manatt

Digital Health—Disruptive Technology or Just a Disruption?

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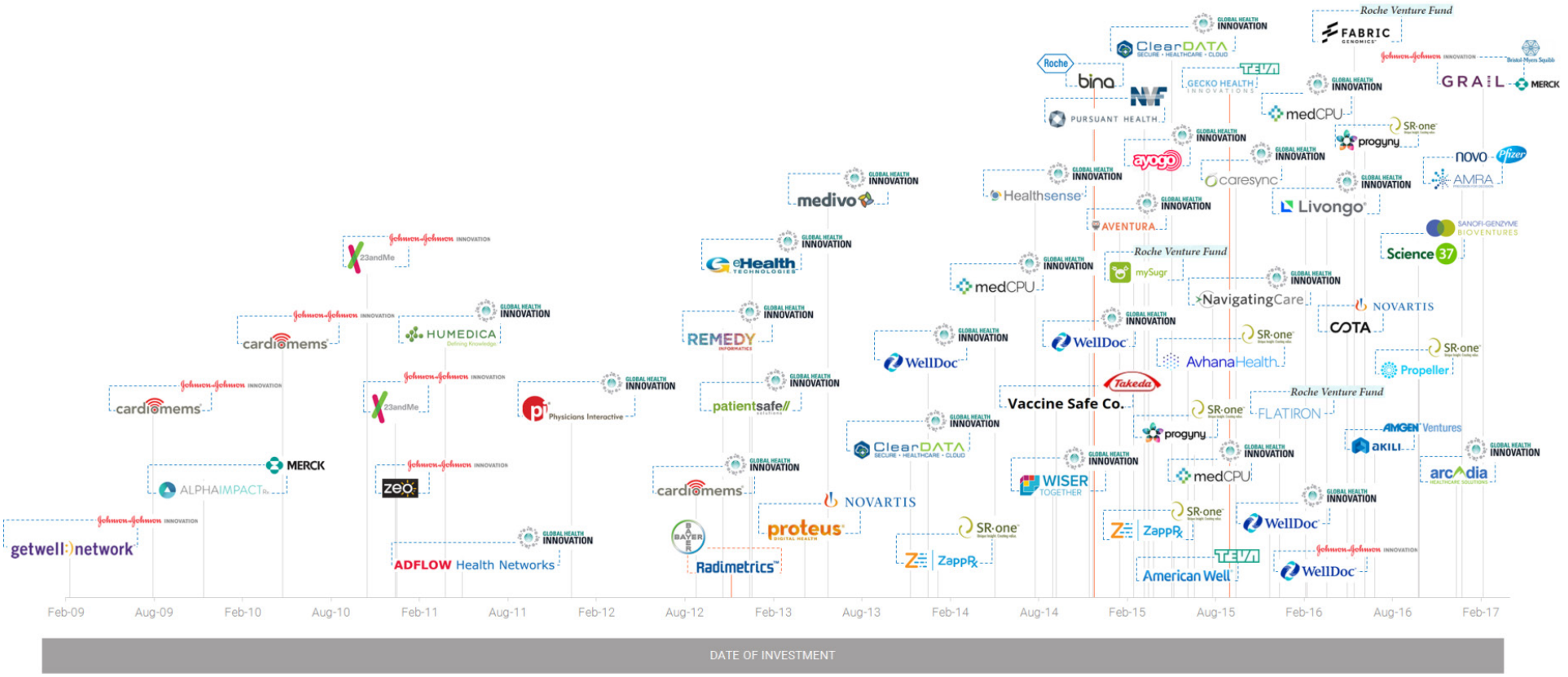
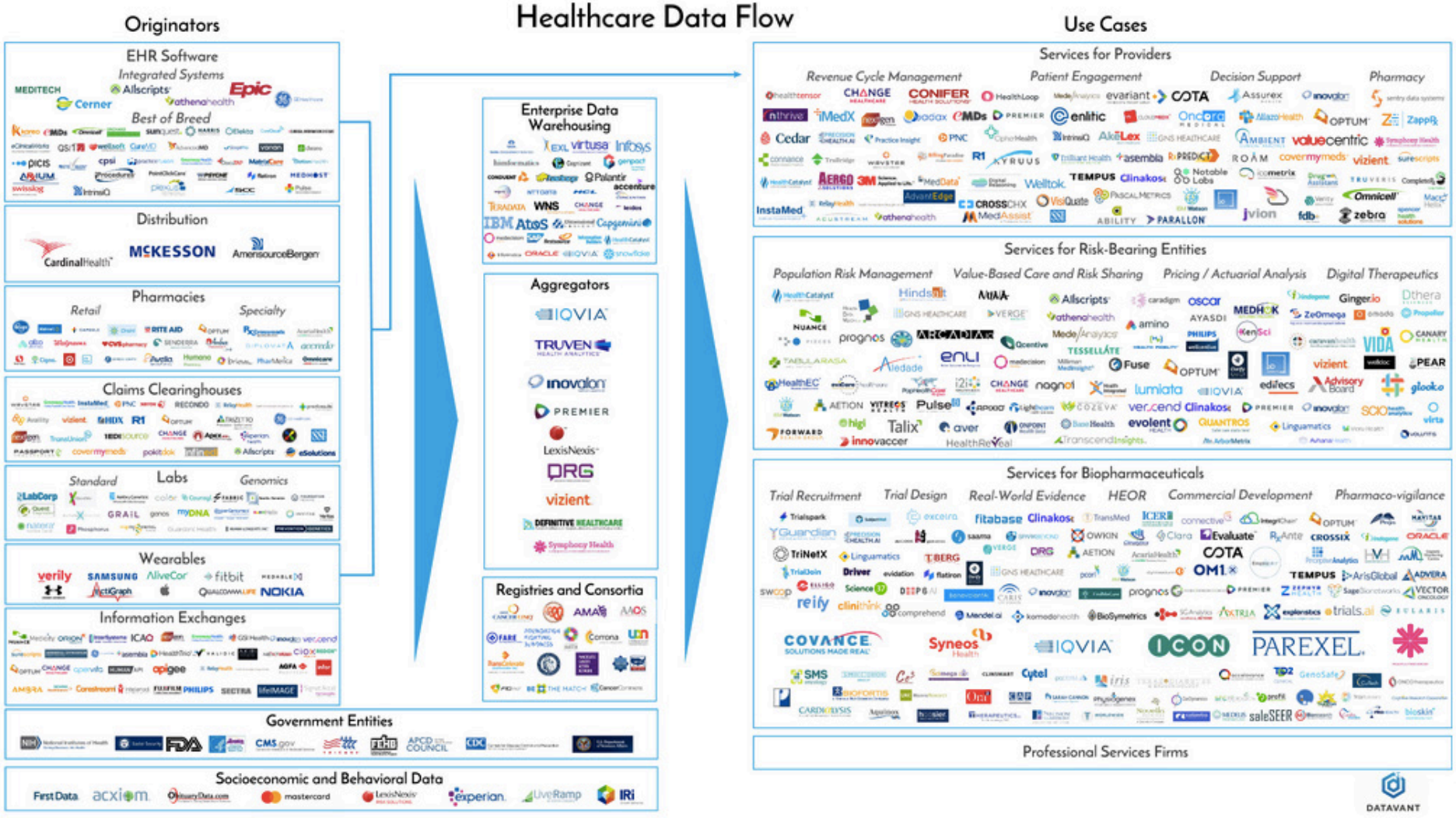
Tech Is Everywhere, But Is It Ready for Prime Time?

Pharma Investments & Acquisitions in Digital Health Companies From 2009 to 2017



Lots of Innovation, But It Can Be Overwhelming…

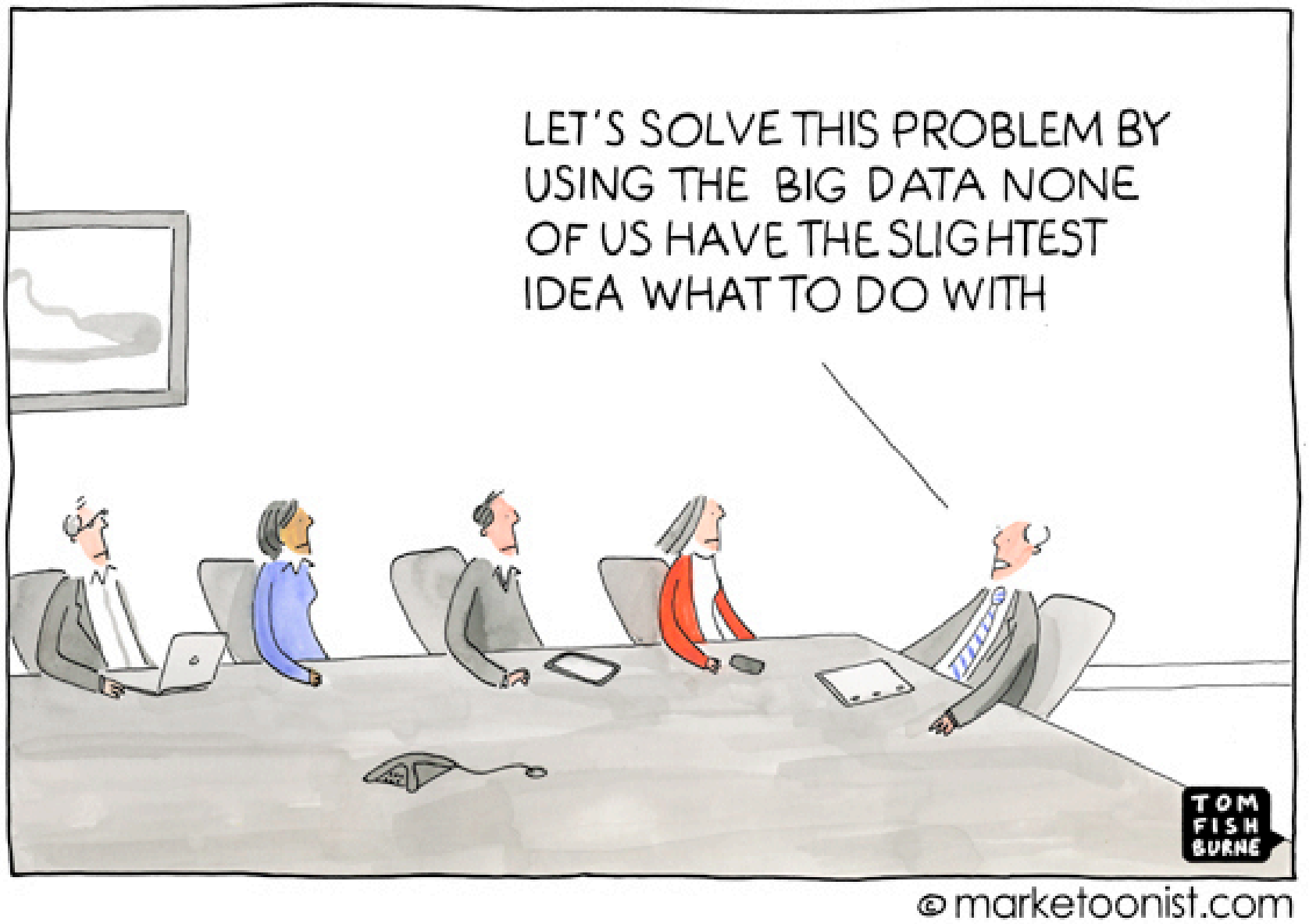


This is but a small subset of players…

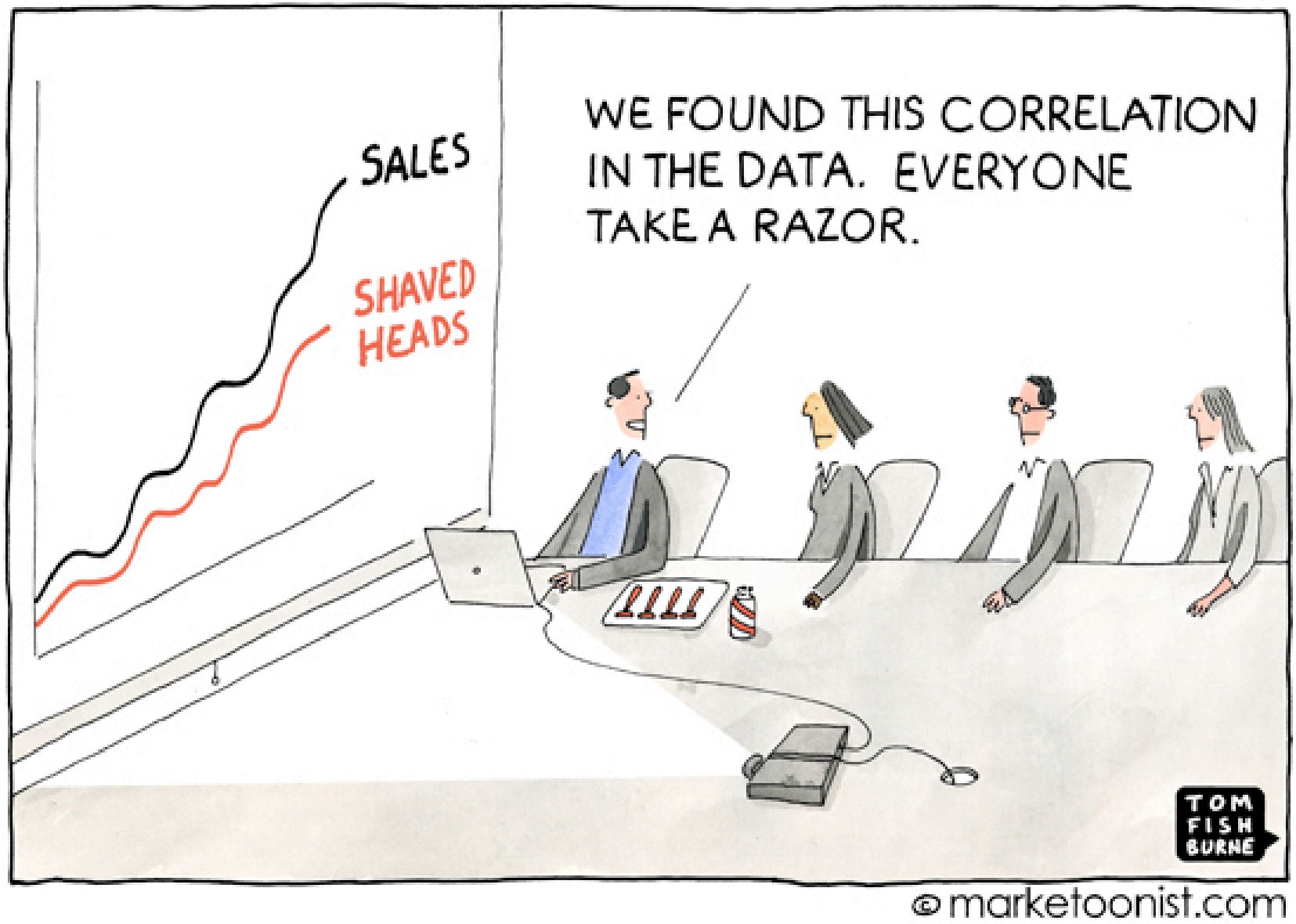
Compounded by a Proliferation of Data

"After careful consideration of all 437 charts, graphs, and metrics, I've decided to throw up my hands, hit the liquor store, and get snockered. Who's with me?!"

Much of It Unusable by Providers, Payers or Patients

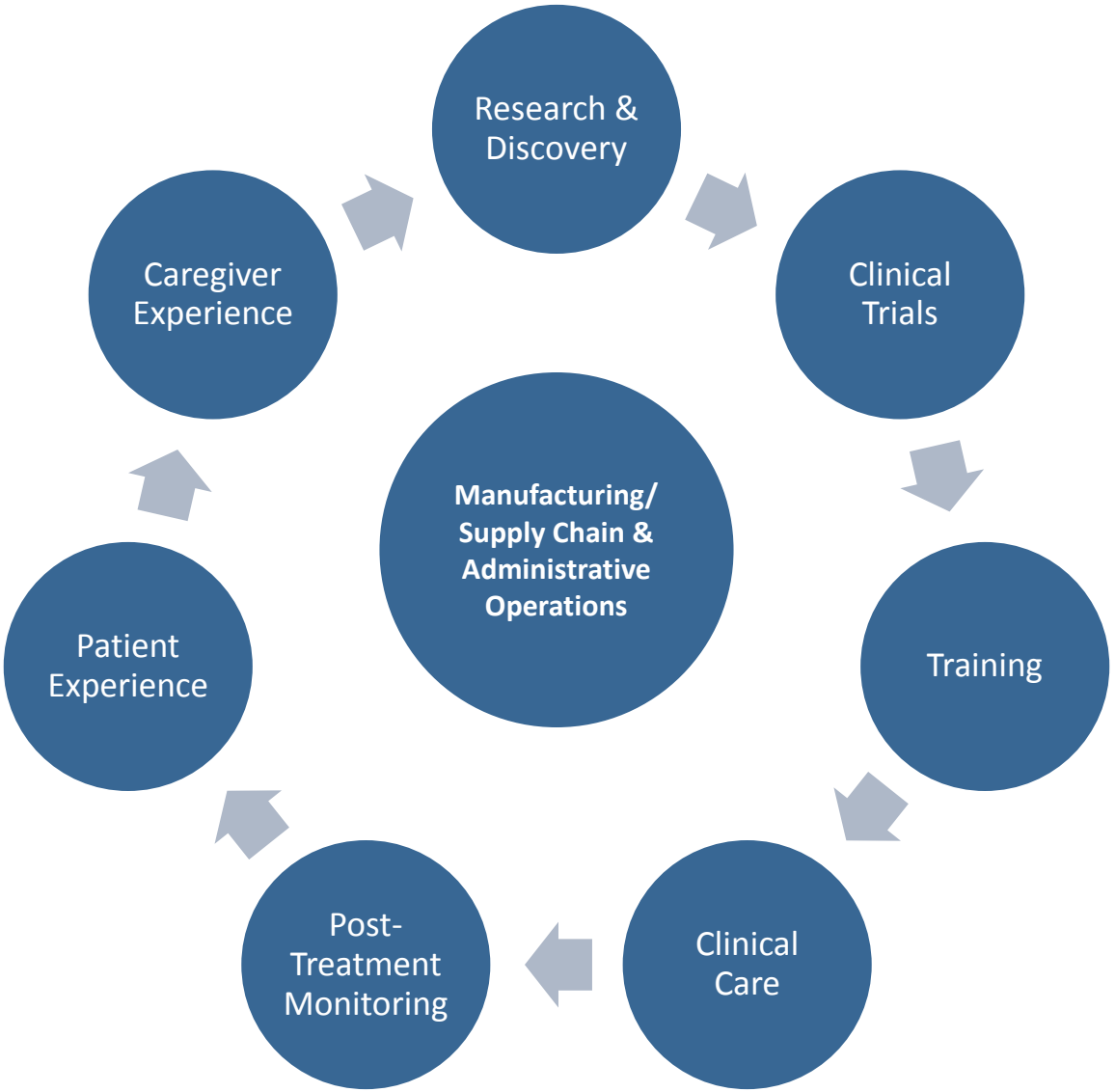


The Search for Meaning…



…Especially in Clinical Practice

Digital Technology: High-Value Pharma Use Cases



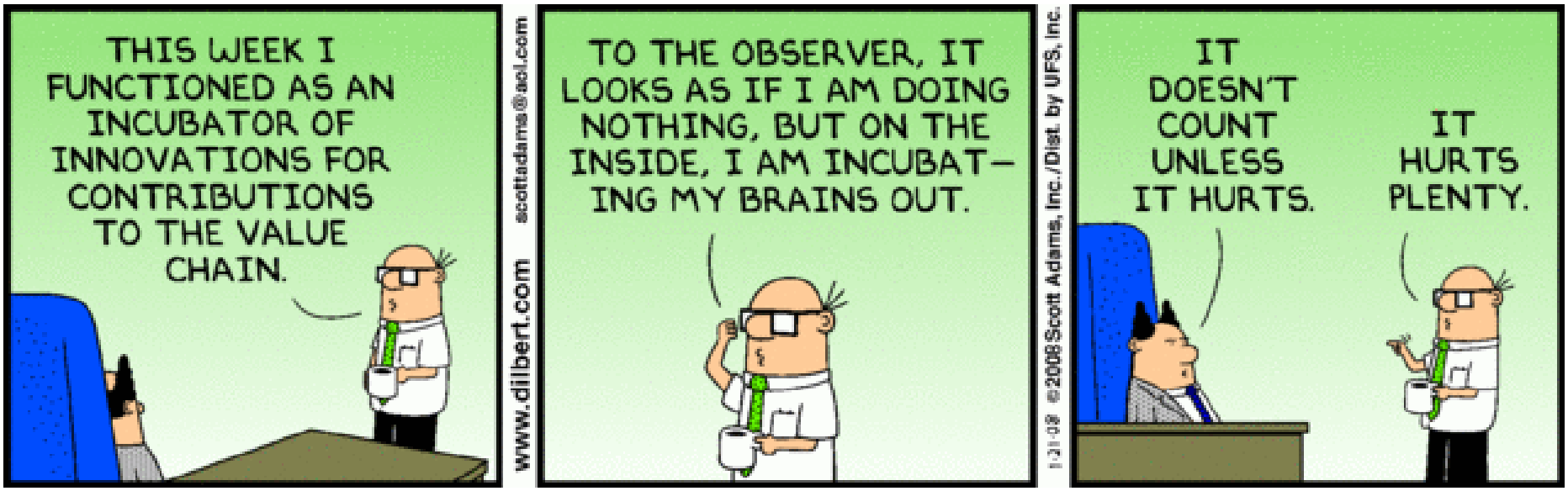
Audience Poll #1:

What do you consider to be the best short-term use case for digital health, where it can create the most immediate value?

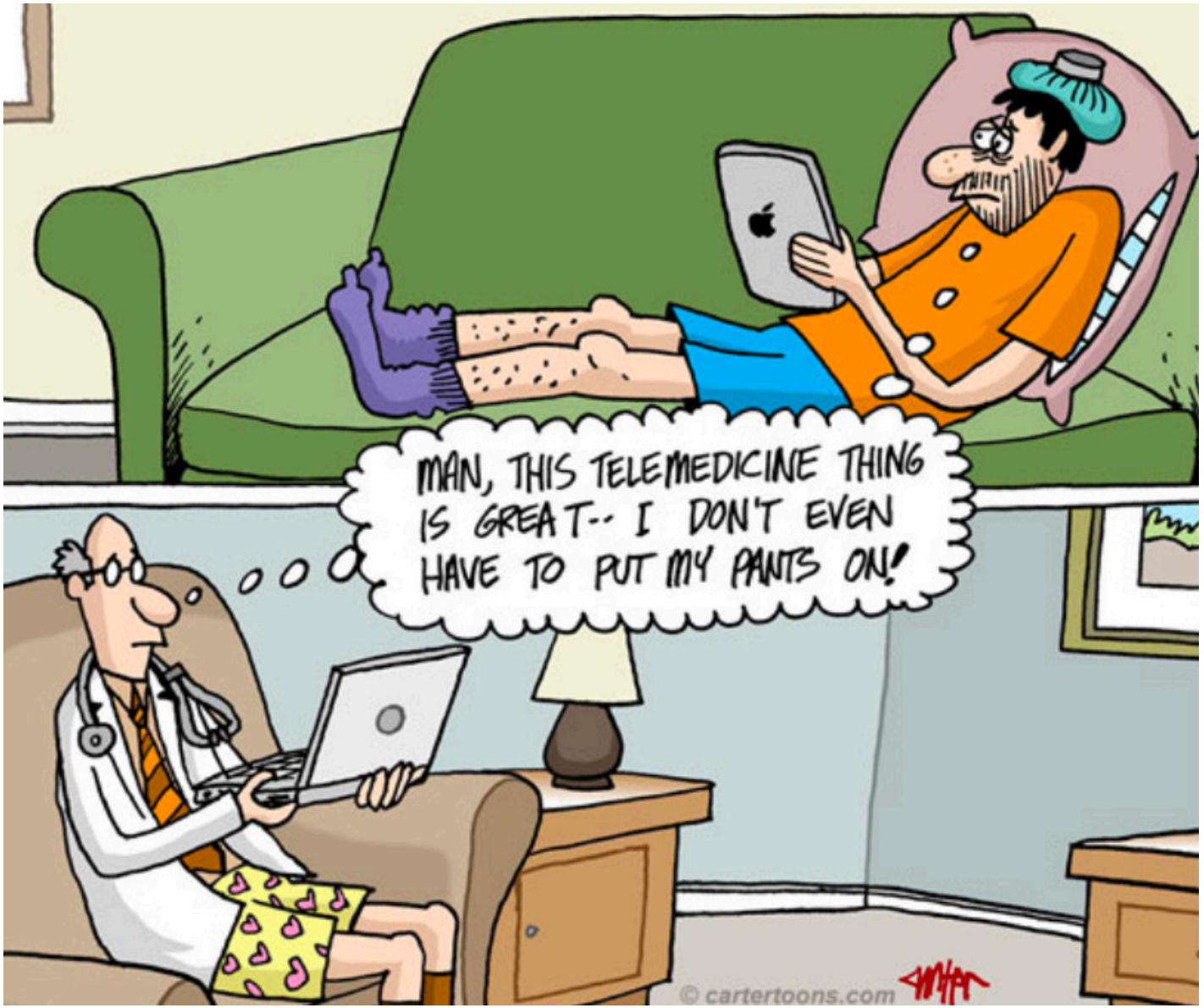
1. Research and discovery
2. Clinical trials
3. Post-treatment monitoring
4. Administrative operations/supply chain
5. Patient experience

The Newish, New Things

- Telemedicine & Remote Sensing
- Artificial Intelligence (AI)
- Blockchain
- Digital Therapeutics
- 3D Printing
- Virtual Reality
- Voice



Telemedicine & Remote Sensing



Opportunities for Pharma & Telemedicine—Clinical Trials

Opportunities

Recent Partnerships

evidation

Lilly

Project Baseline

NOVARTIS

Pfizer

Otsuka

SANOFI

Science 37

NOVARTIS

Boehringer Ingelheim

ucb

SANOFI

Opportunities for Pharma & Telemedicine—Diagnosis and Treatment

Opportunities

Recent Partnerships

proteus DIGITAL HEALTH

Otsuka

Reckitt Benckiser

dr. on demand

Walmart

Great-West

Teladoc HEALTH

AI: Great Promise, a Long Way Away From Nirvana

bloomberg.com

AI Will Give Us Better French Fries

Apr. 26th, 2018 Send to Kindle

cnbc.com

A.I. could lead to a nuclear war by 2040, think tank warns

Apr. 25th, 2018 Send to Kindle

"In from 3 to 8 years we will have a machine with the general intelligence of an average human being."

— Marvin Minsky

Guess What Year

AI Today and Tomorrow

10 AI Applications That Could Change Health Care

APPLICATION	POTENTIAL ANNUAL VALUE BY 2026	KEY DRIVERS FOR ADOPTION
Robot-assisted surgery	$40B	Technological advances in robotic solutions for more types of surgery
Virtual nursing assistants	20	Increasing pressure caused by medical labor shortage
Administrative workflow	18	Easier integration with existing technology infrastructure
Fraud detection	17	Need to address increasingly complex service and payment fraud attempts
Dosage error reduction	16	Prevalence of medical errors, which leads to tangible penalties
Connected machines	14	Proliferation of connected machines/devices
Clinical trial participation	13	Patent cliff; plethora of data; outcomes-driven approach
Preliminary diagnosis	5	Interoperability/data architecture to enhance accuracy
Automated image diagnosis	3	Storage capacity; greater trust in AI technology
Cybersecurity	2	Increase in breaches; pressure to protect health data

SOURCE ACCENTURE

Since 2016, over 1100 healthcare AI/ML companies have been funded—next up: AI to help us sort through AI companies!

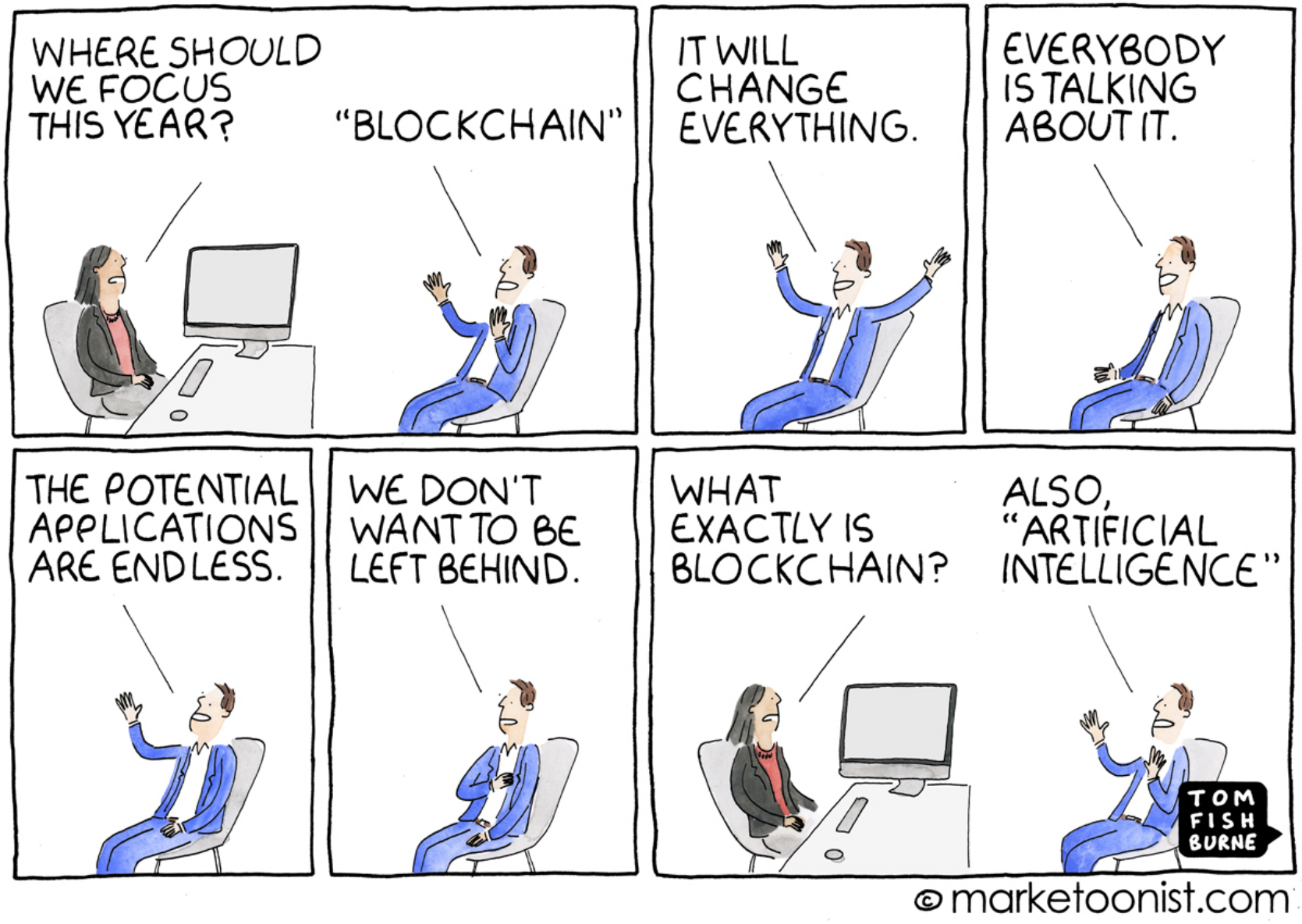
Not So Fast…

Audience Poll #2:

What do you consider to be the greatest barrier to significant AI adoption in the pharmaceutical and biotech industry?

1. Data quality too poor to have predictive value
2. Researcher/Physician discomfort with “being replaced by software”
3. Cultural issues; hard to change historical way of doing things
4. We don’t have the right people in place with advanced technology skill sets
5. Companies providing AI products don’t understand the industry well enough to make products valuable

Blockchain

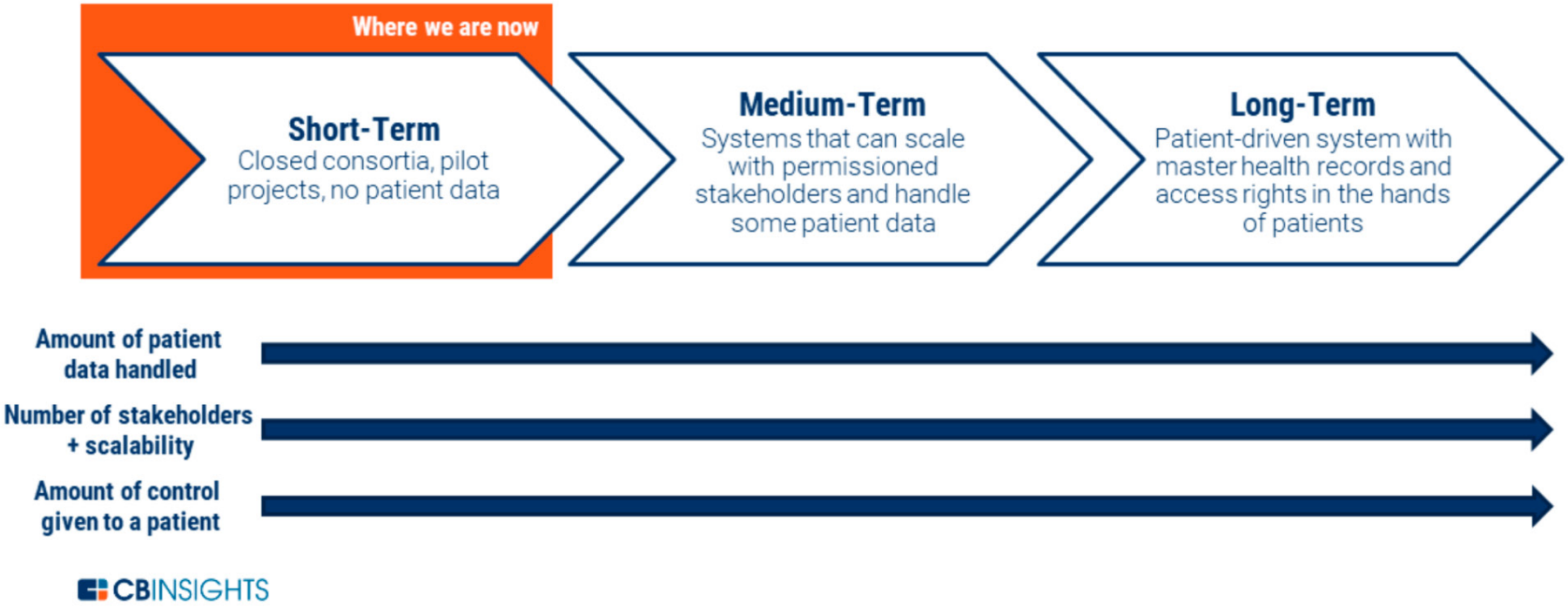

WHERE SHOULD WE FOCUS THIS YEAR?
"BLOCKCHAIN"
IT WILL CHANGE EVERYTHING.
EVERYBODY IS TALKING ABOUT IT.
THE POTENTIAL APPLICATIONS ARE ENDLESS.
WE DON'T WANT TO BE LEFT BEHIND.
WHAT EXACTLY IS BLOCKCHAIN?
ALSO, "ARTIFICIAL INTELLIGENCE"
TOM FISH BURNE
© marketoonist.com

How Will Blockchain Play Out?

WHAT DOES TOMORROW LOOK LIKE?

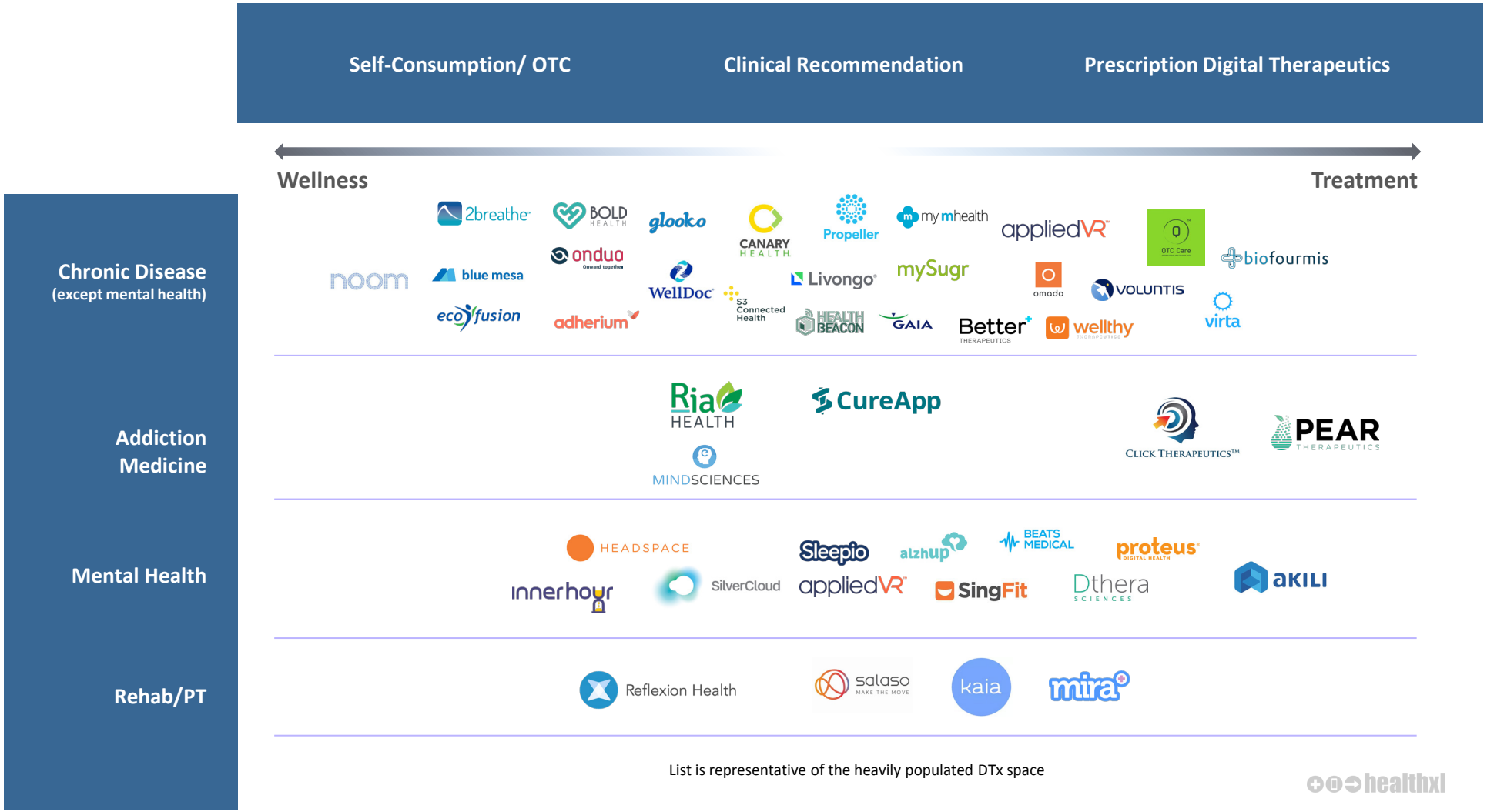
Blockchain + Healthcare: A Potential Roadmap

Use cases for blockchain will start in small projects that reduce duplicative work but can eventually shift to a system where patient's control access rights to their data



Digital Therapeutics

Digital Therapeutics—Landscape



List is representative of the heavily populated DTx space

healthxl

DTx Clinical Validation—What's Out There?

- From the HealthXL Platform's DTx dashboard, there are 179 identified studies on PubMed that map to 58 DTx companies
- Of these, 49 studies have been published by the top 5 funded companies
- The studies vary in size, design (safety/feasibility/usability studies, technical evaluations, randomized clinical trials)
- A number of these DTx have undergone bench tests and are the subject of white papers that are not peer-reviewed and are do not appear in medical journals

PDT vs D2C : Highest Funded DTx vs Evidence* **DTx with most clinic ≠ evidence**

most funded

PDT	Num of Publications
1. Proteus Digital Health	14
4. Akili	5
5. Pear Therapeutics	1

D2C	**Num of Publications**
2. Livongo	14
3. Omada Health	15

DTx	Num of Publications
Silver Cloud Health	17
Propeller Health	16
Glytec	13
Brainsway	12
Virta	12
WellDoc	12
Voluntis	9

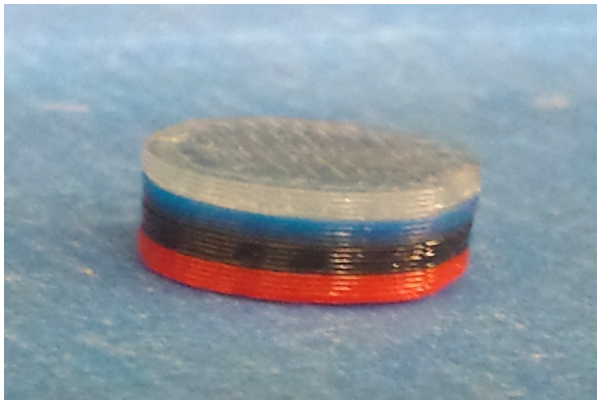
healthxl

*All publications captured on PubMed through company names and author affiliations

3D Printing

You see Mum, I told you that if I can spin a web, I can do 3D-printing...

CartoonStock.com



Virtual Reality

CartoonStock.com

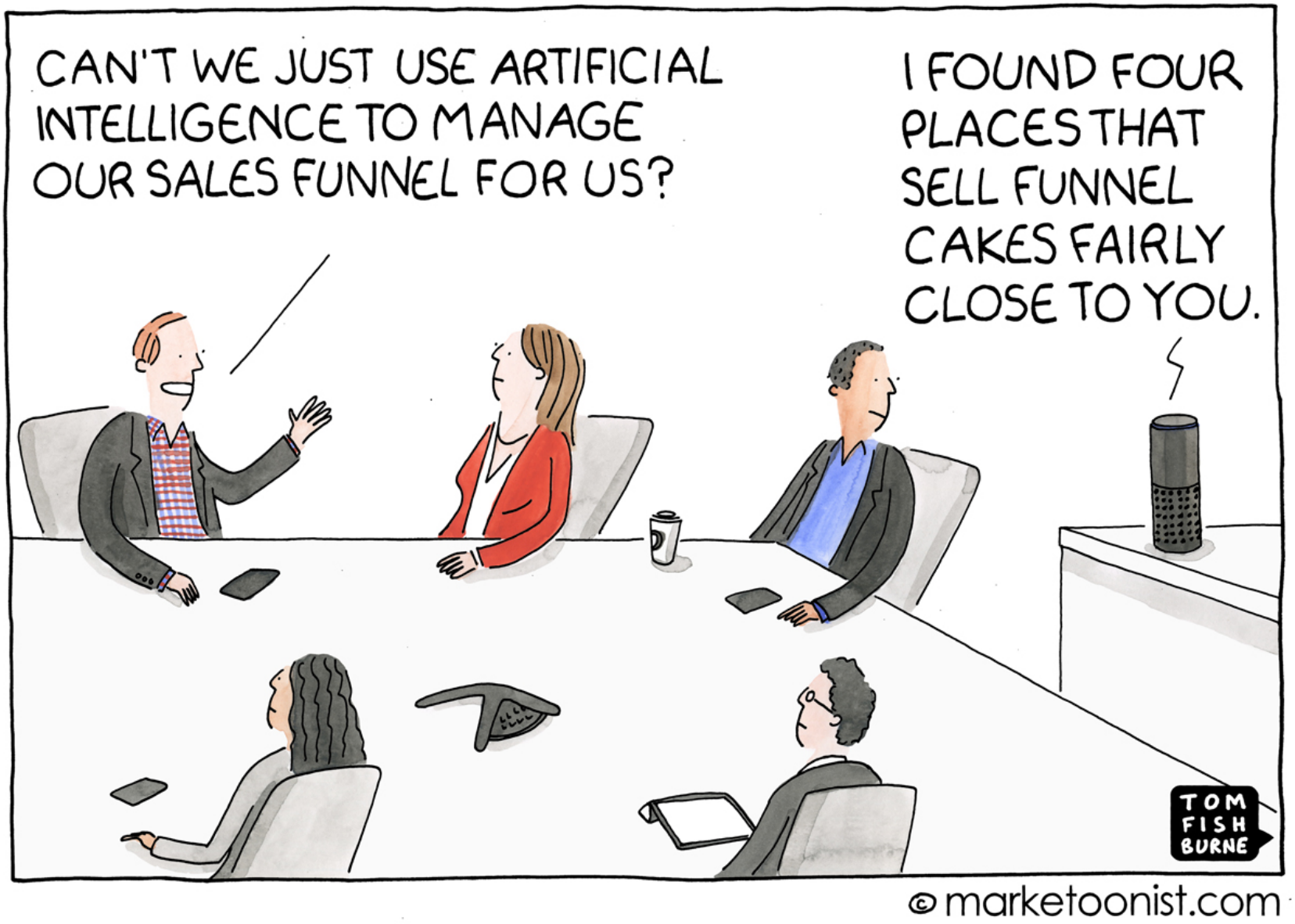
Virtual Reality is Already in Use

- Reduction of anxiety before surgery
- Postsurgical pain management
- PTSD treatment
- Physical and stroke rehabilitation
- Patient education preprocedure
- Physician training for surgery

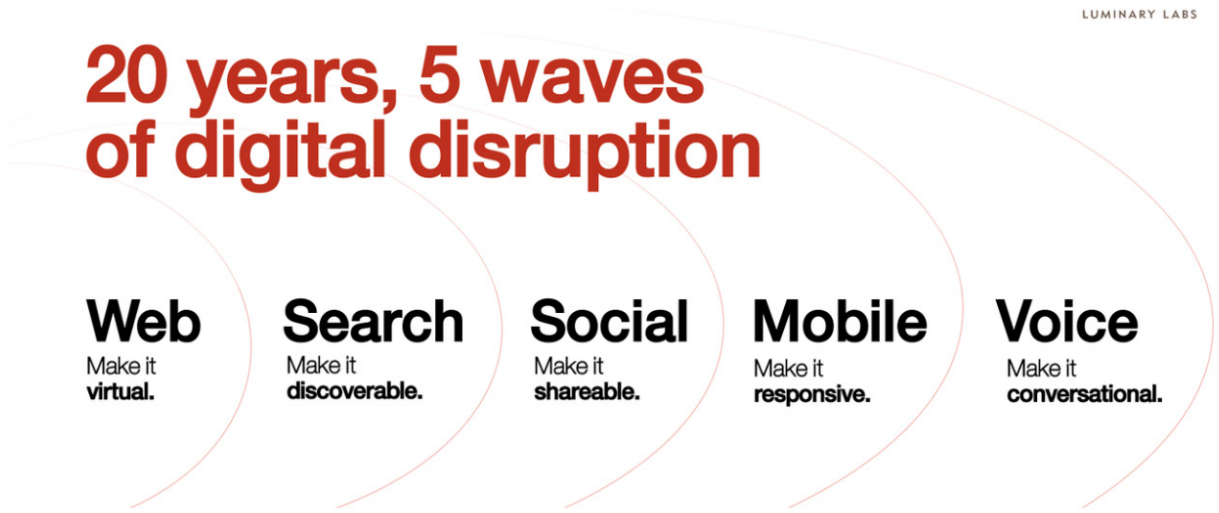
CEDARS-SINAI

Lucile Packard Children's Hospital Stanford

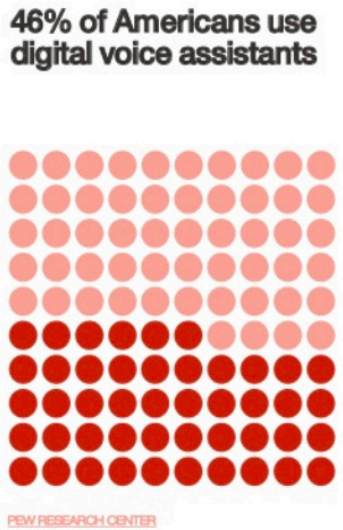
Voice as User Interface

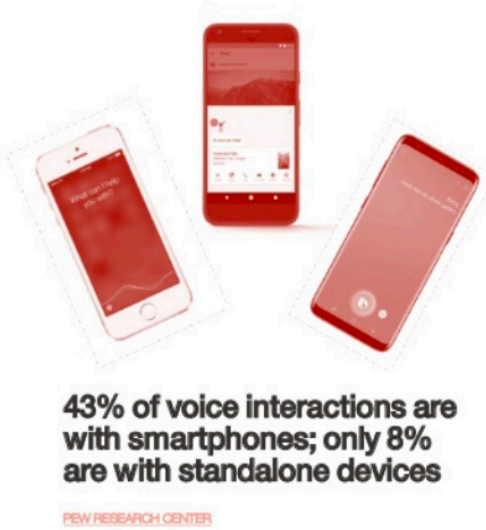


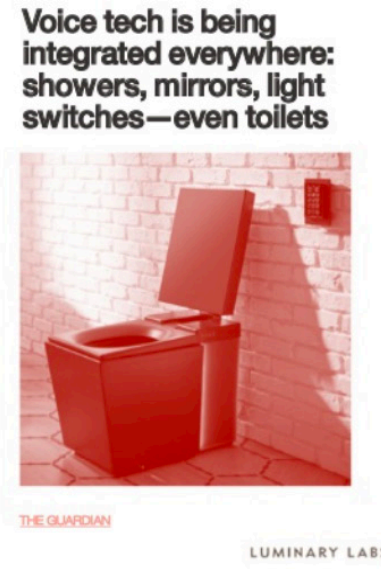
Voice: The Harmonious Integration of AI, IoT and UX



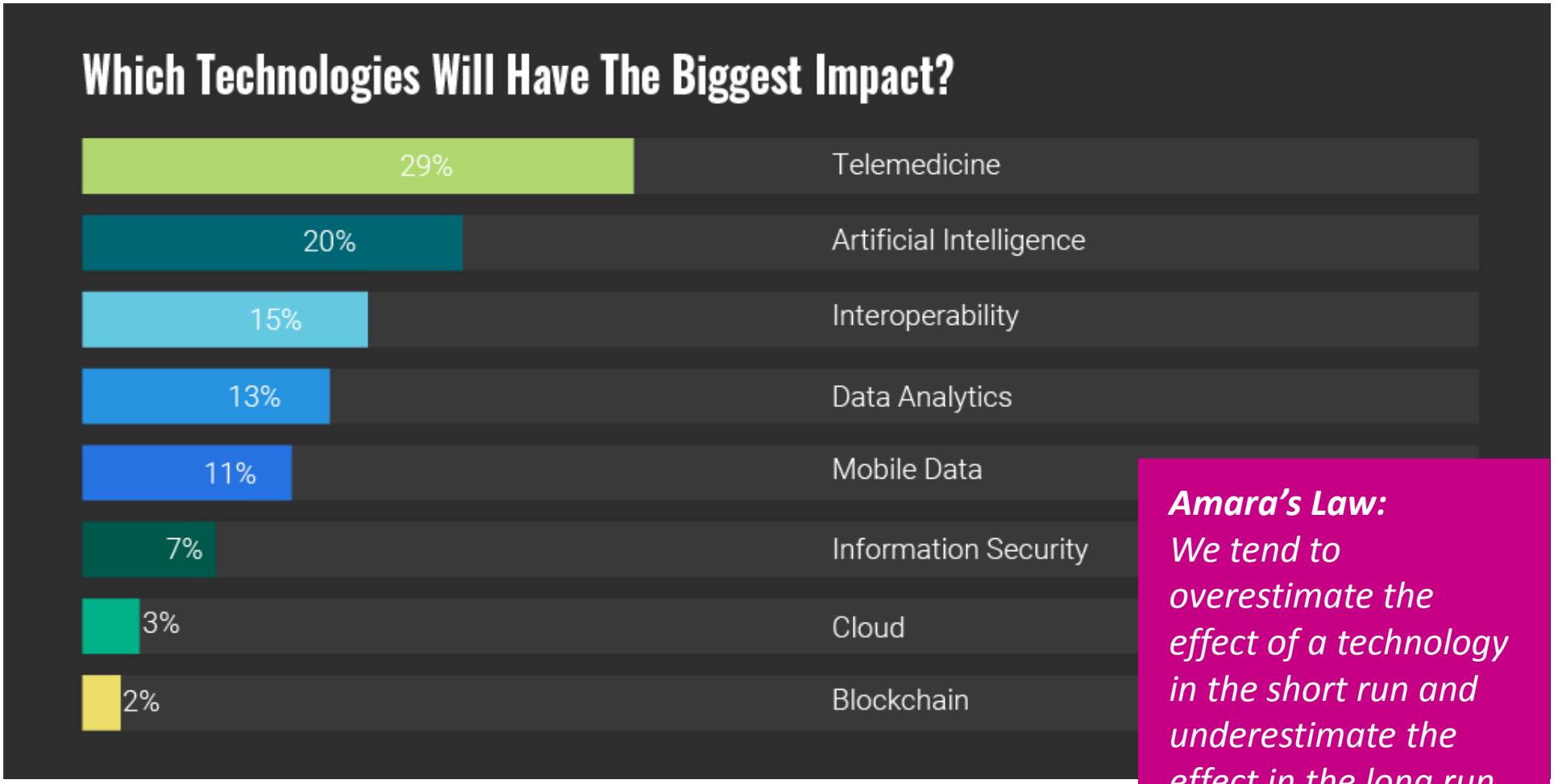
> ***"The next billion people to come on-line may never type an email"***
> ***— Wall Street Journal***







So What's Hype and What's Real?



Amara's Law:
We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run. (Roy Amara, Institute for the Future)

Source: Reaction Data.

Audience Poll #3:

What technology do you believe will have the biggest impact on the healthcare industry overall within the next ten years?

1. Artificial intelligence/machine learning
2. Voice as user interface
3. Telemedicine
4. Digital therapeutics
5. Blockchain

We Have Arrived at the 'Show Me The Money' Phase of the Digital Health Program

- Finally, a demand for evidence of value
- Yesterday's measures: # of investments, # of partnerships, # of pilots
- Today's measures: speed to discovery/market, throughput, revenue impact, margin, adherence, patient satisfaction, customer retention
- Why?
  - No clear correlation between the top five funded digital health startups and the generation of (published) evidence
  - No positive correlation between the global NCD burden and number of digital health-related studies
  - Collective $40 billion invested in digital health since 2010—the value generated is not in the same zone

In Conclusion

- Digital technology suffers from an abundance of hype and a lack of clean and useful data
- But it also offers much promise: already a reality in some places, with oncology, metabolic disorders getting particular attention
- The age of evidence is here…as is the expectation of patient-reported data
- Many parts of biology still mysterious—can't program what we don't understand
- The **patients** and **workers** of the next decade won't ever look up from their phones and want everything to feel like Amazon Prime
- Innovation is as much cultural as technical
  - New thinking often requires new people
  - Data science, consumer experience, design thinking are essential skill sets—soft skills must mesh with science

Thanks for Your Time!

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