AI in Healthcare: Hope vs. Hype

J.D. Whitlock, MPH, MBA

CIO, Dayton Children's

dayton children's

Boonshoft
School of Medicine
WRIGHT STATE UNIVERSITY

HiMSS

CENTRAL & SOUTHERN OHIO *Chapter*

"WE ALWAYS OVER ESTIMATE THE CHANGE THAT WILL OCCUR OVER THE NEXT 2 YEARS AND UNDER ESTIMATE THE CHANGE THAT WILL OCCUR OVER THE NEXT 10."
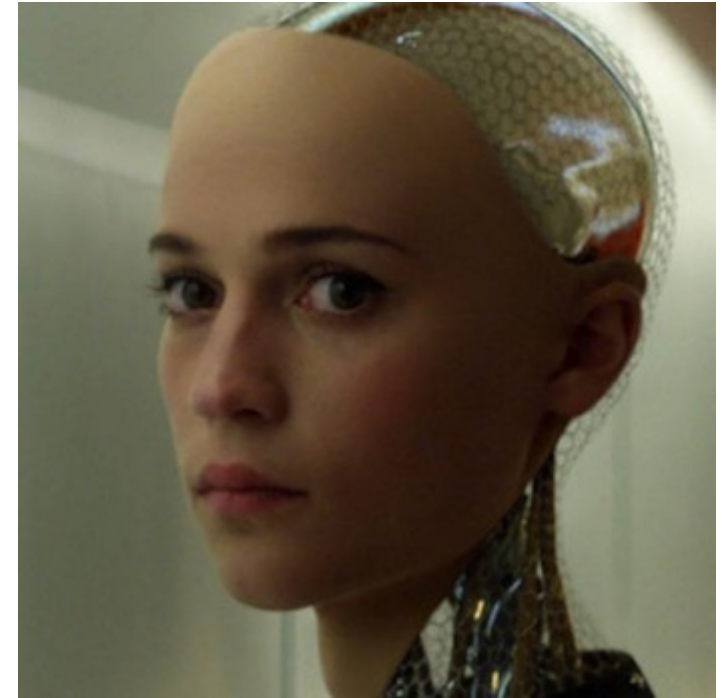
- BILL GATES

Atul Grover, MD, PhD @AtulGroverMD

30 years from now we may have AI doing a lot of work but I don't foresee Artificial Compassion

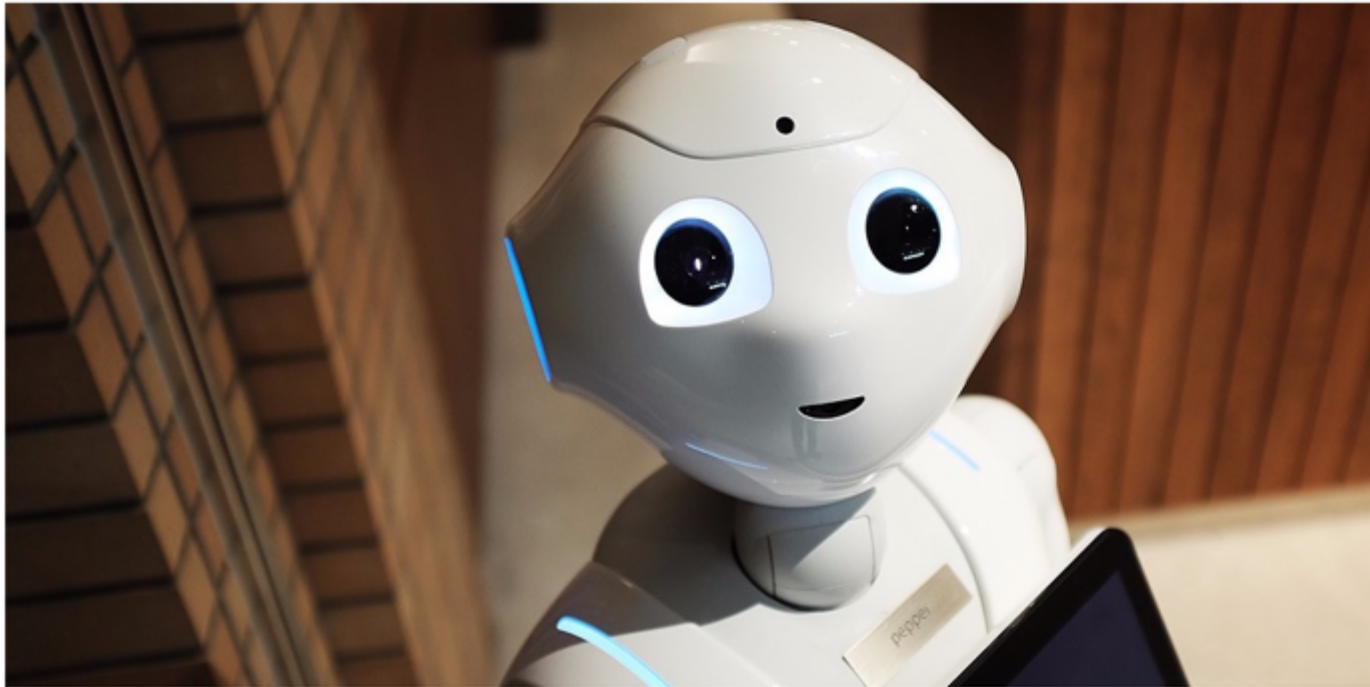Isaac Kohane @zakkohane replying to @AtulGroverMD

If 30 years from now, an AI talking to you SEEMS more compassionate than many harried docs today, will the distinction matter?

Dr. Alexa Is Ready to See You: Are You Ready for AI Doctors?

September 17th 2019

Artificial Intelligence (AI) has rapidly gone from something we only see in sci-fi movies to a technology we interact with every day. From making product recommendations to finishing your sentences, AI is everywhere.

But will AI replace doctors in a hospital?

https://hackernoon.com/dr-alexa-is-ready-to-see-you-are-you-ready-for-ai-doctors-4rje3a5w

Viewpoint

May 20, 2019

Artificial Intelligence in Health Care
Will the Value Match the Hype?

Ezekiel J. Emanuel, MD, PhD[1,2]; Robert M. Wachter, MD[3]

» Author Affiliations

Artificial intelligence (AI) and its many related applications (ie, big data, deep analytics, machine learning) have entered medicine's "magic bullet" phase. Desperate for a solution for the never-ending challenges of cost, quality, equity, and access, a steady stream of books, articles, and corporate pronouncements makes it seem like health care is on the cusp of an "AI revolution," one that will finally result in high-value care.

While AI has been responsible for some stunning advances, particularly in the area of visual pattern recognition,[1-3] a major challenge will be in converting AI-derived predictions or recommendations into effective action.

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Speaking of Hype ...

t⎯1 You Retweeted

Atul Butte ✔ @atulbutte · May 6

Sometimes I think there are more meetings & conferences about #AI in biomedicine, than there are actual practitioners of #AI in biomedicine...

💬 23   t⎯1 **111**   ♡ 443   ✉

Atul Butte ✔

@atulbutte

Physician scientist, entrepreneur. Director, Institute for Computational Health Sciences (@UCSF_ICHS), Chan Zuckerberg Distinguished Professor, @UCSF

◎ San Francisco, CA

🔗 profiles.ucsf.edu/atul.butte

… A Lot of Wasted Private Equity in Healthcare

↩ You Retweeted

Farzad Mostashari ✔ @Farzad_MD · Apr 21
Headline writers, please never ever again use

"_____ startup raises $__M to reimagine healthcare"

Erik Pupo @erikpupo
Parsley Health picks up $10 million to reimagine healthcare | TechCrunch
techcrunch.com/2018/04/17/par...

When Bad Math Kills People

REUTERS

Breast cancer screening failure may have shortened 270 lives in England

LONDON (Reuters) - As many as 270 women in England may have died prematurely of breast cancer because of an IT failure that led to 450,000 patients missing out on routine screening appointments.

Health Secretary Jeremy Hunt apologized in parliament for the "serious failure," which he said was the result of a mistake in a computer system's algorithm dating back to 2009 but identified only in January this year. He ordered an independent review.

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Farzad Mostashari ✔
@Farzad_MD

1/ #EpiTwitter tweetstorm coming

Warning: strong opinions

The analysis is naive and the findings are ridiculous; the fact that it was published is a sign that when medical journal editors hear "deep learning AI" their brains stop working.

> **Eric Topol** ✔ @EricTopol · Sep 4
>
> Predicting skin #cancers with deep learning #AI using electronic medical records jamanetwork.com/journals/jamad... importance of medications; non-melanoma AUC 0.89 @JAMADerm
>
>
>
> JAMA Dermatology | Original Investigation
> Assessment of Deep Learning Using Nonimaging Information and Sequential Medical Records to Develop a Prediction Model for Nonmelanoma Skin Cancer

9:46 AM · Sep 7, 2019 · Twitter for Android

https://twitter.com/Farzad_MD/status/1170332477514276864

FDA APPROVALS FOR ARTIFICIAL INTELLIGENCE-BASED ALGORITHMS IN MEDICINE

Date	Company	Description
2014.09.	AliveCor	detection of atrial fibrillation
2016.03.	QbCheck	diagnosis and treatment of ADHDv
2016.07.	InPen	determining insulin dosage
2016.10.	Lumify	ultrasound image diagnosis
2016.11.	One Drop Blood Glucose	quantification of blood glucose levels
2017.01.	Cantab Mobile	memory assessment for the elderly
2017.03.	EnsoSleep	diagnosis of sleep disorders
2017.05.	AmCAD-US	analysis of thyroid nodules
2017.11.	Lepu Medical	detecting arrhythmias
2017.12.	Subtle Medical	medical imaging platform
	BioFlux	detecting arrhythmias
2018.01.	Bay Labs	echocardiogram analysis
2018.02.	Viz.ai	stroke detection on CT
	Arterys Inc	liver and lung cancer diagnosis on CT and MRI
	Empatica	wearable for predicting epilepsy seizures
	Cognoa	autism diagnosis app
2018.03.	Medtronic	predicting blood glucose changes
2018.04.	Idx	detection of diabetic retinopathy
	Icometrix	MRI brain interpretation
2018.05.	Imagen	X-ray wrist fracture diagnosis
	NeuralBot	transcranial Doppler probe positioning
	MindMotion GO	motion capture for the elderly
2018.06.	DreaMed	managing Type 1 diabetes
	POGO	blood glucose monitoring system
2018.07.	Zebra Medical Vision	coronary artery calcification algorithm
2018.08.	Aidoc	CT brain bleeding diagnosis
	iCAD	breast density via mammograhy
	BriefCase	triage and diagnosis of time sensitive patients
	PhysIQ Heart Rhythm Module	detection of atrial fibrillation
2018.09.	Apple	detection of atrial fibrillation
	RightEye Vision System	identifying visual tracking impairment
2018.11.	MaxQ	acute intracranial hemorrhage triage algorithm
2018.12.	ProFound AI	detection and diagnosis of suspicious lesions
	ReSET-O	adjuvant treatment of substance abuse disorder
2019.01.	Verily	ECG feature of the Study Watch
2019.03.	Paige.AI	clinical-grading in pathology
2019.05.	AliveCor	six-lead smartphone ECG
	Zebra Medical Vision	chest X-ray analysis
	Aidoc	flagging pulmonary embolism

Specialties: CARDIOLOGY, PSYCHIATRY, ENDOCRINOLOGY, RADIOLOGY, GERIATRICS, NEUROLOGY, ORTHOPEDICS, EMERGENCY MEDICINE, OPTHTALMOLOGY, PATHOLOGY, ONCOLOGY

TMF⁺ THE MEDICAL FUTURIST

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Diabetic Retinopathy: Problem Statement

- More than 30 million Americans have diabetes
- An estimated 24,000 lose vision each year from diabetic retinopathy, a complication of diabetes
- If caught in its early stages, vision loss and blindness are almost entirely preventable
- Only about half of people with diabetes get regular eye exams

Diabetic Retinopathy: AI Solution

https://www.eyediagnosis.net/idx-dr
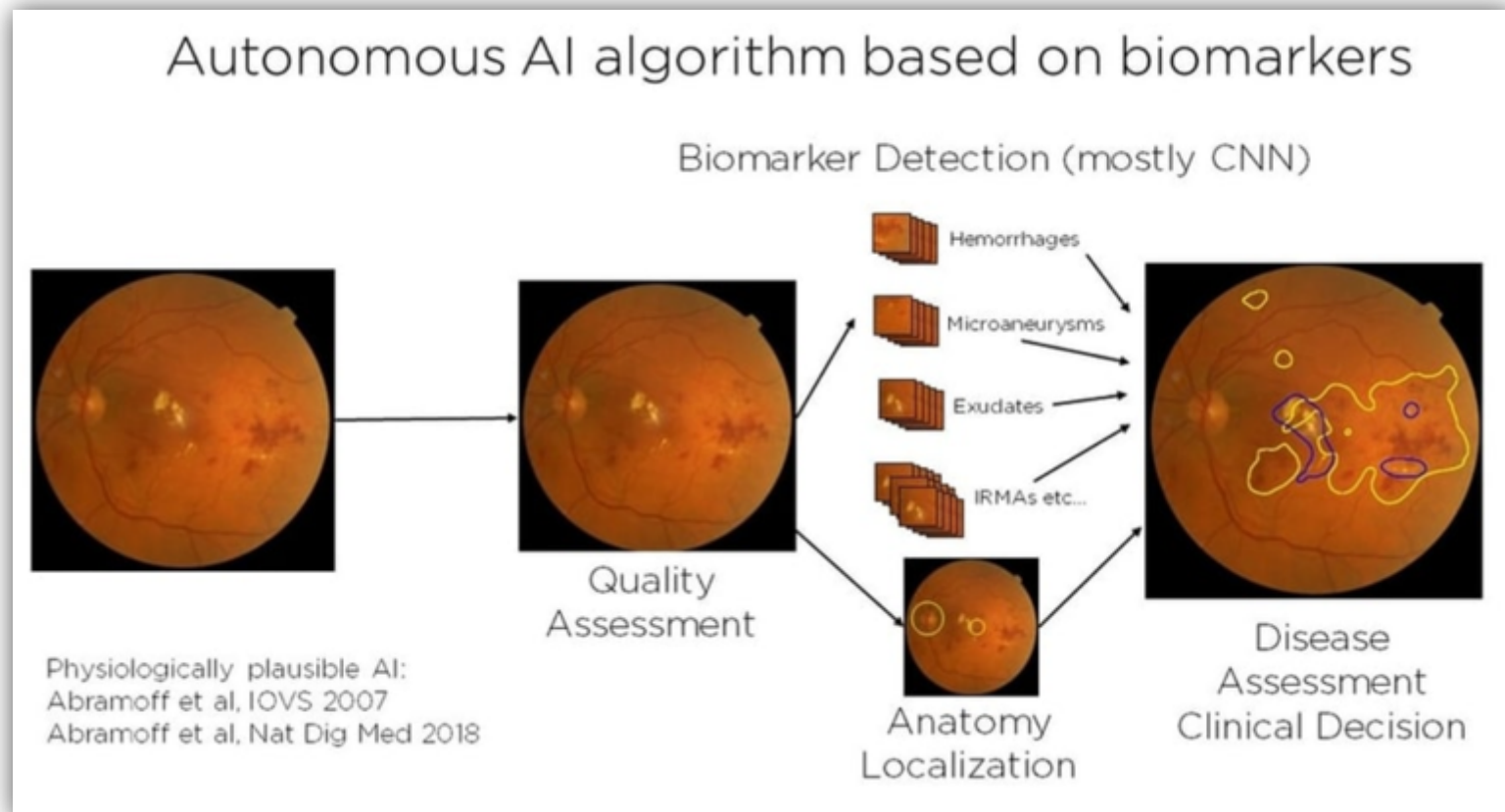
University of Iowa Healthcare rolls out first autonomous AI diagnostic system cleared by the FDA

The artificial intelligence tool detects diabetic retinopathy in medical images, which can help prevent blindness in diabetes patients.

By **Bill Siwicki** | July 12, 2018 | 01:44 PM

- Enables provider practices who are not normally involved in eye care to test for diabetic retinopathy during routine office visits

- After just a few hours of training, non-clinical staff are able to use the system to perform diabetic retinopathy testing

- Black box autonomous AI diagnosis is OK in this particular case because "positive" result is just referred on to an optometrist

- Transformational technology, no clinical workflow challenges, benefit to patient and provider, FDA approval: Should be selling like hotcakes, right?

https://www.healthcareitnews.com/news/university-iowa-healthcare-rolls-out-first-autonomous-ai-diagnostic-system-cleared-fda

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The Last Hurdle ... Billing & Quality Reporting

- In the year since FDA approval, IDx has gained only 15 customers

- Camera is $20K: makes financial sense at larger scale practices, not small individual provider clinics

- Challenges with quality measure reporting due to variation in coding for billing

- New billing code dedicated to this procedure has been approved, but will not be effective until January 2021

- A lot of potential customers in sales pipeline, but they are waiting to pull the trigger until quality reporting and billing issues are resolved

Suchi Saria comments on FDA AI approvals:

- *Almost all have sought approval in applications relying on processing a single image like signal (e.g. CT scan). These are device generated and here, drift—changes in practice pattern across hospitals or over time—isn't a big issue.*

- *OTOH, integrating many streams, especially streams generated by human observations (e.g. clinical notes, lab time series), require tackling drift, which is a challenging issue. Many health systems are deploying home grown algorithms without tackling issues like drift or inadequate monitoring, which I think should be a serious concern.*

https://www.linkedin.com/feed/update/urn:li:activity:6552928045295026177/

Success with Diagnostic Imaging AI

- AI is now better at detecting skin cancer than dermatologists

  - AI AUC .86 vs. dermatologists AUC .79 (P < 0.01)

  - https://academic.oup.com/annonc/advance-article/doi/10.1093/annonc/mdy166/5004443

- AI is now better than radiologists at detecting pneumonia

  - https://arxiv.org/abs/1711.05225

- AI can vastly accelerate alignment of subsequent MRI images

  - https://www.healthdatamanagement.com/news/mit-algorithm-speeds-process-of-image-registration

- AI can save lives by telling a radiologist which study to read first

  - e.g. out of the 10 scans waiting to be read by a radiologist with STAT priority, there appears to be a bleed on #7 so read that one next

AI can now save your life by suggesting to a physician that they should NOT operate on your pancreas

An experimental AI system can predict when pancreatic cysts will become cancerous

By CASEY ROSS @caseymross / JULY 17, 2019

A cluster of pancreatic cancer cells.
ANNE WESTON/FRANCIS CRICK INSTITUTE/WELLCOME

Pancreatic cancer often kills people because they are diagnosed too late, after their tumors have spread. Other patients may die following the removal of harmless cysts that appear threatening amid a fog of imaging data and other clinical information.

But a new artificial intelligence system unveiled Wednesday by doctors at Johns Hopkins offers to provide a clearer picture for patients: In testing, it displayed a superhuman ability to differentiate harmful lesions from ones that pose no threat at all.

A study published in Science Translational Medicine detailing the performance of the system, dubbed CompCyst, reported that its use would have reduced 60% of unnecessary surgeries in patients whose tumors were found not to be harmful following their procedures.

https://www.statnews.com/2019/07/17/an-experimental-ai-system-can-predict-when-pancreatic-cysts-will-become-cancerous/

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AI system can create novel drug candidates in just 46 days, study finds

By CASEY ROSS @caseymross / SEPTEMBER 2, 2019
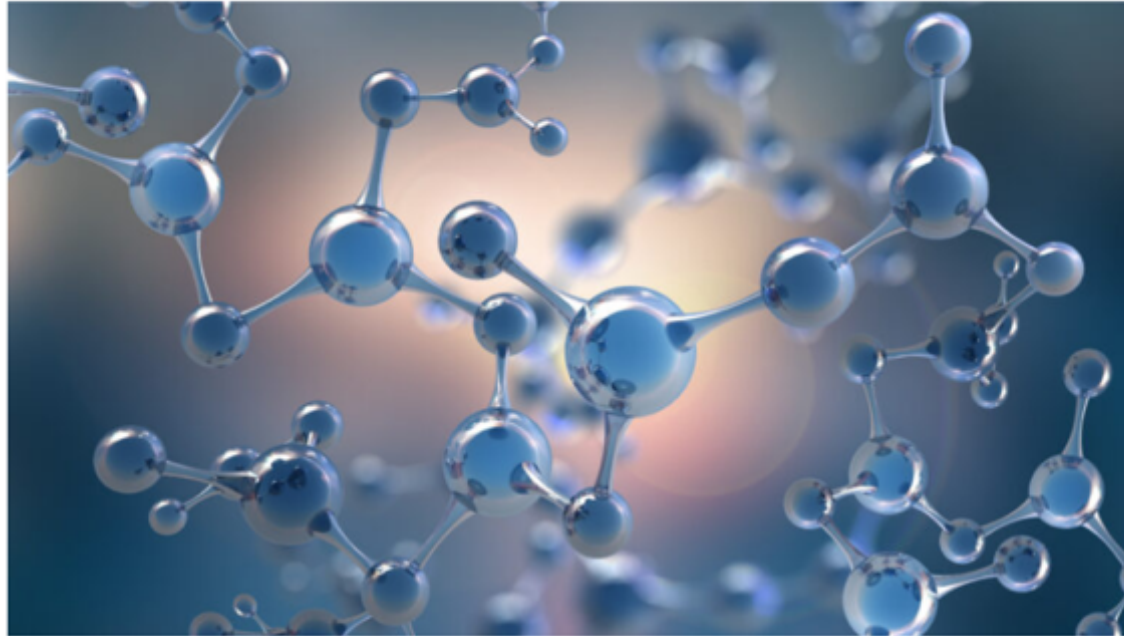
ADOBE

It often takes years and hundreds of millions of dollars to discover a novel drug candidate. It requires the identification of promising molecules that can grab on to the right protein, synthesizing a compound, and then testing it. The process is so complicated that it has defied most computational methods to shorten it.

But a paper published Monday in Nature Biotechnology describes a new method using artificial intelligence that, within 46 days, generated compounds capable of hitting a specific disease target.

September 25, 2018

Effect of Algorithm-Based Therapy vs Usual Care on Clinical Success and Serious Adverse Events in Patients with Staphylococcal Bacteremia
A Randomized Clinical Trial

Thomas L. Holland, MD[1,2]; Issam Raad, MD[3]; Helen W. Boucher, MD[4]; et al

» Author Affiliations | Article Information

https://jamanetwork.com/journals/jama/fullarticle/2703352

https://jamanetwork.com/journals/jama/fullarticle/2703302

Public Health
Prevent. Promote. Protect.

- Randomized trial that included 509 adults with staph infections

- Use of an algorithm compared with usual care resulted in a statistically similar success rate for antibiotic therapy

- The patients whose protocols were set by the algorithm were on the drug for an average of 4.4 days, compared to 6.2 days for those in the usual practice group

- Given that vancomycin is the most commonly prescribed antibiotic in U.S. acute care hospitals and one whose use is associated with growing antibiotic resistance, this could have a significant public health effect if it could be deployed widely

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Patient Deterioration Early Warning

Creating a Better Early Warning System

Pain Point

- Current industry standard patient deterioration early warning systems are anything but early – they often don't give hospital staff time to intervene and are plagued with false positives

Challenges

- Labs and Vitals are constantly changing, so early warning systems needs to detect patterns over time
- The early warning system needs to be evaluated in real-time
- Our Rapid Response team needs to be notified via their normal workflows – in the electronic medical record system – so they can quickly jump into the patient's chart

Ochsner's Patient Deterioration Model

- We used over 1 billion clinical data points, including vitals, lab result values, nursing assessments, and echocardiograms, to create a deep recurrent neural network

- With the results of this model, a newly created Rapid Response team of providers gets real-time notifications when patients exceed a certain risk threshold

- The team can quickly assess the patient and take immediate action

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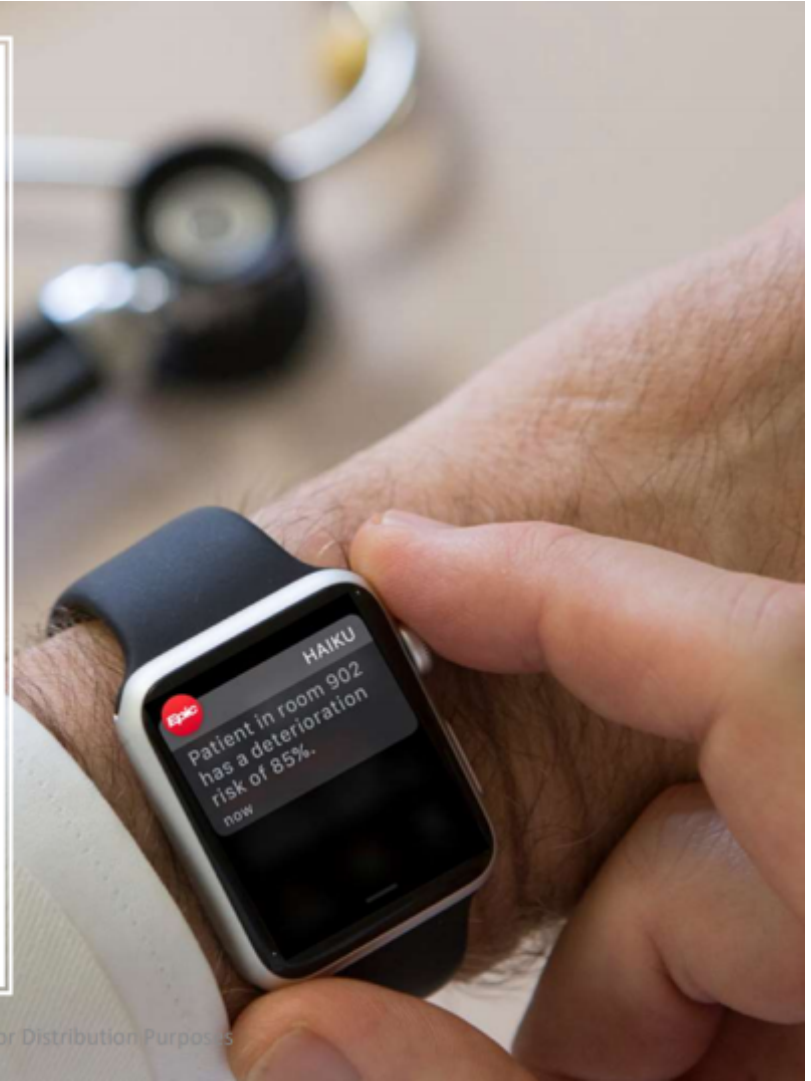
Impressive Results at Ochsner

Pilot Intervention Results

During our 90-day pilot at Ochsner Medical Center, the team successfully reduced codes outside of the ICU by 44%

Over 40% of alerts resulted in transfer to the ICU

Over 25% of alerts resulted in end of life conversations

https://news.microsoft.com/transform/ochsner-ai-prevents-cardiac-arrests-predicts-codes/

○ NHRMC Custom Alexa Skills (customer facing)

NHRMC Welcome/Orientation Message
- Room Orientation and personalized greeting from our CNO

Informational Voice Skills
- Patient & Guest NHRMC Dining Options
- TV Channel Guide

NHRMC Survey
- Create voice skill for ad hoc patient satisfaction survey

Concerns / Complaints
- Create a channel for patients / guests to submit a "concern" / "complaint"

New Hanover
Regional Medical Center

○ NHRMC Custom Alexa Skills (Clinical Skills)

Drug Information
- Voice skill to provide information on 15 most common medications.

Rounding Assistant
- Voice skill to simplify EMR entry of repetitive hourly rounding actions

Sample Utterances:
- *Echo*, tell *Margaret* chart Pain Assessment 6
- *Echo*, tell *Margaret* chart POSS 2
- *Echo*, tell *Margaret* chart Urinary Output 200 Milliliters
- *Echo*, tell *Margaret* chart Pulse 60
- *Echo*, tell *Margaret* chart Respiration 36
- *Echo*, tell *Margaret* chart Meals Breakfast 75%
- *Echo*, tell *Margaret* chart Activity Ambulate in hallway 15 feet
- *Echo*, tell *Margaret* chart rounding 3P's

New Hanover
Regional Medical Center

AI Applied to Clinician Performance

Surgical Innovation

ONLINE FIRST

June 20, 2018

Automated Performance Metrics and Machine Learning Algorithms to Measure Surgeon Performance and Anticipate Clinical Outcomes in Robotic Surgery

Andrew J. Hung, MD[1]; Jian Chen, MD[1]; Inderbir S. Gill, MD[1]

≫ Author Affiliations | Article Information

https://jamanetwork.com/journals/jamasurgery/fullarticle/2685266
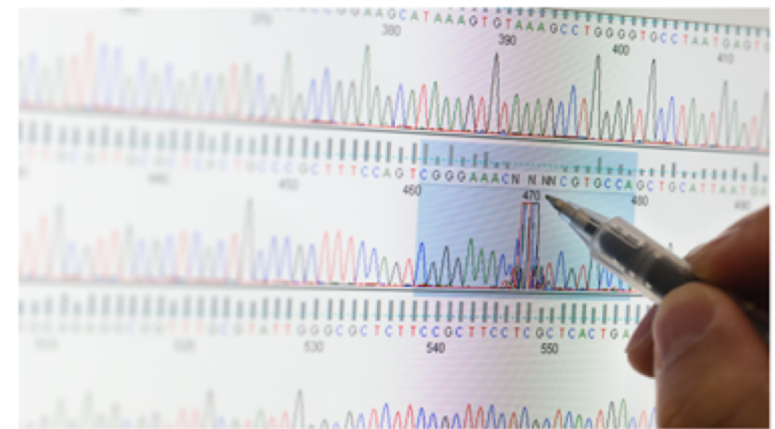
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Pharmacogenomics testing + family history questionnaires + clinical decision support in EHR workflow = beginnings of practical precision medicine

How NorthShore tweaked its Epic EHR to put precision medicine into routine clinical workflows

The hospital tapped FHIR-based alerts to deliver recommendations about genomics and genetic testing without bogging down doctors with too many extra clicks.

By **Mike Miliard** | December 18, 2017 | 10:22 AM

http://www.healthcareitnews.com/news/how-northshore-tweaked-its-epic-ehr-put-precision-medicine-routine-clinical-workflows

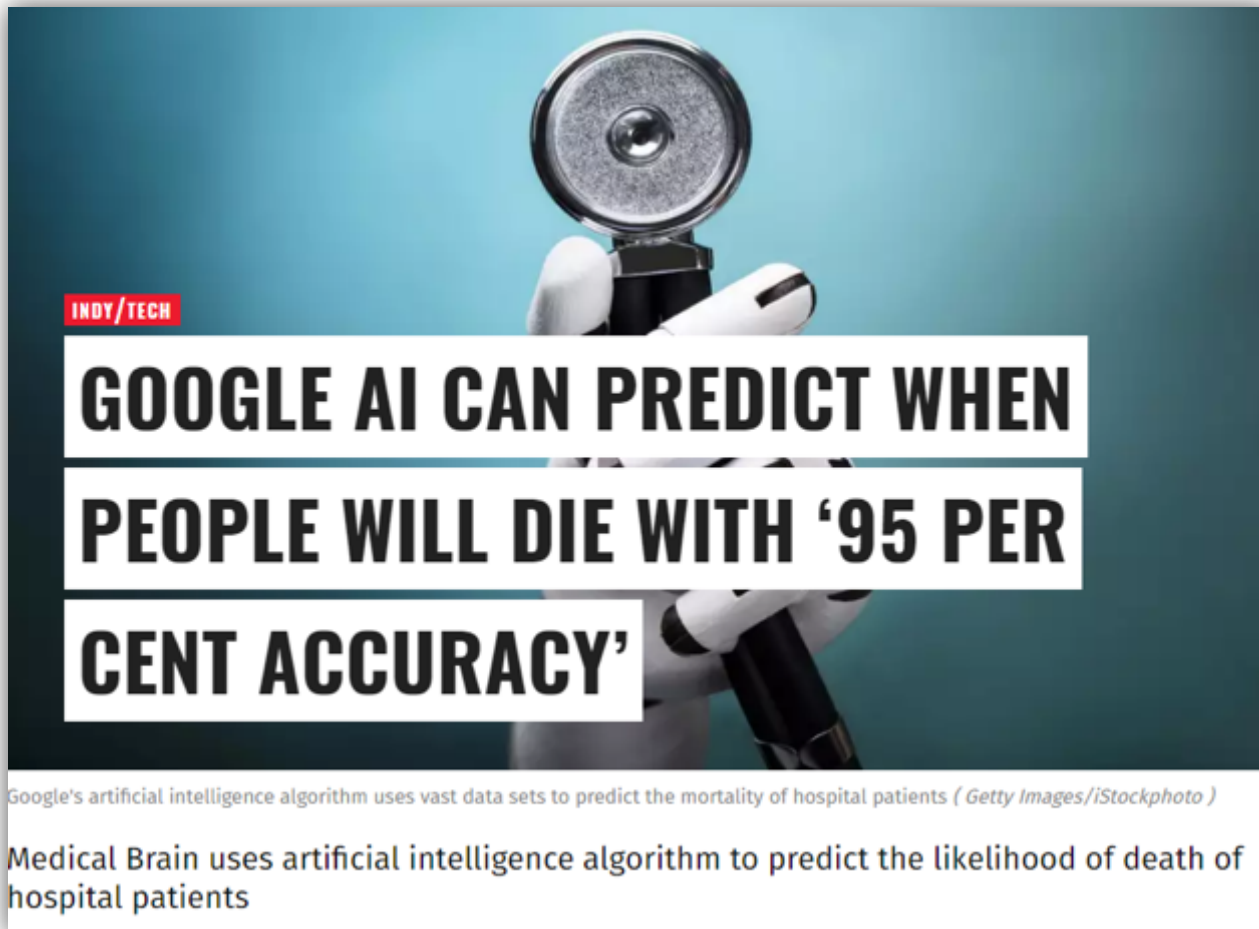# Eric Schmidt Keynote at HIMSS18: "Run to the Cloud"

Wes Rishel @wrishel · Jul 10
The road to health IT inconsequentiality is paved with the hubris of ginormous tech companies that expected to revolutionize healthcare

RIP
Google HEALTH
2011

Apple HealthKit   VS.   Google Fit

Google Medical Brain! Robot Hands!

INDY/TECH

GOOGLE AI CAN PREDICT WHEN PEOPLE WILL DIE WITH '95 PER CENT ACCURACY'

Google's artificial intelligence algorithm uses vast data sets to predict the mortality of hospital patients (*Getty Images/iStockphoto*)

Medical Brain uses artificial intelligence algorithm to predict the likelihood of death of hospital patients

https://www.independent.co.uk/life-style/gadgets-and-tech/news/google-ai-predict-when-die-death-date-medical-brain-deepmind-a8405826.html

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Reality Check on Google Medical Brain

- Data lab exercise, nothing is operational

- Neural network *("throw in the kitchen sink")* approach to data assumes you have access to the whole kitchen sink, which is a bad assumption in this case

- *"For now, the company says it's too early to settle on a business model"*

- Getting operationalizable, commercializable, clinical data at large scale is very difficult

https://www.healthdatamanagement.com/articles/google-continues-work-to-use-machines-for-health-analytics

- You want what? All EHR data and all paid claims data for hundreds of thousands of patients with a specific chronic disease?

- Most patients have clinical data in multiple EHRs, from multiple vendors, which presents a massive data acquisition and semantic normalization challenge

- Even in a single enterprise EHR, there are many data holes between patients with the same condition

- Paid claims data come in different formats from each payer and are difficult to normalize

- And those are just the technical challenges

Mayo Clinic, Google partner to use AI, patient data to catapult research

By Joseph Goedert

Google Cloud and Mayo Clinic are working together to improve patient outcomes, transform clinician experiences, support clinical research and revolutionize healthcare delivery.

Google brings its cloud platform and artificial intelligence capabilities, while Mayo brings its clinical expertise and a strategy to advance the diagnosis and treatment of disease.

Epic Cosmos

Epic unveils patient data research initiative, new software

Jackie Drees - Thursday, August 29th, 2019 Print | Email

in SHARE   Tweet   Share 5

At Epic's User Group annual meeting Aug. 27, CEO Judy Faulkner and other executives revealed several initiatives and products the EHR vendor is focusing on to support evidence-based patient care research and enhanced clinical workflows, *Wisconsin State Journal* reports.

Ms. Faulkner highlighted Cosmos, a new Epic program that is designed to mine data from millions of patient medical records at various health systems to help research the effectiveness of treatments.

"This will revolutionize healthcare, when the [physician] has evidence-based medicine from 230 million people," said Ms. Faulkner, according to the report. "It will be a cosmic … leap forward."

IBM Watson Health

- $15B acquisition strategy that built complementary strengths (Explorys, Truven, Phytel)

- Data on 50M patients

- Small army of data scientists with skills to combine clinical and paid claims data, generate hundreds of quality measures, build new predictive risk scores with machine learning

- Technical ability to connect to many different EHRs

Driving Better Outcomes at the Point of Care
J.D. Whitlock
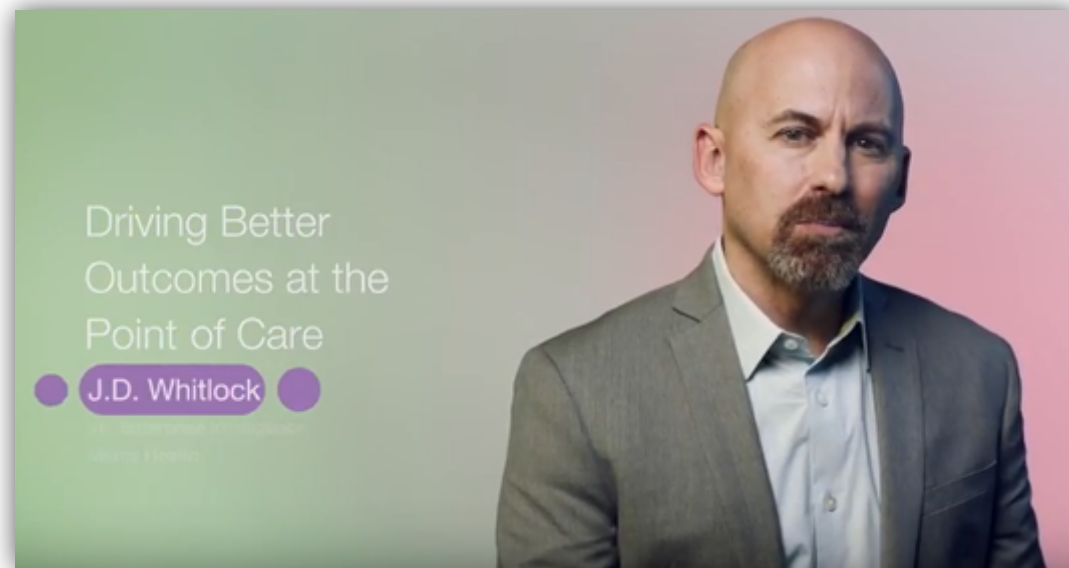
Clinical Decision Support with Mortality Risk

- Inclusion Criteria: Patients with a One-Year Mortality Risk > 50%

- Exclusion Criteria: Hospice or Palliative Care Dx, Hospice Admission, Hospice/Palliative Care Departments, Hospice/Palliative Care Specialties, active Hospice or Palliative Care consult

This patient has an estimated 1-year mortality of over 50% and may be a candidate for Hospice or Palliative Care. If advanced directives are not on file, consider engaging patient to complete.

Estimated 1-year Risk Mortality Score: 60.44%

This is a prognostic risk (%) to predict the 1-year mortality among patients in a population aged 65 years and older based on 37 unique conditions plus age and sex as independent variables. The conditions are: MI, CHF, PVD, CVD, RA, HTN, dementia, chronic pulmonary disease, collagen vascular disease, ulcer, liver disease, diabetes, hemiplegia, renal failure, tumor, leukemia, lymphoma, metastatic cancer, HIV/AIDS, arrhythmia, valvular disease, pulmonary circulation disease, paralysis, hypothyroidism, coagulopathy, obesity, weight loss, fluid/electrolyte disorder, blood loss anemia, deficiency anemia, drug/alcohol abuse, psychosis, depression, neurodegenerative disease.

The Bigger They Are,
The Harder They Fall

STAT+

IBM's problems with Watson Health run deeper than recent layoffs, former employees say

By CASEY ROSS @caseymross and IKE SWETLITZ @ikeswetlitz / JUNE 11, 2018

*I*t was an expensive gamble. IBM spent billions acquiring a trio of companies with vast stores of patient health data, in the hope that its vaunted Watson supercomputer could mine that information for business and clinical insights to sell to U.S. hospitals. But it hasn't worked out that way.

https://www.statnews.com/2018/06/11/ibm-watson-health-problems-layoffs/

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Cancer Care is Ripe for AI

- Good news: A lot of new clinical trials with a lot of new treatments targeted at cancer mutations (personalized medicine)

- Bad news: Too many new clinical trials for Oncologists to realistically track, and the medical science is changing too fast to keep up

- Oncologists can get 100+ page EHR reports along with a newly referred patient

- Good targets for AI:

  – Matching patients to clinical trials based on their clinical data including both discrete data and NLP of physician notes

  – Summarizing key points of long EHR reports

  – Summarizing new medical knowledge in helpful ways

Watson for Oncology

IBM pitched its Watson supercomputer as a revolution in cancer care. It's nowhere close

By CASEY ROSS @caseymross and IKE SWETLITZ @ikeswetlitz / SEPTEMBER 5, 2017

FEB 19, 2017 @ 03:48 PM   207,821 👁   ⭐ EDITOR'S PICK   2 Free Issues of Forbes

MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine

MIT Technology Review

A Reality Check for IBM's AI Ambitions

Challenge: Social & Liability Issues of AI in Healthcare

"Healthcare organizations must build and train their AIs to provide clear explanations for the actions the AI systems decide to take, in a format that people understand."

Accenture

DIGITAL HEALTH TECH VISION 2018

73% of health executives are planning to develop internal ethical standards related to the use of AI to ensure their AI systems are designed to act responsibly.

81% of health executives agree that organizations are not prepared to face the societal and liability issues that will require them to explain their AI-based actions and decisions, should issues arise.

https://www.accenture.com/t20180518T100409Z__w__/us-en/_acnmedia/PDF-78/Accenture-digital-health-tech-vision-2018.pdf

Challenge: Incomplete Clinical Data

- Example: Predicting the progression of Chronic Kidney Disease (CKD)

  – CKD is an excellent target for predictive modeling

  – CKD model worked well … for the 10% of patients that had the right combo of lab data in their medical record

- Some current research focuses on building models that are adaptive to missing data in EHR, and designing new statistical machine learning techniques that can address these computational challenges

May 29, 2018

Big Data and Predictive Analytics
Recalibrating Expectations

Nilay D. Shah, PhD[1]; Ewout W. Steyerberg, PhD[2]; David M. Kent, MD, MS[3]

≫ Author Affiliations | Article Information

"More than 1,000 cardiovascular clinical prediction models have been developed and cataloged, yet only a small number of these are routinely used to support decision making in clinical care. It seems unlikely that incremental improvements in discriminative performance of the kind typically demonstrated in machine learning research will ultimately drive a major shift in clinical care."

https://jamanetwork.com/journals/jama/fullarticle/2683125

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AI @ dayton children's

- In production today
  - DarkTrace cybersecurity app
  - Epic EHR predictive model for risk of admission or ED visit in next 6 months

- Within the next year
  - Epic EHR predictive model for pediatric sepsis
  - Epic EHR predictive model for pediatric deterioration
  - Epic EHR predictive model for patient no-shows to clinic appointments
  - Chatbot on our public website
  - Factoring AI capabilities into our next generation enterprise imaging architecture purchase

- In consideration
  - AI assisted surgical & anesthesiology coding (billing)
  - AI powered apps on Epic's "App Orchard" app store

DarkTrace: Practical AI in Cybersecurity

Real-time threat visualization, notification & remediation, leveraging AI to identify anomalous network traffic

Pediatric Risk of Admission or ED Visit

AI as Timesaver for Physicians

The AI applications that I see being adopted near-term really have to do with being able to discern patterns in data, patterns in past histories that a human doctor could, <u>if given enough time</u>, discern on their own.

Colt Courtright

Director, Corporate Data & Analytics

Premera Blue Cross

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Artificial intelligence (in healthcare) *has promise but like other fads before it, today the hype is far, far greater than the value delivered and largely remains in the confines of grant-funded pilot projects – little at scale.*

John Moore

CEO, Chilmark Research

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