

# The Future of Healthcare: Humans and Machines Partnering for Better Outcomes

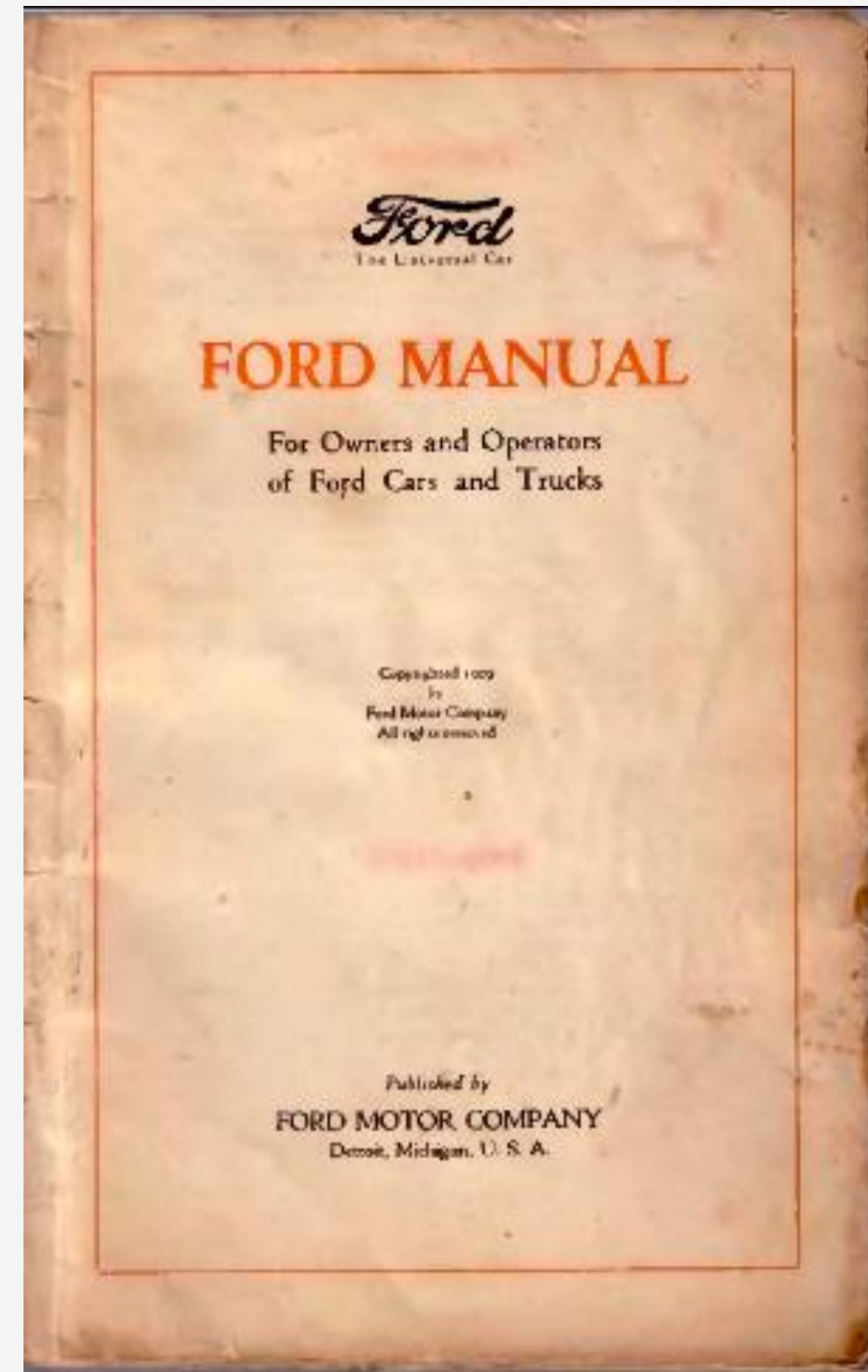
**EMMANUEL FOMBU, MD, MBA**



OWNER'S  
MANUAL

MODEL  
NEWBORN  
BABY





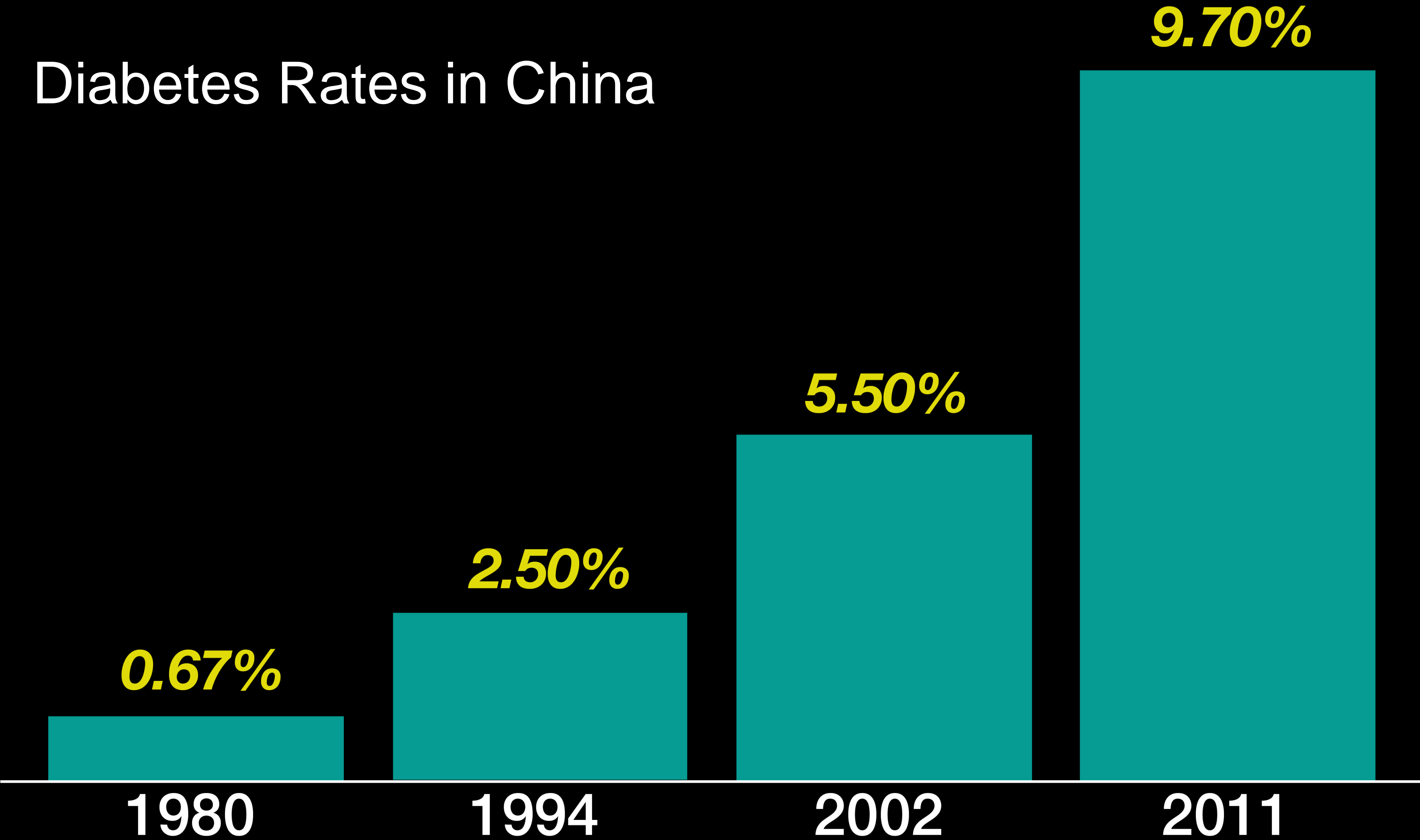
The image shows the cover of a modern iPad user guide. At the top left, it says "New: Apple iPad user guides" with an Apple logo. At the top right, it says "BDM's". The main title is "The iOS 10 iPad Manual" in large black font. Below the title, it says "The complete & jargon free manual for all iPad owners". There are two callouts: a red one on the left that says "Over 900 tips & guides inside" and a blue one on the right that says "Updated for the new iPad Pro 10.5\". The central image shows three iPads displaying different screens: a lock screen with a colorful abstract pattern and the time 13:46, a home screen with various app icons, and an app drawer. At the bottom, it says "Everything you need to know about your Apple iPad answered inside..."







# Diabetes Rates in China







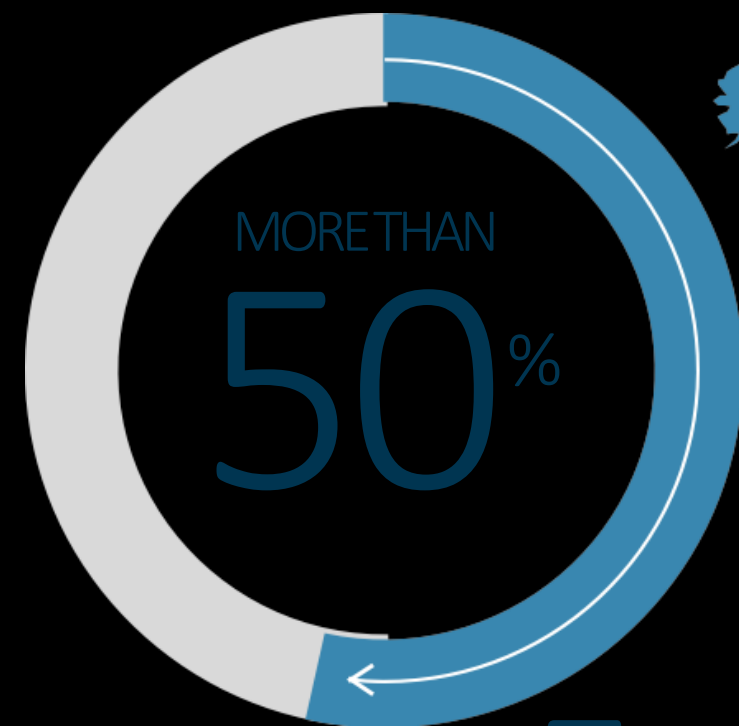


# Complex chronic conditions – trillion dollar problem



GLOBAL economic burden for chronic diseases

## 47 trillion dollars



OF THE WORLD LIVES  
WITH CHRONIC DISEASES

## 5 major chronic diseases

Cardiovascular Disease | Chronic Respiratory Disease  
Cancer | Diabetes | Mental illness

In the US alone **59%** of the adult population have 1 or more chronic diseases. They take up **90%** of the healthcare spending and are:



**20%** more likely to be re-hospitalized within 30 days post discharge



**400%** more likely to have an emergency room visit



Cost **550%** more for annual care

## 99%

Of disease management is in the hands of individuals and their families

**FIGURE I: Value in Healthcare**

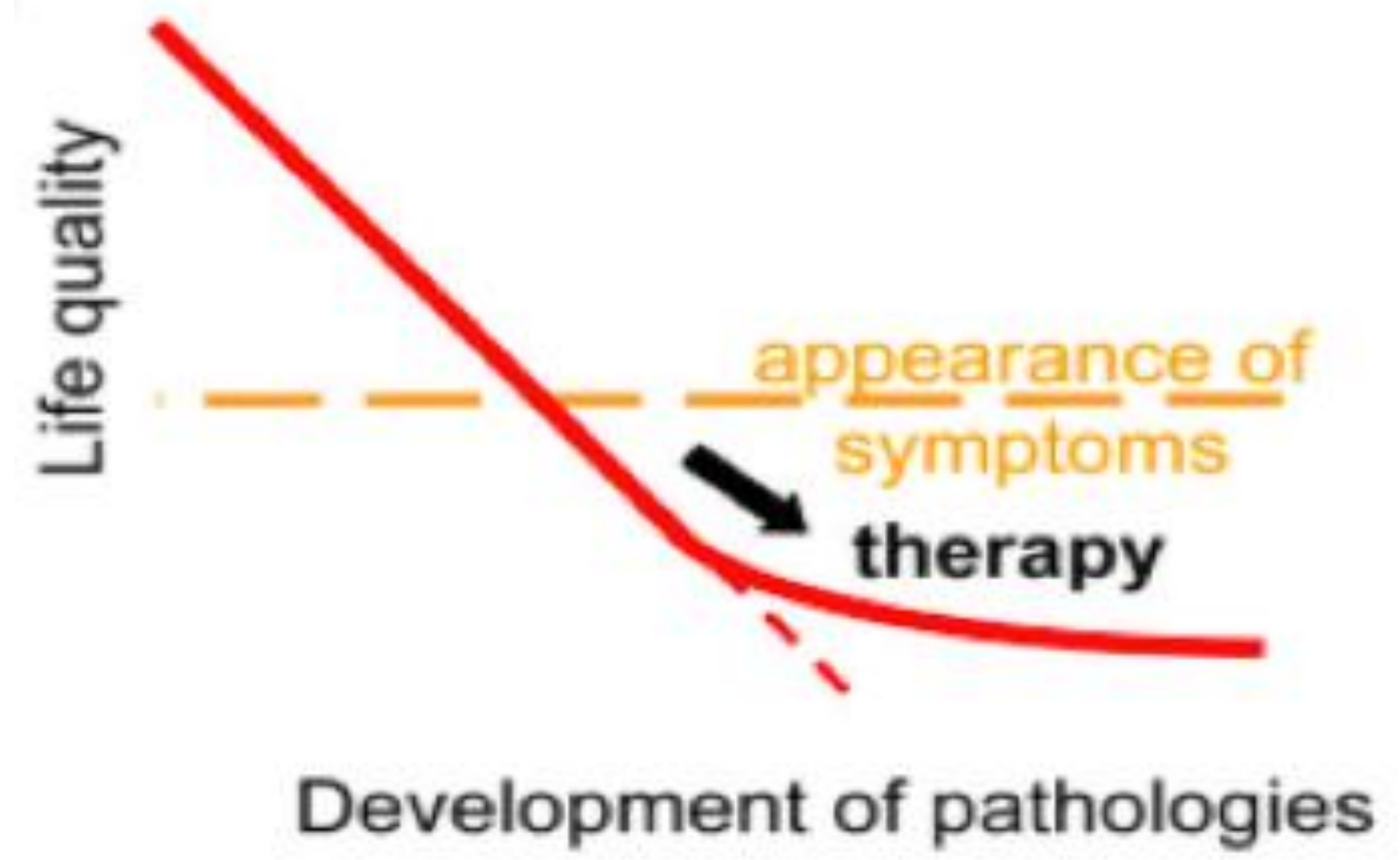








# Current healthcare





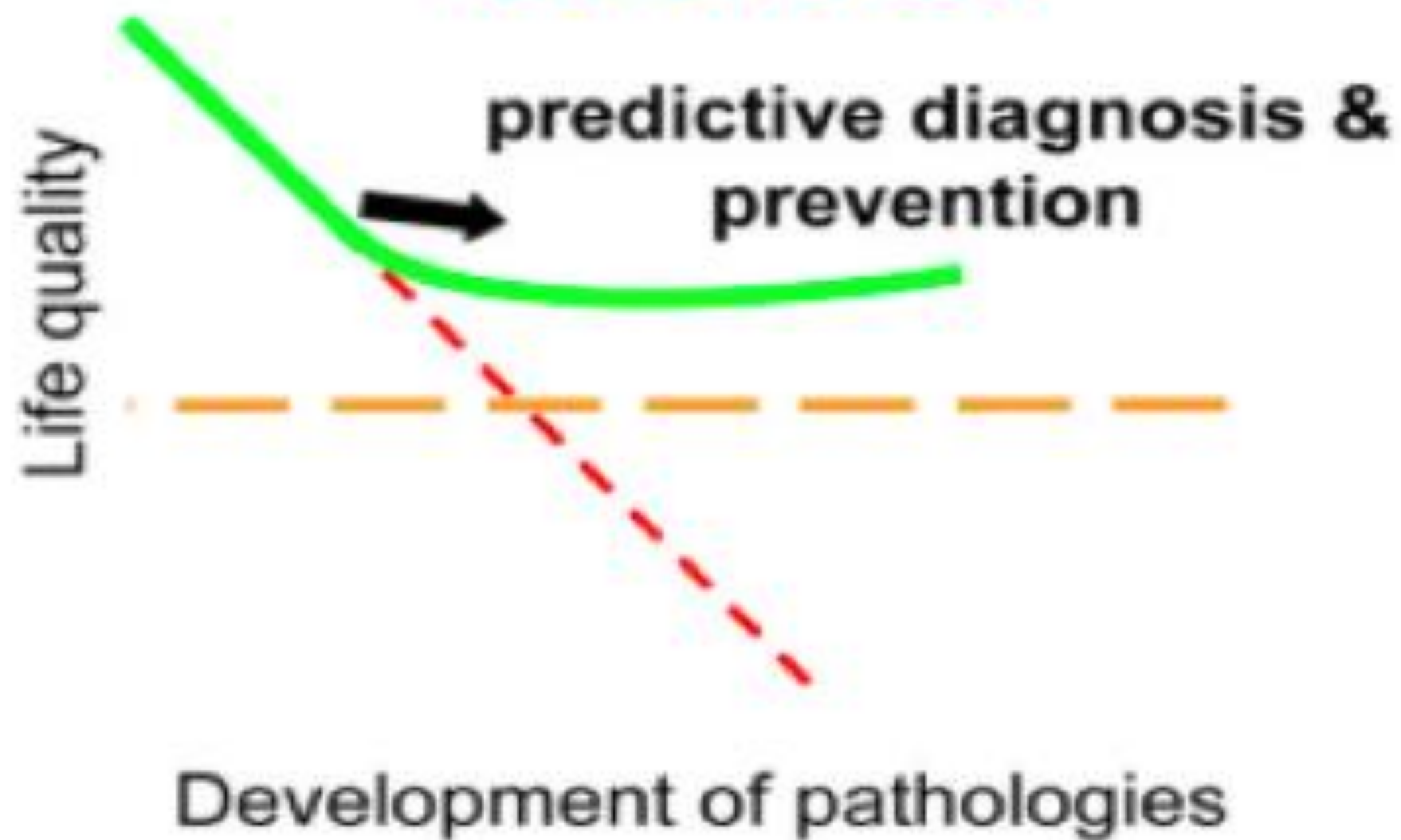
I STILL CAN HEAR MY DOCTOR SAYING: 'THAT'S HARMLESS. YOU'LL BE WELL IN NO TIME!'

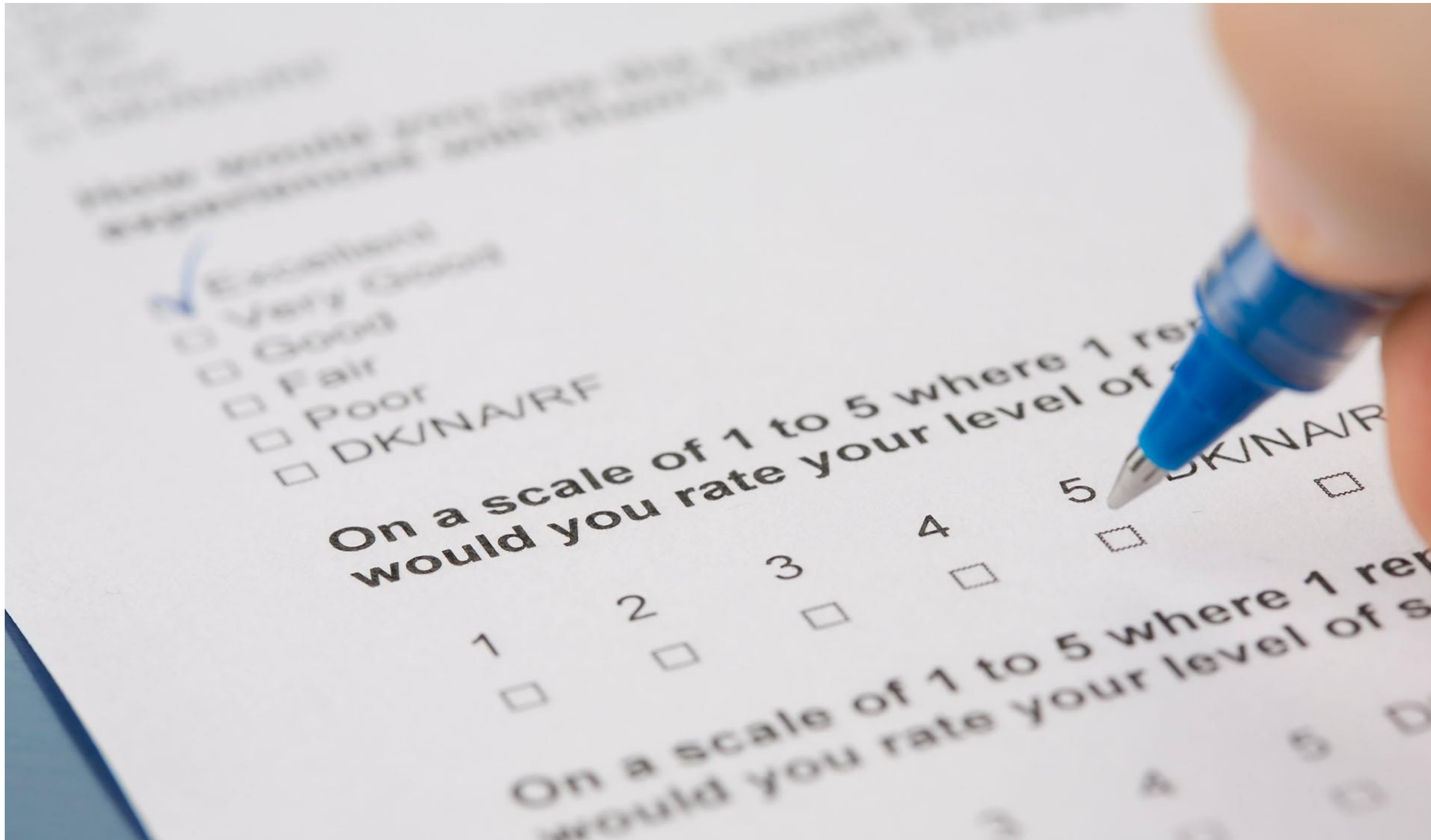


SHAW



## Desirable healthcare





### Limitations of traditional questionnaire-based patient reported outcomes

- Subjective
- Long recall periods
- Subject to patient recall and reporting bias

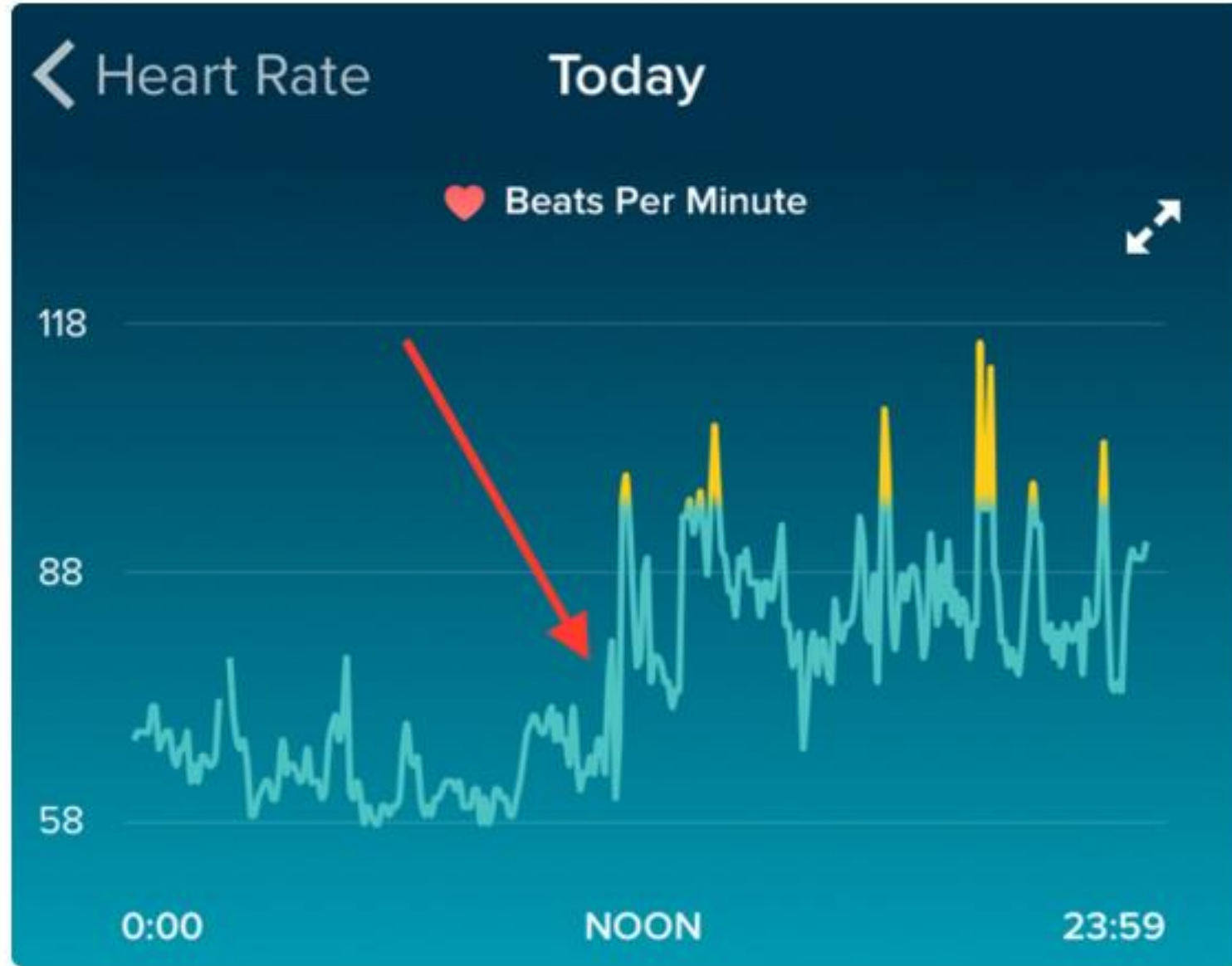
# Measuring Health Related Quality of Life



**Koby**  
@iamkoby

Follow

Breakup, as captured by my fitbit. [#breakup](#)  
[#Fitbit](#)



RETWEETS  
2,345

LIKES  
3,122



10:55 AM - 19 Jan 2016





# JACC

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

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JACC Journals

Journal of the American College of Cardiology  
Volume 73, Issue 9 Supplement 1, March 2019  
DOI: 10.1016/S0735-1097(19)31455-X

HEART FAILURE AND CARDIOMYOPATHIES

SACUBITRIL/  
FAILURE WITH  
RANDOMIZED,

Raj M. Khandwalla, D  
Owens and Steven St



# JACC

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August 2017 Volume 23, Issue 8, Supplement, Page S69

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### AWAKE-HF: Rationale and Design of a Study Using a Wearable Biosensor to Objectively Evaluate the Effect of Sacubitril/Valsartan Initiation on Measures of Physical Activity, Symptoms, and Sleep, as Health-Related Quality of Life Functions in Subjects with Heart Failure

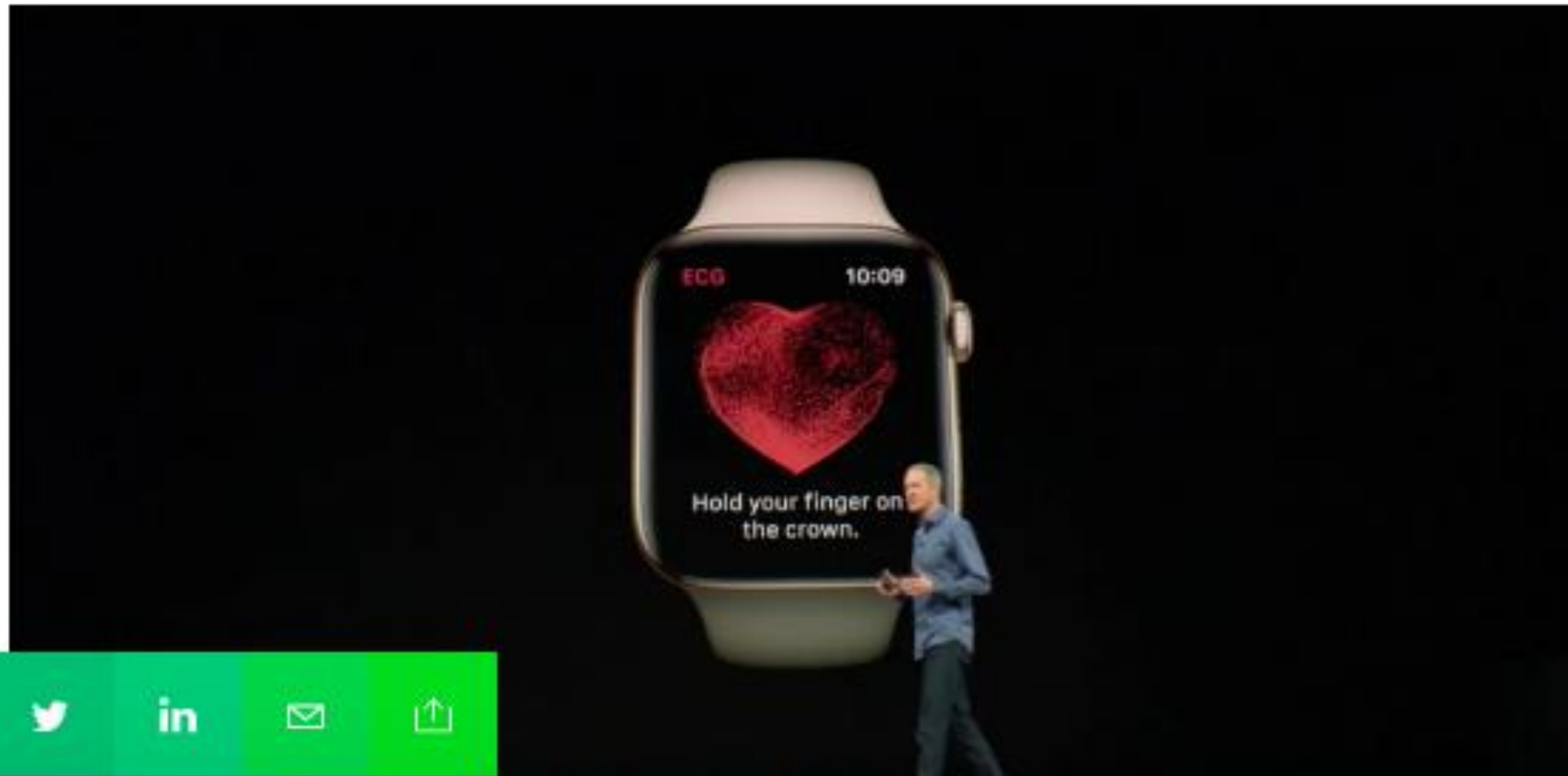
Raj M. Khandwalla<sup>1</sup>, Kade T. Birkeland<sup>1</sup>, James Thomas Heywood<sup>2</sup>, Robert L. Owens<sup>3</sup>, Steven Steinhubl<sup>2</sup>, Daniel Grant<sup>4</sup>, Kevin McCague<sup>4</sup>, Emmanuel Fombu<sup>4</sup>, Jerome B. Riebmam<sup>4</sup>



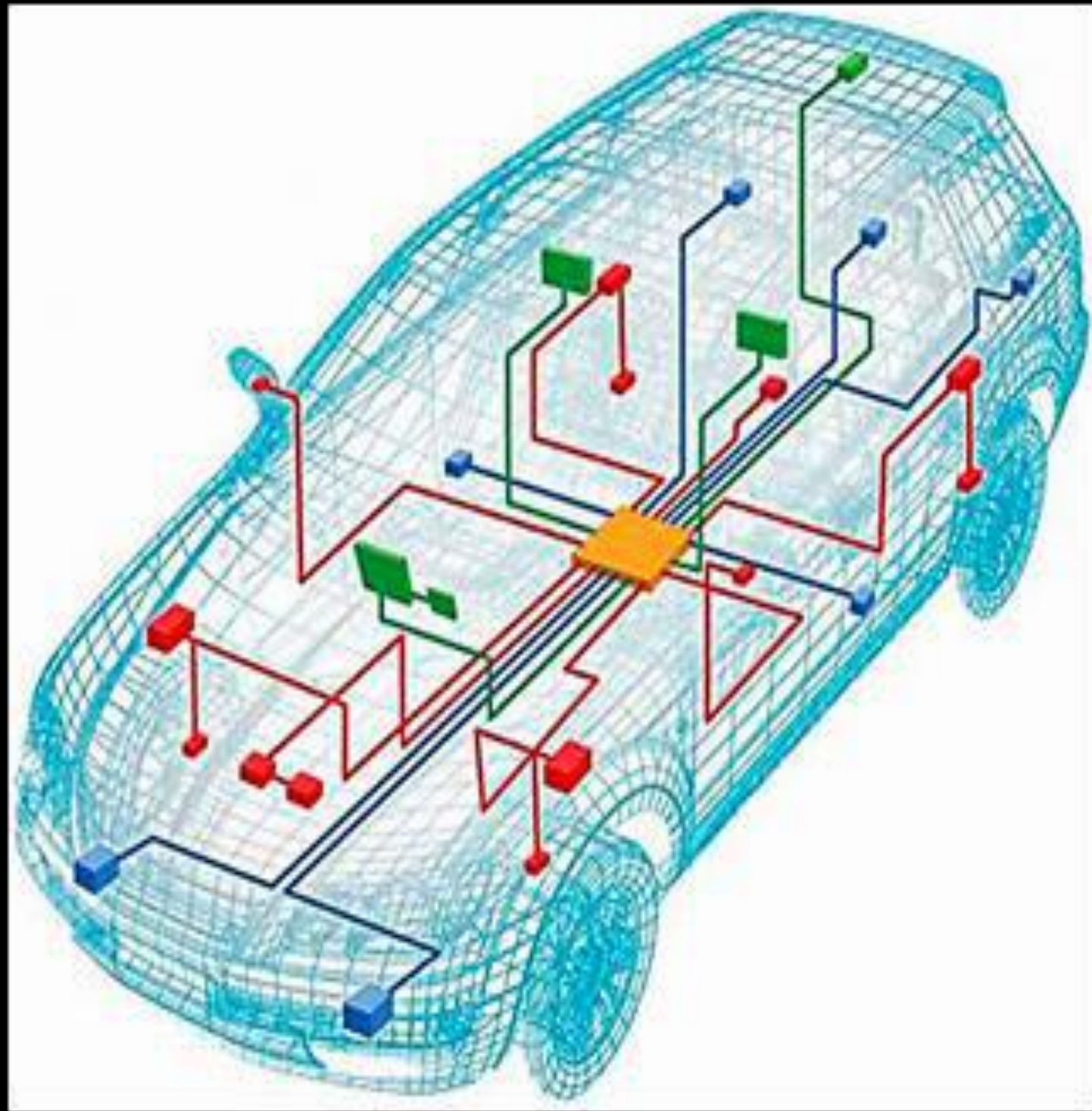
# Apple Watch Series 4 can detect AFib and perform an ECG

Matt Burns @mjburnsy / 1:27 pm EDT • September 12, 2018

 Comment





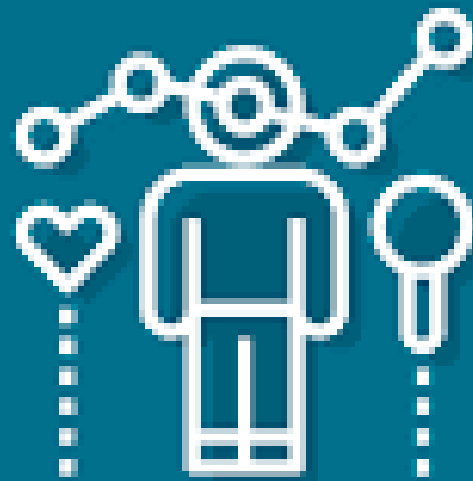


Automotive Systems Map



Visual sensor warning dashboard

**THE FUTURE OF MEDICINE:**

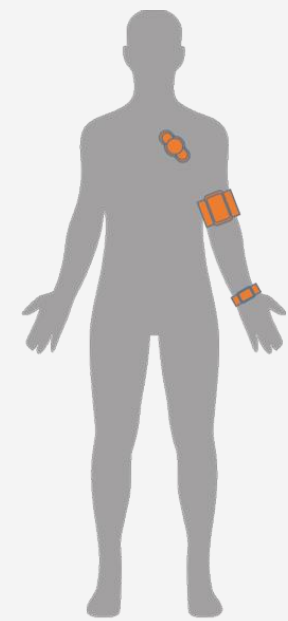


**PREDICTIVE  
PERSONALIZED  
PREVENTIVE  
PARTICIPATORY**

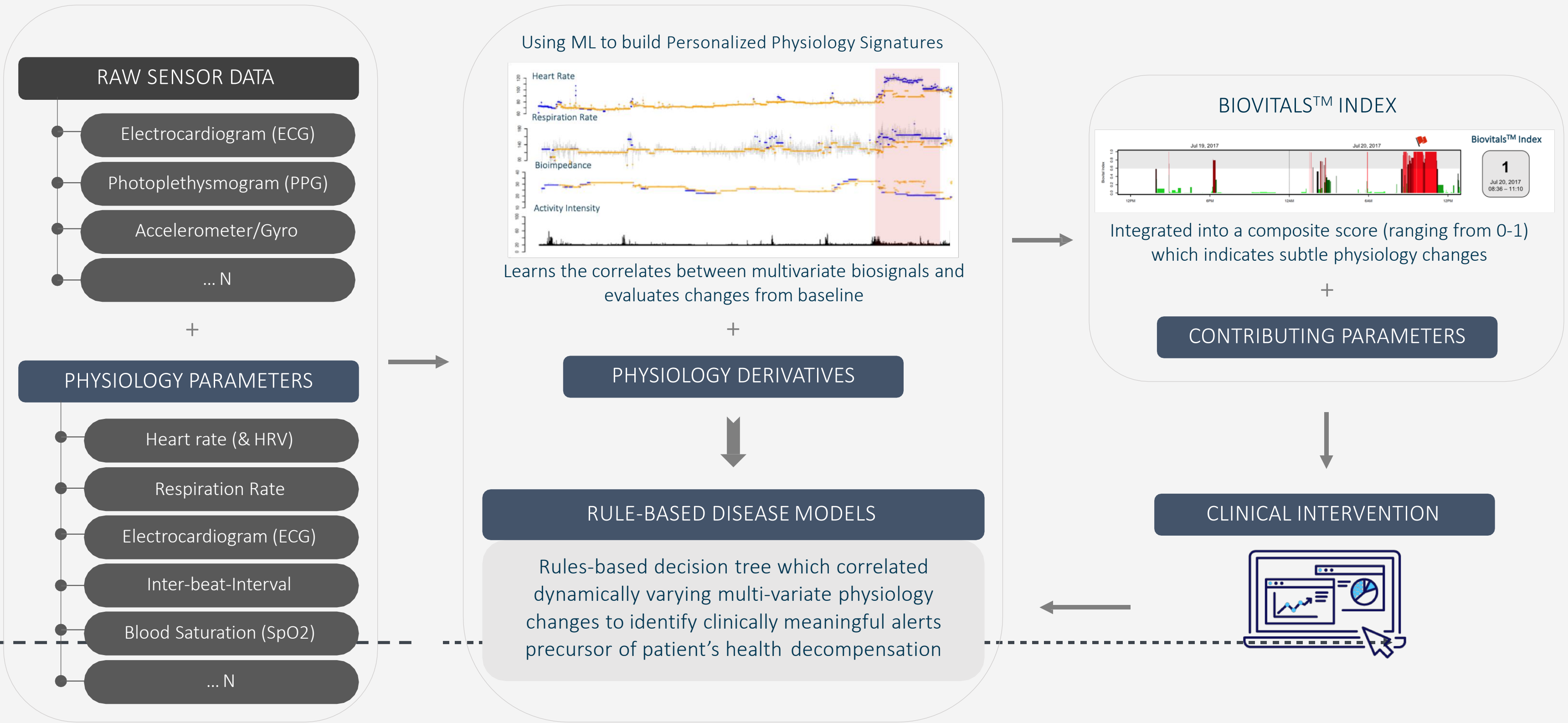


# Managing Chronic Diseases by Targeting Physiological Signs

“Predicting and Preventing Serious Medical Events using Artificial Intelligence”



Noninvasive FDA/CE mark medical grade wearables





\$2000 vs \$115,000





Rodgers Ssekawoko Muhumuza, left, checked Owamani Bruce for pneumonia with a portable ultrasound scanner in the Kabale district in western Uganda.

GLOBAL HEALTH

## *In African Villages, These Phones Become Ultrasound Scanners*



The future of health is in your DNA.



NEBULA  
GENOMICS



# What if I ?

eat less meat

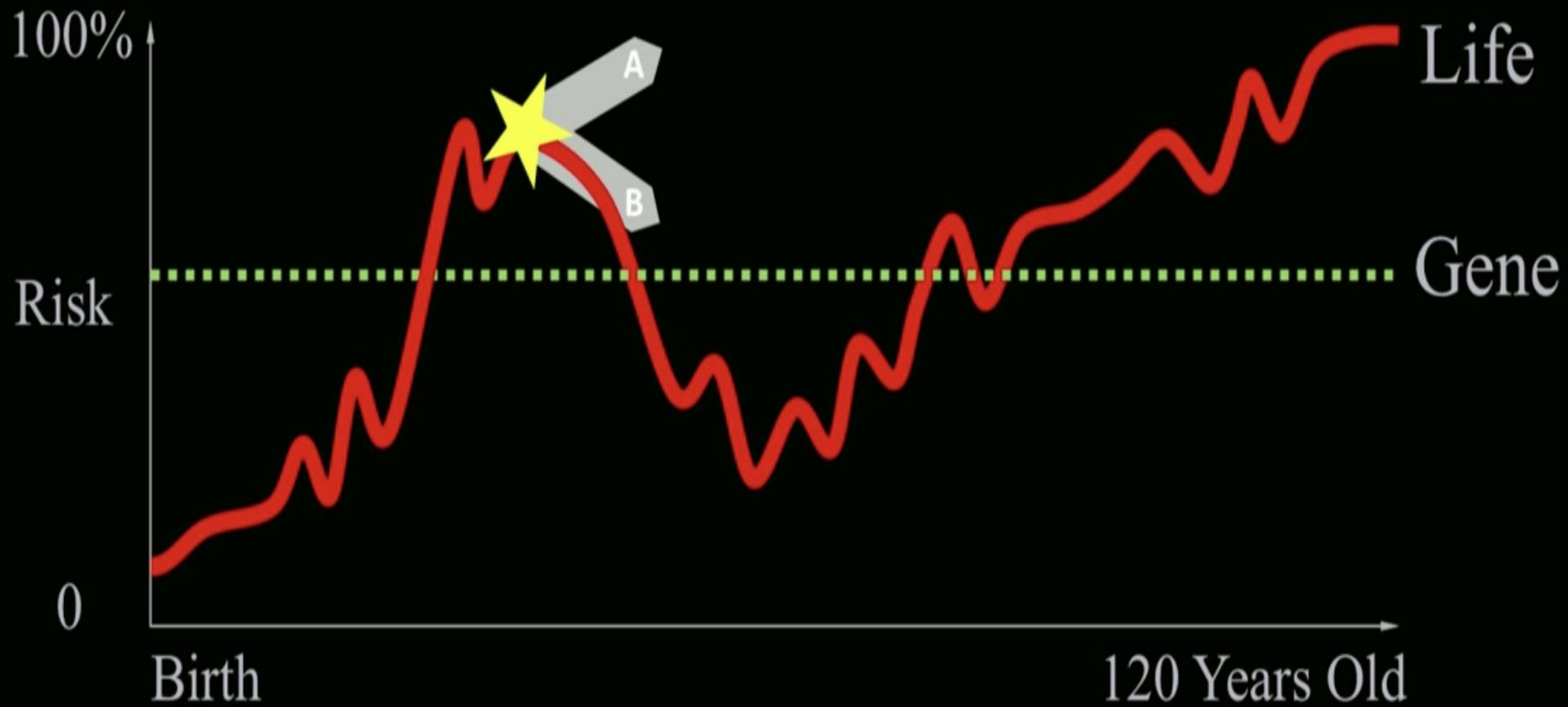
exercise 2x a week

don't sleep for 3 nights

climb Kilimanjaro

drink more wine





LONGER &  
HEALTHIER LIVES