Longitudinal Data

Healthcare Deep Dive Series

Wednesday, January 22nd, 2020

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Contents

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Executive Summary

Thesis:

- **Longitudinal Data will become increasingly important in clinical care, pharmaceutical development, and patient empowerment**

Problem/Opportunity:

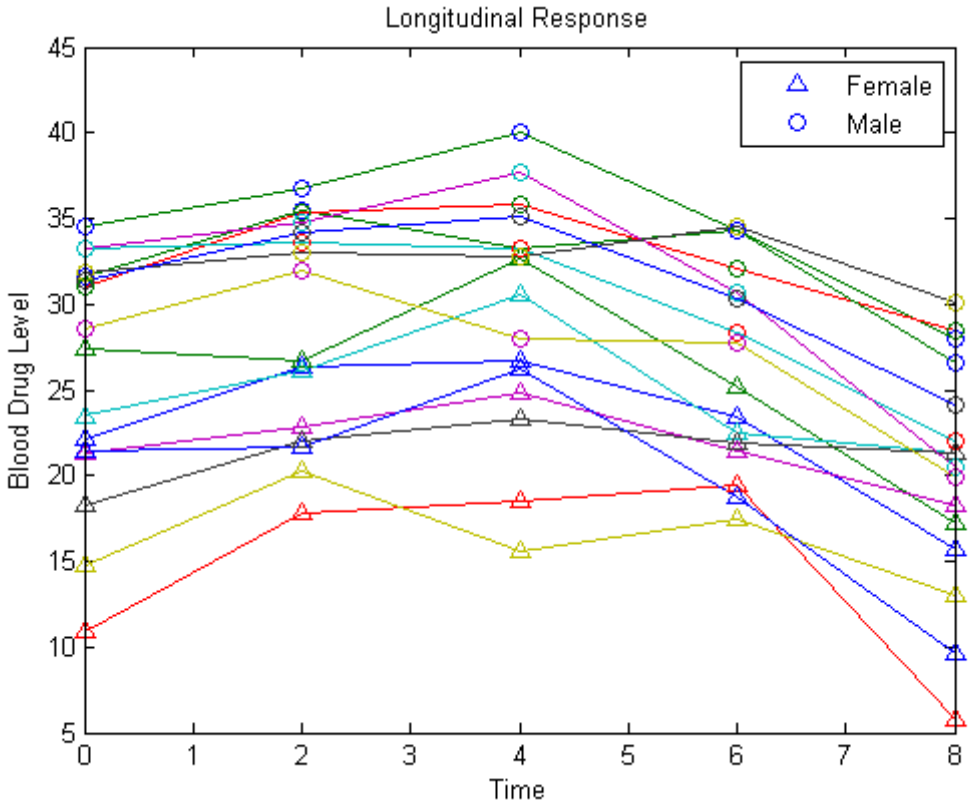
- **Patients have historically been subjects in the healthcare transaction despite laws that empower them. As people live longer, they are engaging more with their healthcare – this is partially due to the fact that engagement increases with illness.**
- **Longitudinal data is becoming more important as compared to episodic data because we're moving from acute care to chronic care. Chronic conditions have the highest touch point with the healthcare system.**
- **Comparing a patient against his former self is often more powerful than comparing to the population**
- **Systems used to generate health data are designed for operations, not to organize data effectively for research or analytics. As a result data is fragmented and siloed (healthcare industry is the biggest buyer of fax machines)**
- **The sources of patient data are increasing (i.e. patient data is no longer only spinning off of patient/clinician interactions). Genomics, epigenetics, proteomics, microbiome, lifestyle, demographics, geography, etc. will all contain valuable data**
- **The push for value-based care over volume-based care will increase the need for reliable data**

Solutions and Technology:

- **There are four main platform and technological trends that will help to unlock the opportunity:**
  - **New sources of data collection i.e. connected devices**
  - **Patient-centric platforms**
  - **Data structure technologies i.e. taking unstructured noisy data and making it structured**
  - **Data sharing platforms i.e. what do we do with this data now? –Related to patient centric platforms – patients have autonomy**

What are Longitudinal Data?

- Track the same sample at different points in time
- Longitudinal data allow for the measurement of within-sample change over time, enable the measurement of the duration of events, and record the timing of various events.
- APLD can be obtained from various sources, including electronic medical records, pharmacy records, physician surveys, hospitalized patient billings, medical claims data, and patient diaries. The common characteristic of this data is that it reflects actual patient behavior in real time and not after-the-fact. Therefore, there is no risk of interviewer bias or recall errors.



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What does the literature say?

ARTICLES
https://doi.org/10.1038/s41591-019-0414-6
nature medicine

A longitudinal big data approach for precision health

Discussion Section from Article:

“The untargeted longitudinal big data approach led to a number of discoveries in other areas such as cardiology, oncology, hematology and infectious disease, indicating that broad profiling is valuable for disease detection in many different areas.”

Chronic Diseases: Leading Causes of Death, Disability, Costs

6 IN 10

Adults in the US
have a **chronic disease**

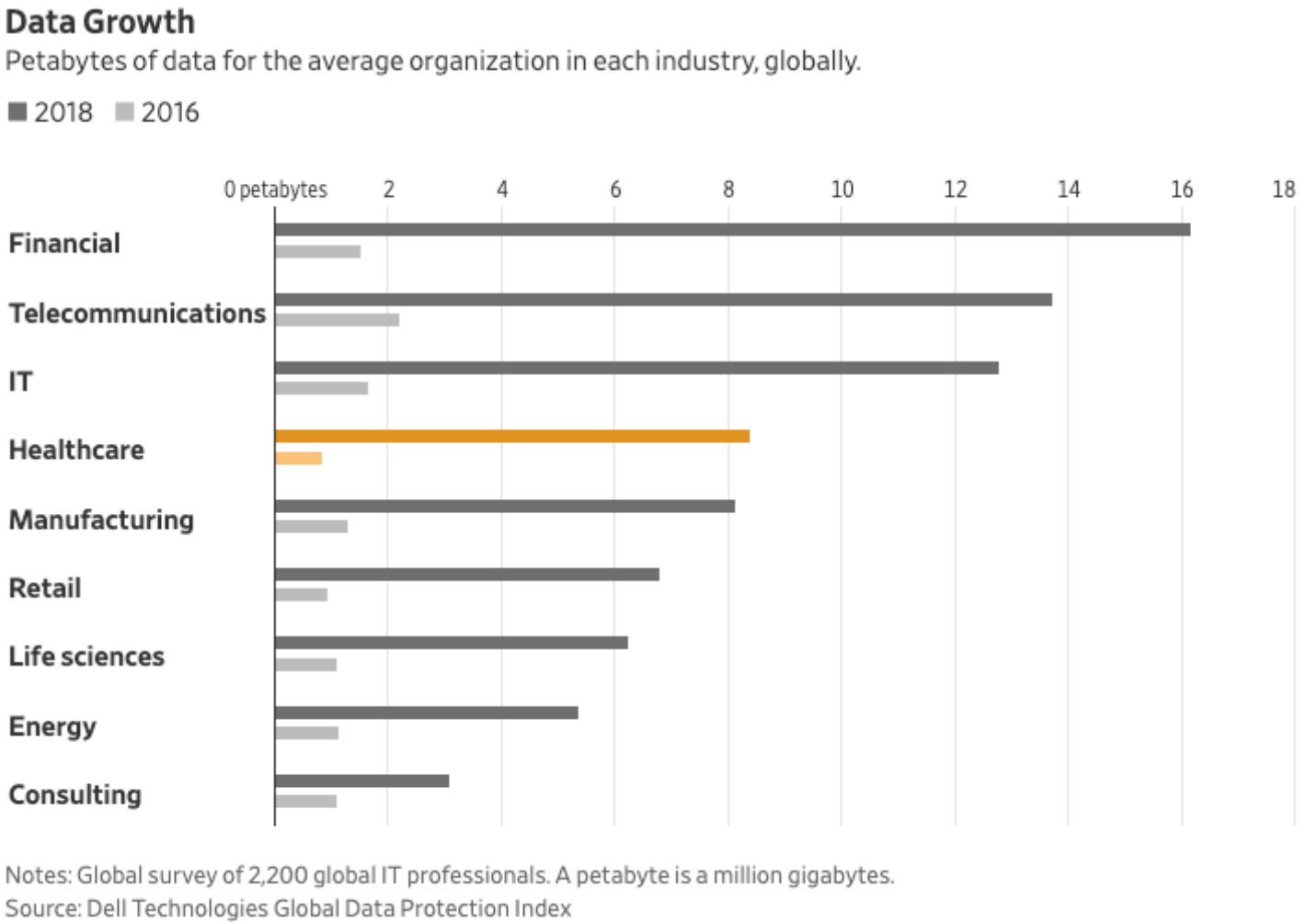
4 IN 10

Adults in the US
have **two or more**

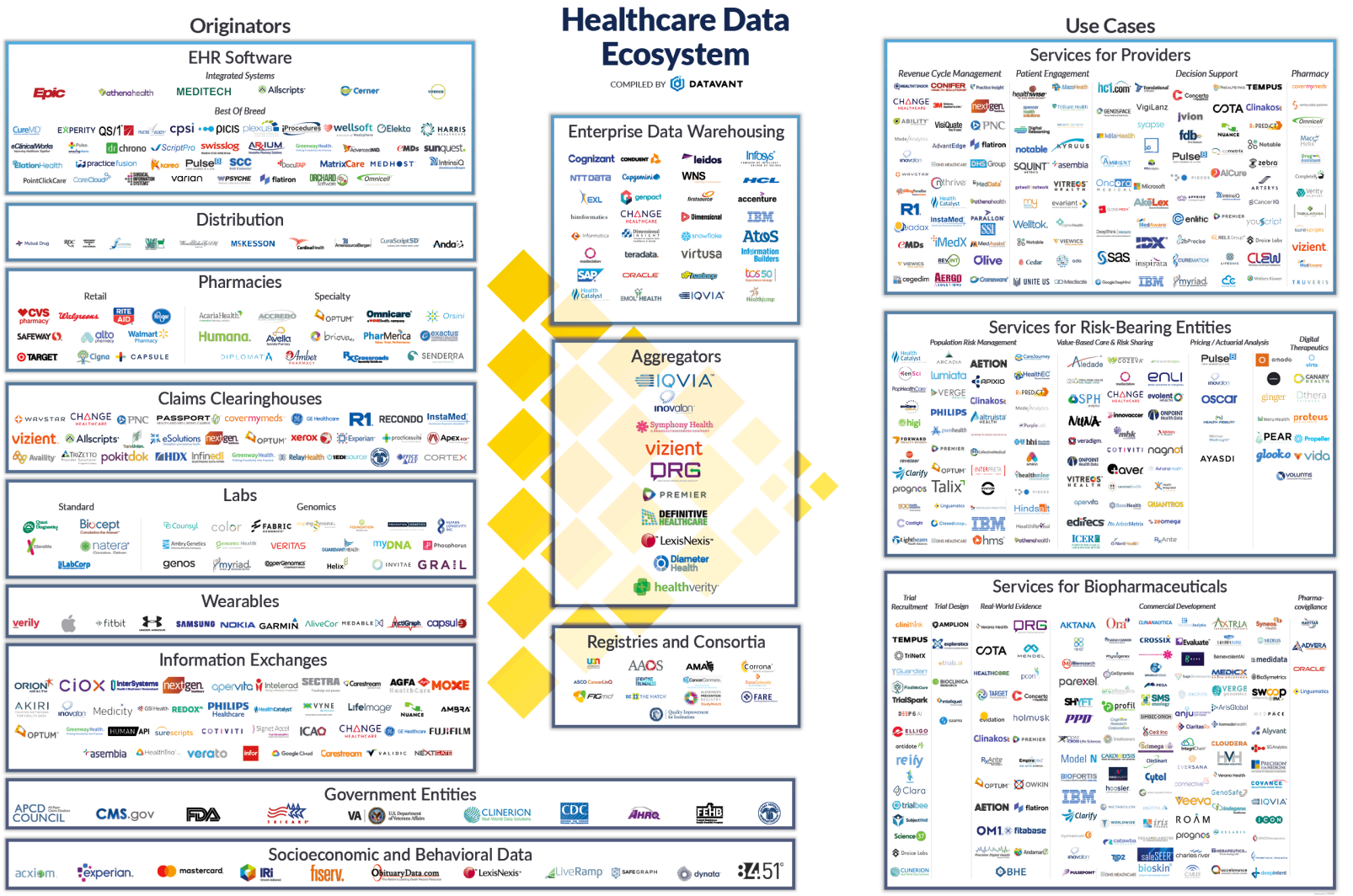
THE LEADING CAUSES OF DEATH AND DISABILITY
and Leading Drivers of the Nation's **$3.5 Trillion** in Annual Health Care Costs

cdc.gov

Industries Spinning Off Data

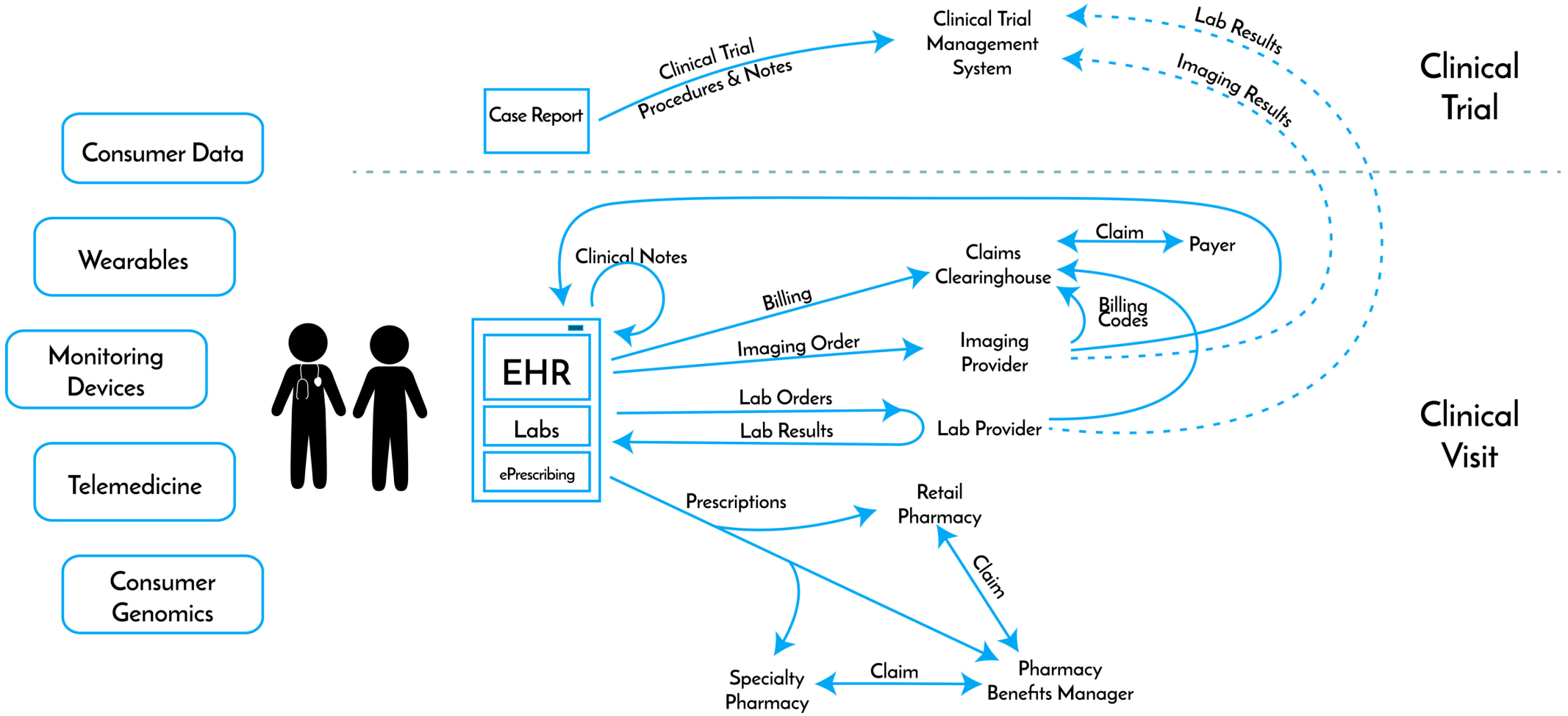


Healthcare Data Market Map



Healthcare Interactions: All are Data Points

Data Origination and Exchange



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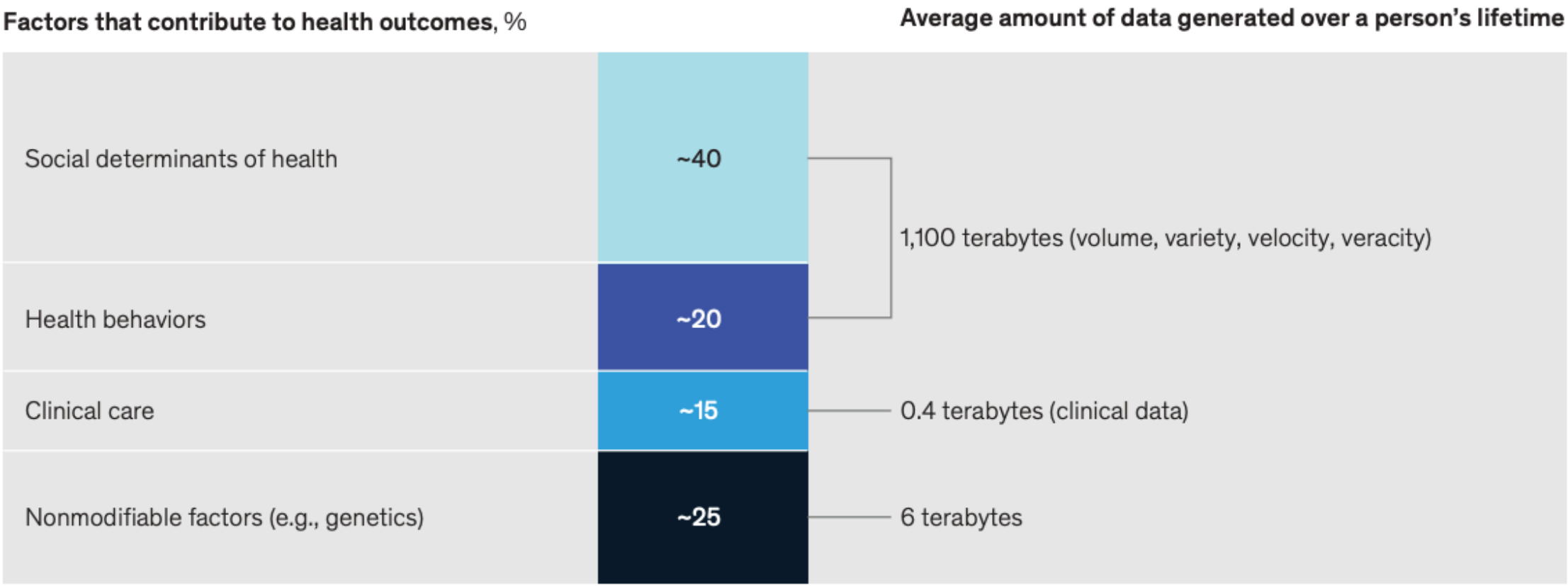
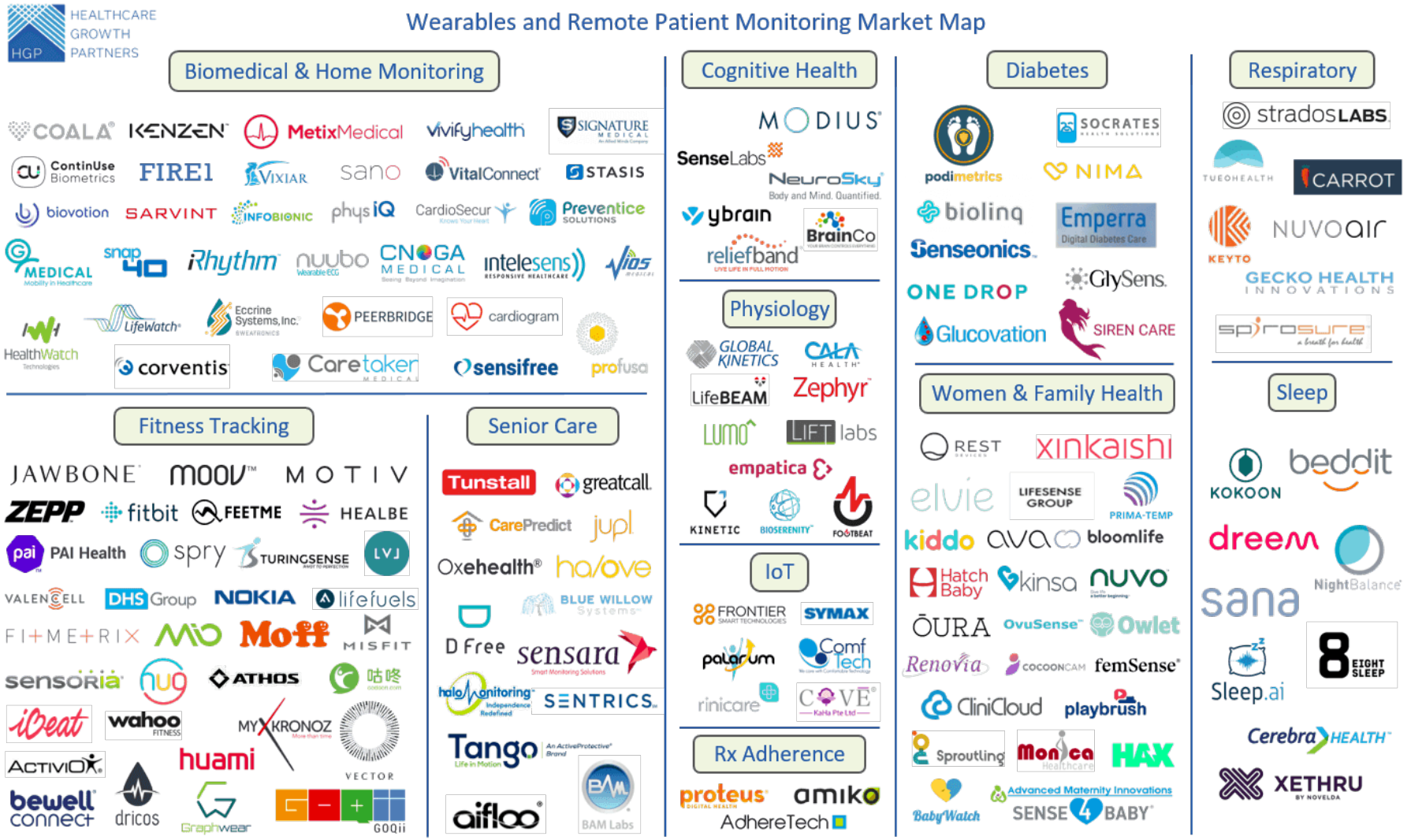
Different health factors and their data

EHRs will be outpaced by the amount of data coming online.



How to capture? Wearable/Connected Devices Market Map



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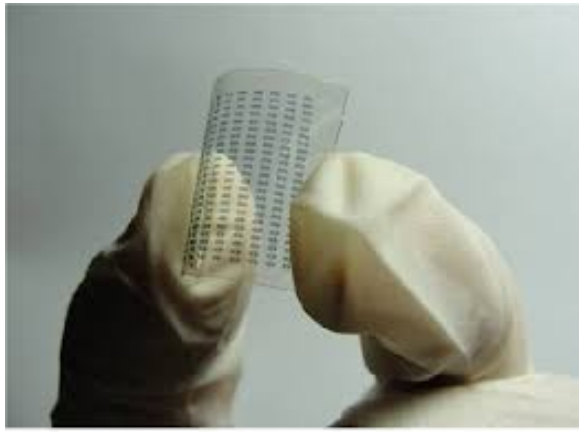
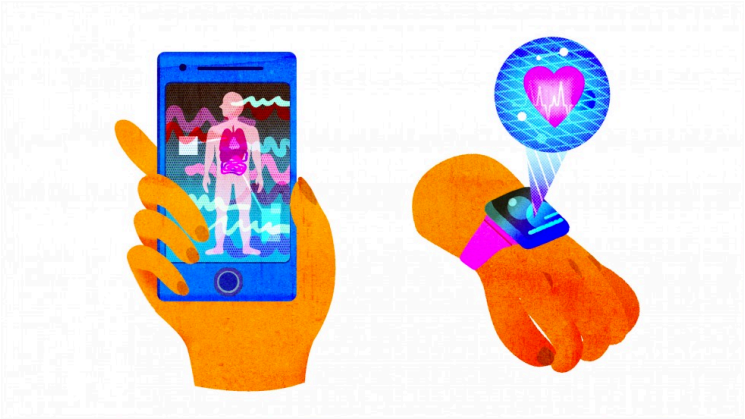
Wearable/Connected Devices

Soft Electronics



Wireless Communication

Devices!



Takeaways

- As of January 2019, there were 370 registered clinical trials and 682 publications specific to Fitbit devices. There are around 431 wearable devices available to consumers from 266 vendors.
- Feeds longitudinal data engines and confirms real world evidence after clinical trials.

Startup Highlights:

READOUT NIX™

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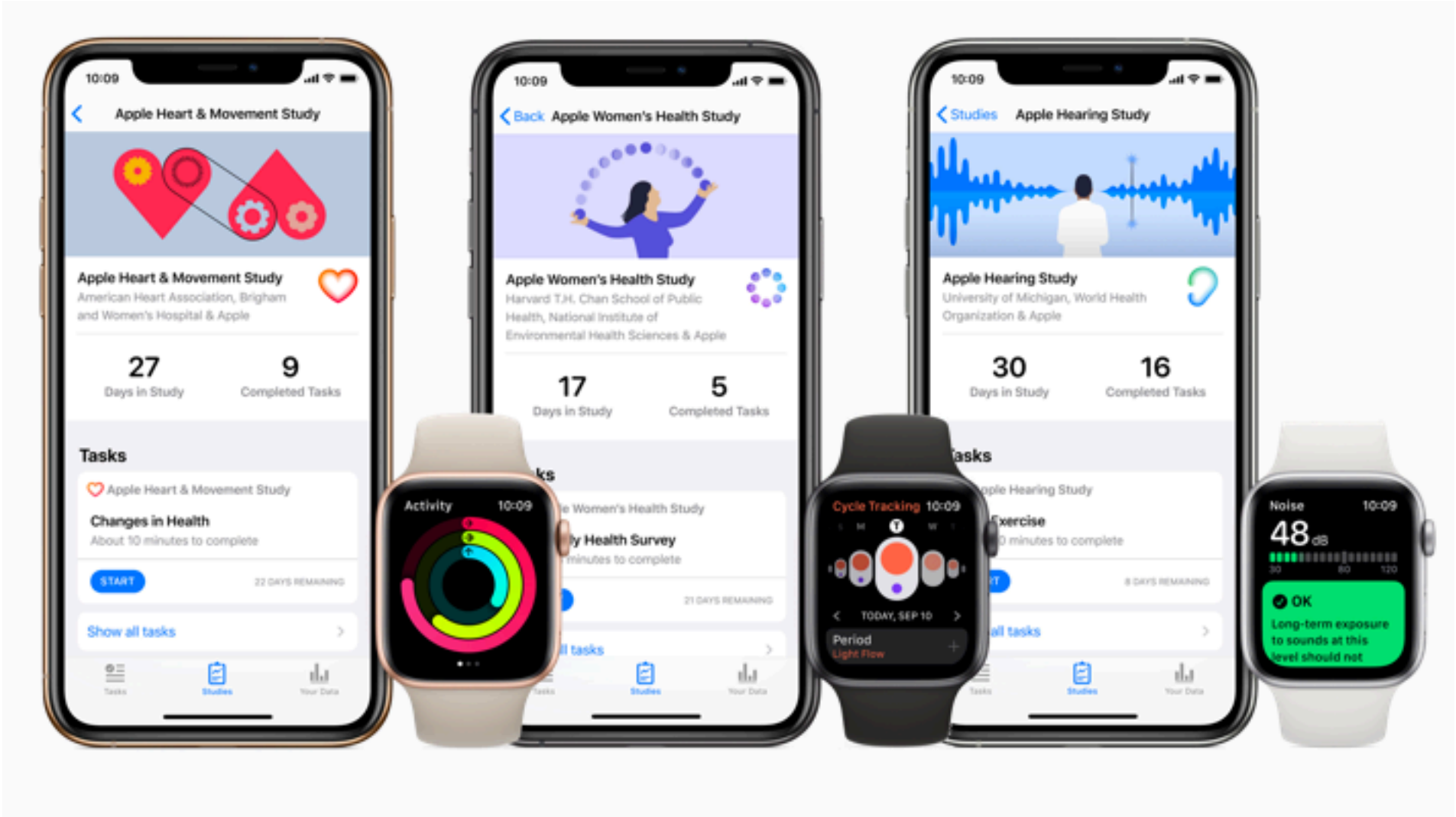
Special Guests: Nix & Readout

- Developing a biosensor platform that measures hydration in real time
- Beachhead Market: Athletes
- Large applicability for healthcare, indications for which hydration is paramount:
  - Chronic Kidney Disease
  - Sickle Cell Anemia
  - Diabetes

- Breath-analysis device with clinical grade accuracy for measuring blood-ketone levels, an important indicator of a patient's metabolism.
- Ketogenic Diet is gaining strong clinical interest as a means of combating or reversing T2D
- Verifies ketosis 30X more accurately than consumer ketone breath measures – metabolic scale that quantifies how well the body is burning fat

Apple: One App for 3 Longitudinal Studies



Challenges Facing Wearables

"…for wearable devices to be effectively deployed in healthcare and research, the cold truth is that they must overcome not only economic, regulatory and technological challenges but also the obstructive obstinacy of established healthcare culture." – *Nature Biotechnology*

- **Is the data clinical grade? Are those 10k steps you took 8k steps?**
- **If the data is clinical grade, data integration is still a hurdle**
- **Security and directed control over data – where is it going?**
- **Reimbursement is still challenging?**
- **False positives and excessive calls to the doctor and — for atrial fibrillation in the case of the Apple Heart Study — unnecessary treatment that could worsen outcomes**

Patient & Provider Analytics Platforms

Hugo

- Technology: Leverages individuals HIPAA rights to get access to data on their behalf
- Investment: Unkown Angel round
- Status: Working with FDA on post market studies to validate efficacy of interventions

MDCLONE

- Technology: Synthetic data and longitudinal organization
- Investment: $26M Series B @ | $46M raised to date | OrbiMed & LightSpeed
- Status: Clients include WashU's School of Medicine

ciitizen

- Technology: Platform that allows patients to securely collect and share their data
- Investment: $20M raised | Series A pre-money: $49m | A16Z led the roud
- Status: Starting with cancer patients. Competing against Apple Health Records

evidation

- Technology: Platform & service that organizes data from disparate sources, including wearables
- Investment: $30M Series C @ $160 | Led by SV Health | $60M raised to date
- Status: 12 week feasibility study monitoring 31 people, collected 16TB of data

Other Notable Players

AETION

TriNetX

Hu-manity.co

Source: Pitchbook & iSelect Fund Data

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AI/ML Solutions: Patient, Provider, Life Science Cos.

HEALTH [at] SCALE TECHNOLOGIES

- Technology: Ingests patient data and suggests best hospital and best doctor for the job
- Investment: $16M Series A, Optum led
- Status: Being used by an undisclosed group of hospital systems and payers

GENOOX

- Technology: Converter and manager of Genomics Data
- Investment: $6M A led by TriVentures in May ‘18
- Status: Partnered with Microsoft Genomics to handle the NGS pipeline for clinics and researchers

Clinithink

- Technology: Converter of unstructured data into structured
- Investment: Series B+ led by Merck Global Innovation Fund

flatiron

- Technology: Data analytics and organization for cancer clinics
- Investment: $1.9B acquisition by Roche, operating subsidiary
- Status: Data from 265+ onc. practices. Partnered with NCI. Touches 2m+ cancer patients annually

Other Notable Players

HealthCatalyst®

Source: Pitchbook & iSelect Fund Data

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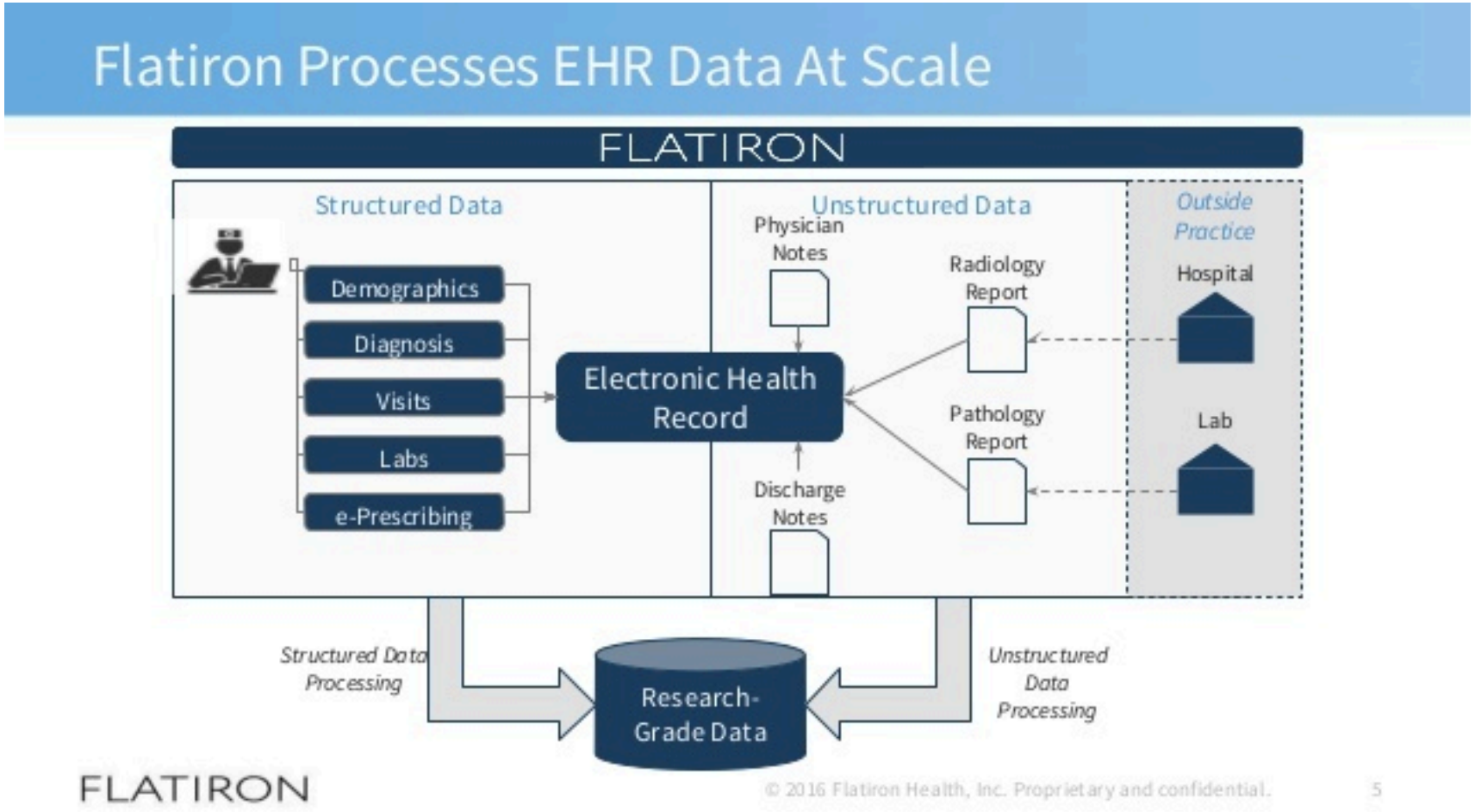
Flatiron's Process



M&A

fitbit

- Purchased by: Google for $2.1B in Nov. 2019
- Status: 3rd place behind Apple Watch and Samsung. Captured 11% market share in Q3 2019

Livongo®

- Technology: Chronic Care Management
- Investment: 7/25/19 $355M IPO
- Status: $2.7B Market Cap

flatiron

- Purchased by: Roche for $1.9B
- Status: Data from 265+ onc. practices. Partnered with NCI. Touches 2m+ cancer patients annually

HealthCatalyst®

- Technology: Analytics, Data Warehousing, Data Integration
- Investment: 7/25/19 $182M IPO
- Status: $1.35B Market Cap

Source: Pitchbook & iSelect Fund Data

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Pharma, Payers, & Synthetic Control Arms?

Pharma

- Need many applicable patients. Longitudinal data pre-qualifies.

Payers

- Won't reimburse without real world evidence. Can't answer without the right data and the right structure.

Synthetic Control Arms

- Control arms without the use of a placebo – i.e. using historical data of similar cohorts as those taking the active drug
- Currently Flatiron is simulating data to prove the validity of the approach with the FDA
  - Regulatory tailwinds: Dr. Amy Abernethy, former CMO at Flatiron, was recently appointed Deputy Commissioner of the FDA

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Thank You For Joining!

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