

1 in 20
Google searches
are health
related



WHY DEPRESSION?

DEPRESSION IS
HIGHLY PREVALENT

300M

people suffer from
depression globally,
WHO has declared it a
leading cause of
disability [[WHO](#)]

MANY PEOPLE DON'T
GET TREATMENT

50%

of people with
depression in the US
did not get any
treatment [[JAMA](#)]

TREATMENT IS
OFTEN DELAYED

7 YRS

average time from
onset to treatment in
the US [[JAMA](#)]

TREATMENT IS
EFFECTIVE

70%

of patients can
improve, often in a
matter of weeks
[[NIMH](#)]

Google has the reach, scale and technology to help

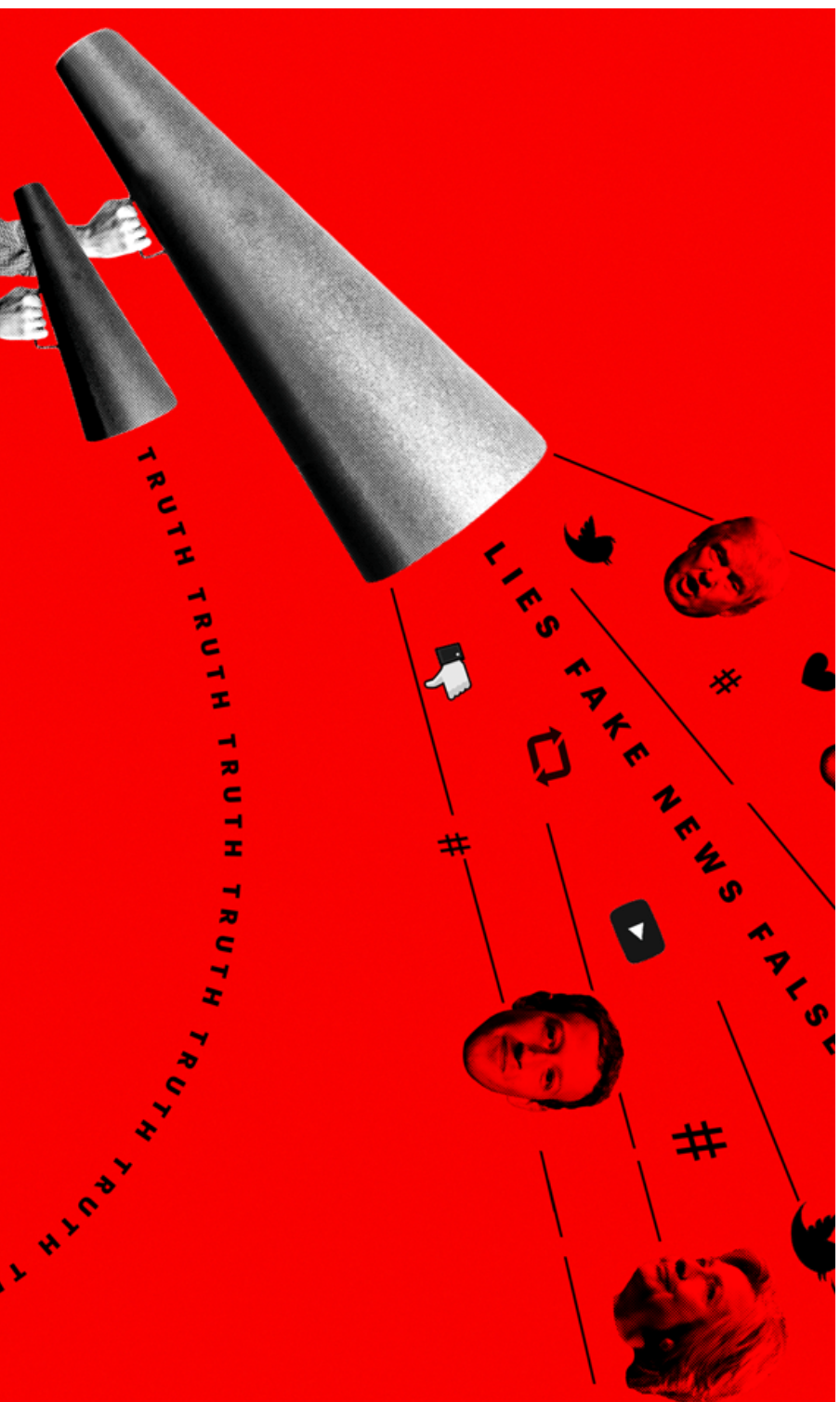
PRODUCT OVERVIEW: What is PHQ-9?

PHQ-9 is a Patient Health Questionnaire, with 9 questions, that is used to measure depression severity

PATIENT HEALTH QUESTIONNAIRE - 9				
Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

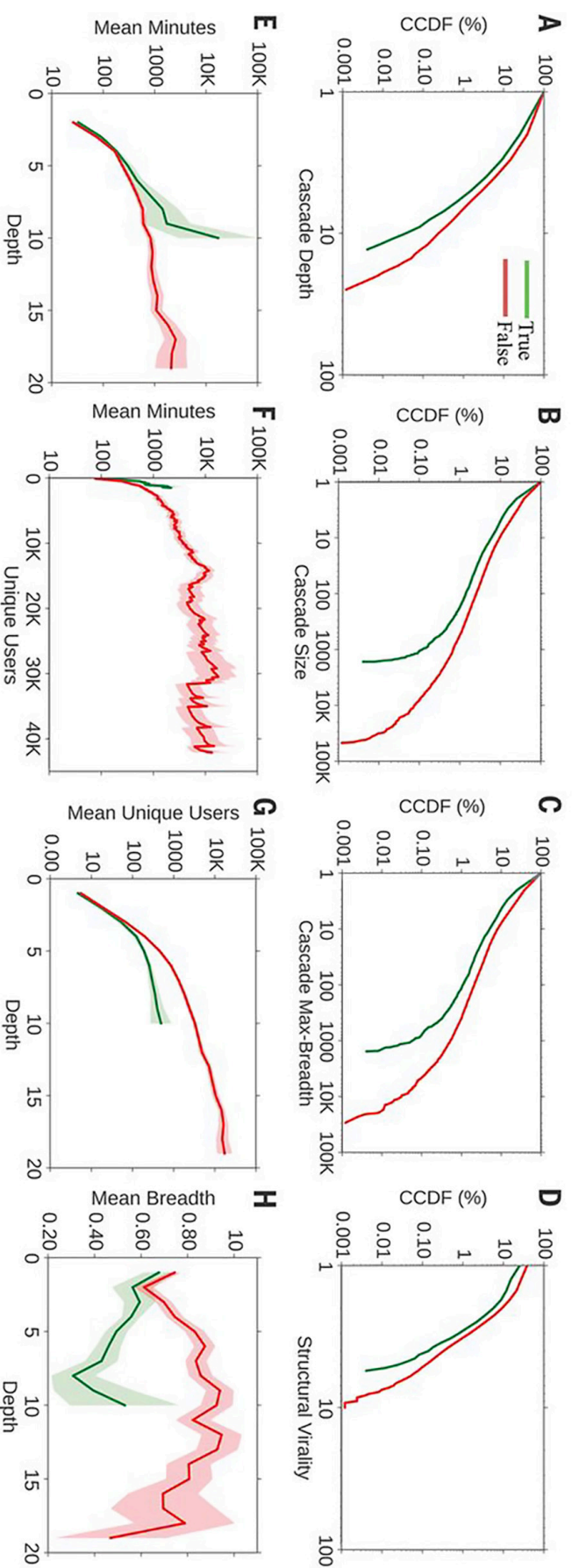


Technology advances; people stay the same.



Krista Kennell / Stone / Catwalker / Shutterstock / The Atlantic
<https://www.theatlantic.com/technology/archive/2018/03/largest-study-ever-fake-news-mit-twitter/555104/>

Complementary cumulative distribution functions (CCDFs) of true and false rumor cascades



Vosoughi S, et al. Science. 2018;359:1146-51.

TABLE 1 – Proportions of Polarized and Antivaccine Tweets by User Type: July 14, 2014 - September 26, 2017

Note. NA = not applicable because of insufficient data; NBC =National Broadcasting Network. A statistically significant result indicates that a certain type of account posts polarized or antivaccine tweets at a rate that differs significantly from that of accounts with bot scores < 20% (likely humans). Polarized proportion is the ratio of all nonneutral tweets to all tweets. Antivaccine proportion is the ratio of antivaccine tweets to polarized tweets. Raw counts are shown in Table E (available as a supplement to the online version of this article at <http://www.ajph.org>).

a. No longer significant after controlling for multiple comparisons using the Holm–Bonferroni procedure

* $P < .05$; ** $P < .01$; *** $P < .001$.

User Type	Polarized, %	Antivaccine, %
Assorted users, bot score, %		
<20	31	35
20-80	39***	60***
>80	26	49* ^a
Unknown	37* ^a	62***
Known bots and trolls		
NBC Russian trolls	20* ^a	47
Content polluters	38	60***
Fake followers	0	NA
Traditional spambots	3***	0
Social spambots	18**	56* ^a
Sophisticated bots	28	44
Congressional list Russian trolls	39	48



Source: Broniatowski et al., "Weaponized Health Communication: Twitter Bots and Russian Trolls Amplify the Vaccine Debate" Am J Public Health. Published online ahead of print August 23, 2018: e1–e7. doi:10.2105/AJPH.2018.304567, Table 1

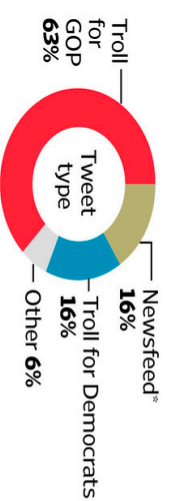
Date of download: 9/08/2018

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Sowing Division

Twitter accounts linked to Russian trolls created thousands of tweets about the Affordable Care Act, peaking during last year's GOP-led repeal efforts.

Tweets by Russian trolls on Twitter about health care



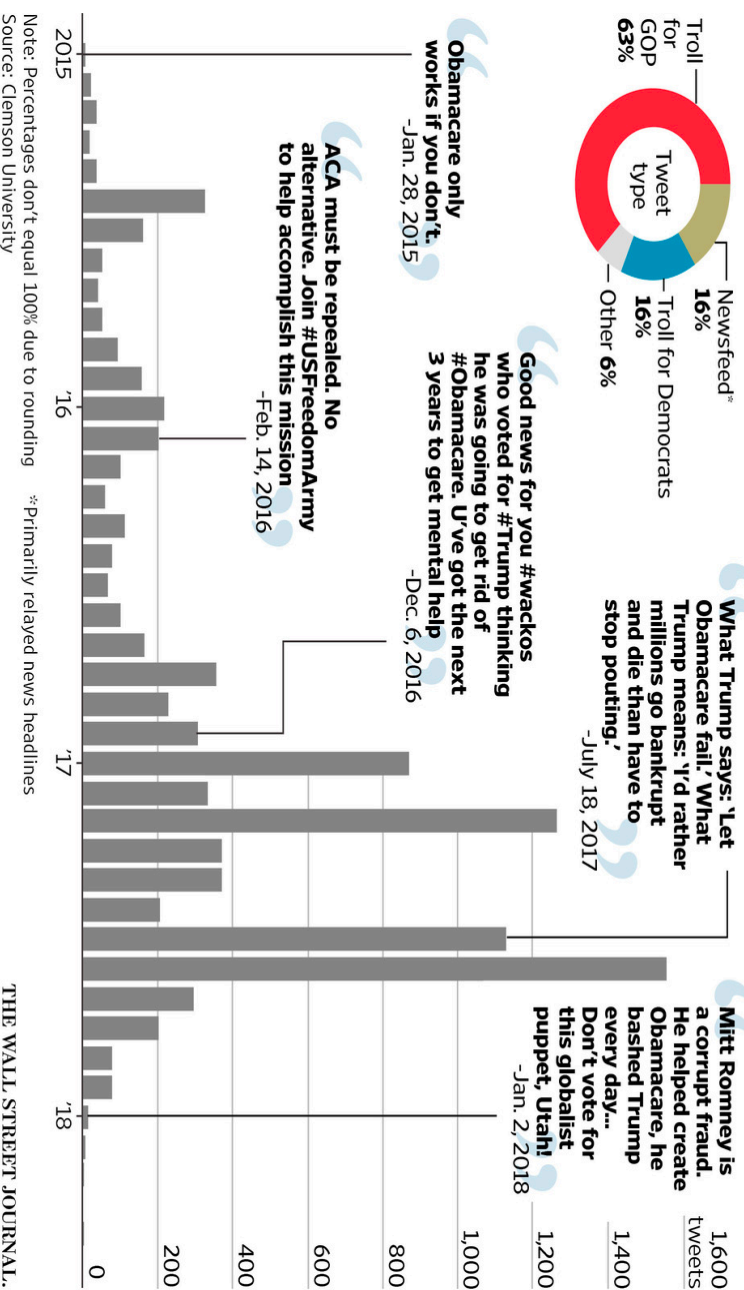
“What Trump says: ‘Let Obamacare fail.’ What Trump means: ‘I’d rather millions go bankrupt and die than have to stop pouting.’”
-July 18, 2017

“Mitt Romney is a corrupt fraud. He helped create Obamacare, he bashed Trump every day... Don’t vote for this globalist puppet, Utah!”
-Jan. 2, 2018

“Good news for you #wackos who voted for #Trump thinking he was going to get rid of #Obamacare. U’ve got the next 3 years to get mental help”
-Dec. 6, 2016

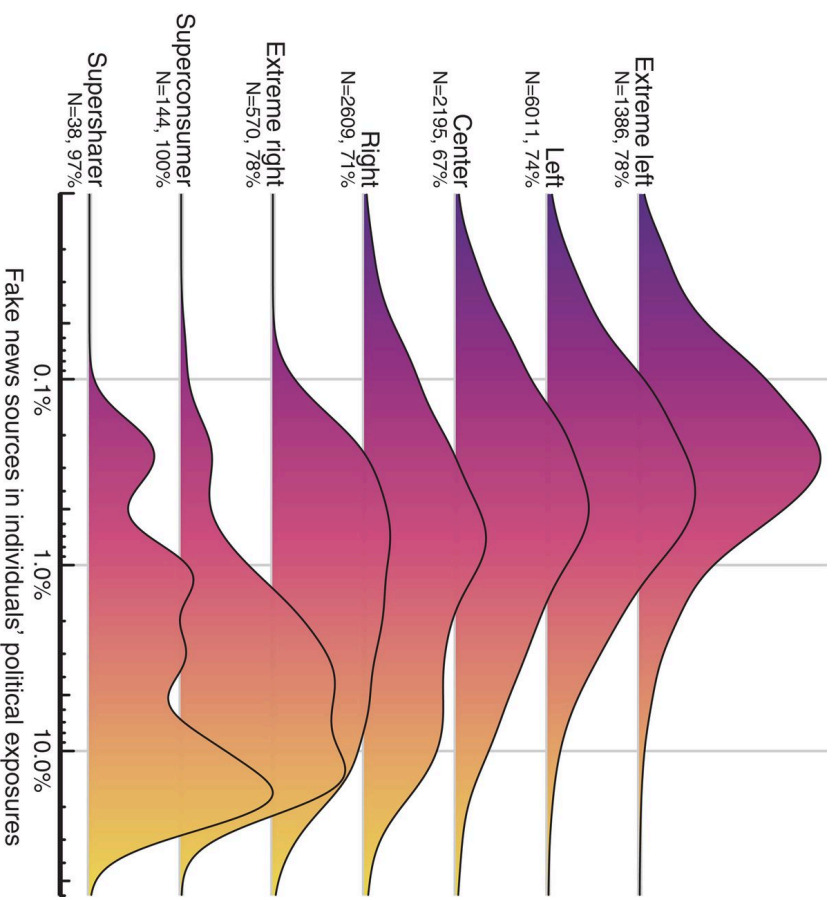
“ACA must be repealed. No alternative. Join #USFreedomArmy to help accomplish this mission”
-Feb. 14, 2016

“Obamacare only works if you don’t.”
-Jan. 28, 2015



Note: Percentages don't equal 100% due to rounding
Source: Clemson University

Fig. 3 Probability density estimates for the percentage of content from fake news sources in people's news feeds (for people with any fake news exposures).



Nir Grinberg et al. *Science* 2019;363:374-378

CONCRETE CHANGES DUE TO THE 4TH INDUSTRIAL REVOLUTION

1. “Home inversion”—prevention and chronic care will move to the home, school, workplace and neighborhood
2. Health care team—function will be optimized to enable members to function at the top of their capability with task shifting to community health workers and nurses for many activities in the home
3. Clinic visit preparation—will set up using interactive system at home using sensors, cell phones and chatbots
4. Clinic visits—will be virtual in many cases, but when human interaction useful, clinician and patient will talk and interact physically (clinic notes done using NLP and AI)
5. Post-clinic visit—information will be available on an as-needed basis, tailored to the needs, health literacy and numeracy of the patient

CONCRETE CHANGES DUE TO THE 4TH INDUSTRIAL REVOLUTION

6. Behavior change—will be reinforced by the digital environment
7. Procedures and surgeries—will be monitored by a digital environment in which ML will be used to guide procedures;
8. Ingestion of data across the spectrum of biology, clinical, imaging, sensors, behavior, social interactions and environment will be routine
9. Precision medicine will stratify people based on risk and knowledge of effective interventions, and personalized medicine will tailor actions to the needs and values of people and families
10. Population health will use the same information aggregated at the level of families, neighborhoods, precincts, towns, counties, states and regions



Digital transformation

2010

Individual Productivity and IT Silos

- Data on premise, hard to access, analyze and use
- Productivity tools built for individual, local usage
- IT focusing on **where** it computes

Mapping Human Health

2020

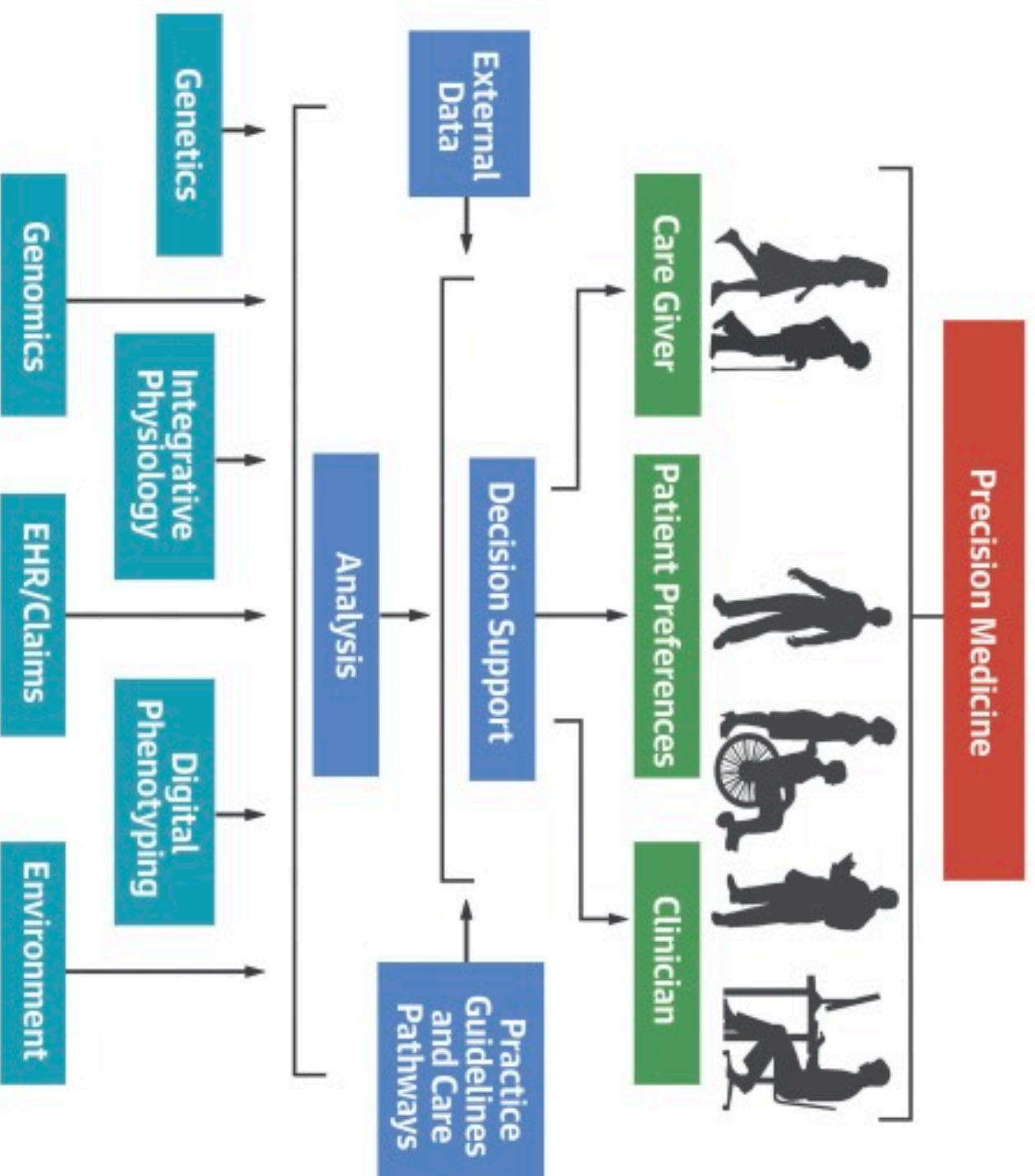
Collective Intelligence and Distributed Computing

- Data stored in cloud, simple to query
- Collaborative, cloud based productivity
- Machine learning drives deep, actionable insights
- IT changing **how** it computes

History of Digital Disruption

Company /Industry	Core Business	Transformational Change	Digital Disruption Enhance Existing Income Model?	Successful Internal Transformation?	Digital Disrupter
	Photographic Film & Paper	Digital Photography	NO	X	  SONY  
	Selling Books from Stores	Online Book Orders	NO	X	
	Lending Money	ATMs and Online Banking	YES	✓	All Modern Banks
	Video Rental	Digital Streaming	NO	X	
	Facility based health care	"Home inversion", Digitally Enabled health at home, school and work	NO	?	?

CENTRAL ILLUSTRATION: Precision Medicine



Population health

