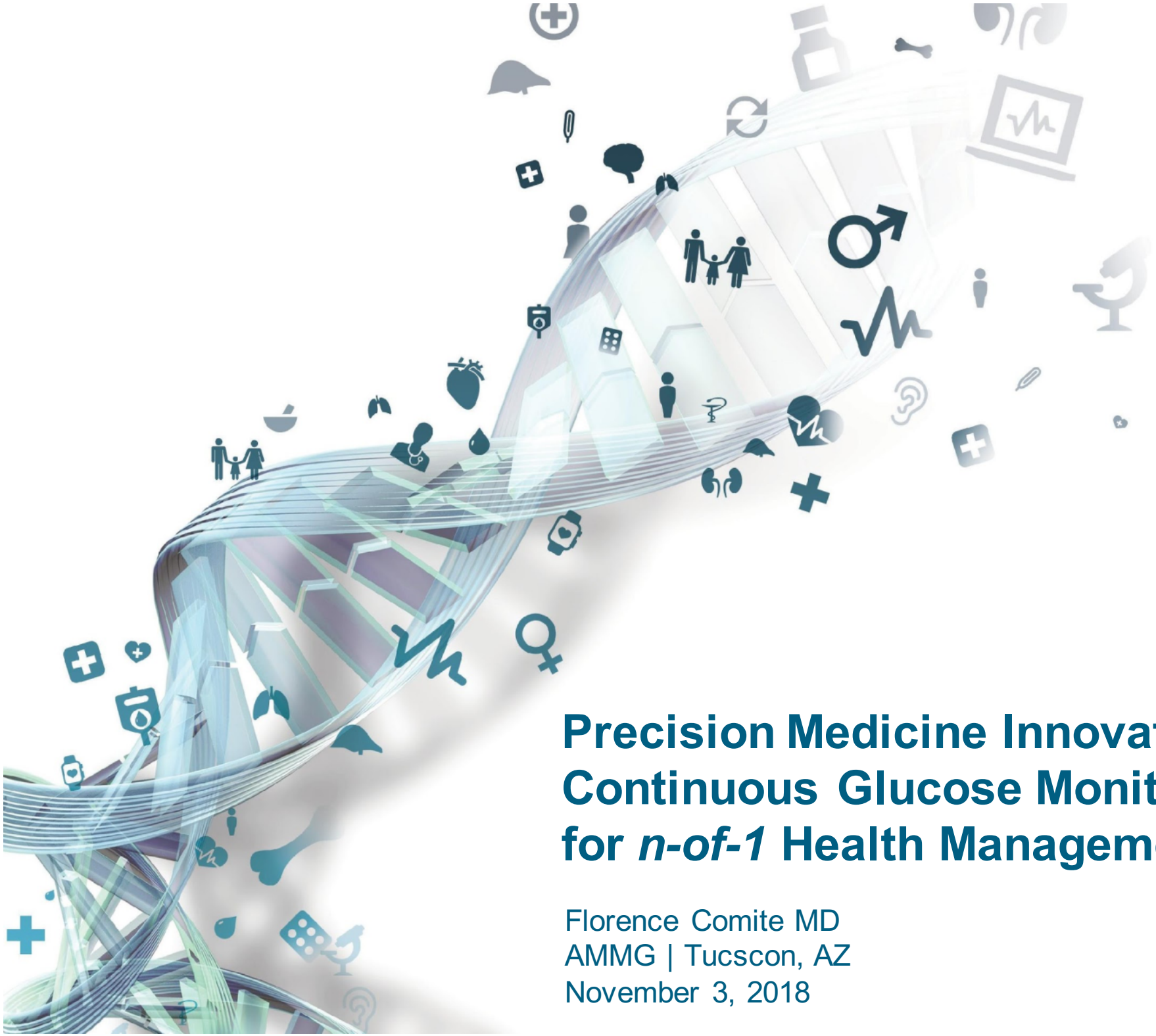
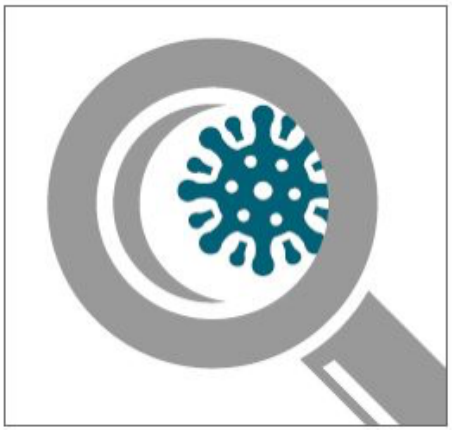


Precision Medicine Innovation: Continuous Glucose Monitors for *n-of-1* Health Management

Florence Comite MD
AMMG | Tucscon, AZ
November 3, 2018

Precision Medicine: *n-of-1* Data-Driven Health Care



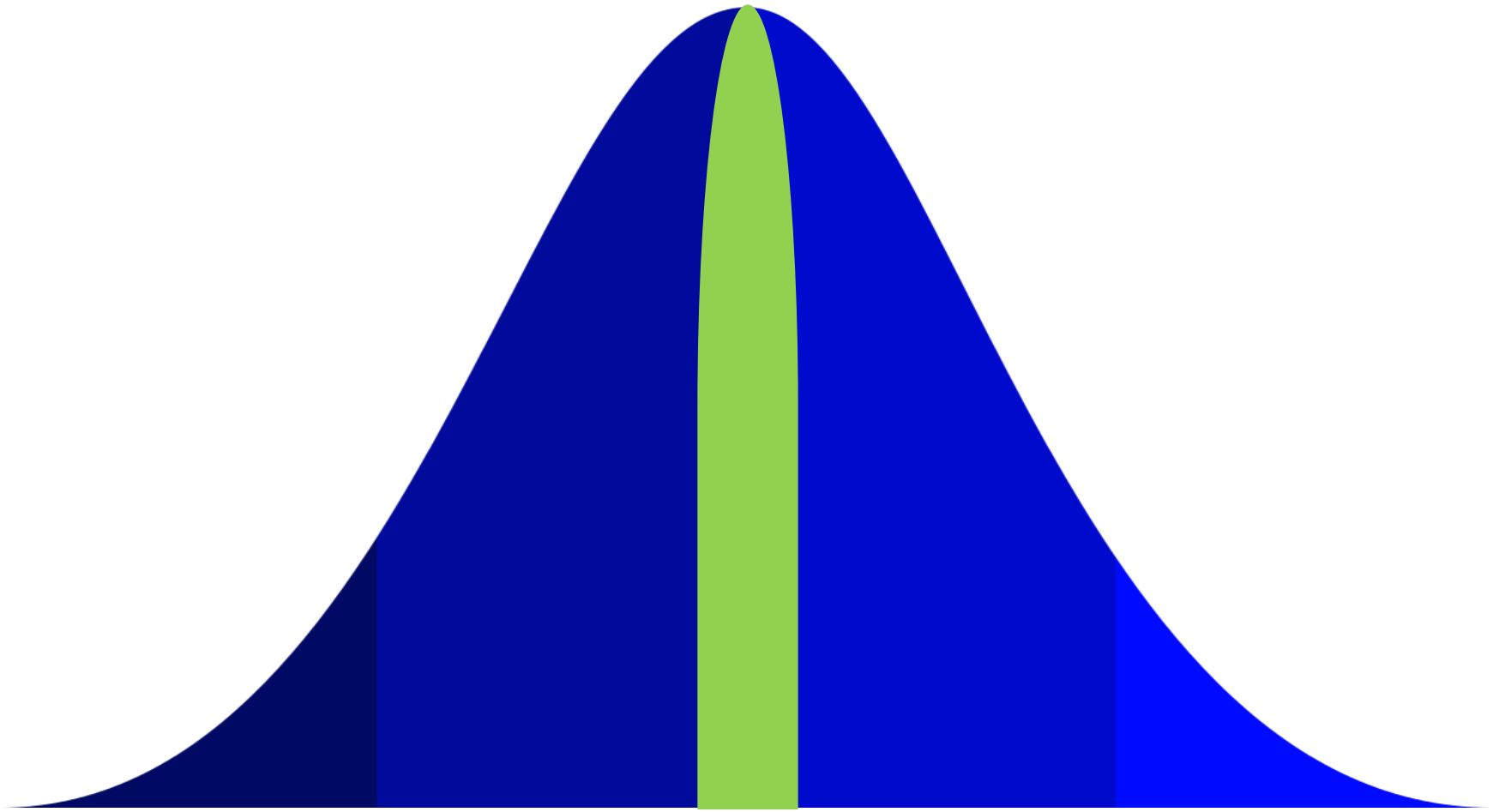
Detect

Predict

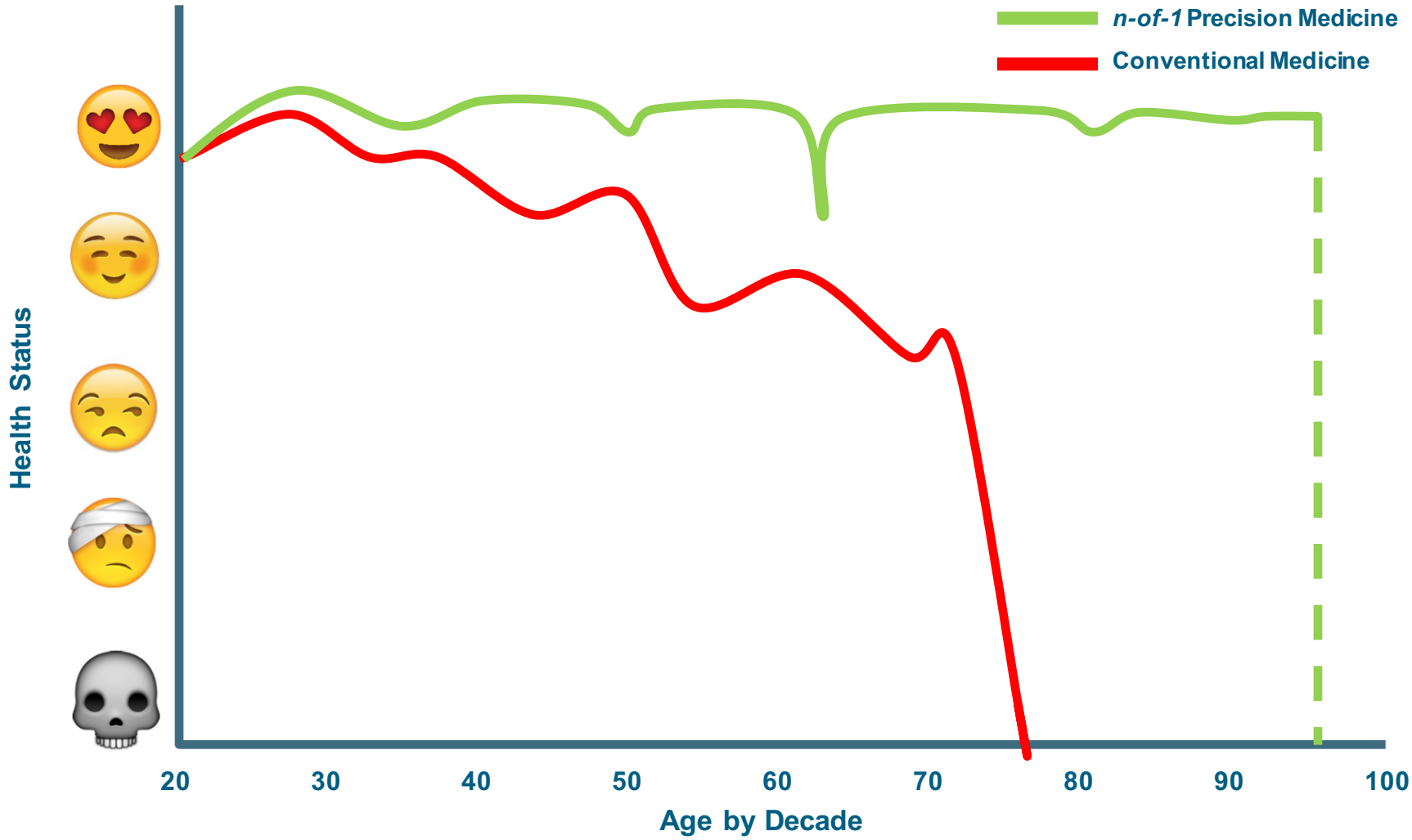
Reverse

Own

Why Does it Matter? There Is No Normal

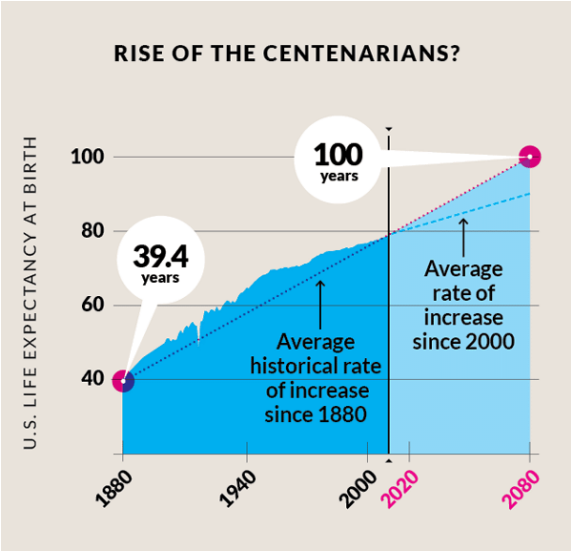


The Ultimate Goal: Extend The Health Span



~~Wealth~~ *Health* to Last a Lifetime

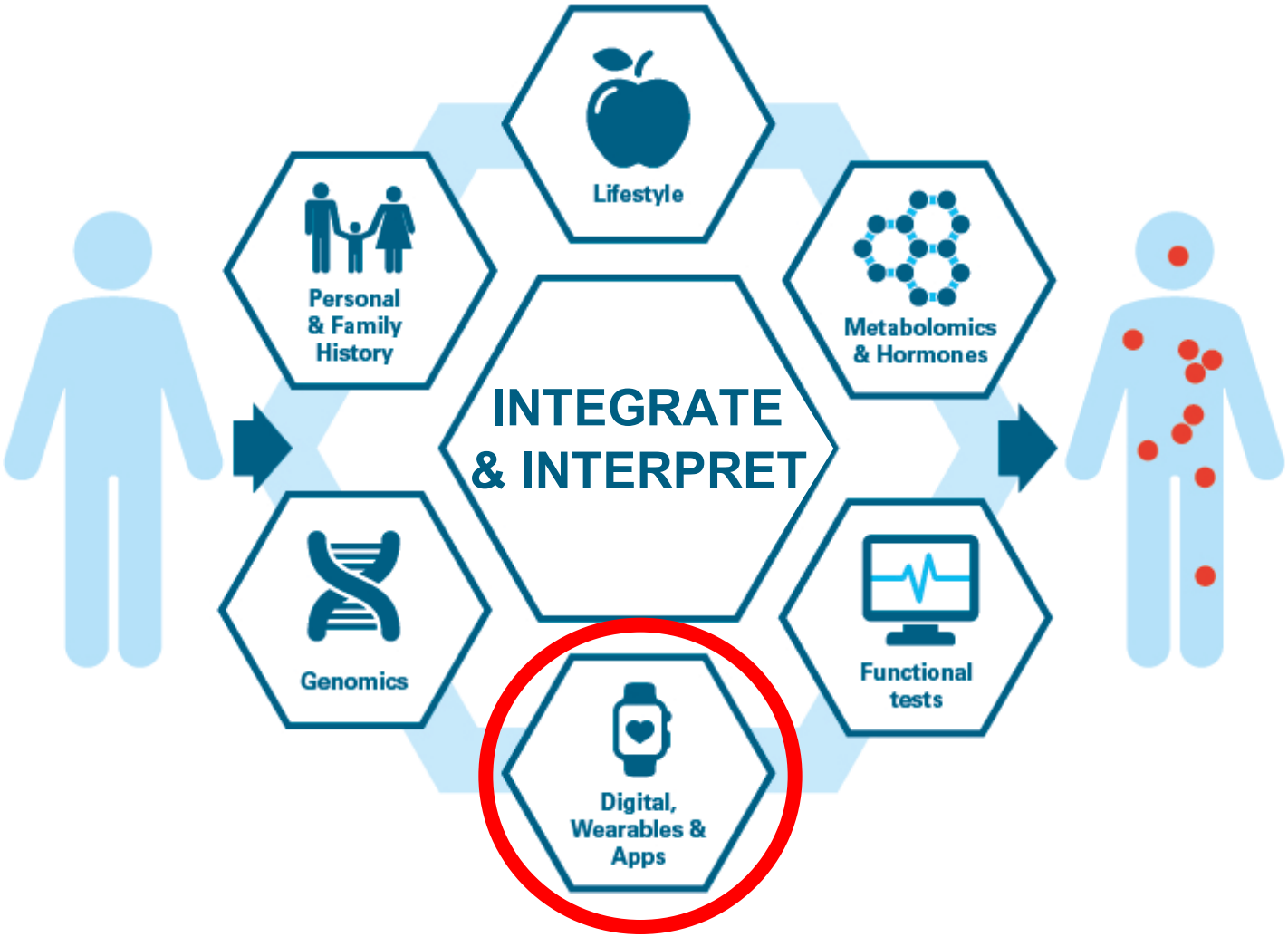
Fred Lamprey, 90, WWII pilot still flying



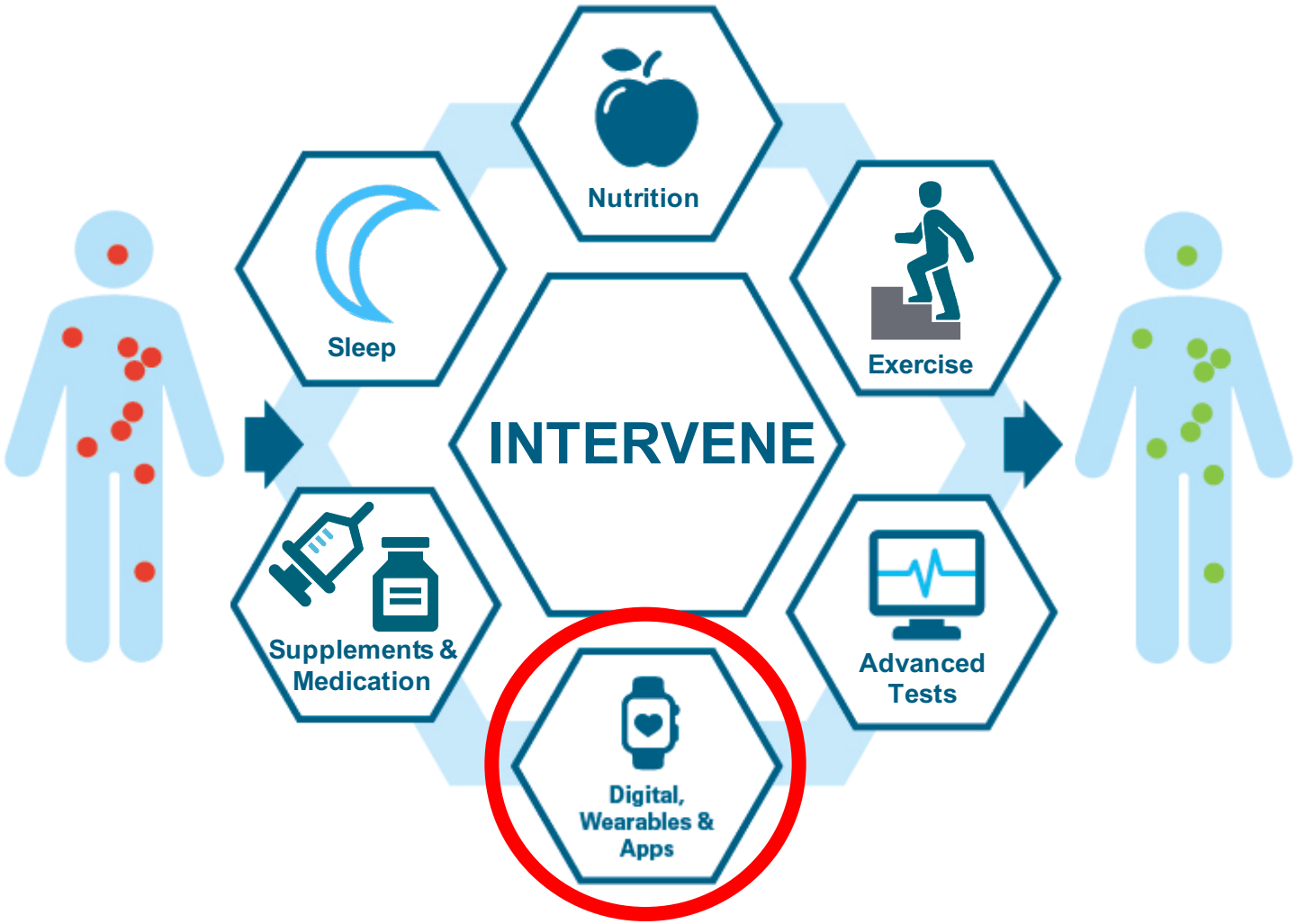
Hildegund Buerkle, 83, world record sprinter

Bette Calman, 87, world renowned yogi

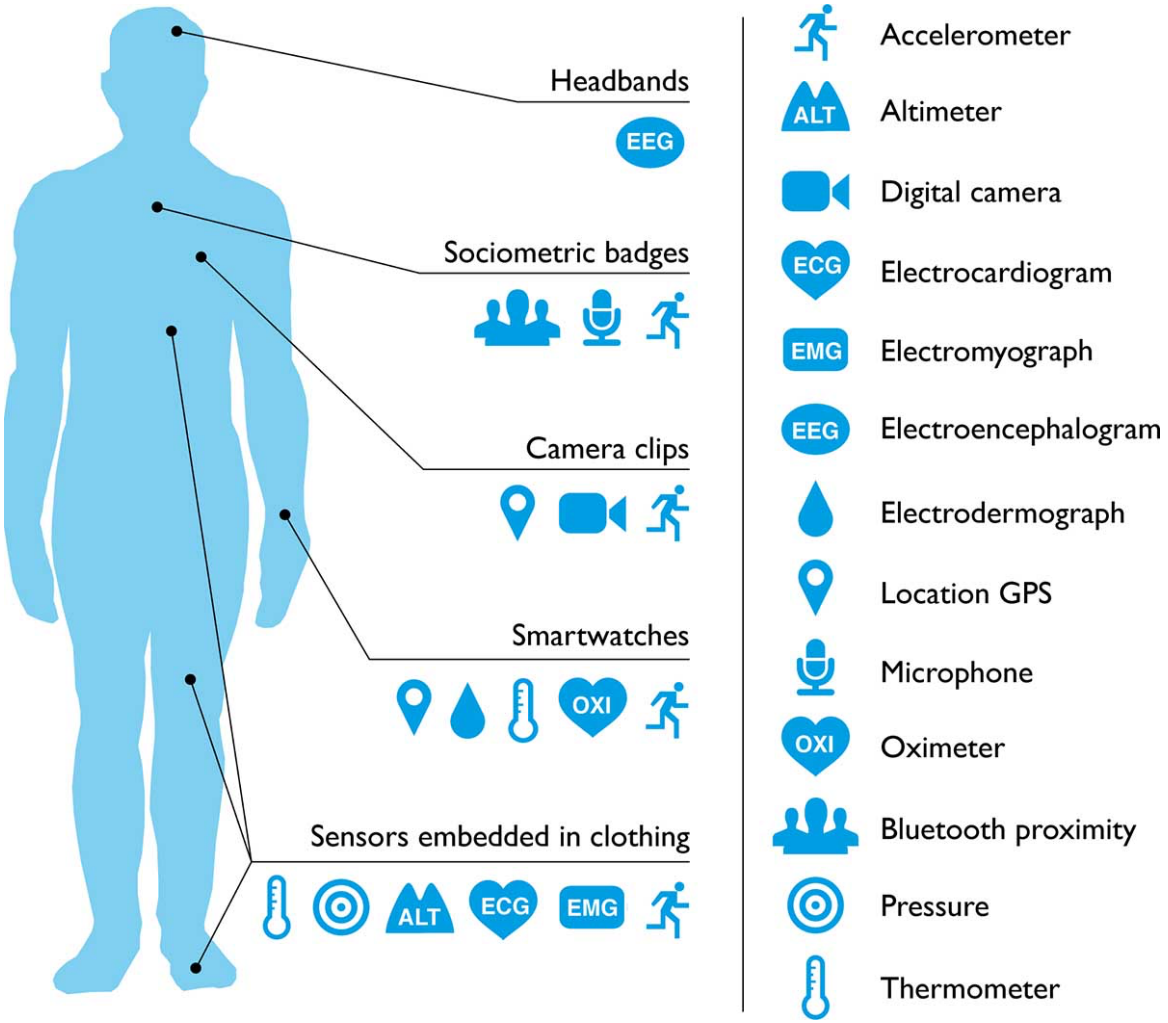
Precision Medicine Begins With *n-of-1* Data



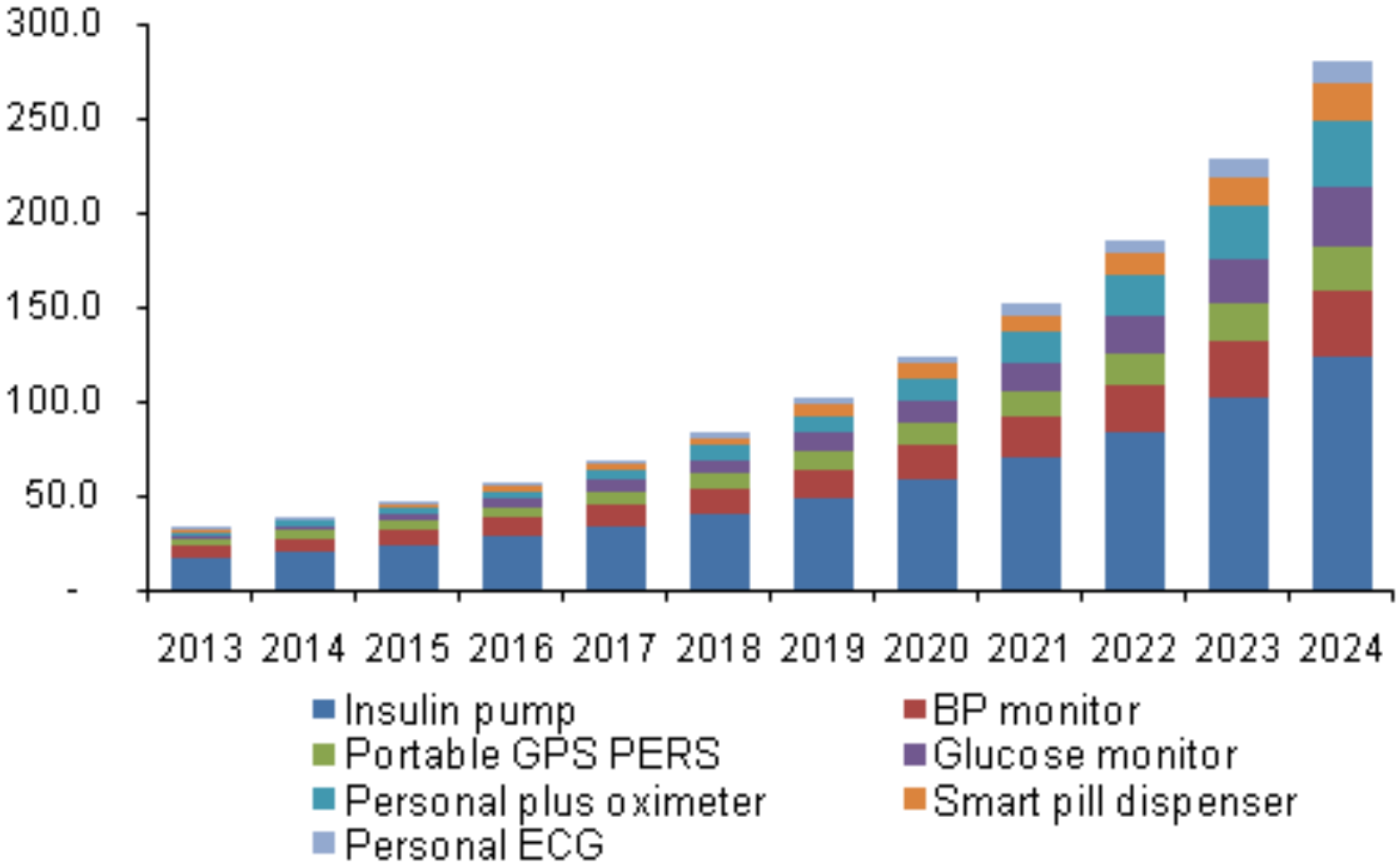
Developing Data-Informed Interventions



Wearables Tech: Capturing *n-of-1* Health Data, In Real Time

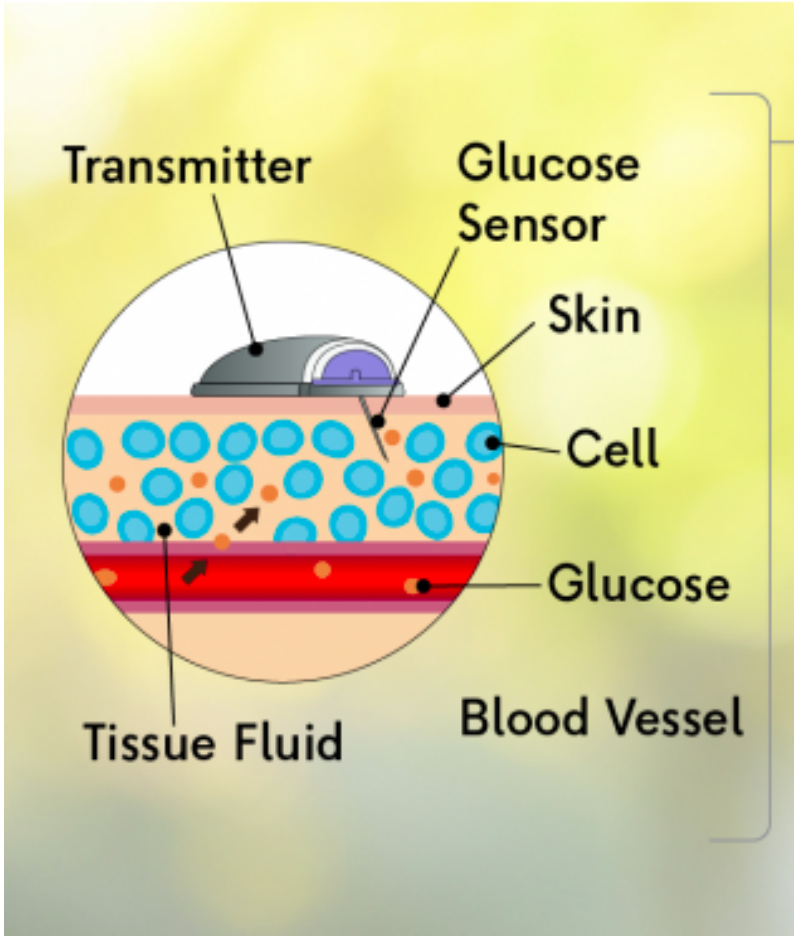


Why You Should Care About Your Patient's Wearables, Now



SOURCE: Grand View Research, "Connected Health And Wellness Devices Market Analysis By Type, By Product, By End-Use And Segment Forecasts To 2024.

Glucose Monitors: Using Wearables to Reverse Disease



Glucose Monitors In the News

FDA News Release

FDA authorizes first fully interoperable continuous glucose monitoring system, streamlines review pathway for similar devices

For Immediate Release

March 27, 2018

"The ability of this device to work with different types of compatible devices gives patients the flexibility to tailor their diabetes management tools to best meet personal preferences," said Donald St. Pierre, acting director of the Office of In Vitro Diagnostics and Radiological Health in the FDA's Center for Devices and Radiological Health. "In addition, the FDA has taken steps to expedite the review process for similar, integrated CGMs and make these types of systems available to patients as quickly as possible while also helping to ensure their safety and reliability."

What Does The Literature Say?
Widely Cited as Beneficial Among Type I Diabetics

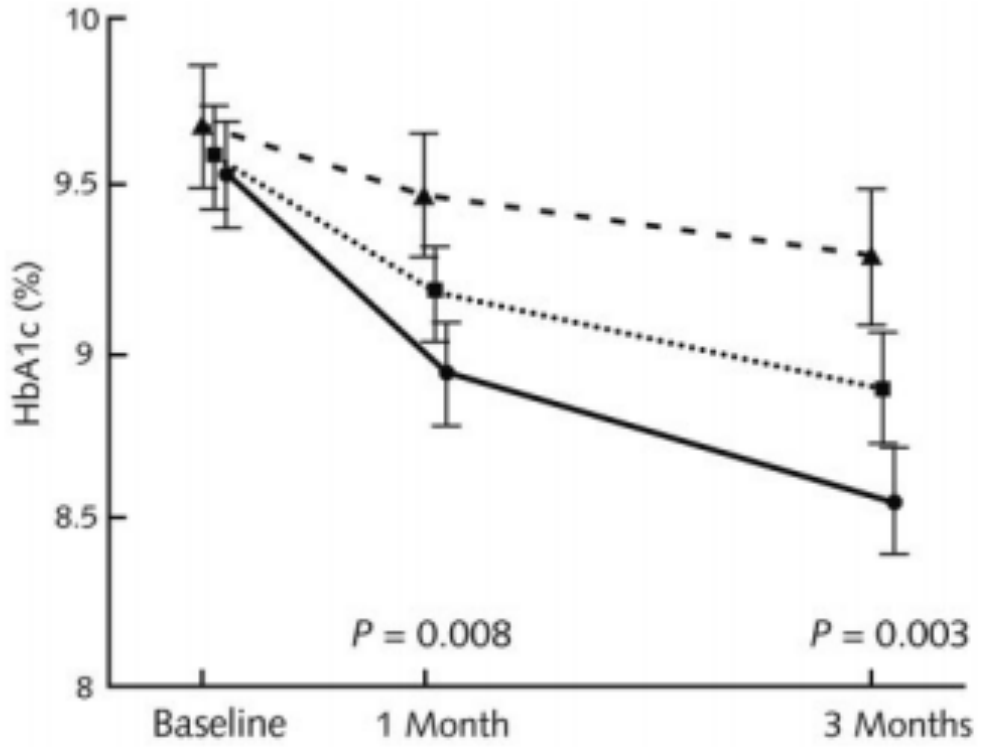
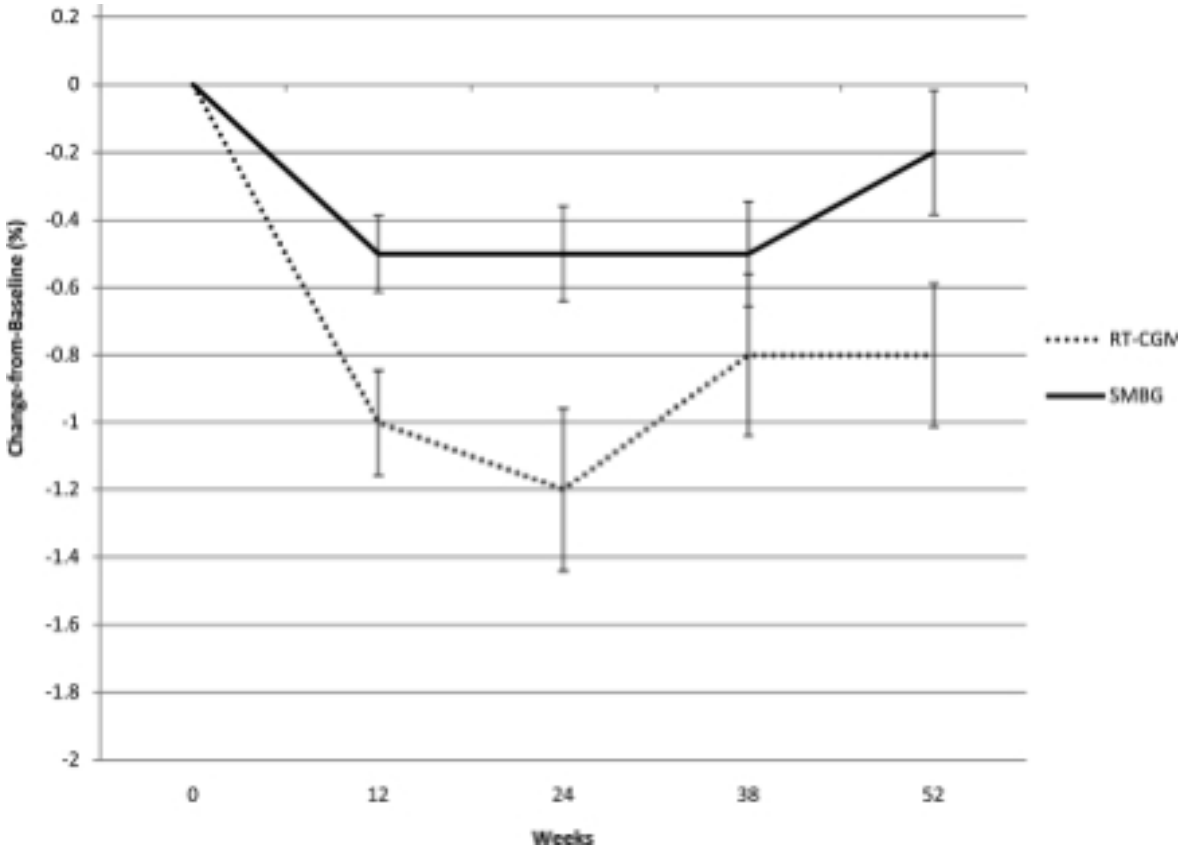


Figure 1—*Change from baseline at 1 and 3 months of AIC. Values are means ± SE. P values correspond to the difference in change from baseline between the continuous and control groups. ●, continuous group (arm 1); ■, biweekly group (arm 2); ▲, control group.*

Deiss D, Bolinder J, Riveline JP, Battelino T, Bosi E, Tubiana-Rufi N, et al. Improved glycemic control in poorly controlled patients with type 1 diabetes using real-time continuous glucose monitoring. Diabetes Care. 2006;29(12):2730–2.

What Does The Literature Say?
May be Helpful Among T2 Diabetics

Mean change in HbA1c over time, comparing CGM (dotted line) to standard measures (solid line).



Vigersky RA, Fonda SJ, Chellappa M, Walker MS, Ehrhardt NM. Short- and long-term effects of real-time continuous glucose monitoring in patients with type 2 diabetes. Diabetes Care. 2012 Jan;35(1):32-8. doi: 10.2337/dc11-1438. Epub 2011 Nov 18.

What Does The Literature Say? Promise for Prediabetics …

Indian Journal of Endocrinology and Metabolism
Wolters Kluwer -- Medknow Publications

Continuous glucose monitoring system and new era of early diagnosis of diabetes in high risk groups

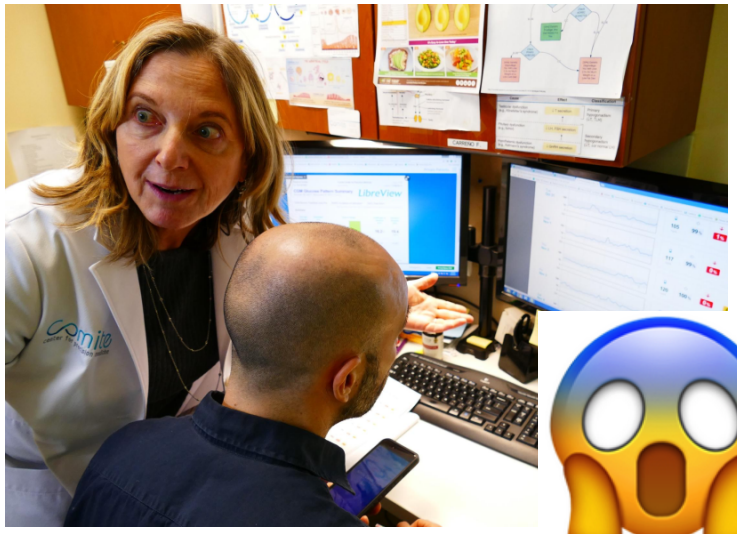
Ashraf Soliman, Vincenzo DeSanctis, [...], and Nagwa E Eldarsy

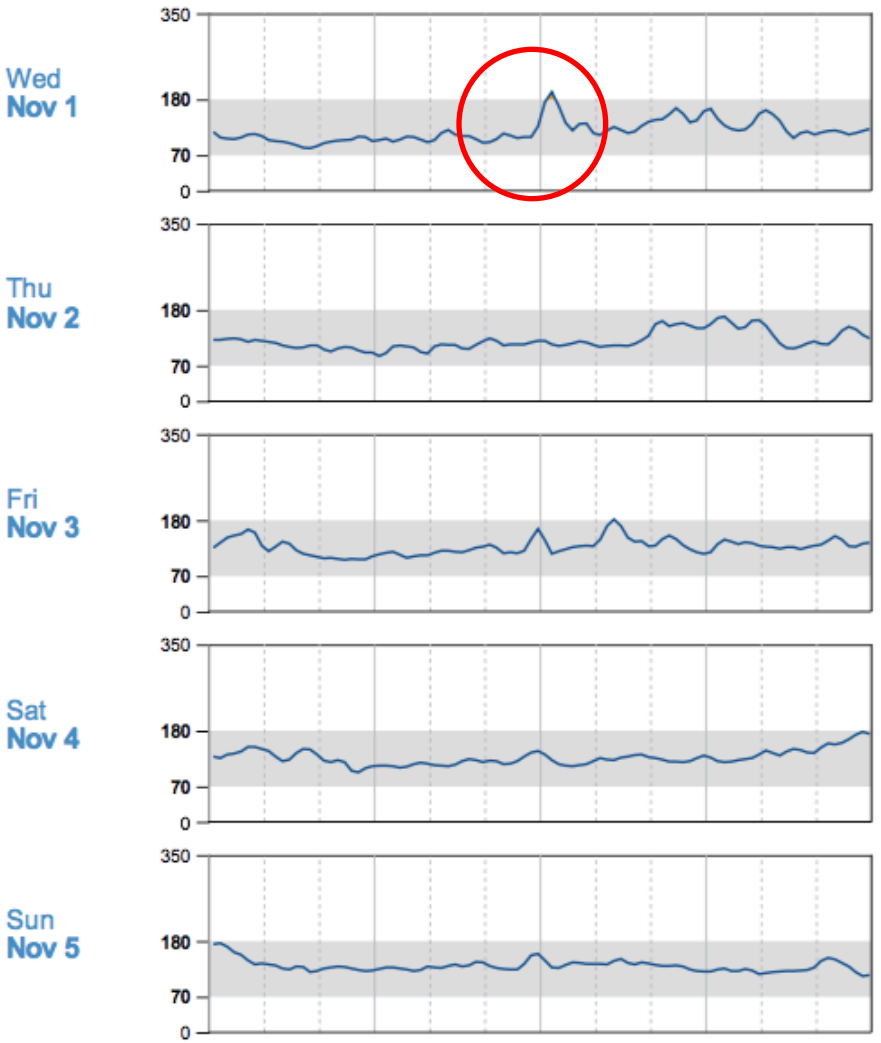
	Duration of BG monitoring	Timing	Accuracy of Dx Prediabetes	Frequency of Dx Prediabetes	Challenge type/Environment
OGTT	2 hours	Prospective	Accurate	++	After Glucose load
CGMS	3-5 days	Prospective	Less Accurate	+++	Real life detailed excursions of BG
Combined CGMS + SGMS	3-5 days	Prospective	Accurate	+++	Real life detailed excursions of BG
HbA1C	3 months	Retrospective	Inaccurate	+	Real life average BG

Case Studies from Our *n-of-1* Living Lab

- Incorporate 14-day Glucose Monitor System as part of intervention
- Range of clients: Diabetics, Prediabetics, Self-Quantifiers, Couch Potatoes
- Data blind to client
- Asked to track diet and stressful events (travel, poor sleep, stressful work day)
- Analyze and review results at 7 days and 14 days
- Coupled with blood biomarkers
- Our curiosities: Could the addition of data alone motivate change in lifestyle and/or biomarkers? Would we notice metabolic types? Would the technology add a layer of perspective to predict a diabetic trajectory? What were the pros/cons?

Me First: Insulin Resistance & Dried Mangoes

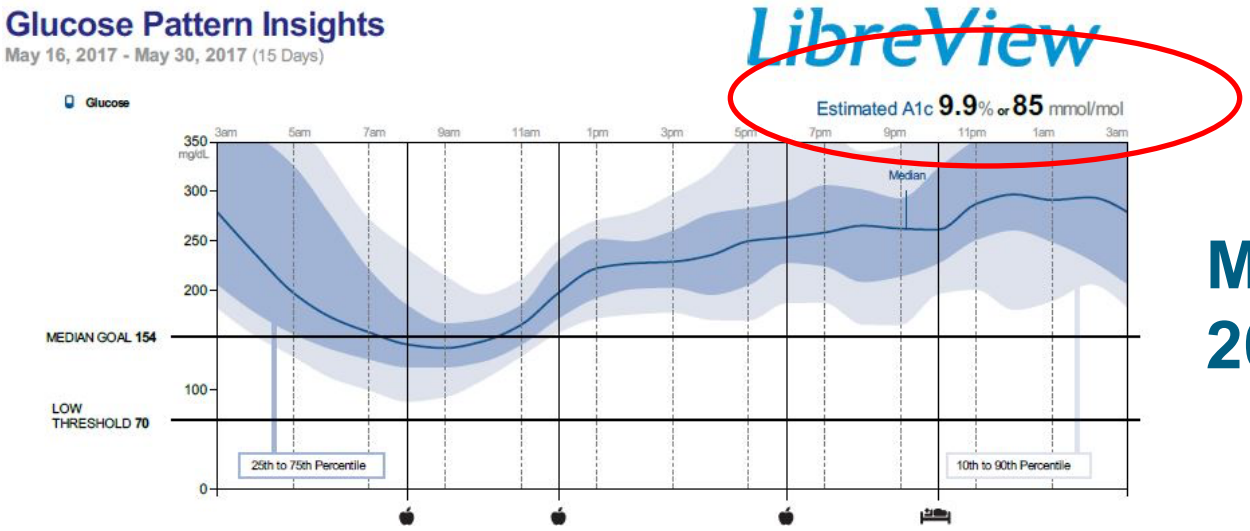




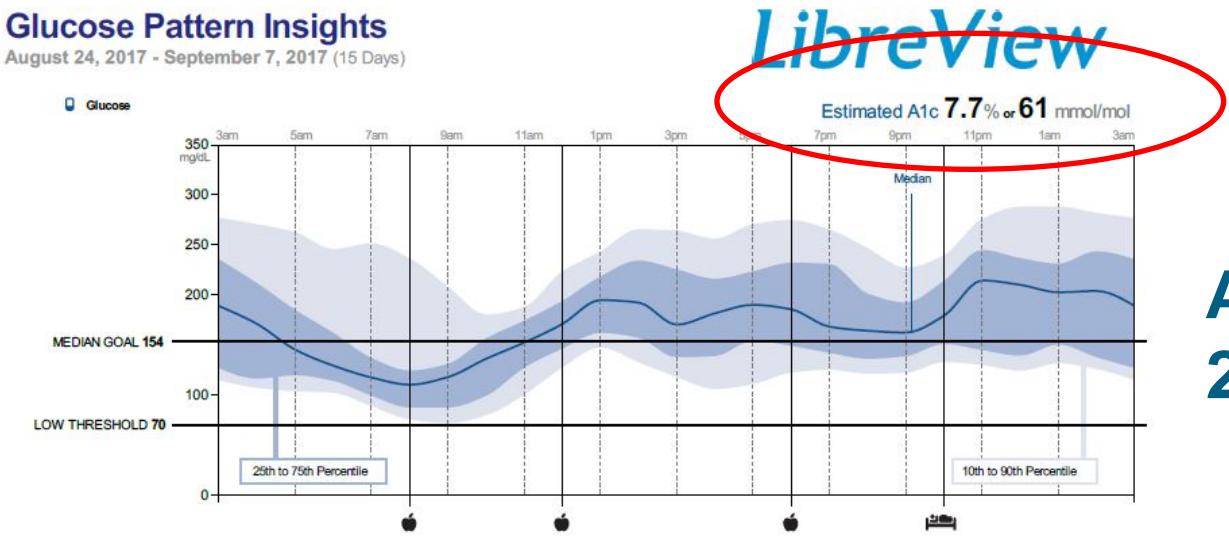
Hardwired Diabetes Risk

Florence KCNQ1 A, C		Harriet KCNQ1 A, A
34%	Absolute estimated lifetime risk.	40%
72%	Comparative genetic risk, compared with reference population.	80%
64%	Proportion of genetic vs environmental (36%) factors contributing to risk of condition.	64%

Case Study: Using Data as Motivation



May 2017



August 2017

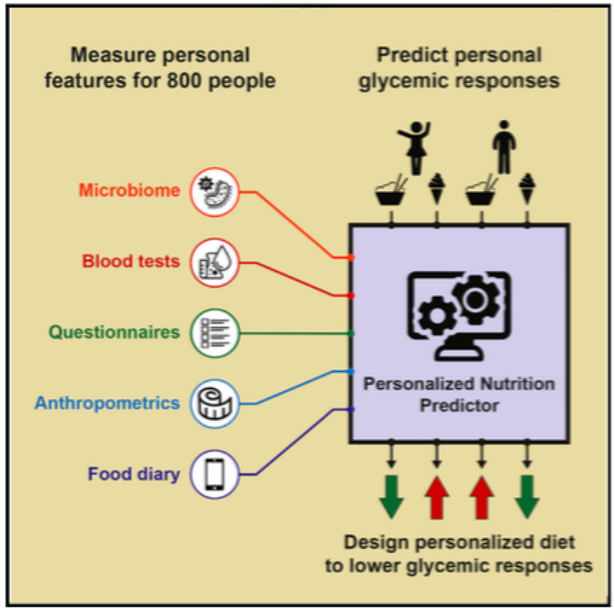
Insights to Personalize Nutrition

Cell

Article

Personalized Nutrition by Prediction of Glycemic Responses

Graphical Abstract



Authors

David Zeevi, Tal Korem, Niv Zmora, ..., Zamir Halpern, Eran Elinav, Eran Segal

Correspondence

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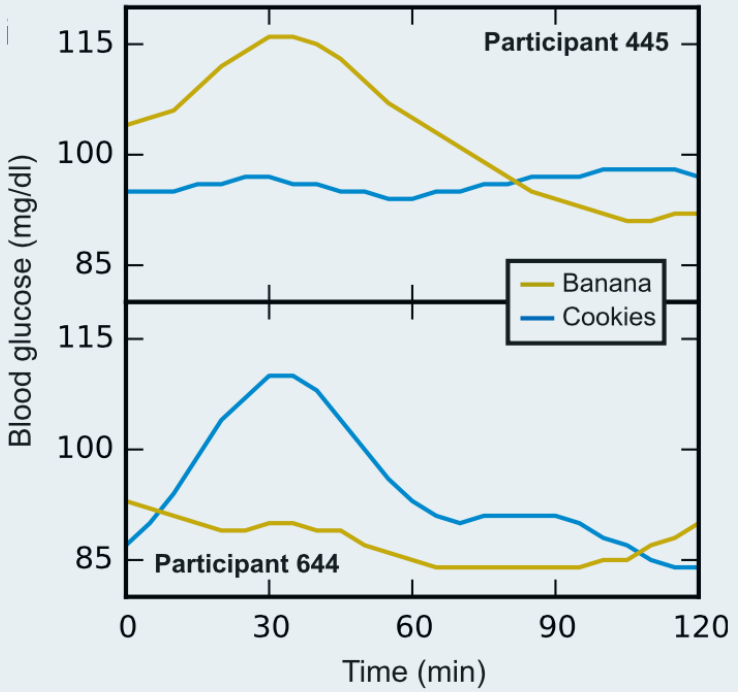
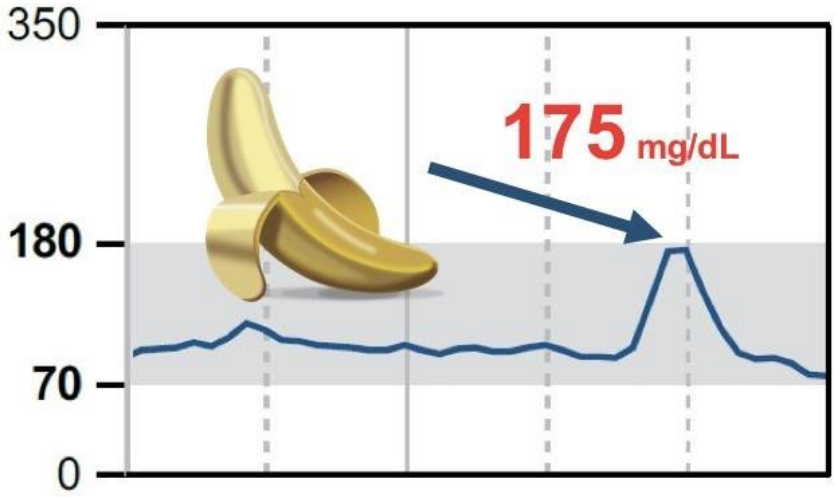
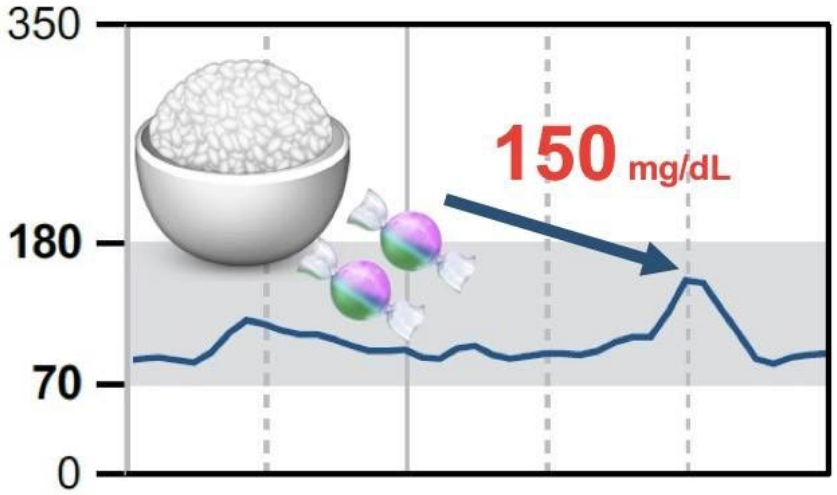
In Brief

People eating identical meals present high variability in post-meal blood glucose response. Personalized diets created with the help of an accurate predictor of blood glucose response that integrates parameters such as dietary habits, physical activity, and gut microbiota may successfully lower post-meal blood glucose and its long-term metabolic consequences.



Case Study: Identifying Metabolic Types

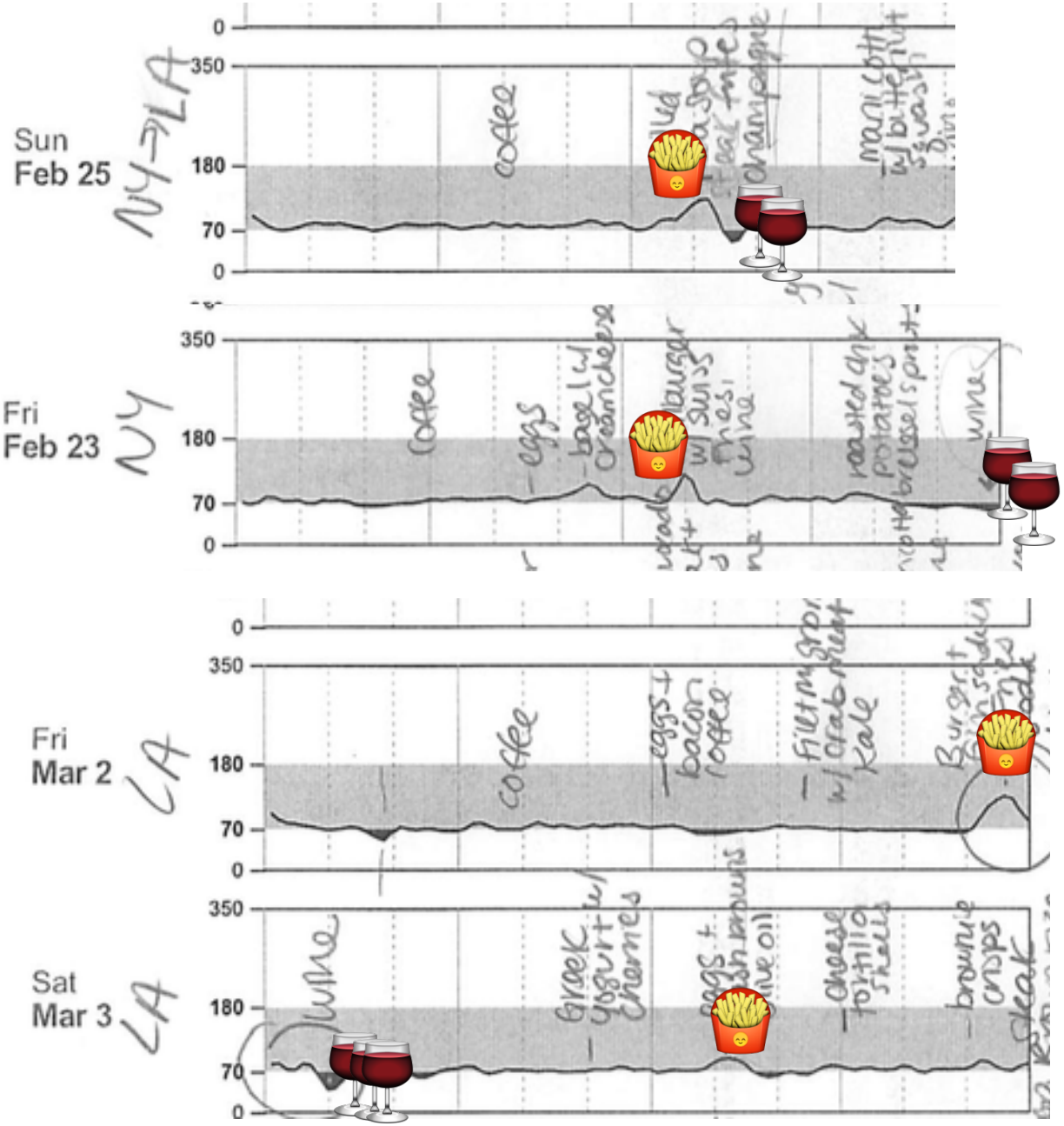




CGM As A Teaching Tool

Pairing CGM with Food Journal

Date	Pacific Eastern City	12:00a 03:00a	01:00a 04:00a	02:00a 05:00a	03:00a 06:00a	04:00a 07:00a	05:00a 08:00a	06:00a 09:00a	07:00a 10:00a	08:00a 11:00a	09:00a 12:00n	10:00a 01:00p	11:00a 02:00p	12:00n 03:00p	01:00p 04:00p	02:00p 05:00p	03:00p 06:00p	04:00p 07:00p	05:00p 08:00p	06:00p 09:00p
2/27/2018	LA to NY						05:15a - PT black coffee x3	06:30a - Black coffee. Blueberries and Strawberries.	Black coffee	airplane breakfast: chicken chorizo w/eggs. Yogurt and fruit. Coffee.						airplane snack: 2 slices of mozzarella and water.	back on E/C	07:00 ET- turkey meatloaf, mashed potatoes, salad and water		08:30 ET - 2 glasses of wine. Aracin balls and cheese at Felice.
2/28/2018	NY to LA					Coffee. Water.		3 eggs. 3 canadian bacon. Coffee x 3			12:30p ET - pasta w/stewed chicken and olives. Water.								08:50p ET- chicken Milanese sandwich w/avocado. Fries. Wine. Water.	flight to LA
3/1/2018	LA							Water. Coffee x 3							Rigatoni Pasta w/fennel sausage. Water.Shared pieces of fried cauliflower.	Water. Coffee.				
3/2/2018	LA							Water. Coffee x 3			3 scrambled eggs, 2 pieces canadian bacon, coffee.				2 pices of filet mignos w/crab meat and late. Water. Coffee.					
3/3/2018	LA								Coffee x 2, greek yogurt w/cherries.			10:30a PT - 4 eggs, hash brown potatoes cooked w/olive oil. Decaf Coffee.					02:30p PT- cheese tortilla shells. Water.			Snack of brownie "crisps"
3/4/2018	LA							Water x2	Coffee x 2			10:30a PT - 3 eggs, pork chop. Decaf Coffee. Water.						04:30p PT - fast food burger, fries and water.		
3/5/2018	LA							06:30a Water.			Coffee. 2 eggs, 1 slice canadian bacon, water, coffee.	10:30a - Water.			filet mignon, aspangus, brussel sprous. Thin apple slices. Water.	02:15p PT - coffee.				


Sun
Feb 25
NY→LA
0
350
180
70
0
coffee
champagne
Fri
Feb 23
NY
350
180
70
0
coffee
eggs
wine
Fri
Mar 2
LA
350
180
70
0
coffee
eggs + bacon
coffee
Kale
Sat
Mar 3
LA
350
180
70
0
wine
Greek yogurt
eggs +
cheese
tortilla chips
brownie crisps

Our Observations

- Could the addition of data alone motivate change in lifestyle and/or biomarkers? **Yes.**
- Would we notice metabolic types? **Yes.**
- Did the tech add a layer of perspective to the prediction of a diabetic trajectory? **Yes.**
- What are the pros? **Partner effectively. Own your health destiny.**
- What are the cons? **Can be annoying. Falls off. Glue. May be less accurate.**

Thank You

Christopher Arboleda
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Erin Gress
Andi Hanken
Amanpreet Kaur
Sarah Lehman
Daniel Lenzo
Nina Luban
Kirby Mateja
Talat Rubin
Gabriella Sansaricq
Umbar Sattar
Cecelia Smith
Michael Tucci
Lloyd Xiao

"You can't list your iPhone as your primary-care physician."

SOURCES

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