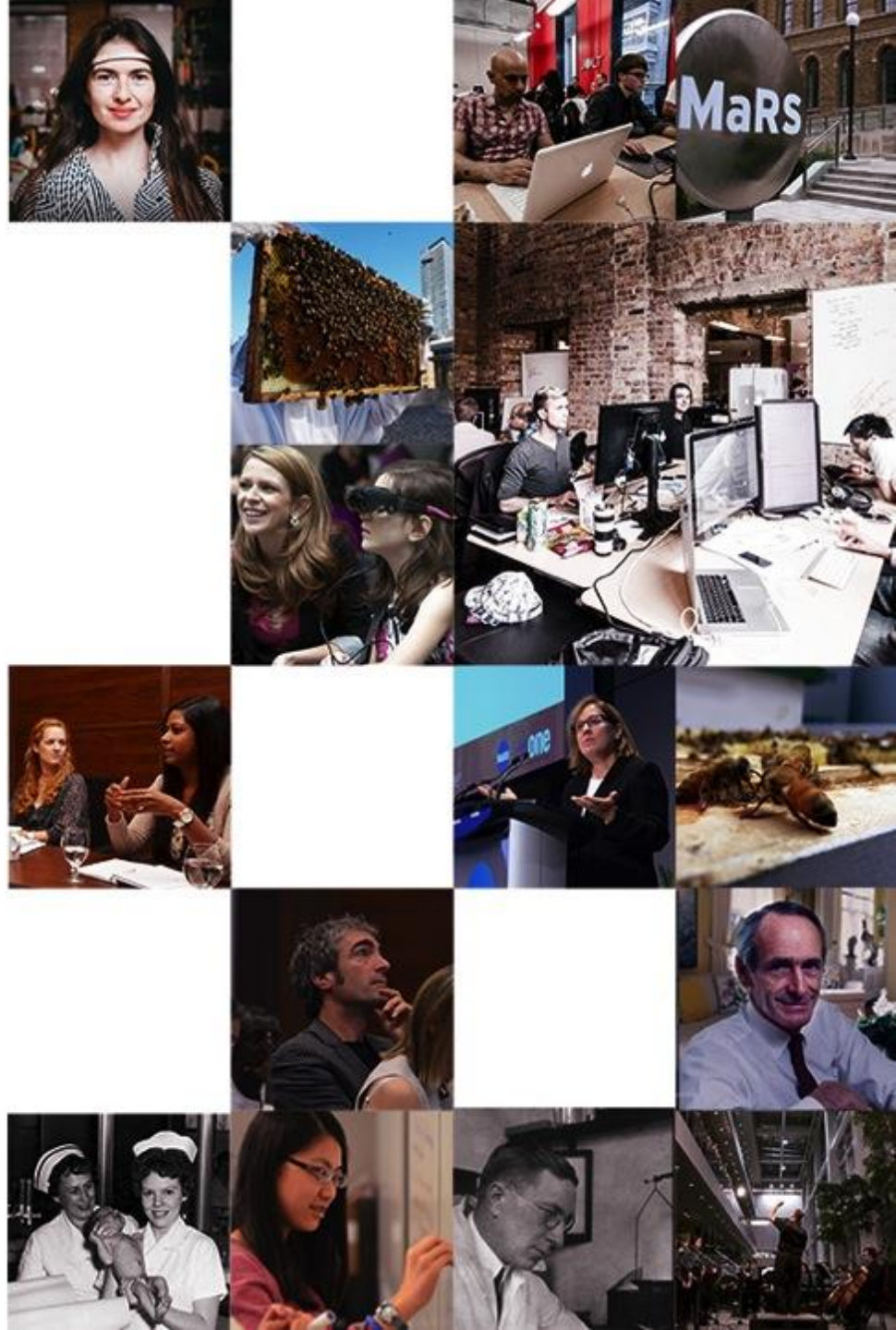


People-Powered Health(Care)

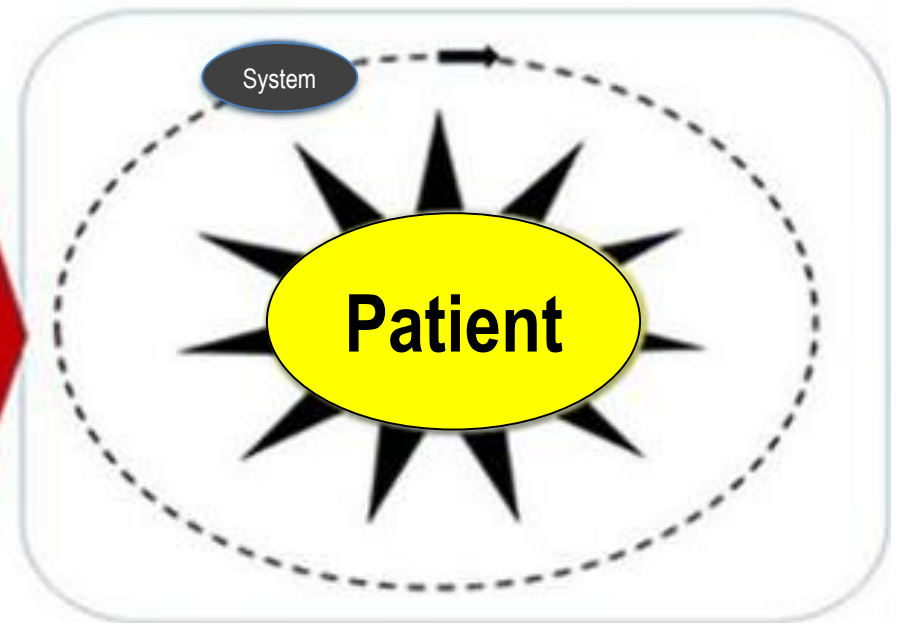
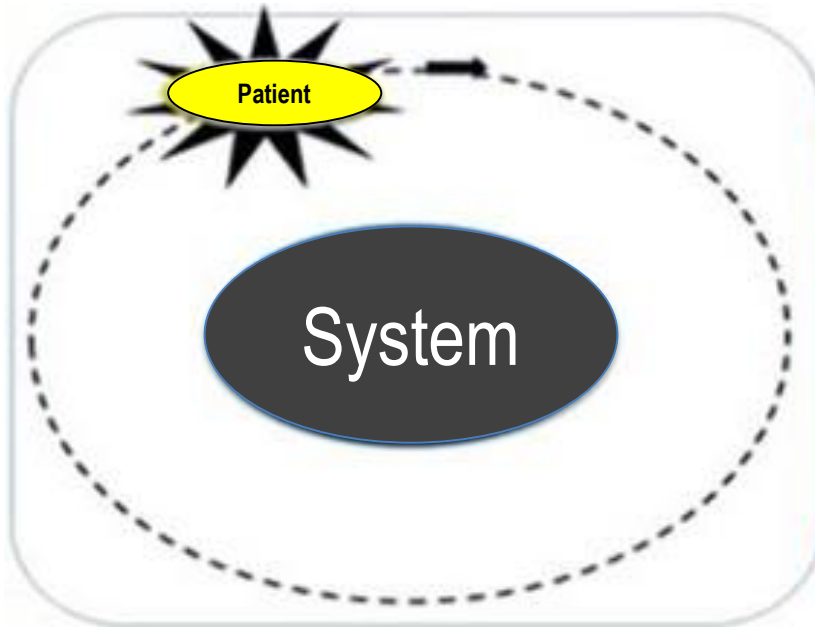
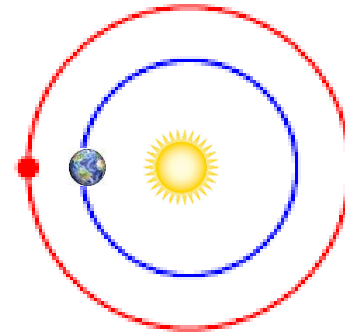
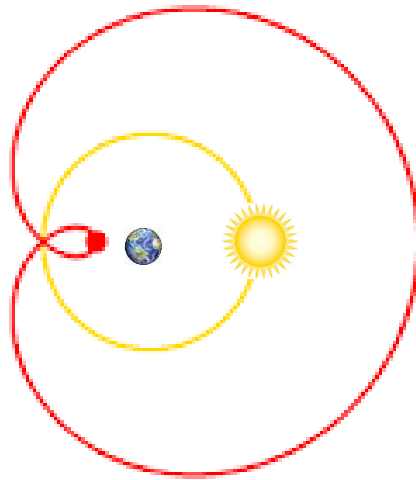
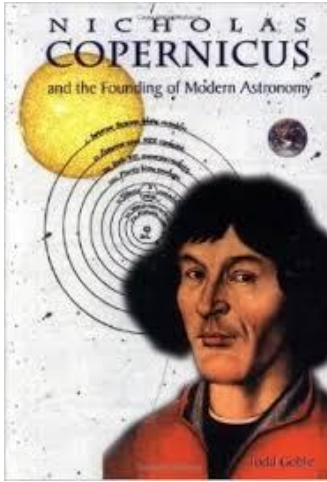
FME

Zayna Khayat, Ph.D.
Radboudumc RShape
MaRS Discovery District
Zayna.Khayat@Radboudumc.nl
@ZaynaKhayat | @REshape | @MaRSDD

4 SEPTEMBER 2017



Health's Copernicus moment



Eric Topol

Eric Topol

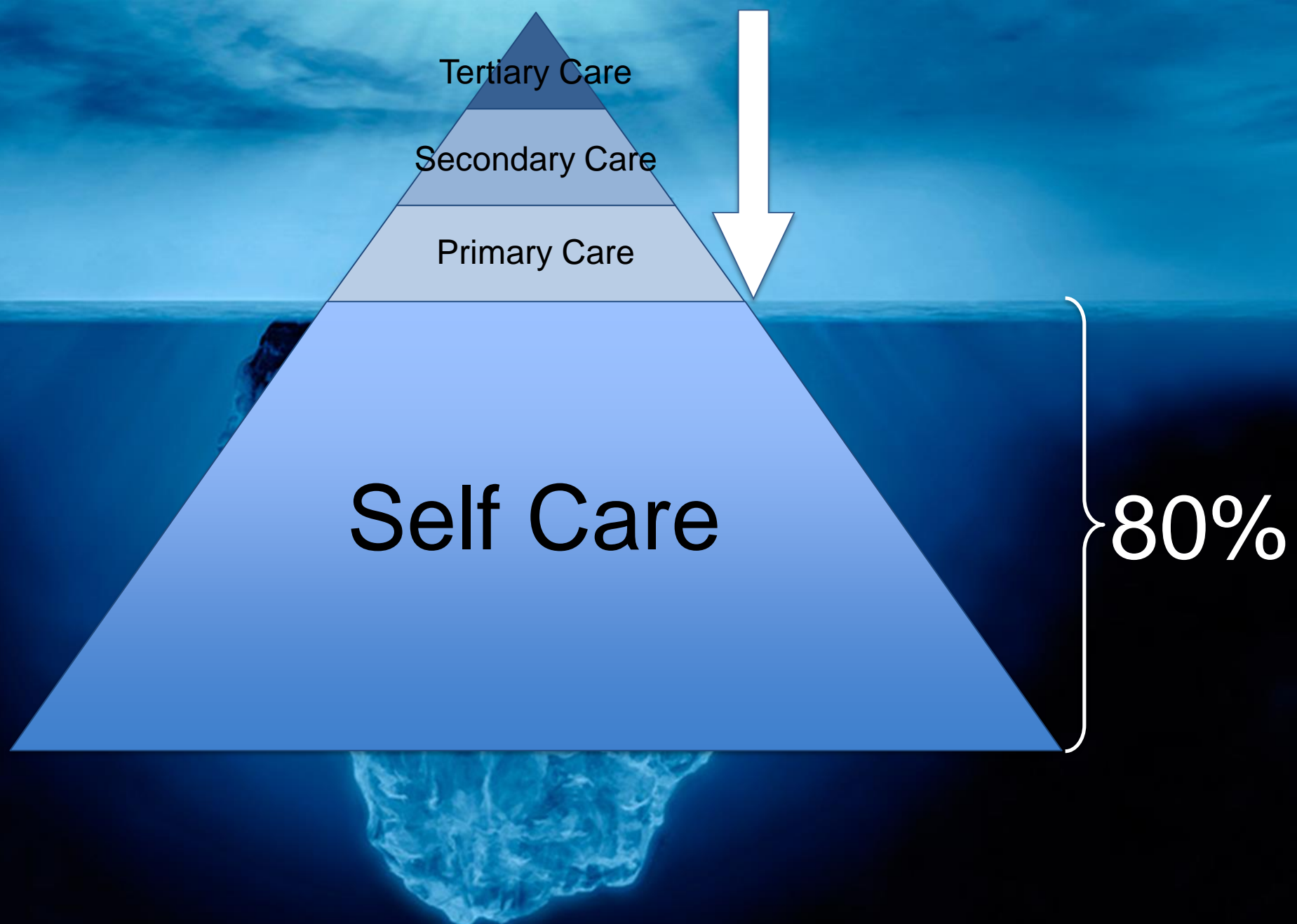
Author of *The Creative Destruction of Medicine*

**THE
PATIENT
WILL SEE
YOU
NOW**

The FUTURE of MEDICINE
is in YOUR HANDS

THE PATIENT WILL SEE YOU NOW

BASIC
BOOKS



People become CEO of their own health

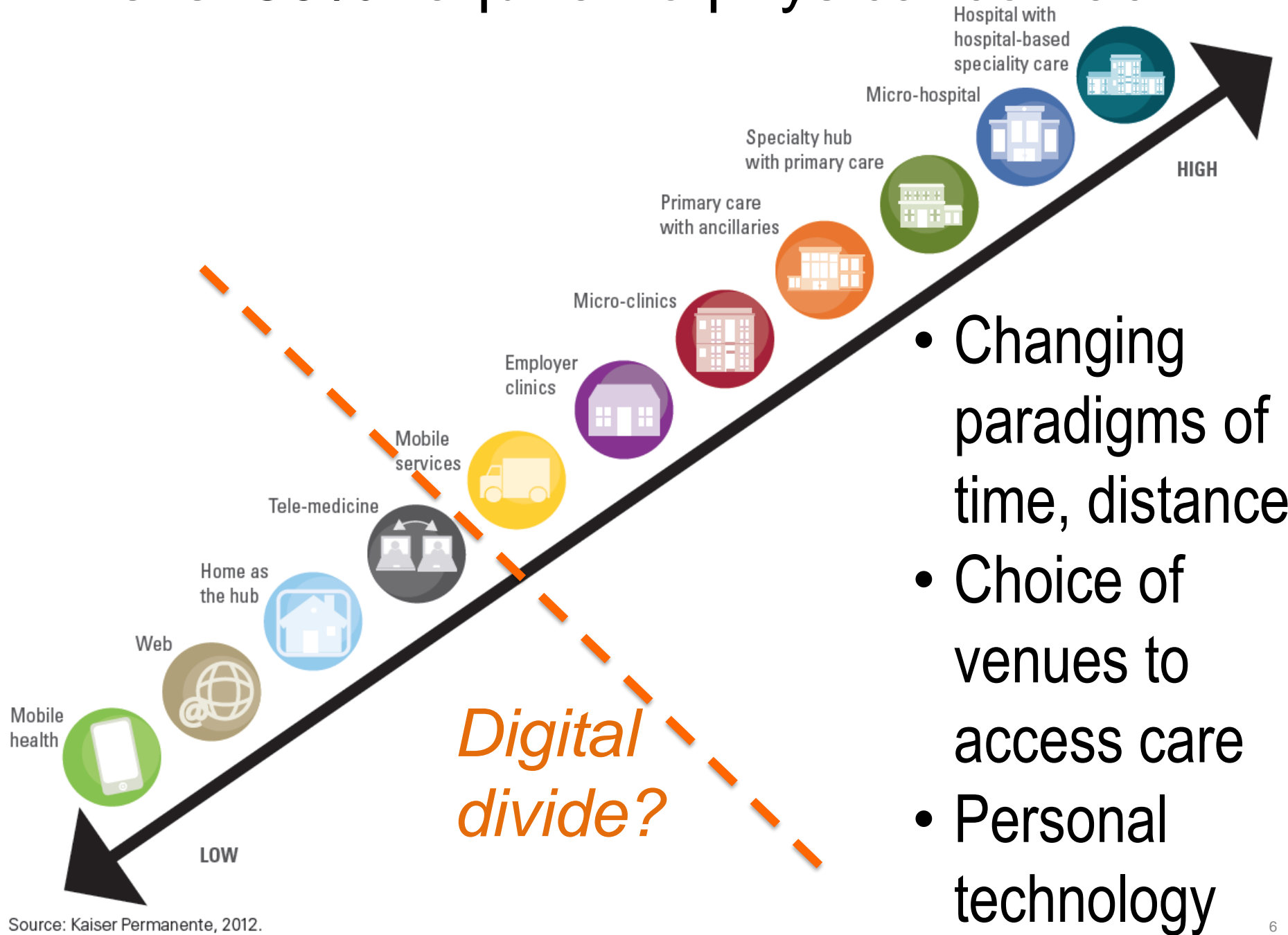
Future of Health

Today: System

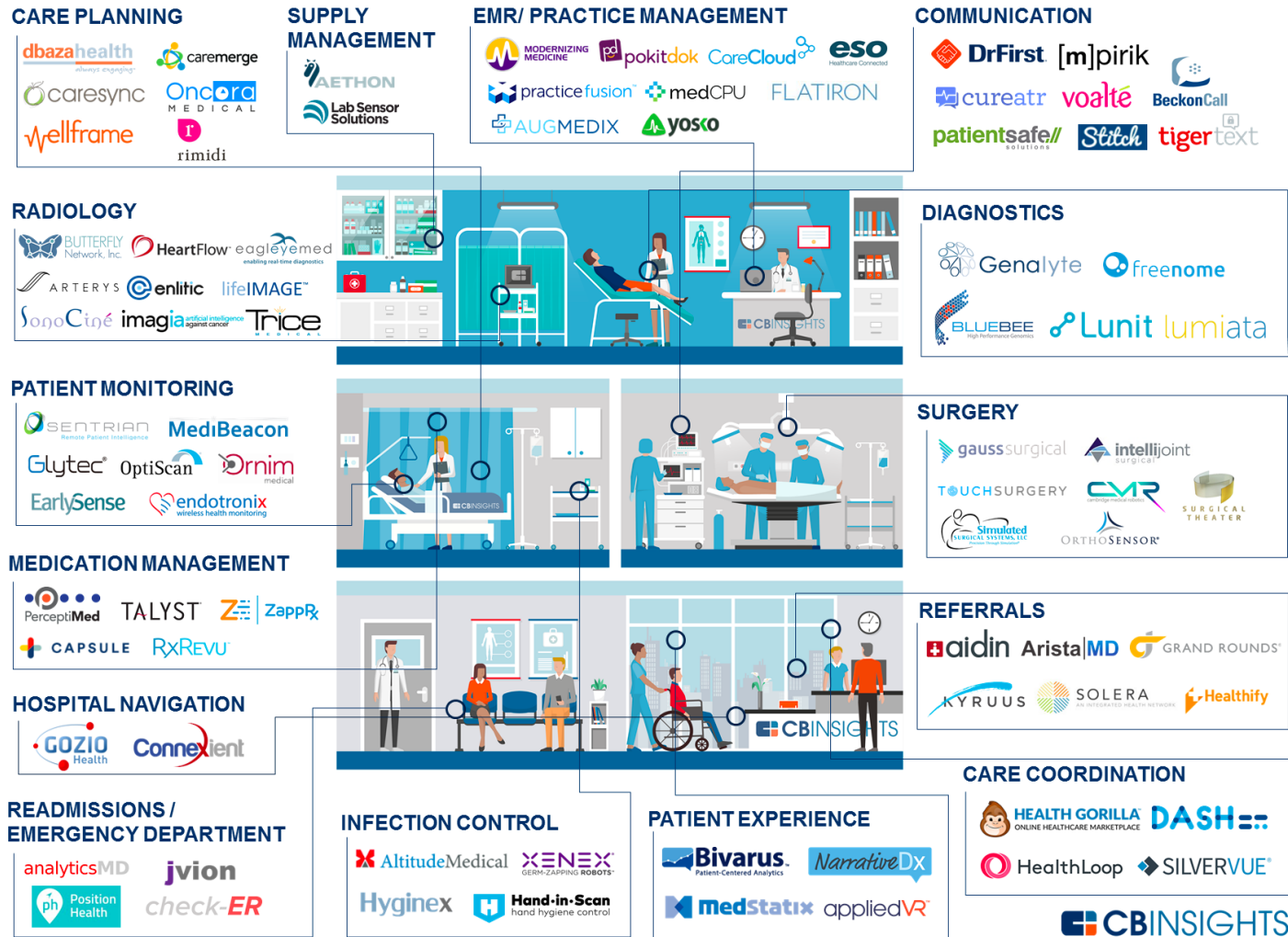
Future: Person

| | | |
|------------------|--------------------------------|-------------------------------|
| Timing | Reactive, sick care | Proactive, predictive |
| Tailoring | 1 size fits all [none] | Individualized configurable |
| Modality | Institution-centred | Digi-cal, decentralized |
| Duration | Episodic, intermittent, silo'd | Continuous team |
| Power | Provider | People-powered |
| Currency | Costs, inputs, volume | Outcomes, value |

1B visits: 80% require no physical contact



Unbundling of traditional players



WORLD
ECONOMIC
FORUM

Healthcare in 2030: goodbye hospital,
hello home-spital



Otoscope



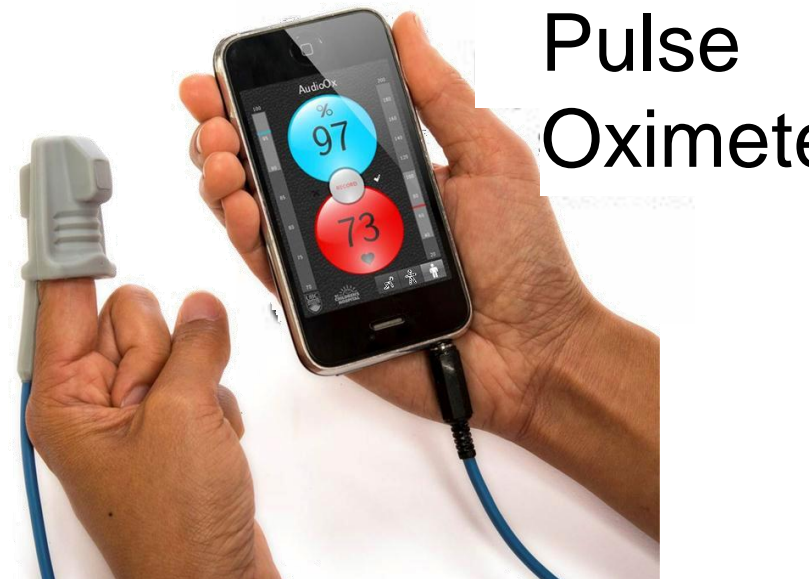
ECG



Glucometer



HIV Test



Pulse Oximeter

No more wires ...



Glucose monitoring on tears



*Microphone
Speaker*



*Microphone
Accelerometer camera
Gyroscope
Magnetometer
Ambient light sensor
Proximity sensor*



*Skin Temperature
Near Body Temperature
Galvanic Skin Response
Heat Flux*



*Accelerometer
Gyroscope
Electric biopotential*



Fall detection



*SpO2
Pulse*



*Accelerometer
Gyrometer
Skin conductance
Step counter
Activity recognizer
Sleep monitoring
GPS
Haptic feedback*



*Accelerometer
Gyrometer
Skin conductance
Step counter
Activity recognizer
Sleep monitoring
Microphone
UV sensor
Barometer
GPS
Screen
Haptic feedback*



Posture monitoring



*Accelerometer
Activity tracker*



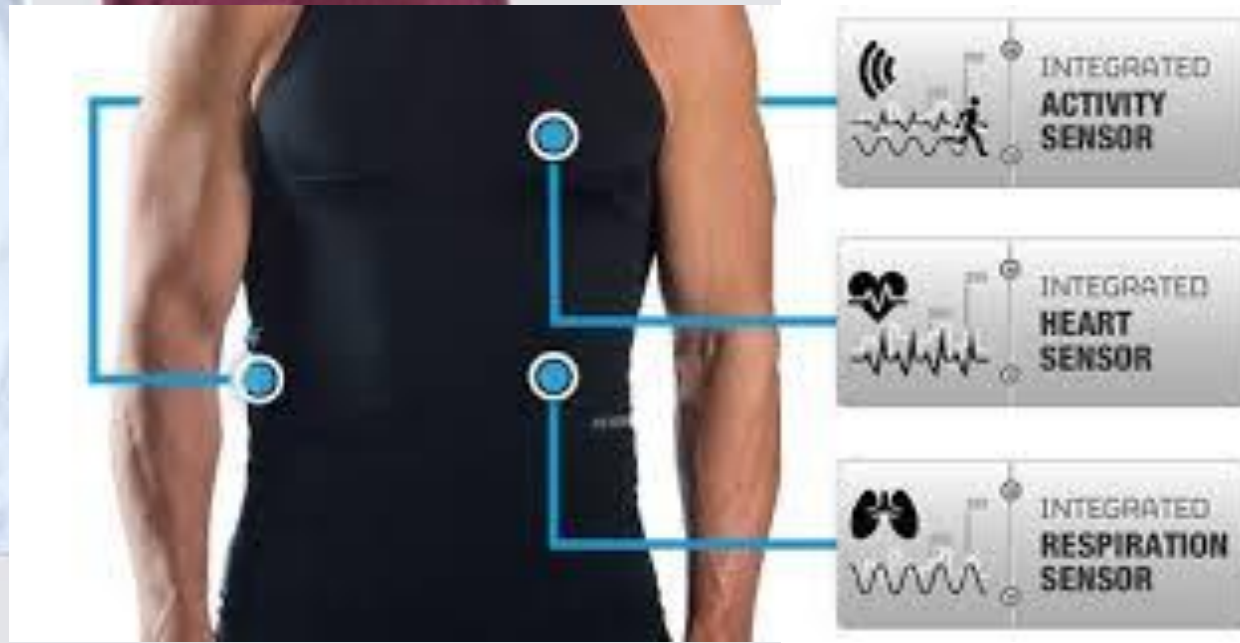
*Pressure sensors
Center of gravity
Accelerometer*



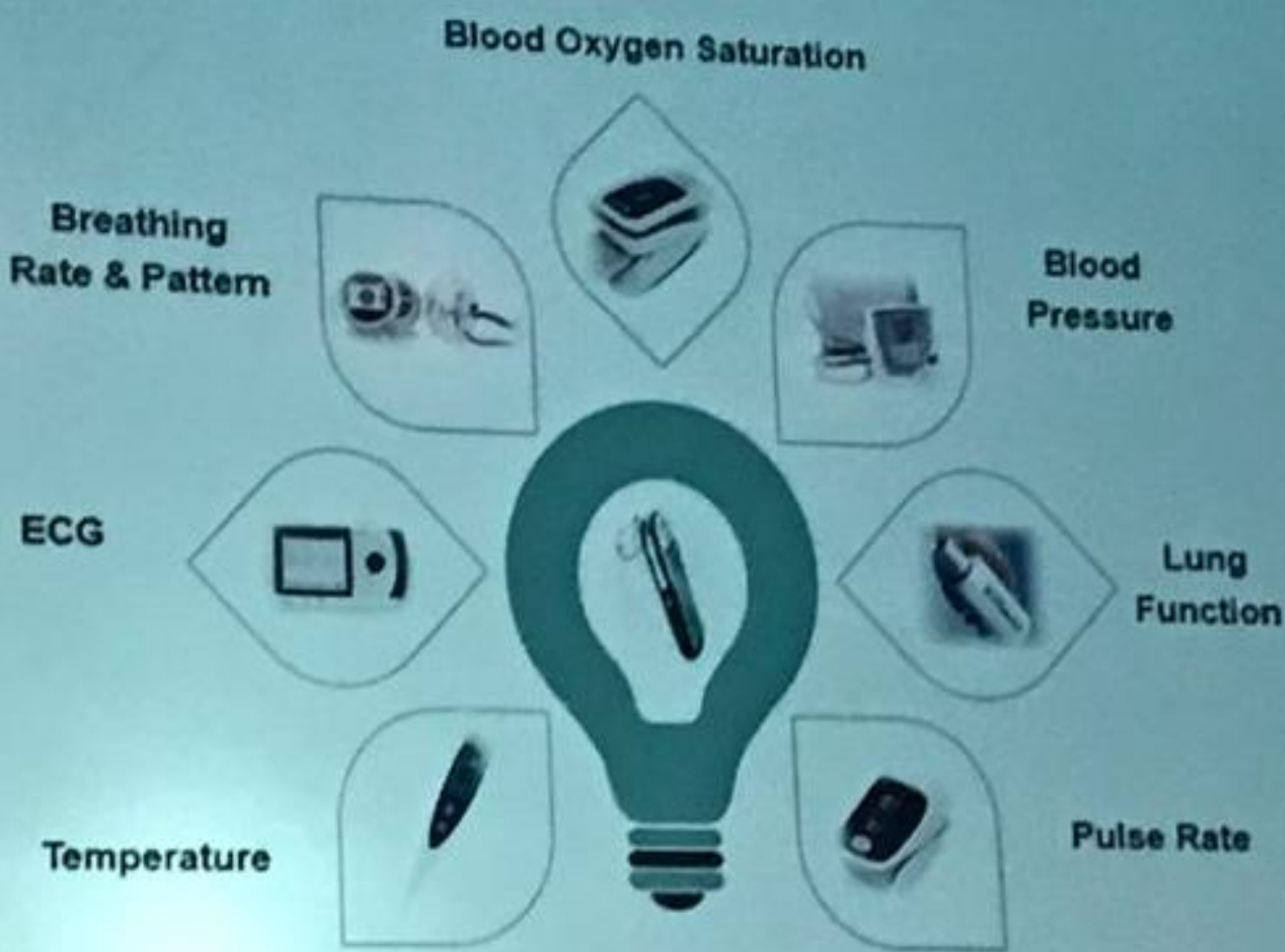
*Moisture sensors
Pressure sensors
Light sensors
Temperature*



Smart Fabrics



Mouth lab!



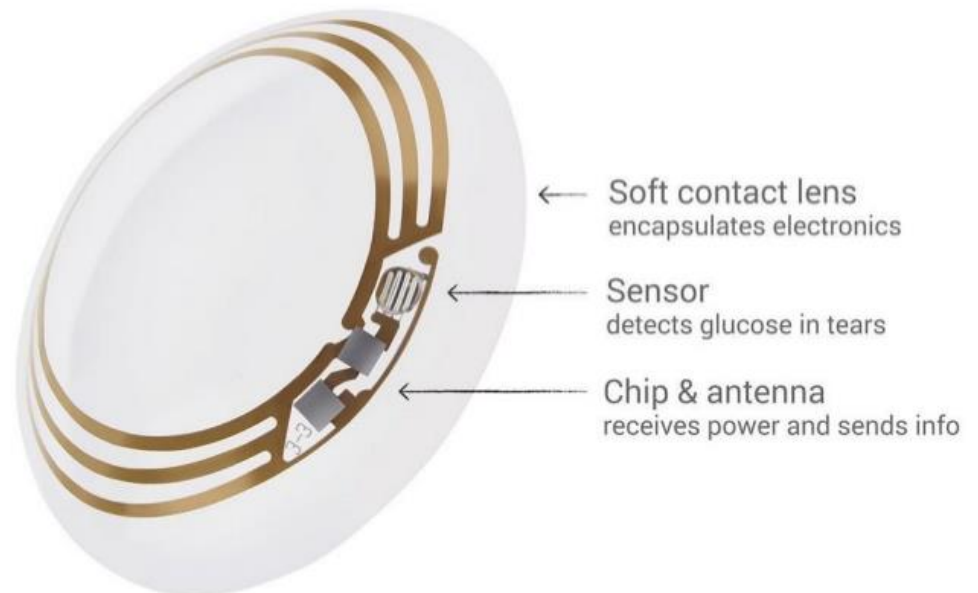
- Respiratory Biochemical Analysis
- Saliva Biochemical Analysis
- Metabolic Rate Analysis
- Dehydration Sensing
- Ketone Sensing
- Carbon Monoxide Sensing

No More Needles: A Crazy New Patch Will Constantly Monitor Your Blood

Imagine if you could always know if your glucose was low or if you were dehydrated. A new painless patch will soon send your vital signs wirelessly to your phone, giving you constant analytics on your health.



Smart contact lens





INTRODUCING EVE KIT

We know that life can get in the way of routine screens, so we're bringing the screening to you! Introducing Eve Kit - a simple, convenient way to screen for HPV and STIs at home

Our goal at Eve Medical is to make cervical cancer and STI prevention easy and accessible for all women.





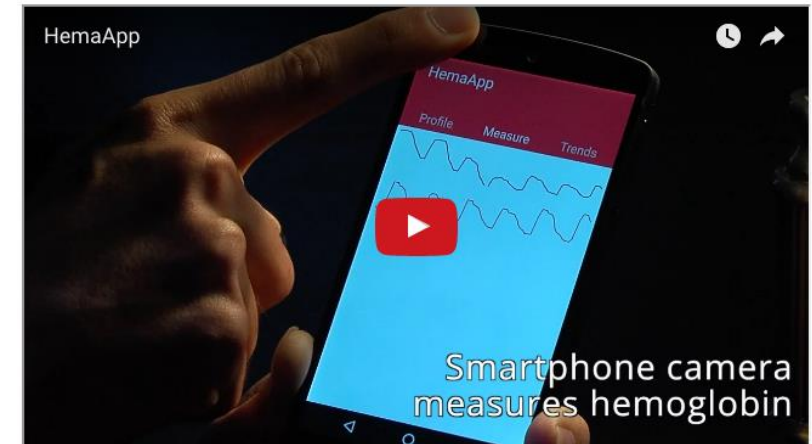
Phone as diagnostic device

Colorimetrix turns smartphone into portable spectrophotometer



Using Your Smartphone to Check for Anemia

A smartphone app called HemaApp has been developed to screen for anemia



Voice Analysis Tech Could Diagnose Disease

Researchers enlist smartphones and machine learning to find vocal patterns that might signal post-traumatic stress disorder or even heart disease.

by Emily Mullin January 19, 2017



CANARY
S P E E C H

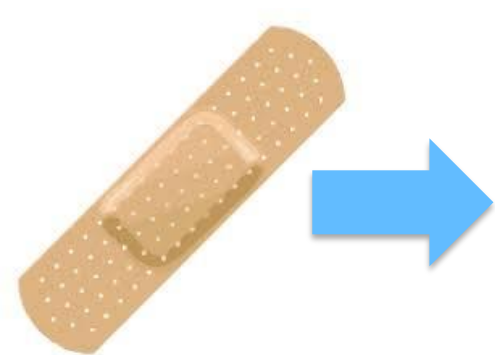
Health insurer calls analysed for signs your voice



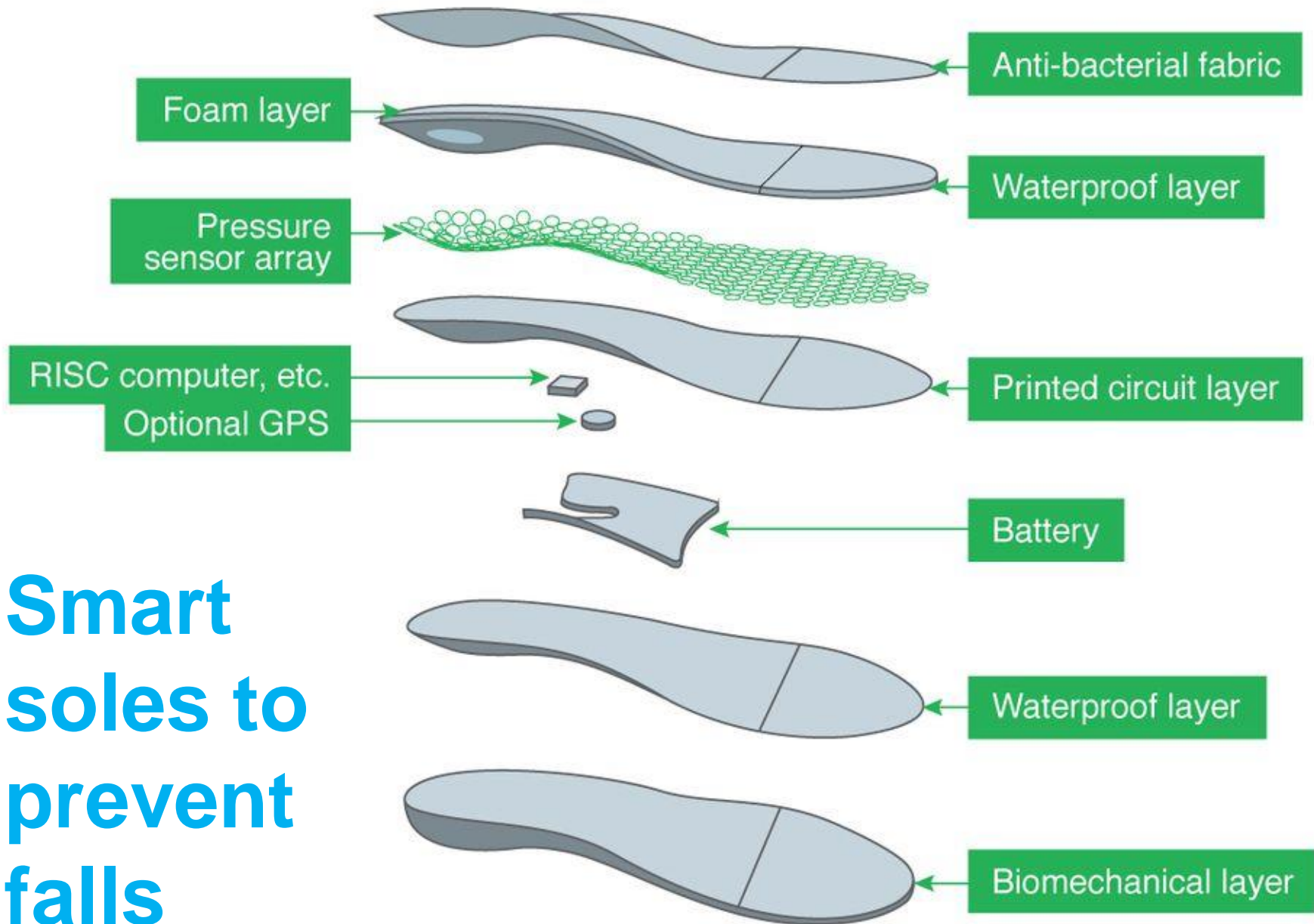
Could your voice give away details of your health?
Letizia Le Furr/Getty

By Matt Reynolds

Did your voice give it away? US start-up Canary Speech is developing deep-learning algorithms to detect if people have health issues. But how much information is being collected about you?



Smart soles to prevent falls



TOPROL XL, 50 MG. TABLET - TAKE 1 AND 1/2 TABLETS DAILY
MICARDIS, 20 MG. TABLET - TAKE 1 TABLET DAILY
BRILINTA, 90 MG. TABLET - TAKE 1 TABLET 2 TIMES A DAY
CRESTOR, 20 MG TABLET - TAKE 1 TABLET DAILY
LEVEMIR (INSULIN) - INJECT 20 UNITS IN MORNING + IN EVENING
(FLEX TOUCH 100 U/ML)

FORTAMET ER, 1000 MG. TABLET - TAKE 1 TABLET
NOVOFINE, 32 GAUGE NEEDLES - FOR THE
PREVACID, 30 MG. SOLUTAB, 1 TABLET DAILY
ONE TOUCH ULTRA TEST STRIPS, QTY. 100
ADVAIR 250/50 DISKUS - INHALE ONE PUFF
PROVENTIL HFA 90 MCG INHALER - INHALE

BY MOUTH EVERY 4 TO SIX HOURS
LEVABUTEROL, 1.25 MG/3ML SOLUTION
(GEN. FOR XOPENEX)

IPRATROPIUM BR 0.02% SOLN., USE
FLONASE, 0.4 CAPSULE - TAKE 1 CAPSULE DAILY

AVODART, 0.5 MG SOFTGEL TAKE 1 CAPSULE DAILY

WELCHOL, 625 MG TABLET - TAKE 6 TABLETS ONCE A DAY

CELEBREX, 200 MG CAPSULE - TAKE 1 CAPSULE DAILY WHEN NEEDED

(OVER THE COUNTER) LOW DOSE BAYER ASPIRIN (COATED ASPIRIN) (.81 MG) (ONCE DAILY)

(OVER THE COUNTER) EXTRA STRENGTH TYLENOL (500 MG) - 4 TO 6 DAILY

(OVER THE COUNTER) FLONASE - 1 TO 2 SPRAYS IN EACH NOSTRIL ONCE DAILY

PROCTOCORT - 1% CREAM - APPLY TWICE A DAY - AS NEEDED

(OVER THE COUNTER) BALNEOL HYGIENIC CLEANSING LOTION - AS NEEDED



MEDAPP

GRIP OP MEDICATIE





"Alexa,
when do I take
my medication?"



An avatar-based platform that enables continuity of care for chronic diseases



It's time to check your blood pressure



Reading...

Citizen hackers, patient-preneurs ...

Patients have to engage in the co-production of health intelligence.



Hacking Diabetes #WeAreNotWaiting

Student designs his own braces using \$60 and a 3-D printer

JENN SAVEDGE 

March 26, 2016, 10:04 a.m.



DIY (Do It Yourself) biotechnology

bio CURIOUS

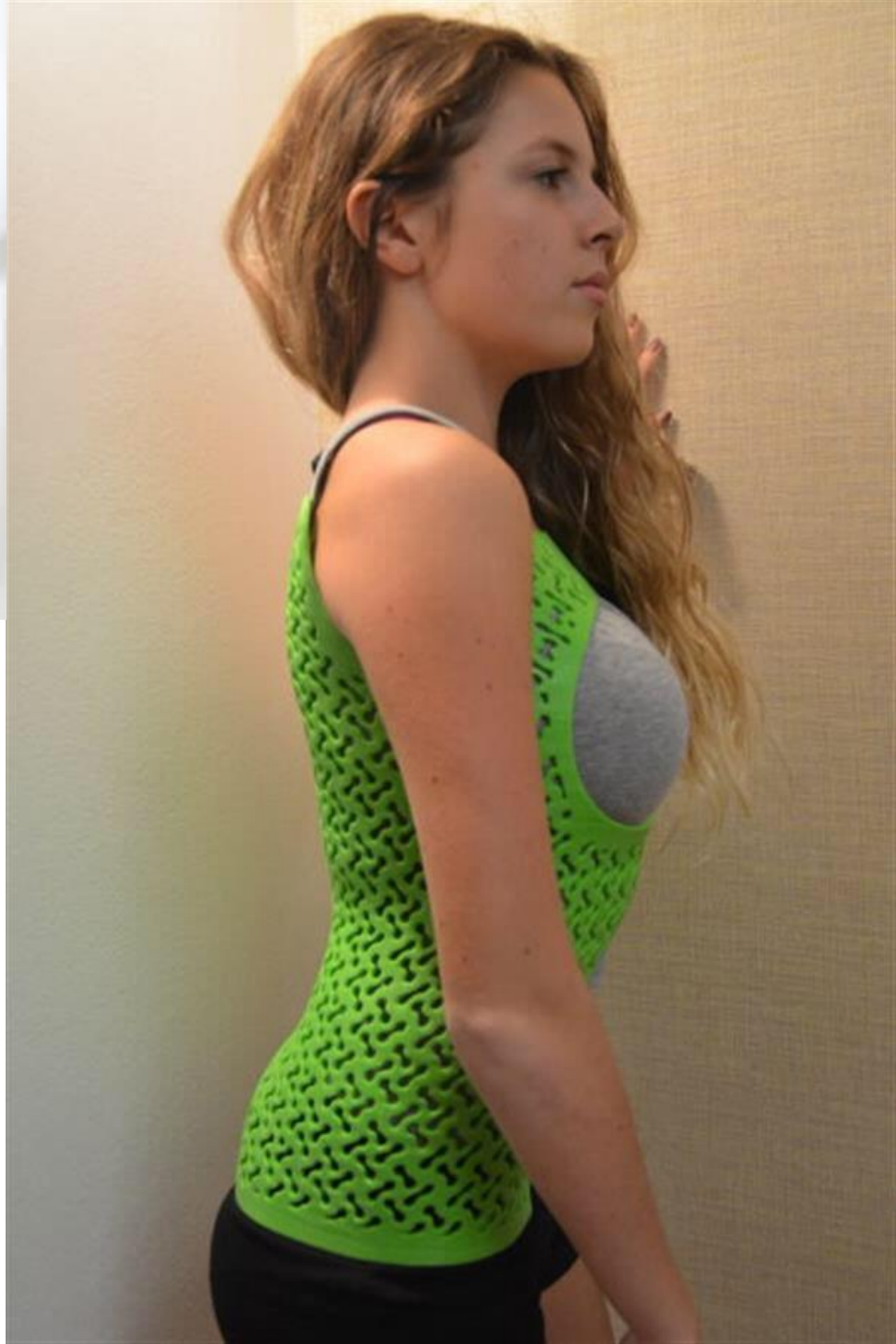
London BiohackSpace

| CATEGORIES | GENE ENGINEERING KITS |
|-----------------------|-----------------------|
| ALL PRODUCTS | |
| PLASMIDS | |
| Bacteria Plasmids | |
| Yeast Plasmids | |
| STRAINS | |
| Bacteria Strains | |
| Yeast Strains | |
| BEGINNER KITS | |
| GENE ENGINEERING KITS | |
| ACCESSORIES | |

| SHOP BY PRICE | | |
|---------------------|---|----------|
| \$0.00 - \$249.00 | Add on - Genetically Engineer Any Bacteria or Baking Yeast to Fluoresce | \$80.00 |
| \$249.00 - \$423.00 | Amino DNA Playground | \$349.00 |
| \$423.00 - \$597.00 | | |

On Sale

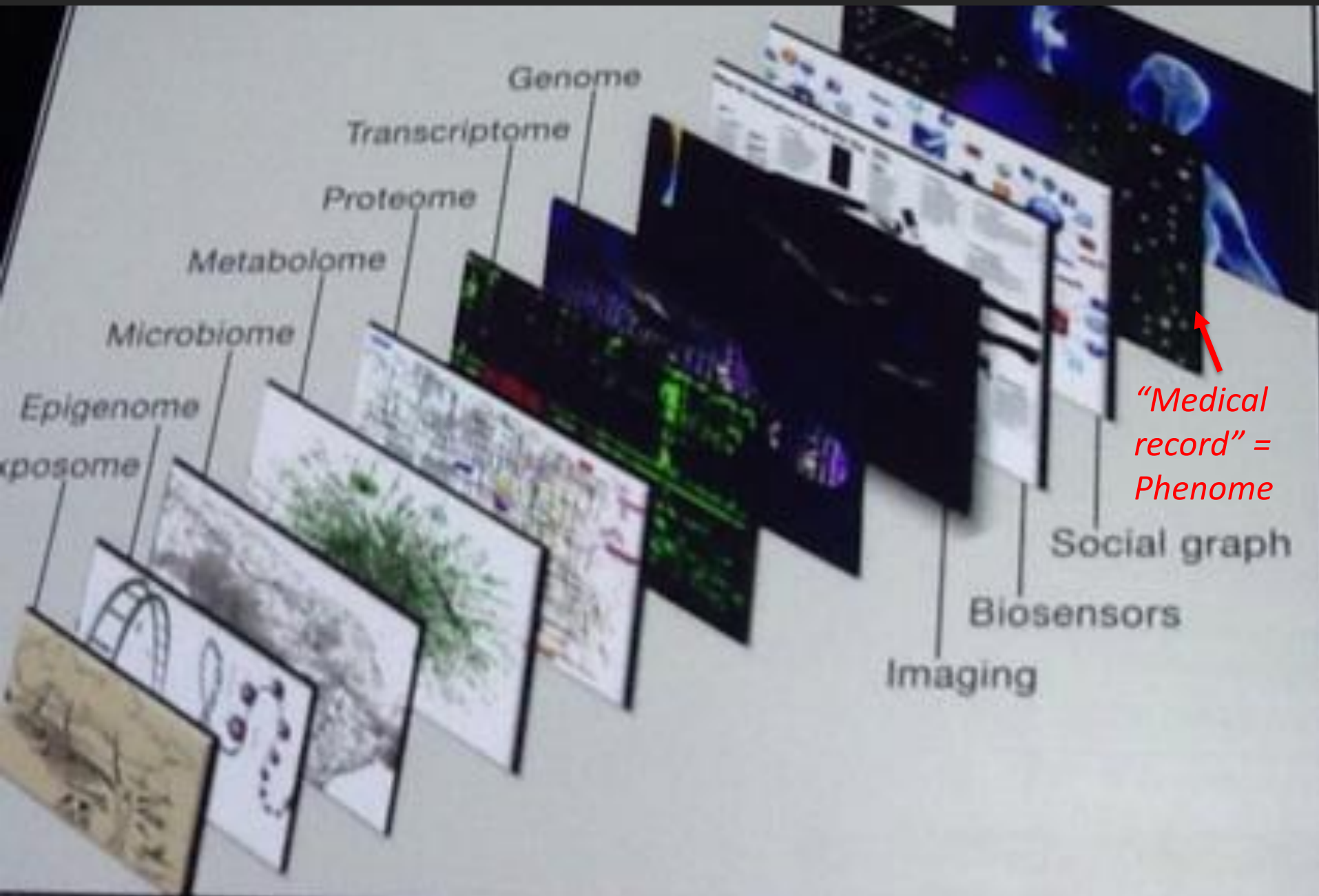




Do-it-yourself hearing aids – order the kit to your home



The Panome Emerges





Traditional Medical Record
~3.5Gb



Human Avatar
>150 Gb

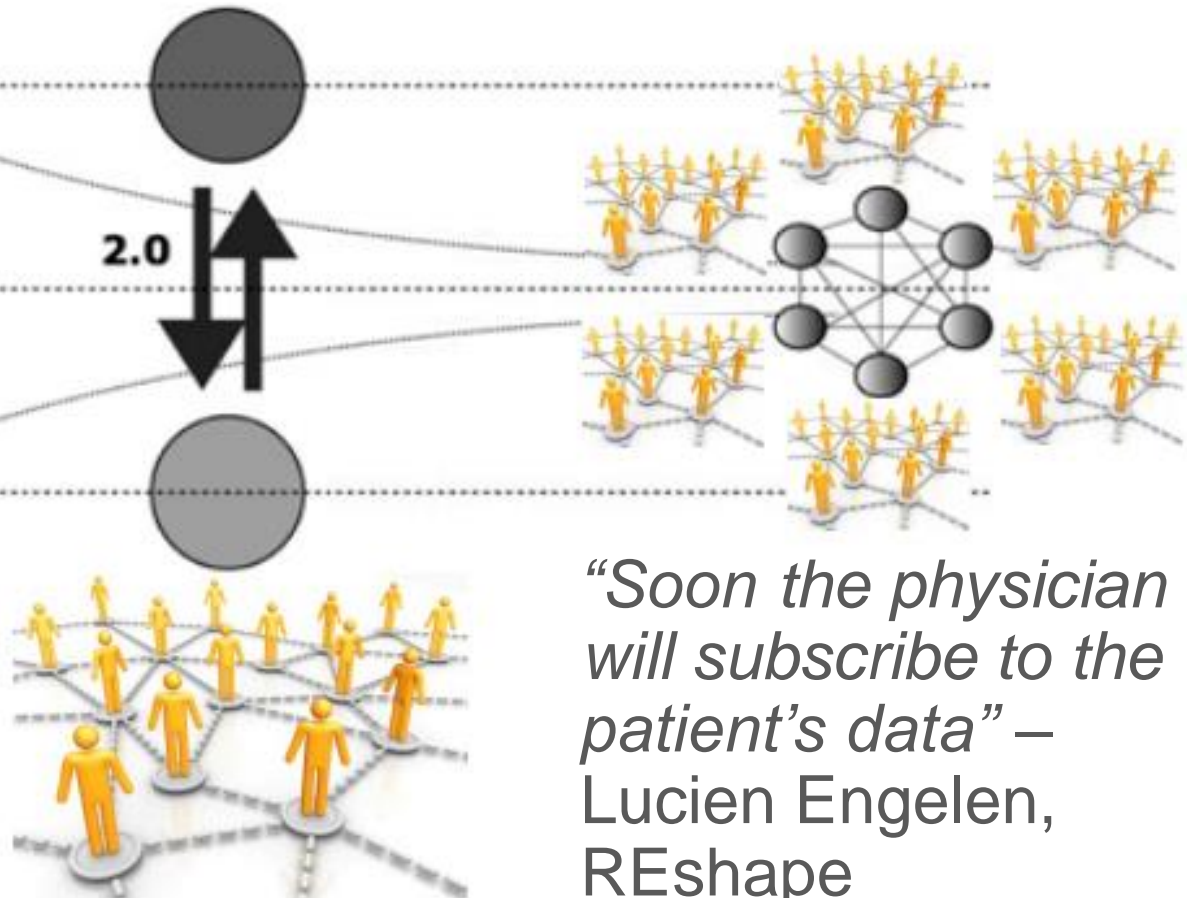
Institutions /
Providers

“When you think of medicine, you won’t think of 1 doctor, you’ll think of a global community of experts aggregated to make sure that every patient gets their answer quickly and inexpensively” - Crowdmed

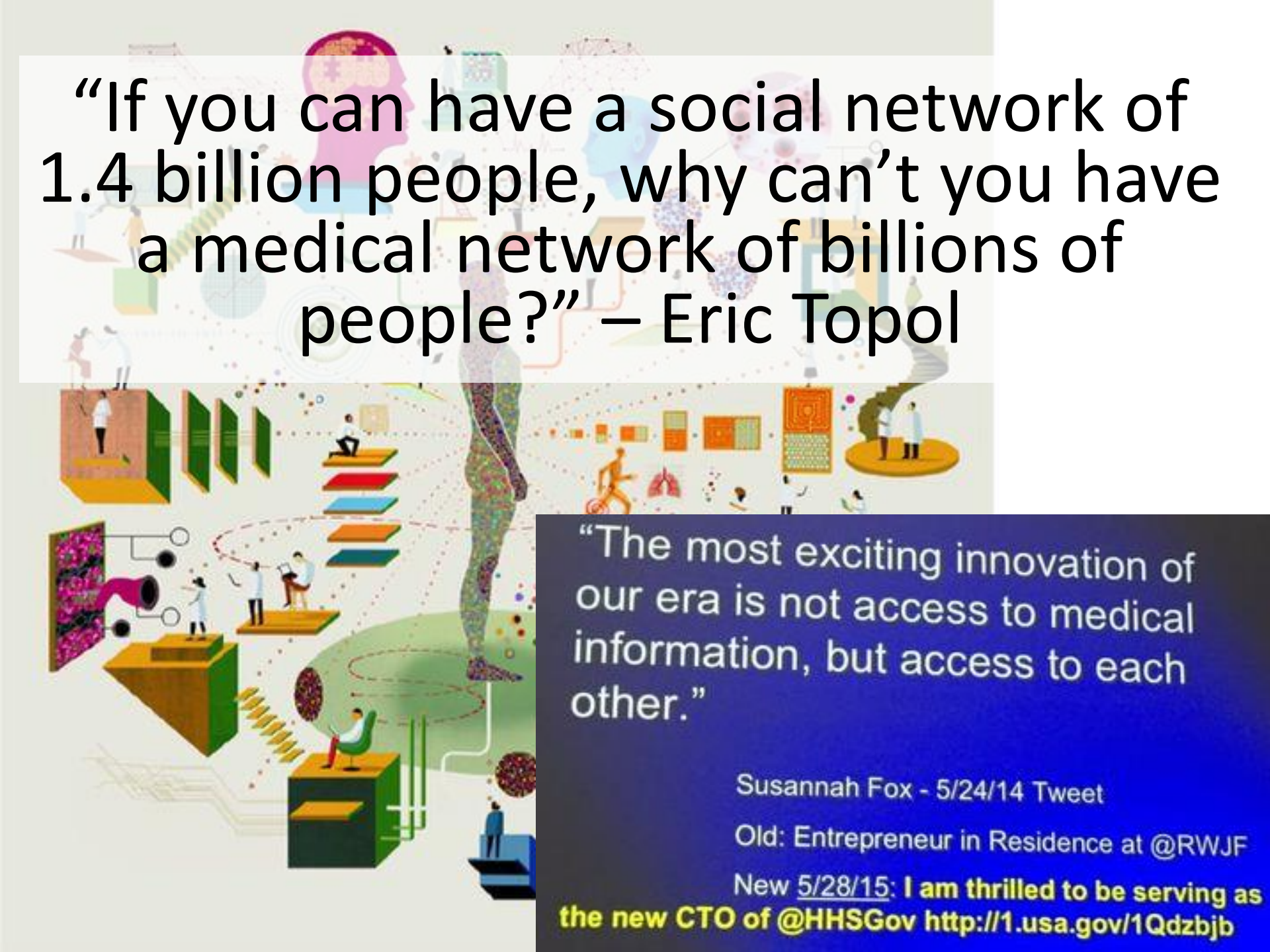
1.0

2.0

Individuals



“Soon the physician will subscribe to the patient’s data” – Lucien Engelen, REshape



“If you can have a social network of 1.4 billion people, why can’t you have a medical network of billions of people?” – Eric Topol

“The most exciting innovation of our era is not access to medical information, but access to each other.”

Susannah Fox - 5/24/14 Tweet


Old: Entrepreneur in Residence at @RWJF

New 5/28/15: I am thrilled to be serving as
the new CTO of @HHSGov <http://1.usa.gov/1Qdzbjb>

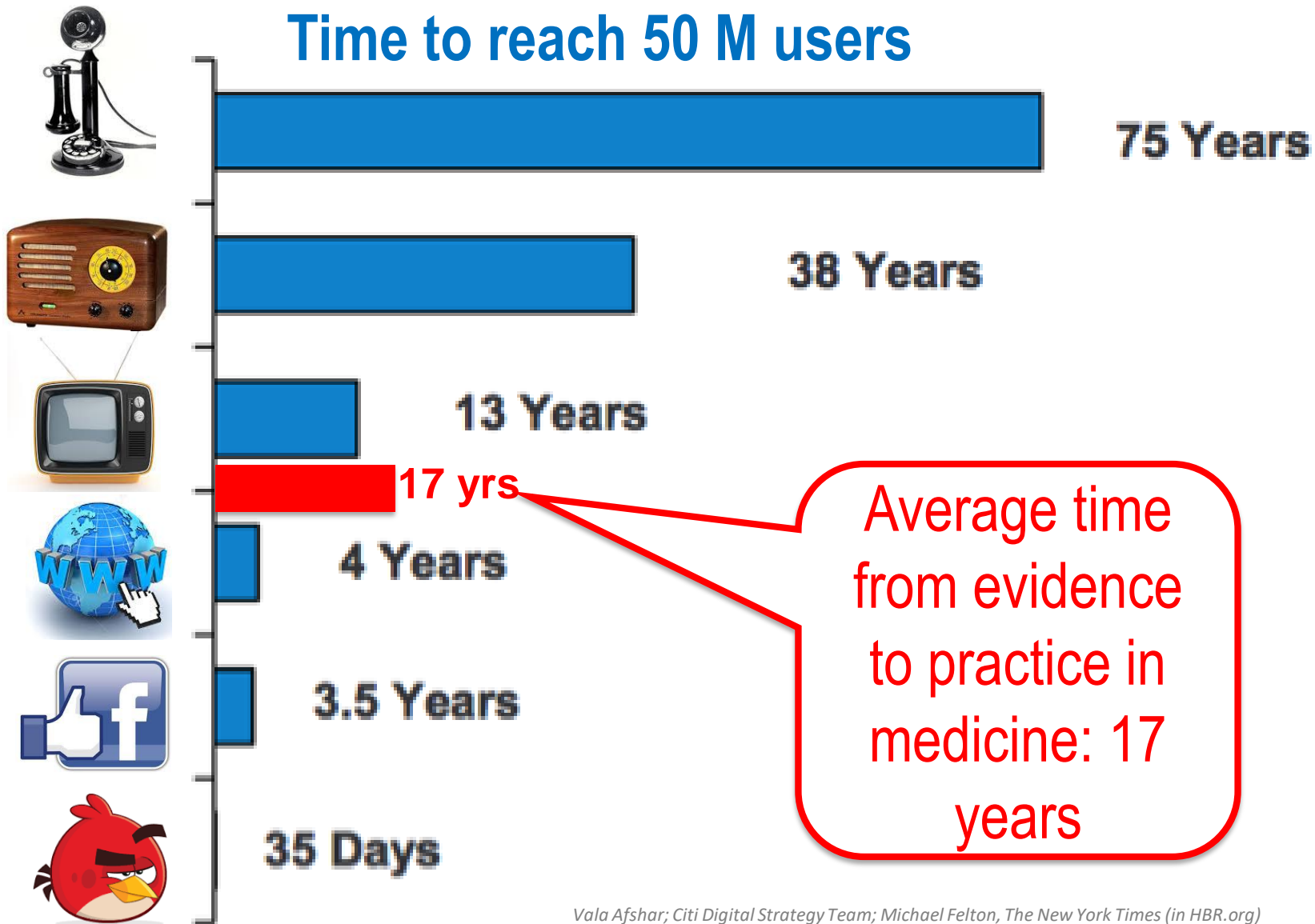


Health Medicine

Medicine Will Advance More in the Next 10 Years Than It Did in the Last 100

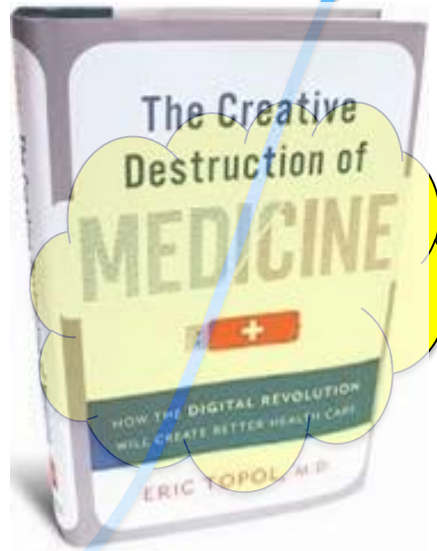
By Vivek Wadhwa - Oct 26, 2016  75,029

Can't innovate linearly in an exponential world



Imperative: creatively destroy yourself

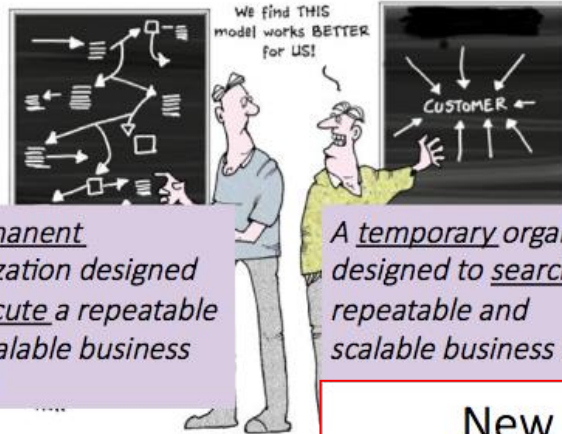
New paradigm:
Citizen



Central paradigm:
System

Which entrepreneurs will get the job done?

Startups



A permanent organization designed to execute a repeatable and scalable business model

A temporary organization designed to search for a repeatable and scalable business model

Source: Steve Blank
November 2015

Healthcare Incumbents



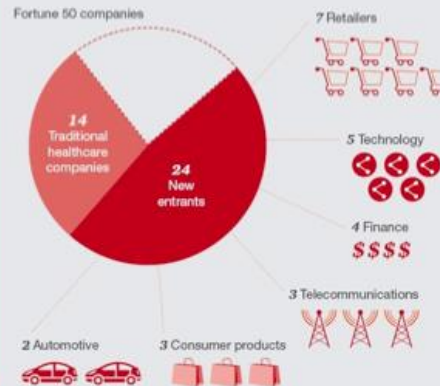
New Entrants in Healthcare

Healthcare's new entrants:
Who will be the industry's Amazon.com?



pwc

Of Fortune 50 companies, 24 are new entrants
The top companies also include 14 traditional healthcare organizations.



Source: Fortune 50, 2013

New healthcare business models emerging

*“Uberization of
[insert health
service]”*



*“Facebook for
Patients”*

*“Airbnb for [insert
care setting]”*



*“YouTube for
Healthcare”*



*“Slack for
Healthcare”*



*“Yelp reviews for
healthcare”*



*“Amazon Alexa [or
Siri] for health”*



New healthcare business models (2)



... for clinical trials recruitment



... for your health.



... for healthcare



... for private health benefits



... for healthcare



... for the body (*wearables*)



... for appointment scheduling



... for healthcare



... for the body



Which entrepreneurs will get the job done?

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Healthcare Incumbents



New Entrants in Healthcare

Healthcare's new entrants:
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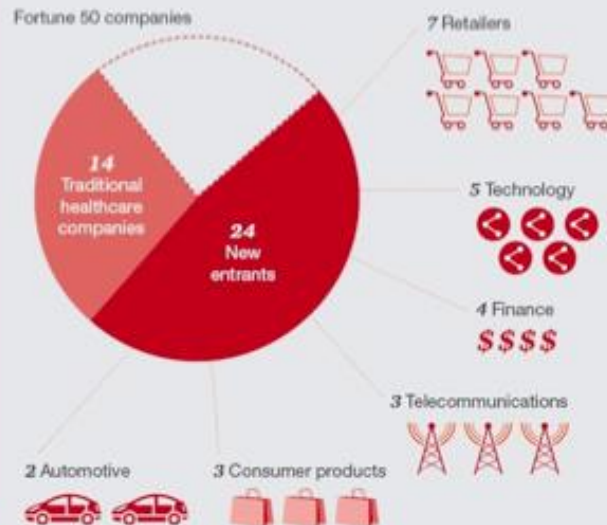


pwc

Of Fortune 50 companies, 24 are new entrants

The top companies also include 14 traditional healthcare organizations.

Fortune 50 companies



Source: Fortune 50, 2013



Companies from
other industries
rapidly entering
healthcare markets



The Best-Positioned Tech Giant In Healthcare? The Answer Might Surprise You



David Shaywitz, CONTRIBUTOR

I write about entrepreneurial innovation in medicine. [FULL BIO](#) ▾

Opinions expressed by Forbes Contributors are their own.

When you think about tech giants playing in healthcare, you think of Google and Verily is doing; you think of Apple and their [HealthKit](#) and [ResearchKit](#) applications as their [rumored plans](#) to organize all your medical data on your iPhone; you may think of Amazon and their [potential entry](#) into the pharmacy market.



Source: Wikimedia Commons and Amazon.com

AMAZON AIMS AT HEALTHCARE

Jessica Mehta • Mon, July 3rd, 2017

Print this article

Is Amazon, the giant online retailer, dropping hints about moving into the healthcare industry?

In May 2017, CNBC reported that Amazon was on the hunt for a general manager to “break into the multi-billion dollar pharmacy market.”

FiercePharma

PHARMA MANUFACTURING MARKETING PHARMA ASIA ANIMAL HEALTH DRUG DELIVERY VACCINES

Vaccines

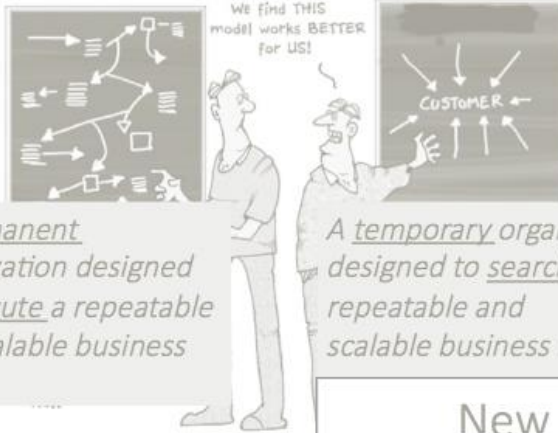
GlaxoSmithKline partners with Alibaba for China HPV vaccine market grab

by Angus Liu | Aug 22, 2017 12:37pm



Which entrepreneurs will get the job done?

Startups

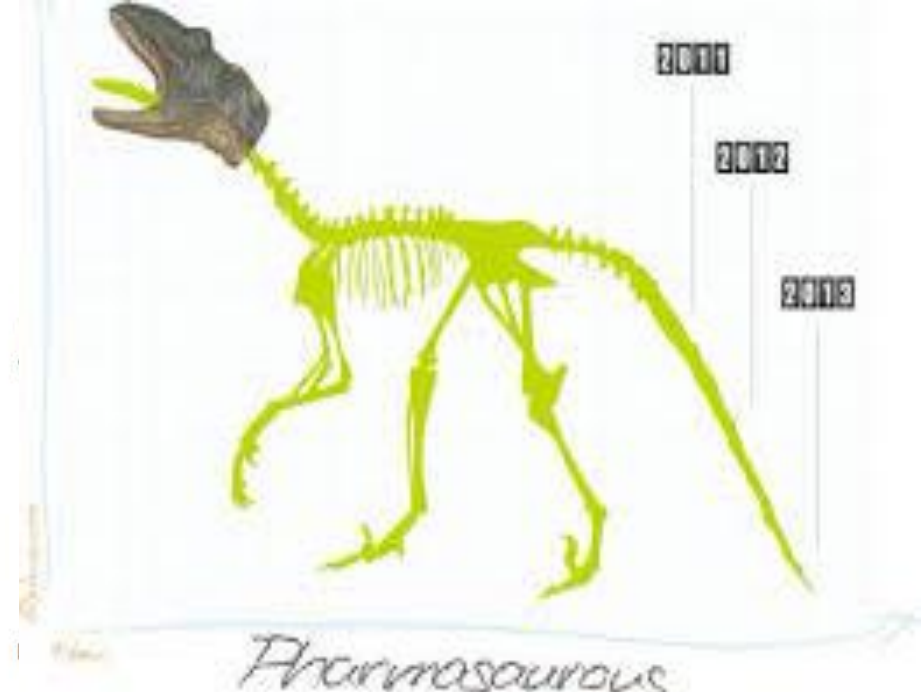


A permanent organization designed to execute a repeatable and scalable business model

A temporary organization designed to search for repeatable and scalable business model

Source: Steve Blank
November 2015

Healthcare Incumbents




2010

2012

2013

Pharmosaurus

Healthcare's new entrants:
Who will be the industry's Amazon.com?



pwc



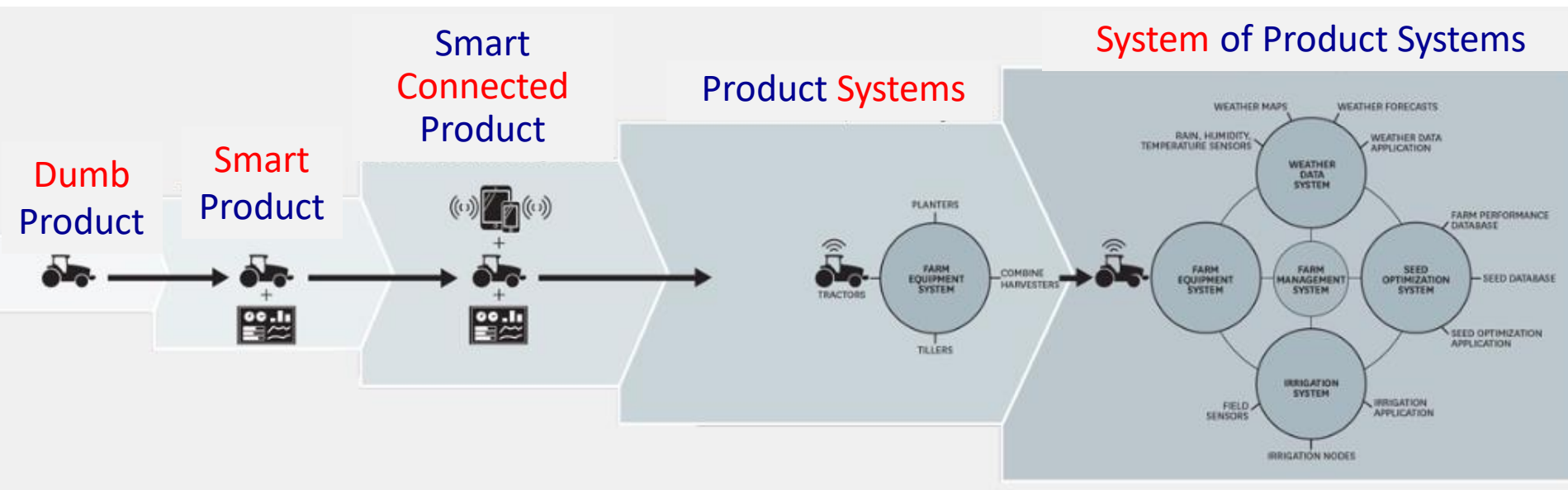
BUILD | BUY | PARTNER



Medtronic

Embed in a “System of Product Systems”

A product/tech that “works” is no longer enough



“Tractor Industry”



“Farm Automation Industry”

Why medtech must go digital: 'You can't bring a knife to a gunfight'

By MEGHANA KESHAVAN

3 Comments / 316 Shares / Oct 7, 2015 at 1:44 PM

 GOT NEWS? SEND US A TIP



Silicon Valley recognizes the power and potential of the healthcare markets, and is coming to play. The medical device industry must quickly adapt to the new digital paradigm, or some of its biggest players like General Electric and Medtronic could get squashed by the likes of IBM, Apple and Samsung – or so said a panel of venture capitalists at this week's [Advamed 2015](#) conference in San Diego.

porter
flying refined

Two-day sale

Count the savings!



Find Best Fares

Book by April 26, 2016
Travel by August 31, 2016
Some conditions apply.

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Your email address

Subscribe

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Medical device co's acquiring digital health companies as business models evolve

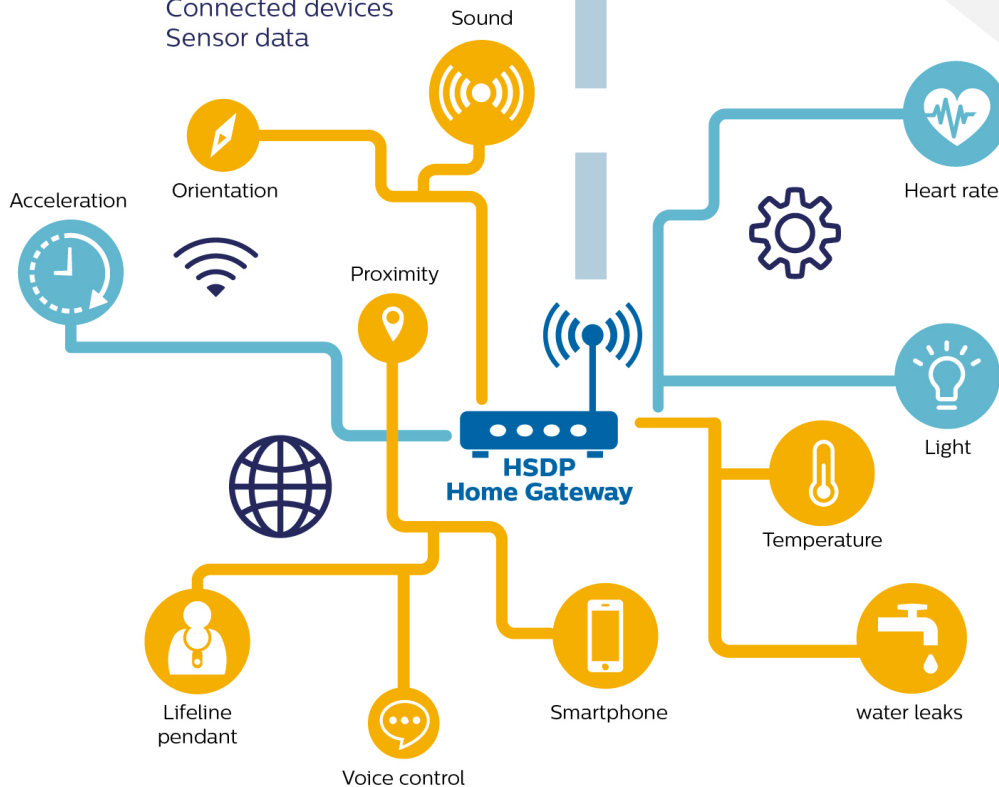


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PHILIPS+amazon

Internet of things

Data sources
Connected devices
Sensor data

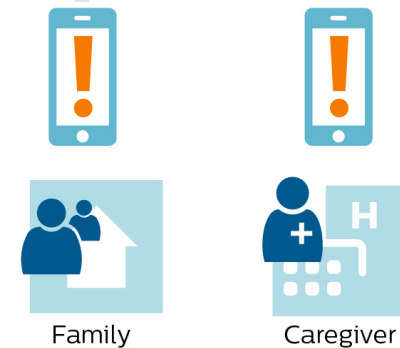


HealthSuite digital platform
device cloud

amazon
web services

Amazon services used by Philips are a.o.:
EC2, S3, Glacier, Lambda, SNS

amazon
web services



Gamification: transforming an unpleasant task into fun & engaging exercise



NINTENDO DS™





Propeller and Novartis collaborate to develop add-on sensor for COPD treatments

By **Heather Mack** | February 08, 2017

SHARE

< Share

33

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in

twitter

Digital respiratory health management company Propeller Health is collaborating with Novartis to develop a custom add-on sensor for the Swiss pharmaceutical company's Breezhaler inhaler, which is used for Novartis's portfolio of COPD treatments. The partnership will be focused in Europe.

The add-on sensor will be developed to work with the capsule-based dry powder inhaler by passively recording and transmitting compliance data to provide information through the Propeller Digital Respiratory Therapy platform to users and their doctors about medication adherence and other factors affecting treatment.



 **Himss** Value Score
Measuring Value. Managing Value.

Demonstrate the
value of your IT
investments.

LEARN
MORE

Future of Health = Innovation

Today: System

Future: Person

| | | |
|------------------|--------------------------------|-------------------------------|
| Timing | Reactive, sick care | Proactive, predictive |
| Tailoring | 1 size fits all [none] | Individualized configurable |
| Modality | Institution-centred | Digi-cal, decentralized |
| Duration | Episodic, intermittent, silo'd | Continuous team |
| Power | Provider | People-powered |
| Currency | Costs, inputs, volume | Outcomes, value |

KEEP CALM & KEEP INNOVATING

Zayna Khayat, Ph.D.

@ZaynaKhayat

INNOVATION

BECAUSE THE FUTURE
MATTERS

Further reading



MaRS Market Insights

Transforming Health:
Towards Decentralized and Connected Care

