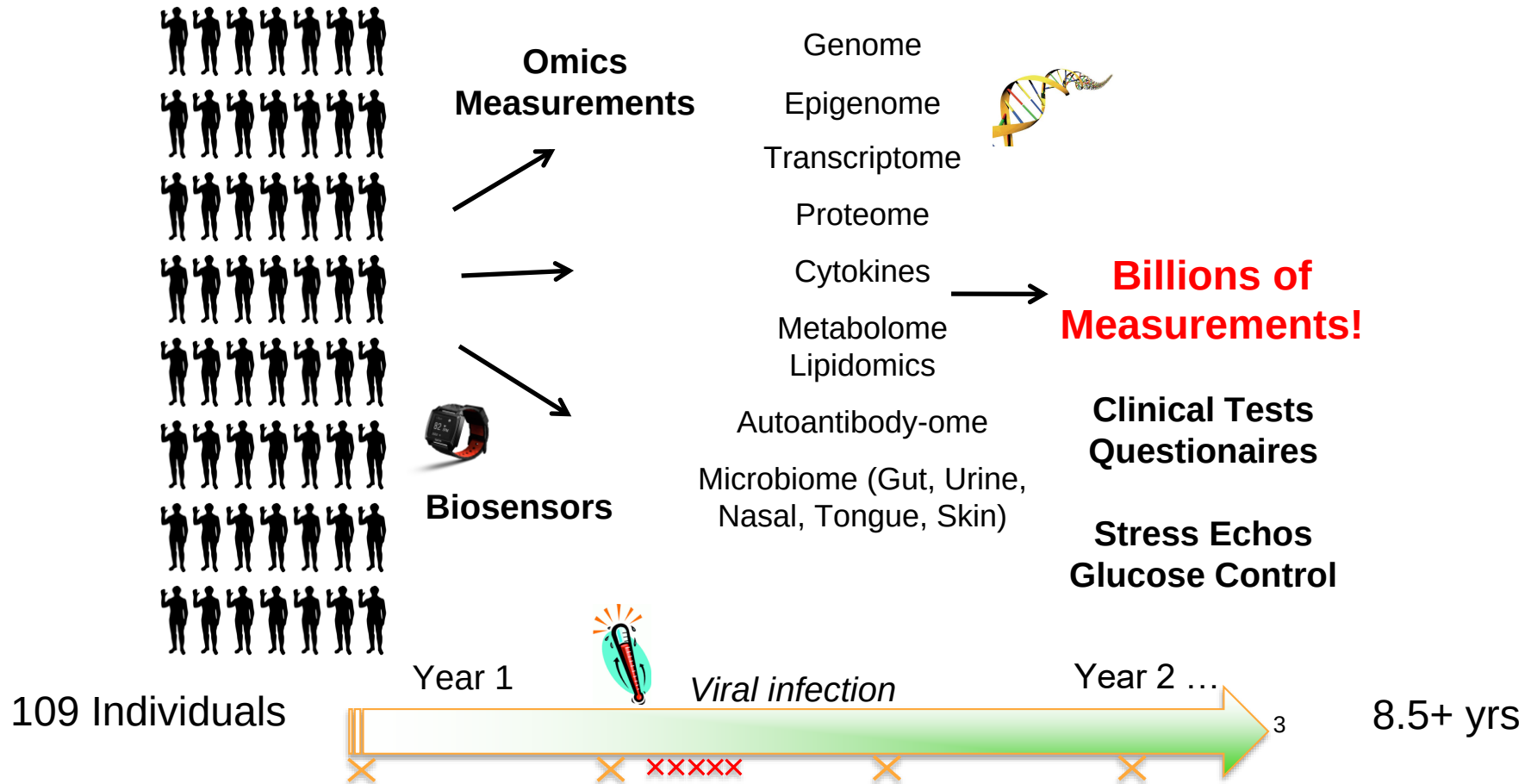
Food



Stress



Longitudinal Personal Omics Profiling



49 Major Health Discoveries

Metabolic

- 1 MODY mutation (gene)
- 1 ABCC8 Mutation (gene)
- 14 New Diabetes

Cardiovascular

- 6 Carotid Plaques (imaging)
- 1 Atrial Fib. (wearable)
- 1 RMB20 mutation (gene)
- 1 Reduced LVEF/GLS (imaging)
- 3 Dilated L. Atrium (imaging)
- 1 Pharmagenomic (gene)

Other

- 1 Sleep Apnea (wearable)
- 1 SLC7A9 mutation (cystinuria risk)
- 2 Macroalbuminuria

Heme/Onc

- 7 Oncologic Risk Genes (Thyroid Cancer in 1)
- 1 Lymphoma (Imaging)
- 1 MGUS (IgM)
- 1 Smoldering Myeloma (IgM)
- 1 α Thalassemia (Clinical)
- 1 β Thalassemia (Gene/Clinical)
- 1 Pros1 Mutation (gene)

Infectious

- 1 Lyme Disease (wearable)



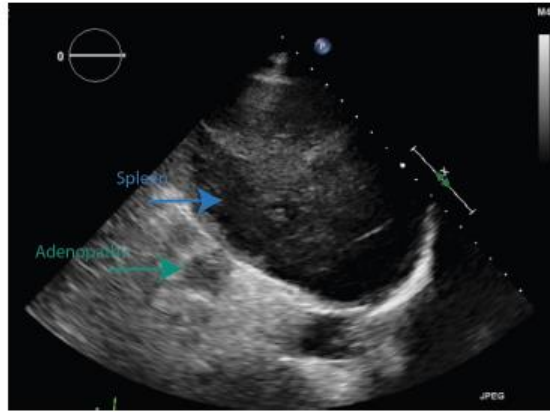
Genome Sequencing – First 70 People

- Twelve have important pathogenic mutations:
 - **SDHB (2X): high freq. of neuroendocrine tumors^**
 - **APC (2X): Colon cancer**
 - **BRCA1: Breast & ovarian cancer**
 - **MUTYH: Colon cancer**
 - SLC7A9: Cystinuria
 - RBM20: Dilated cardiomyopathy^
 - CHEK2: Breast cancer
 - PROC: Affects coagulation
 - HNF1A: MODY mutation^
 - ABCC8: Hyperinsulinemic hypoglycemia
- All have reportable carrier mutations and/or pharmacogenetic variants

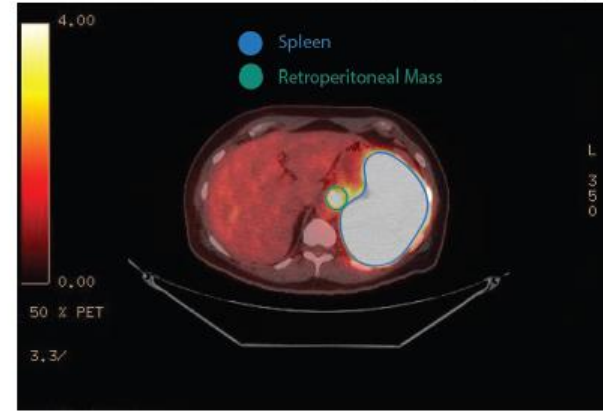


Discovery of B-Cell Lymphoma

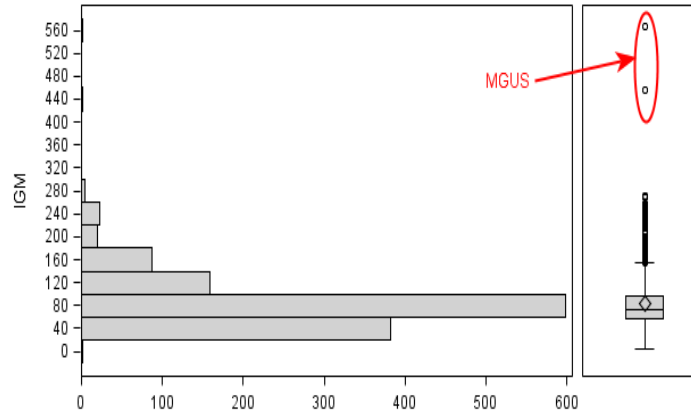
a Abdominal ultrasound



b Positron emission tomography imaging

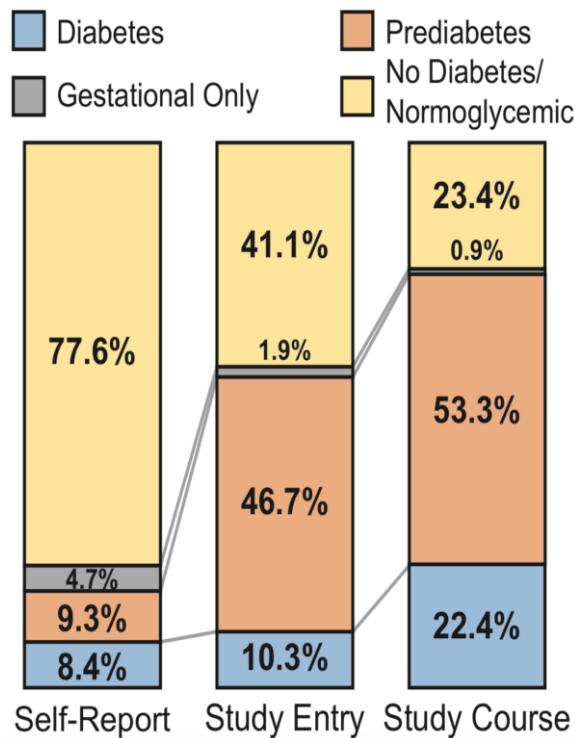


MGUS
PreCancer:
High IgM

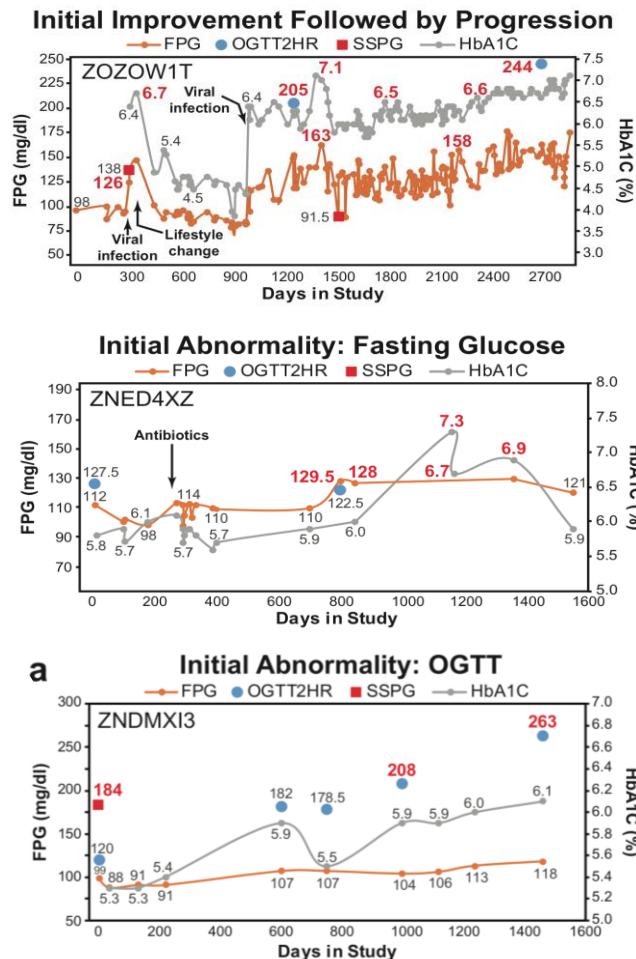


Rose, Contrepois et al.
Nat. Medicine 2019

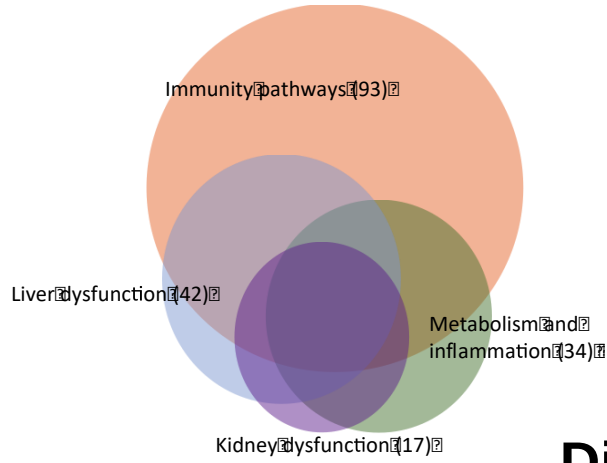
Transitions in DM status



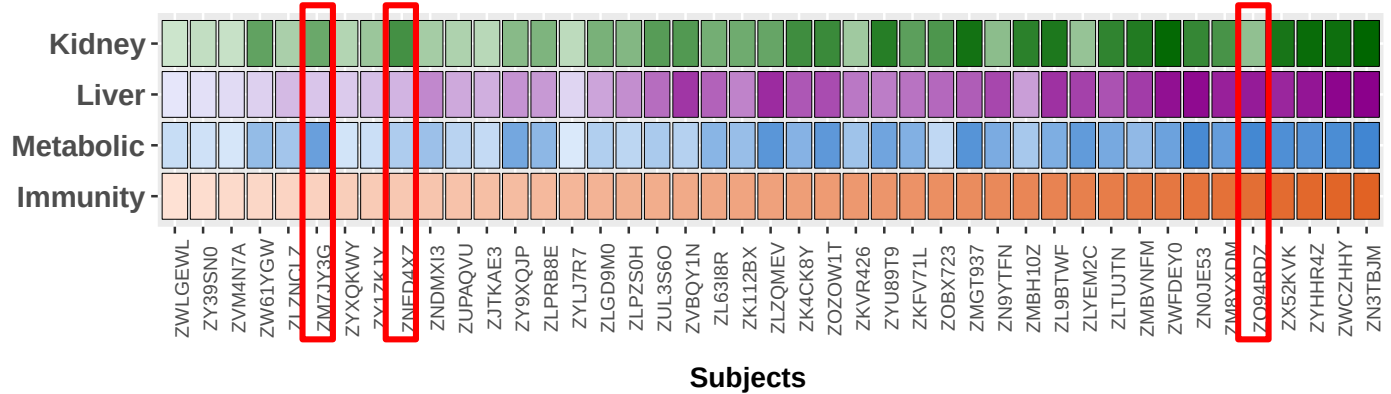
Rose, Contrepois et al. Nat. Medicine 2019



Four General Classes of Aging Molecules



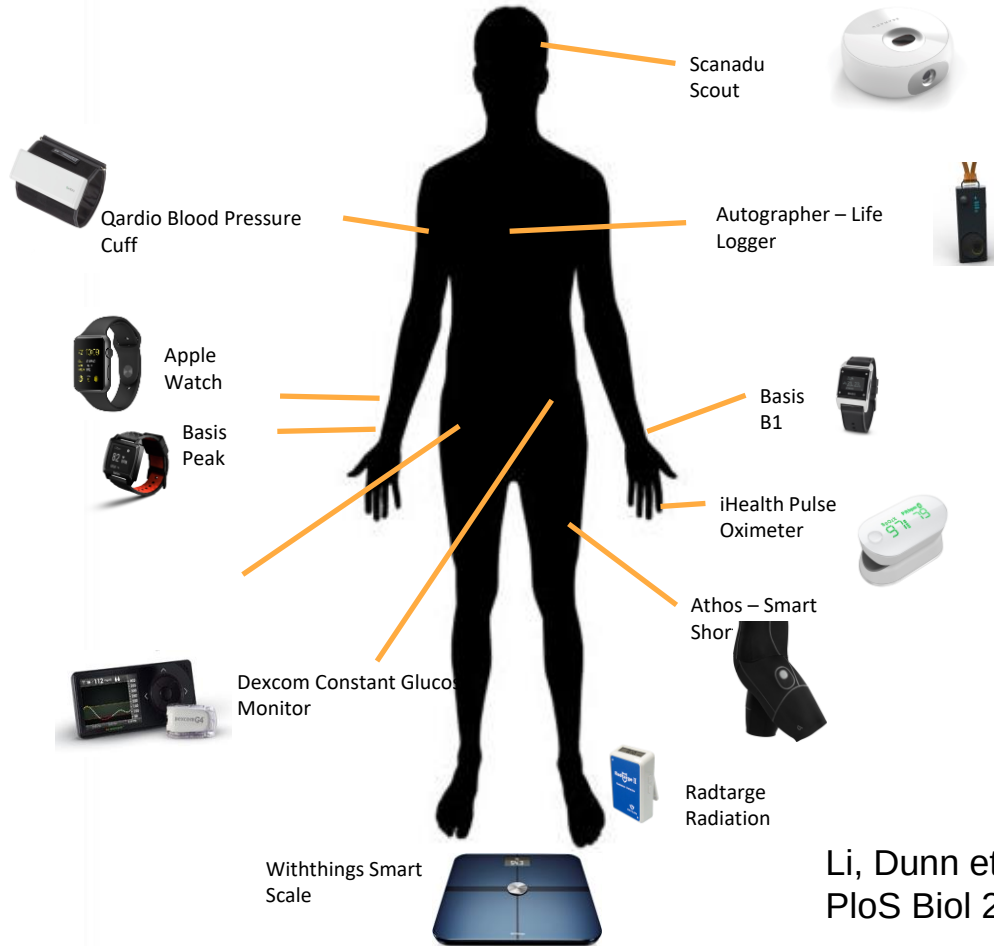
Different People Have Different Ageotypes



Qbio: Benefits of Multi-variate Longitudinal Measurements for Early Detection

	Multi-variate evidence	Rate of change evidence
Early Stage Leukemia		
Low Grade Brain Lesion		
Aortic Aneurysm		
Fatty Liver & Diabetes		
Cardiovascular Disease & Pre-Diabetes		
Early stage pancreatic cancer		
Early stage prostate cancer		
Early stage ovarian cancer		

Wearable Sensors: Over 900 Devices

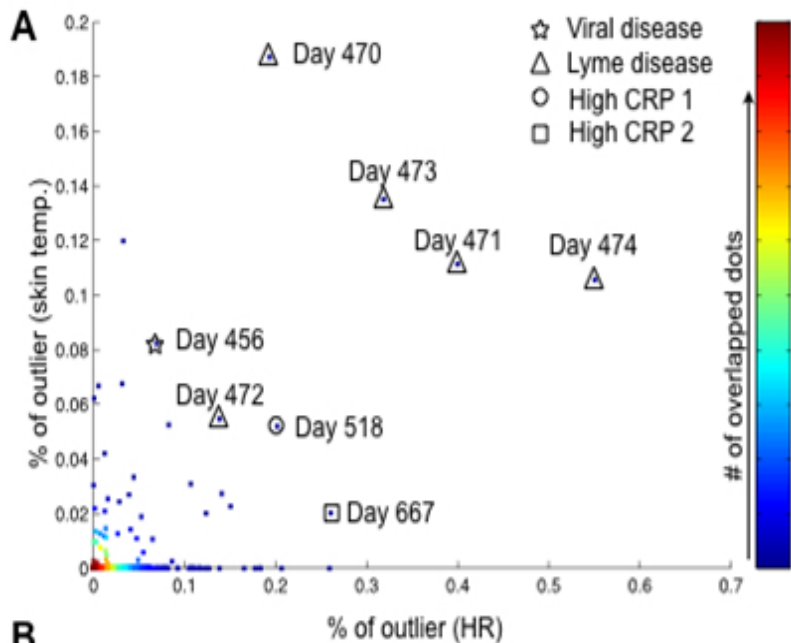


- Worn by millions of people (20% of US)
- Make 100Ks of measurements each day
- Wearables can track many things: HR, HRV, Respiration Rate, SpO2, Skin Temp, Blood Pressure

Li, Dunn et al.
PloS Biol 2017



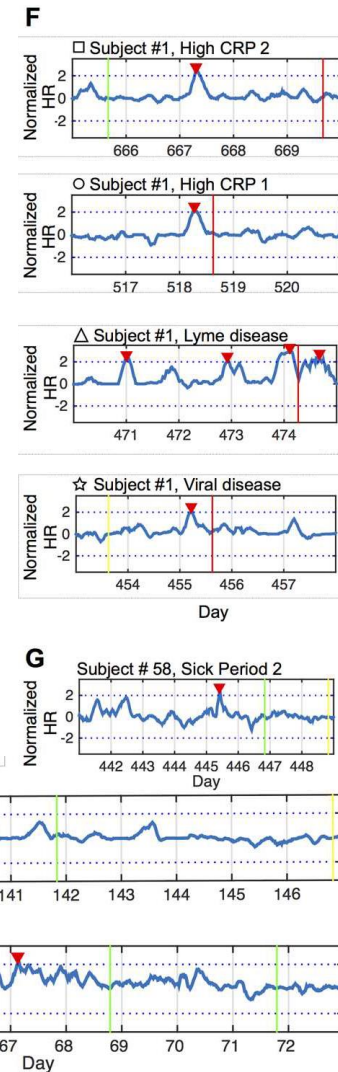
Detects All Days of Illness



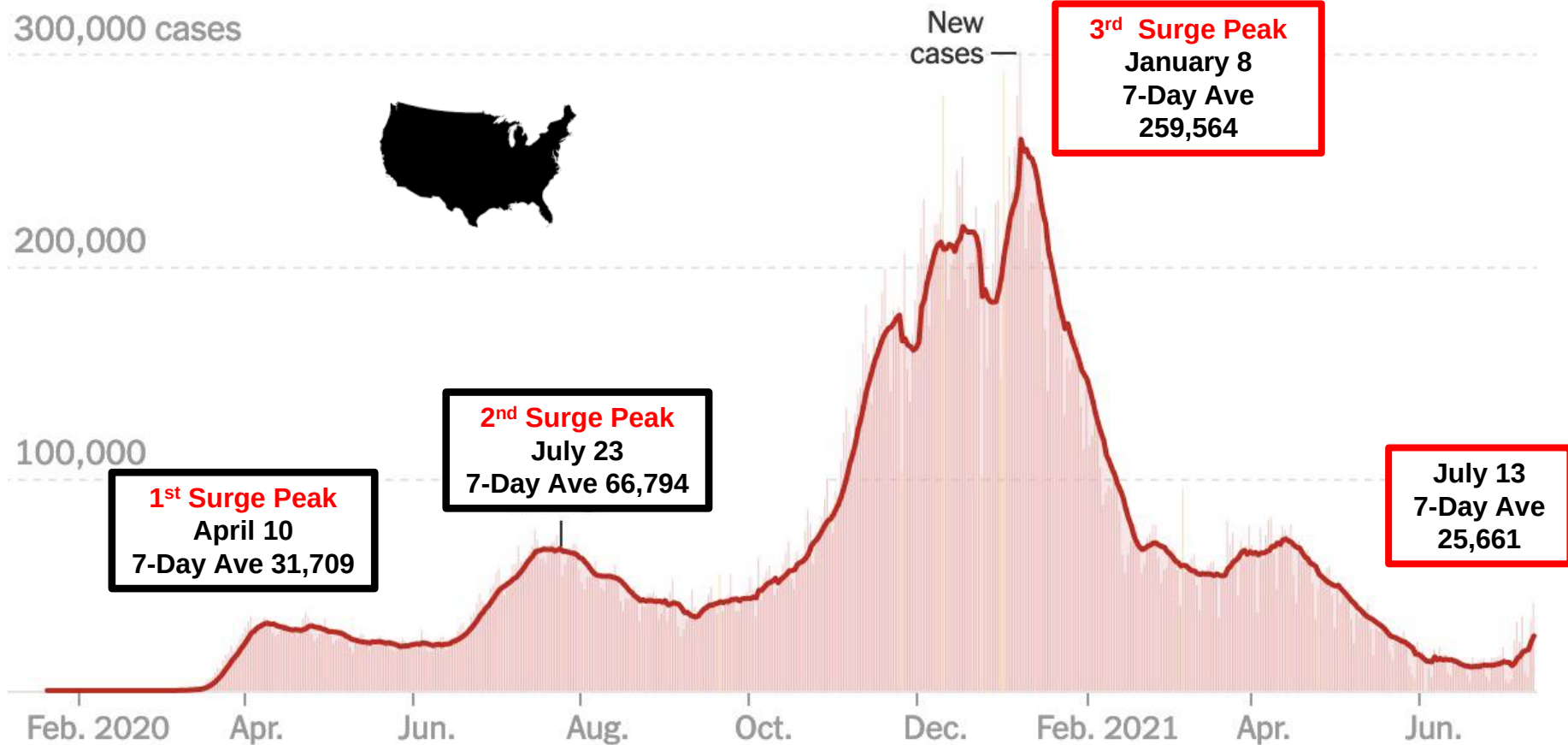
R

Li, Dunn et al. PloS Biol 2017

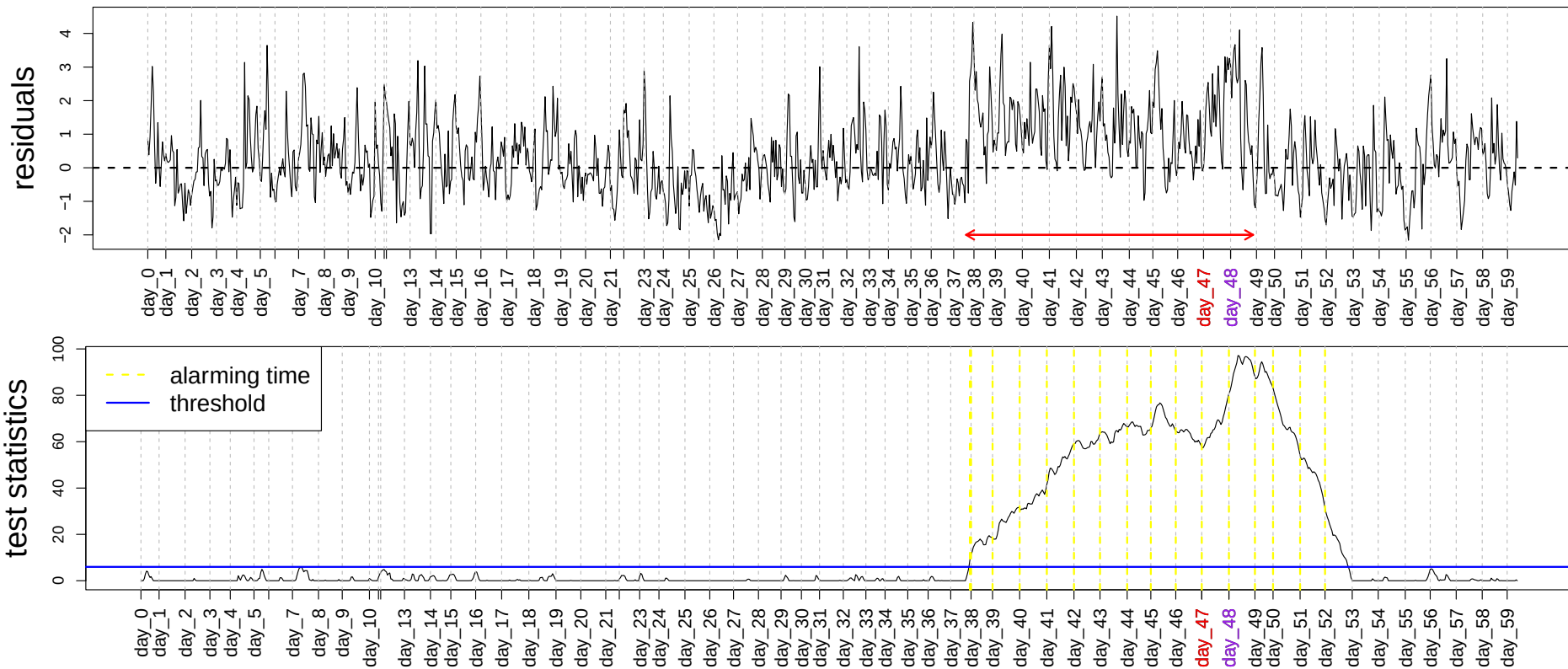
Change-of-Heart Algorithm



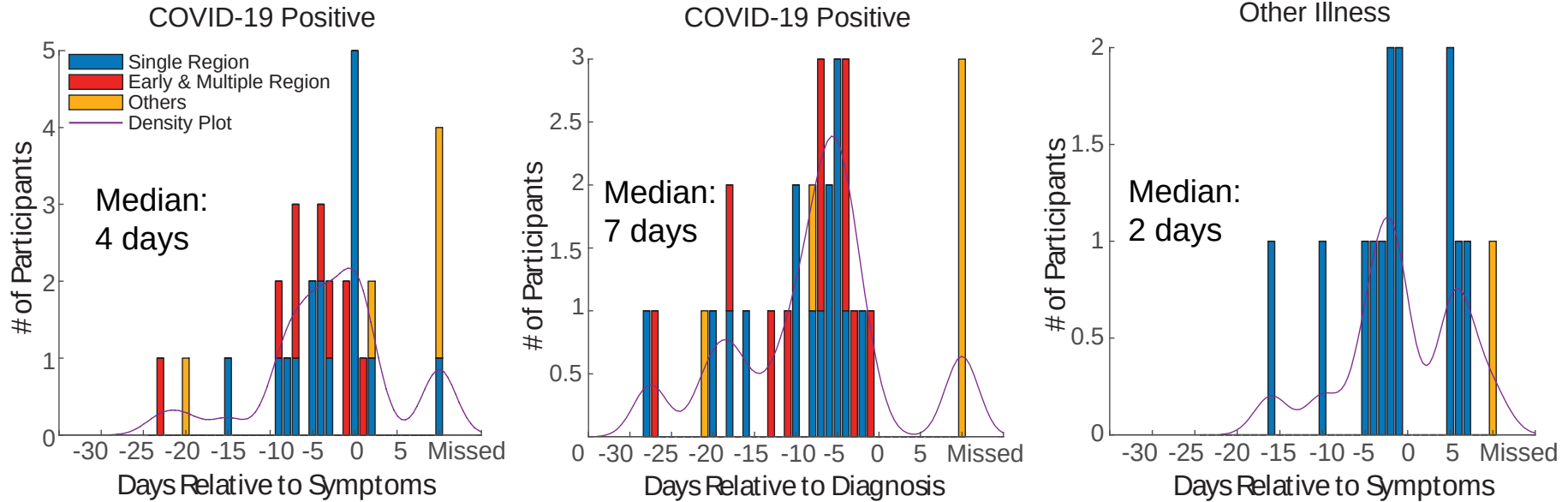
United States COVID-19 Cases/Day



Identifying COVID-19 at early stage

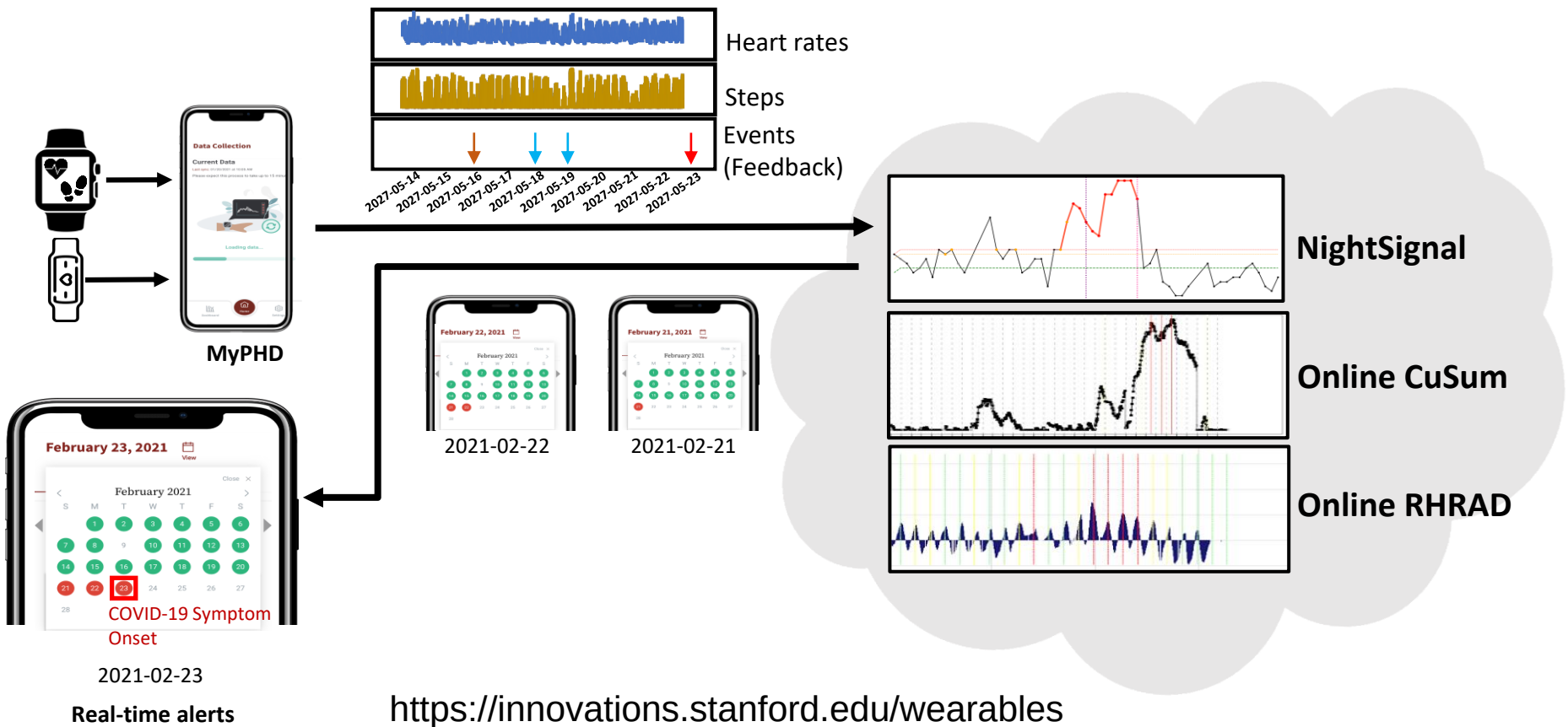


Summary of Early Detection

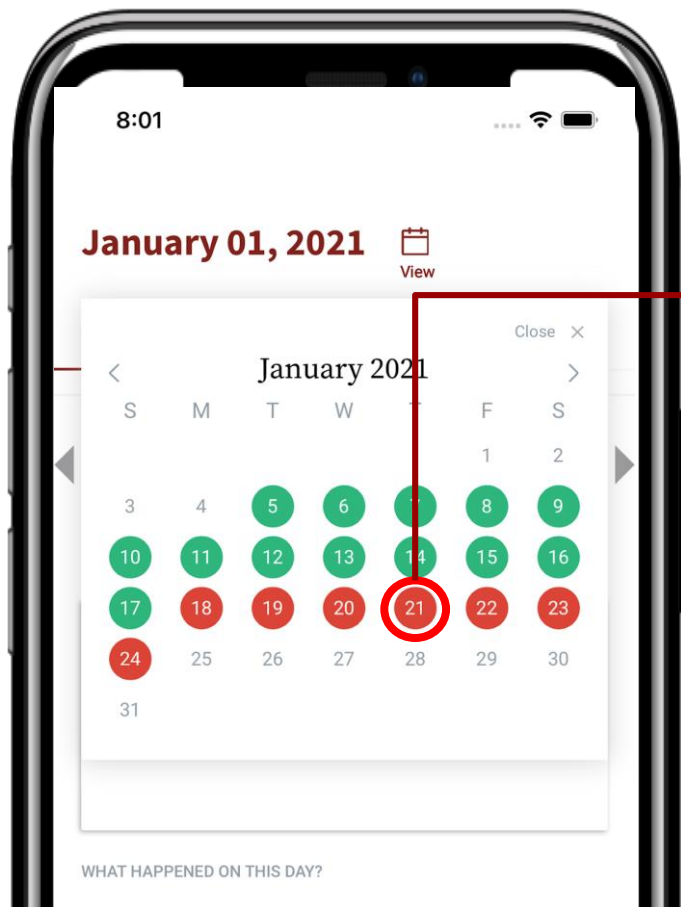


Elevated Heart Rate: 7 Beats/Min

Real-time Alerting Overview



Online Alerting System



Real Covid positive case:

Symptom Onset *

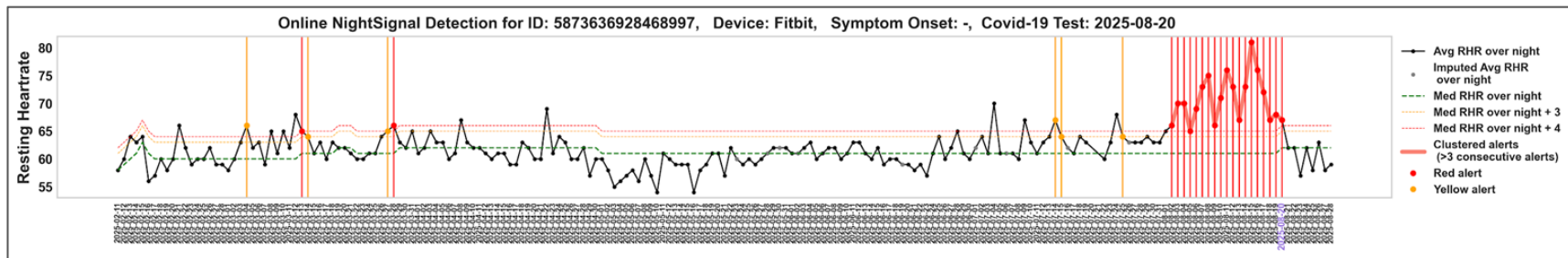
Total = 78% (53/68) of cases

* For privacy reasons, actual dates have been slightly shifted

Asymptomatic Detection Examples

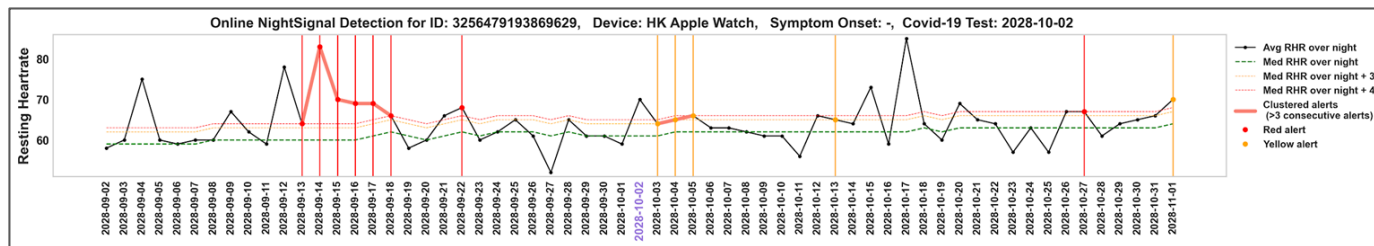
FitBit

NightSignal

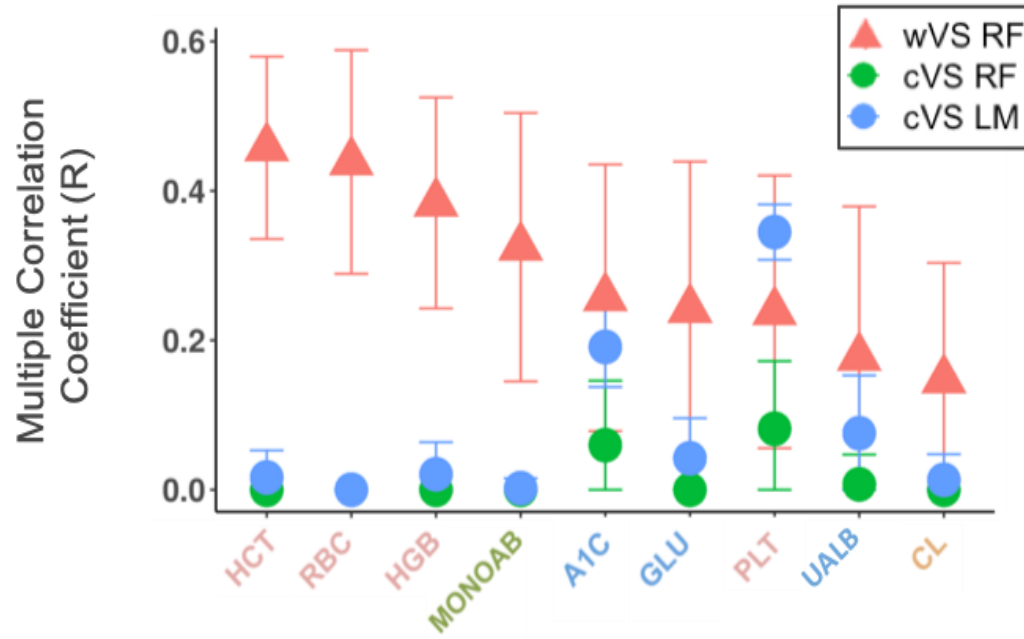


Apple Watch

NightSignal



Prediction of Other Clinical Biomarkers From a SmartWatch



Fiber is good for you!

But which one??



Dietary Fiber

Lignin
Cellulose
B-glucans
Hemicelluloses
Pectins
Gums
Resistant Starch

Soluble Fiber

Primary sources: Oat products and legumes
B-glucans
Gums
Wheat dextrin
Psyllium

Pectin
Fructooligosaccharides
Inulin
Some hemicelluloses

Fermentable Fiber

Primary sources: Oats, barley, fruits, and vegetables
Wheat dextrin
Pectins
B-glucans
Guar Gum
Inulin and oligofructose
Fructooligosaccharides

Viscous Fiber

Pectins
B-glucans
Some gums
Psyllium

Functional Fiber

Resistant dextrins
Psyllium
Fructooligosaccharides
Polydextrose

Insoluble Fiber

Primary sources: wheat bran, some vegetables
Cellulose
Lignin
Some pectins
Some hemicelluloses

Non-fermentable Fibers

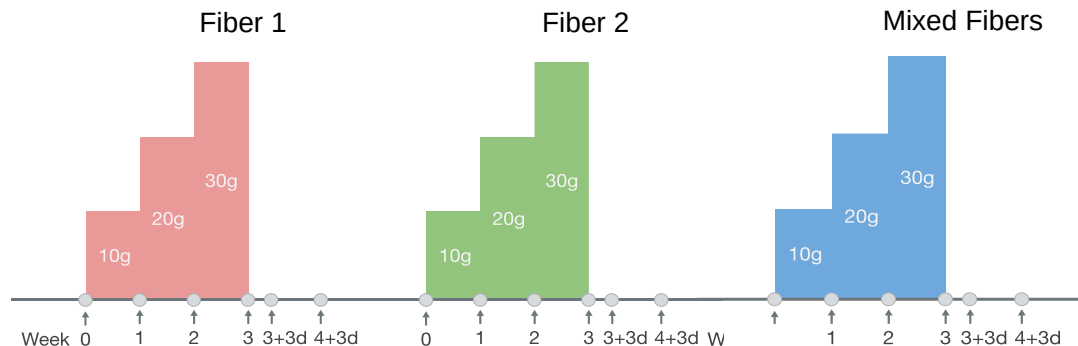
Primary sources: some cereals fibers such as wheat bran
Cellulose
Lignin

Non-viscous Fiber

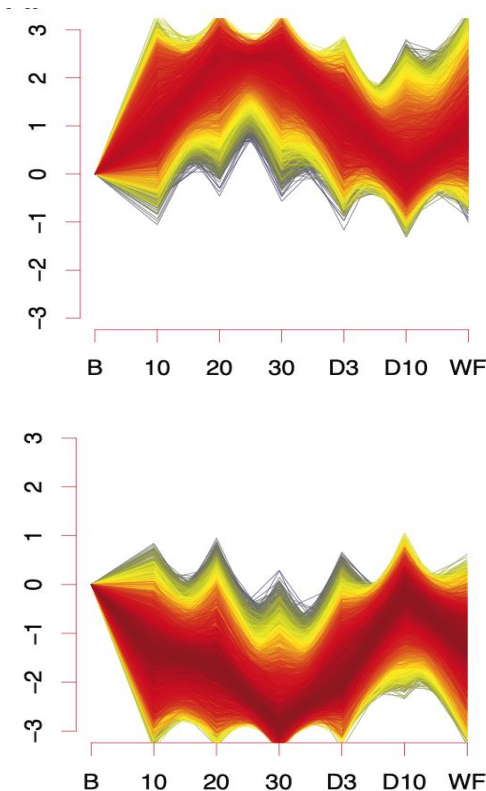
Cellulose
Lignin
Some hemicelluloses

Treat 18 People with different fibers

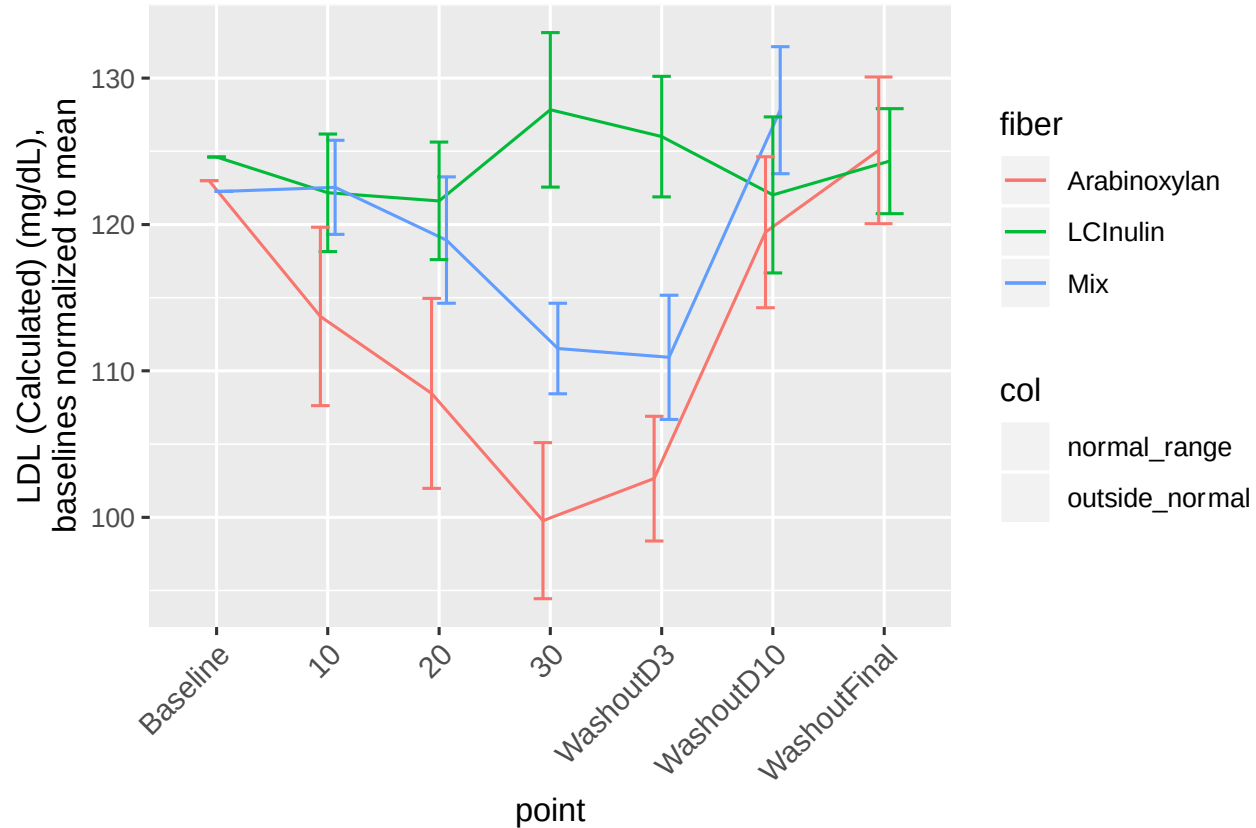
- 18 participants
 - 10 women, 8 men
- Genome plus six omics taken at 18 time points



Arabinoxylan



Arabinoxylan decreases cholesterol



Change in bile acids during fiber supplementation

Arabinoxylan

Inulin

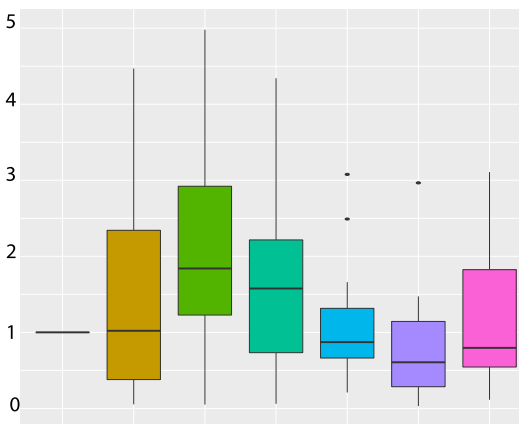
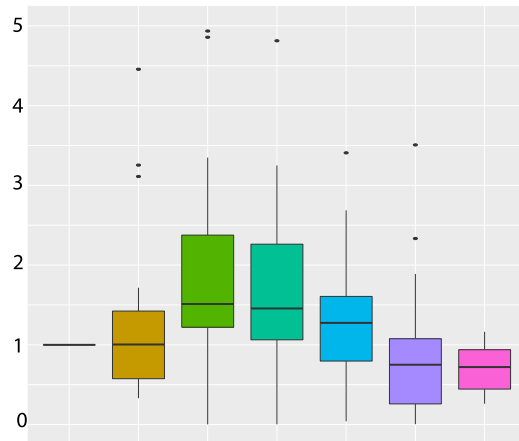
Cholesterol

Liver

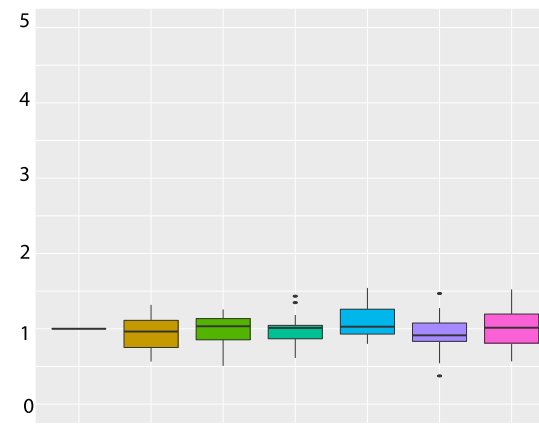
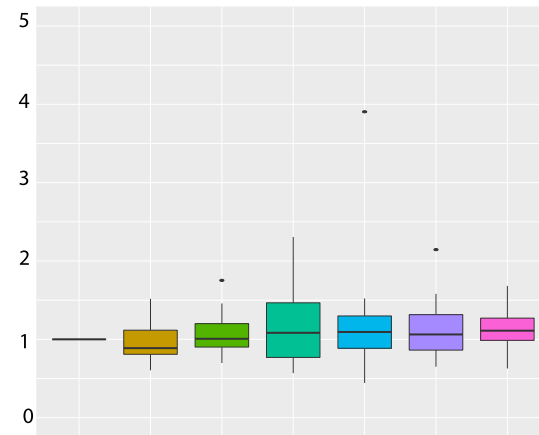
Chenodeoxycholic acid

Lithocholic Acid

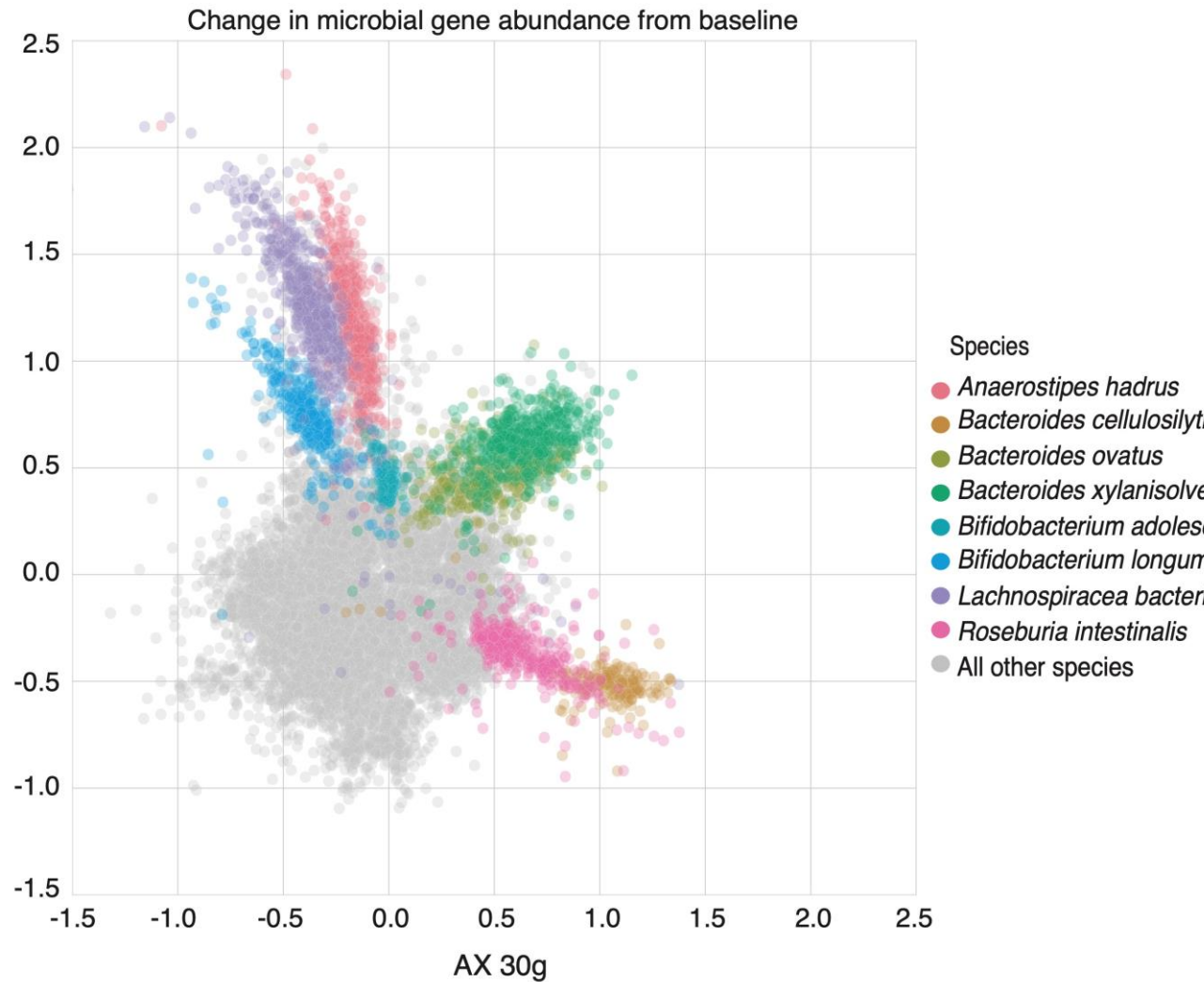
Relative Abundance (norm to baseline)



Baseline
10
20
30
W_D3
W_D10
W_Final

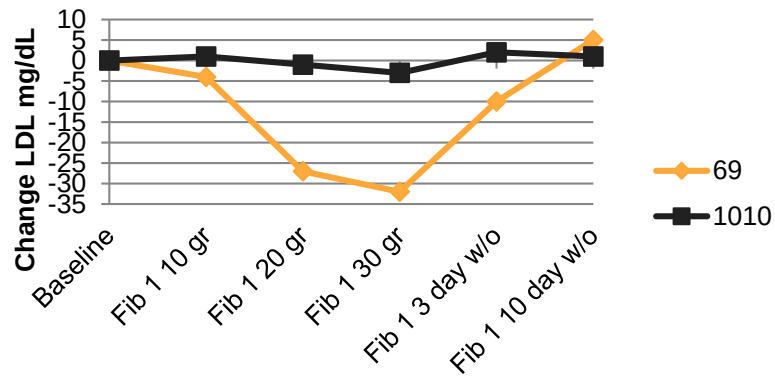


Fibers select
for specific
bacteria

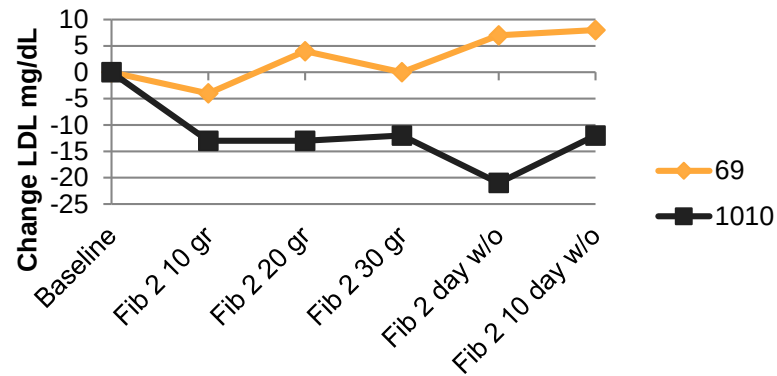


Everyone is Different

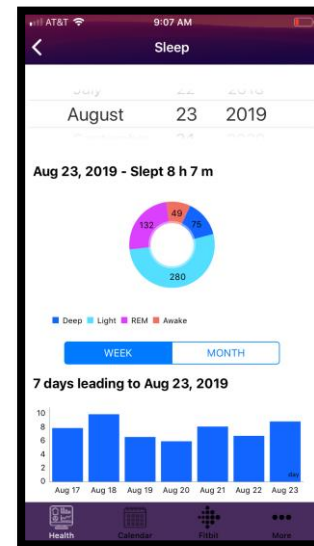
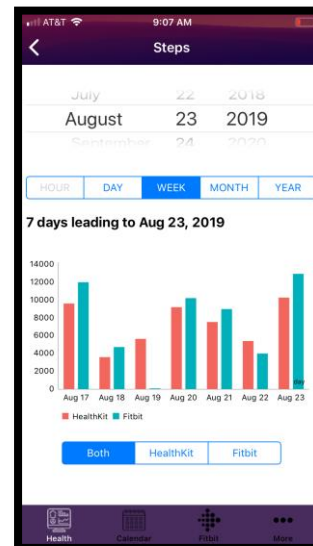
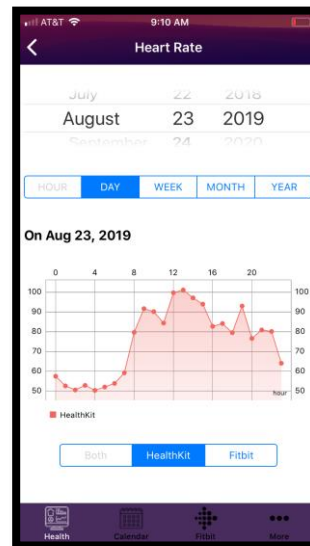
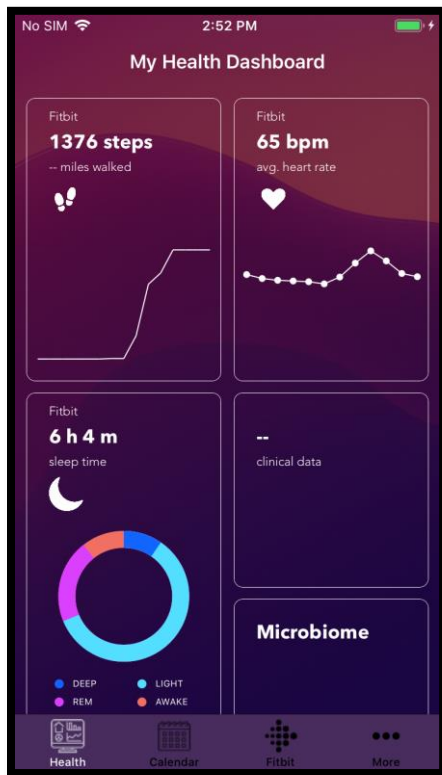
Fiber 1



Fiber 2



My Health Dashboard UI



- Visualize and monitor your health data at different resolutions

Acknowledgements

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Personal Health Dashboard

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Thore Buerger
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Ming Nyguen
Keith Bettinger

Exposome

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Xiao
Li



Amir
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Tejaswin
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Ben
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Alessandra
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Thore
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Jason
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Katherine
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Berry



Dan
Gillespie



Qiwen
Wang



Qinyi
Yao



Kexin
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Wenyu
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