



## AI and Its Impact on Cancer Care – Panel Session

Moderator: **David R. Penberthy**, MD MBA UVa Radiation Oncology

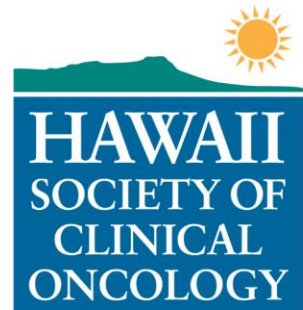
**Jennifer Goldsack**, MChem, MA, MBA CEO Digital Medicine Society (DiMe)

**J. Scott Penberthy**, PhD, Director, Applied AI, Office of CTO, Google

Hawaii Society of Clinical Oncology

Honolulu, Hawaii

November 9, 2024



# Disclosure of Conflicts of Interest

David R. Penberthy, MD MBA  
has the following financial relationships to disclose:

UVA Health Employee  
AstraZeneca Speaker  
ROMTech, Inc. Investor  
TensorBlack, Inc. startup founder  
General Investor, stocks, mutual funds

# Learning objectives

Statement of the  
cancer problem

Current state of  
multidisciplinary  
care

AI and Future  
directions



- Powerful network of >45,000 multidisciplinary practitioners from over 2300 hospitals and practices nationwide in every state
- ~2/3 of the nation's cancer patients are treated by a member of ACCC

[www.accc-cancer.org](http://www.accc-cancer.org)

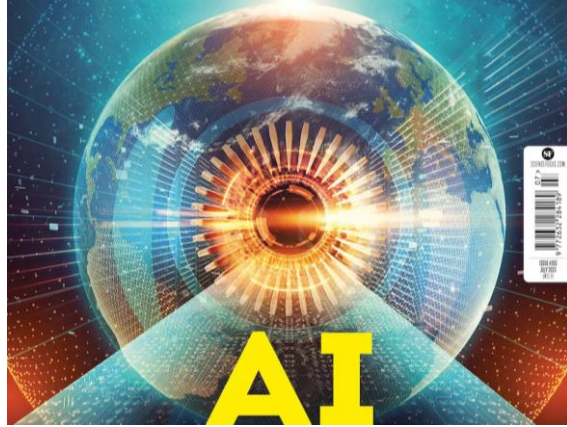
# nature medicine

AI-guided cancer radiotherapy



# Science Focus

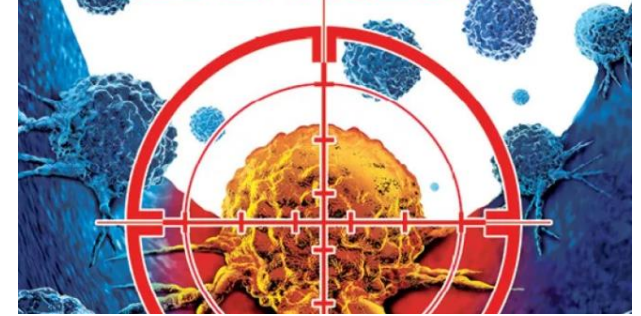
The life and times of FUNGAL BODY SWATCHERS      The hunt for TINY KILLER ASTEROIDS      Could the UK'S TAP WATER RUN OUT?



# Newsweek

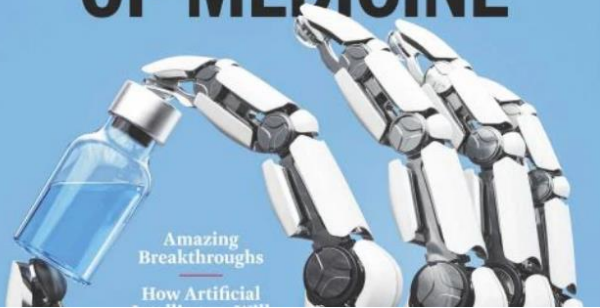
12.01-08.2023

CAN AI BEAT  
**CANCER?**

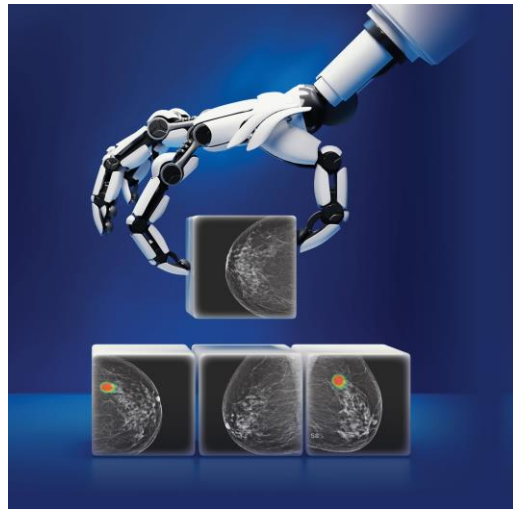


SPECIAL **TIME** EDITION

# THE FUTURE OF MEDICINE



Amazing Breakthroughs  
How Artificial



**MONEY** Make the most of value-based care  
**BUSINESS** Can a third-party vendor grow your practice?  
**CAREERS** Dealing with difficult patients

# 100 YEARS of Medical Economics

SMARTER BUSINESS. BETTER PATIENT CARE.      VOL. 100 NO. 7 JULY 2023

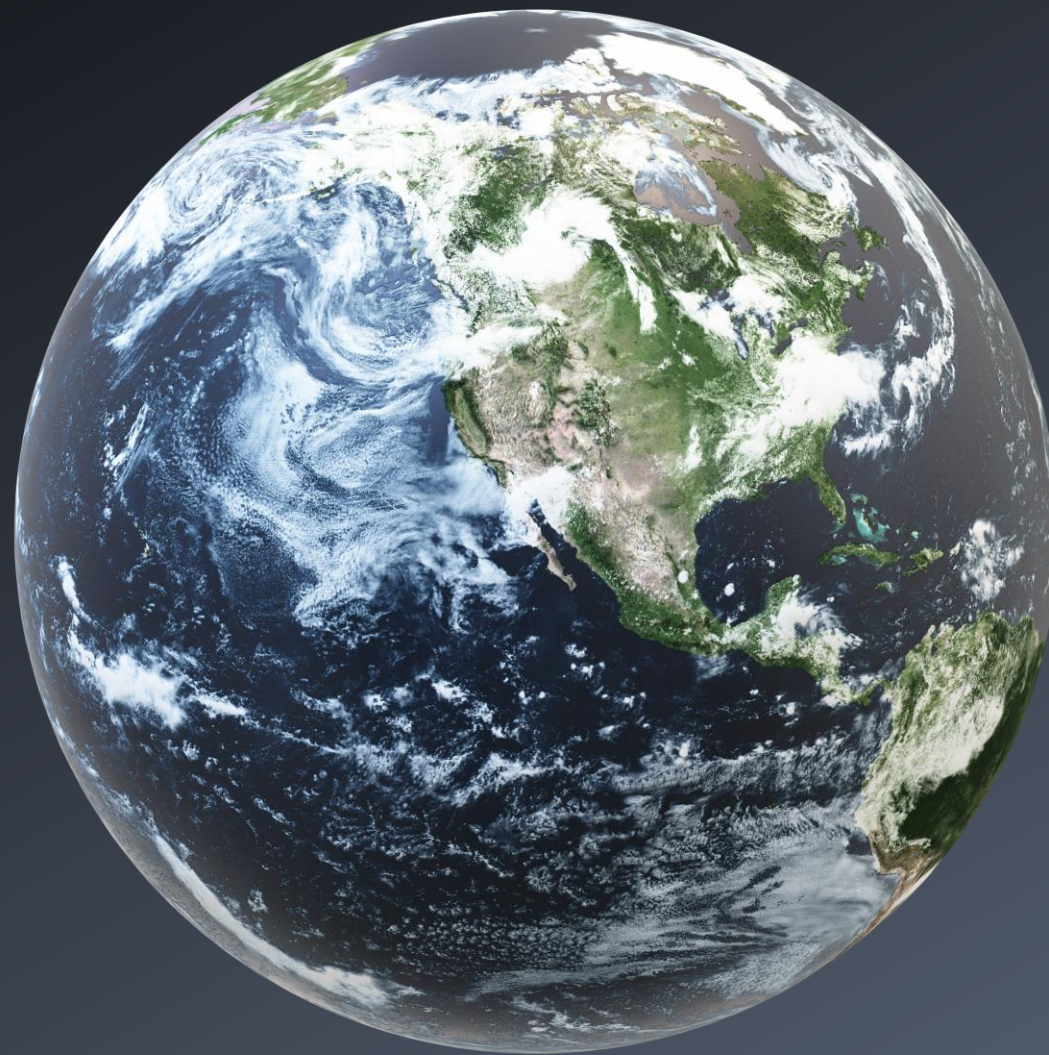
SPECIAL REPORT  
**DR. AI**

How Doctors using ChatGPT and other AI tools will change health care

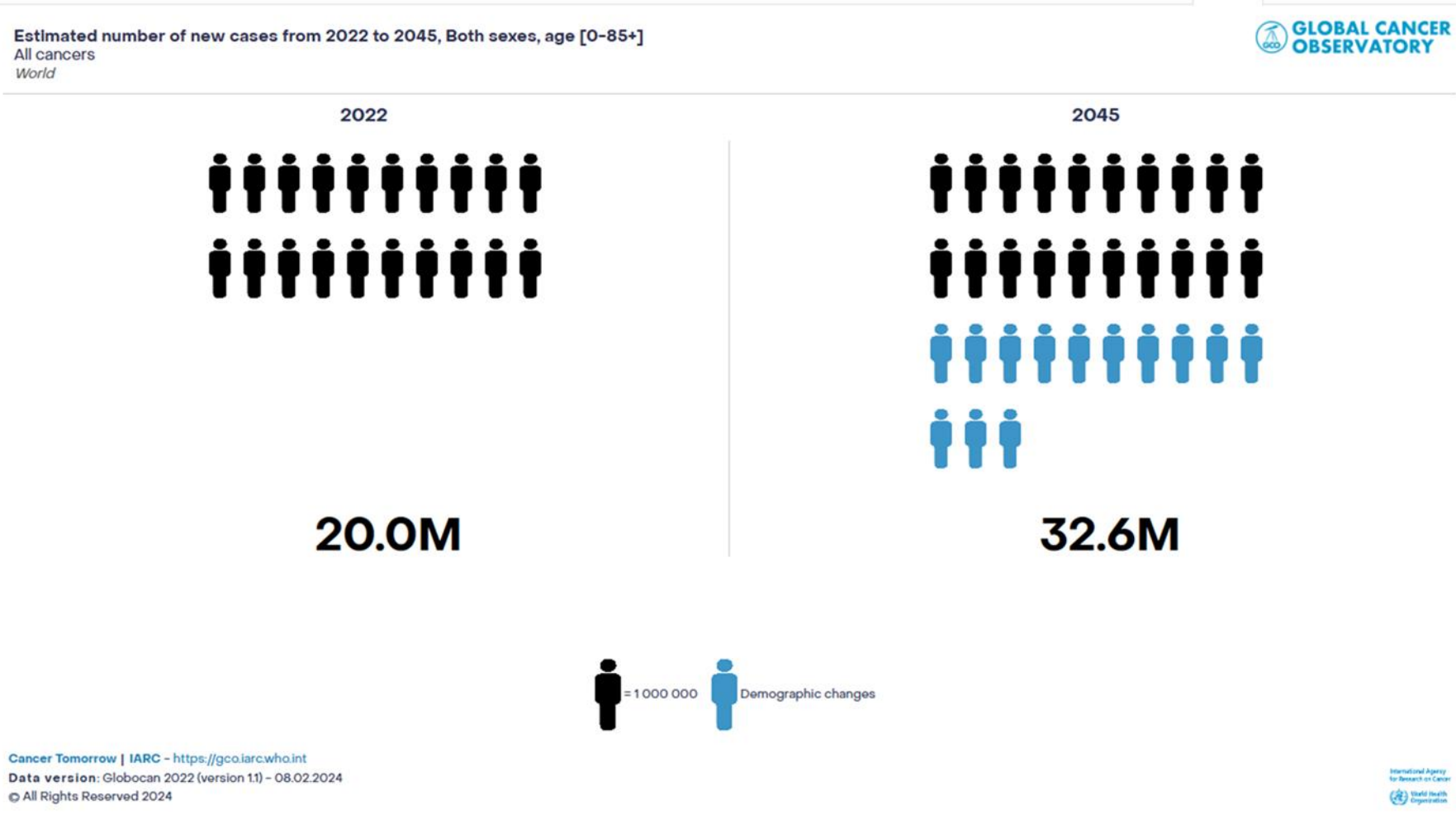




Magnitude



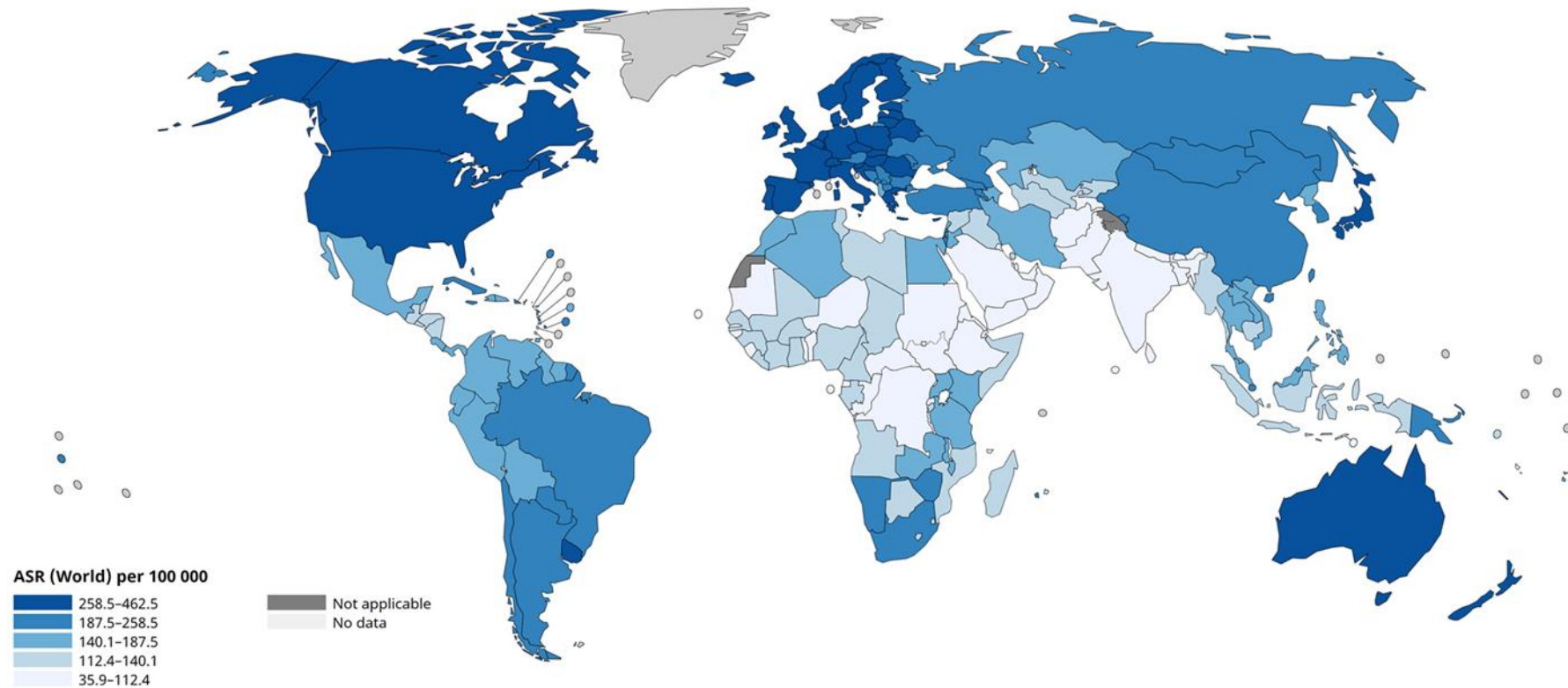
# Worldwide cancer incidence





# Worldwide cancer incidence

Age-Standardized Rate (World) per 100 000, Incidence, Both sexes, in 2022  
All cancers



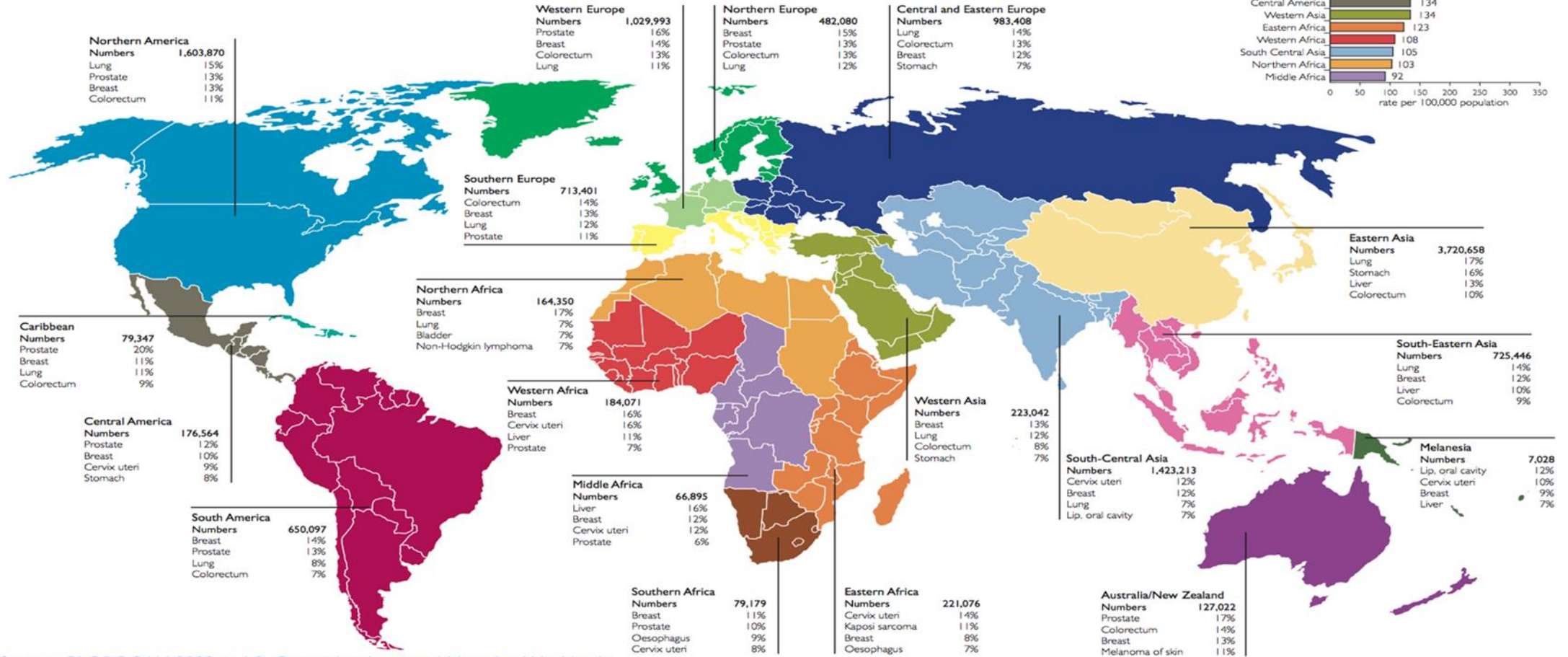
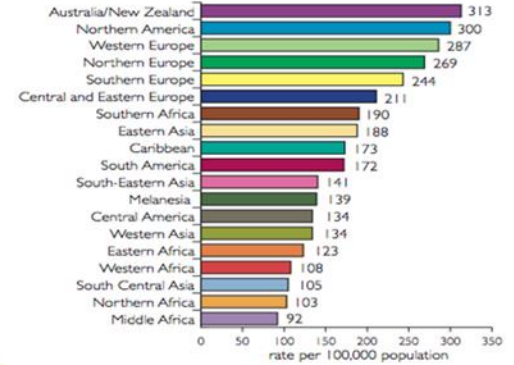
All rights reserved. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization / International Agency for Research on Cancer concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate borderlines for which there may not yet be full agreement.

Cancer TODAY | IARC  
<https://gco.iarc.who.int/today>  
Data version: Globocan 2022 (version 1.1) - 08.02.2024  
© All Rights Reserved 2024

International Agency  
for Research on Cancer  
 World Health  
Organization

# Cancer Incidence Worldwide

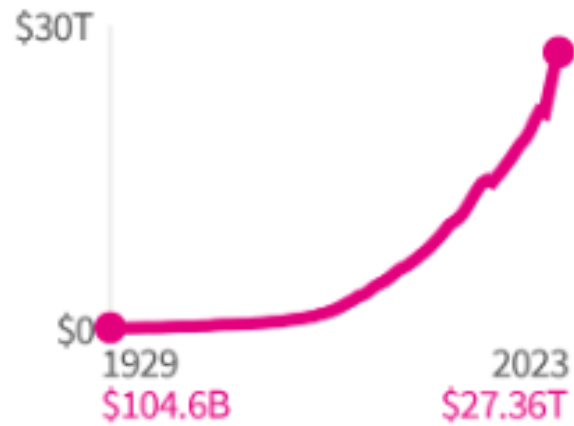
Breakdown of the estimated 12.7 million new cases, World-age standardised incidence rates and the most commonly diagnosed cancers by the different regions of the world, 2008.



Source: GLOBOCAN 2008, v. 1.2, Cancer Incidence and Mortality Worldwide. IARC, 2010 (<http://globocan.iarc.fr>)  
Map updated February 2011

<http://info.cancerresearchuk.org/cancerstats/>

# GDP issues

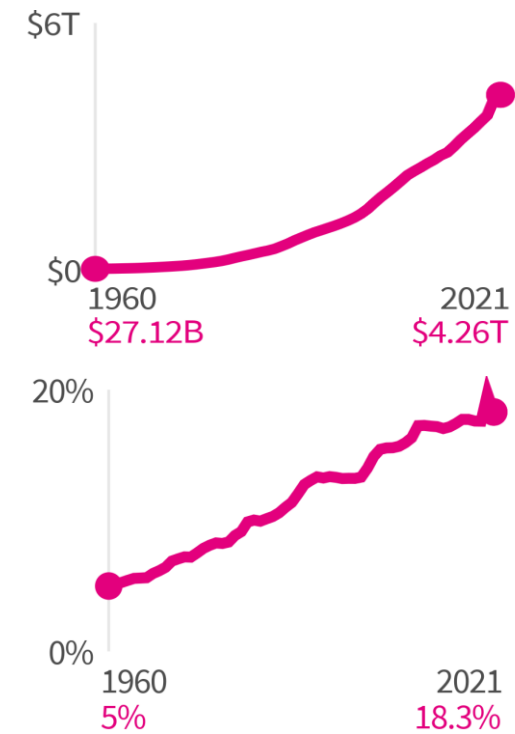


Gross domestic product

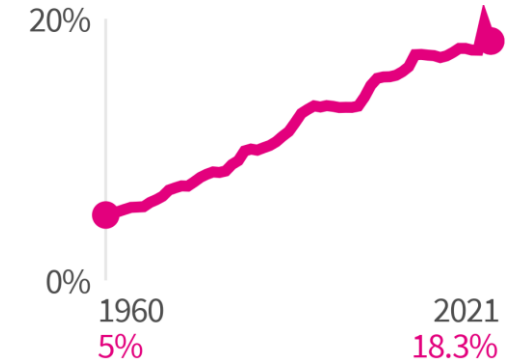
**\$27.36 trillion**

2023

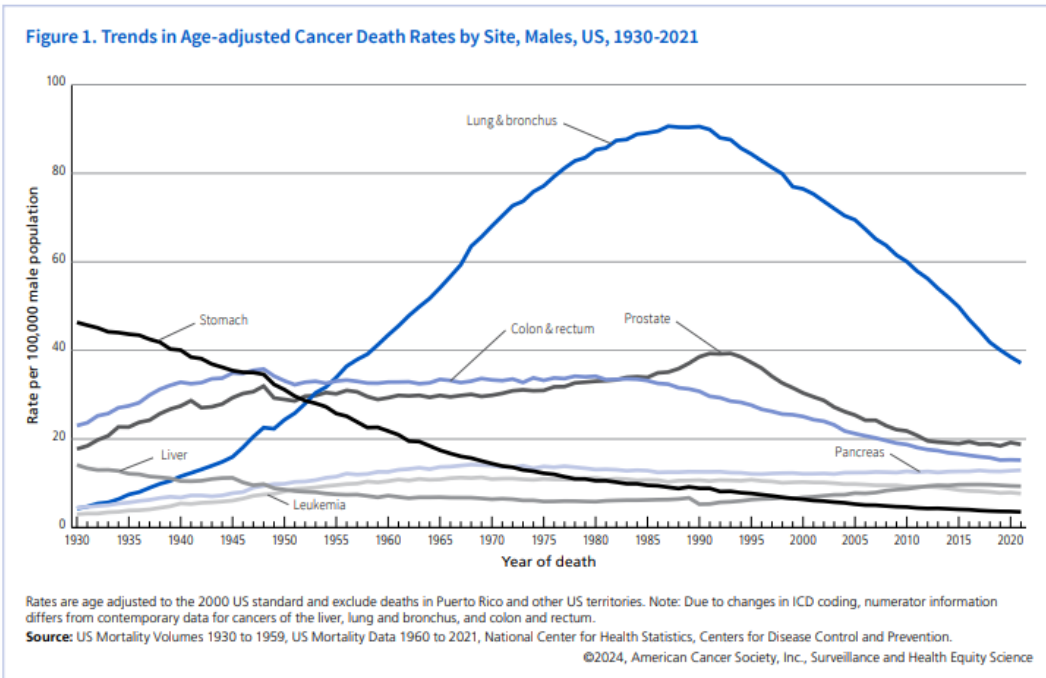
**National spending on  
healthcare goods and  
services**



**Healthcare expenditures  
as a percent of GDP**



# So how are we doing?



## 5

### Takeaways from the Cancer Facts & Figures Report 2022



Lung cancer patients are being diagnosed earlier, and living longer.



In 2022, there will be an estimated 1,918,030 new cancer diagnoses, and 609,360 cancer deaths.



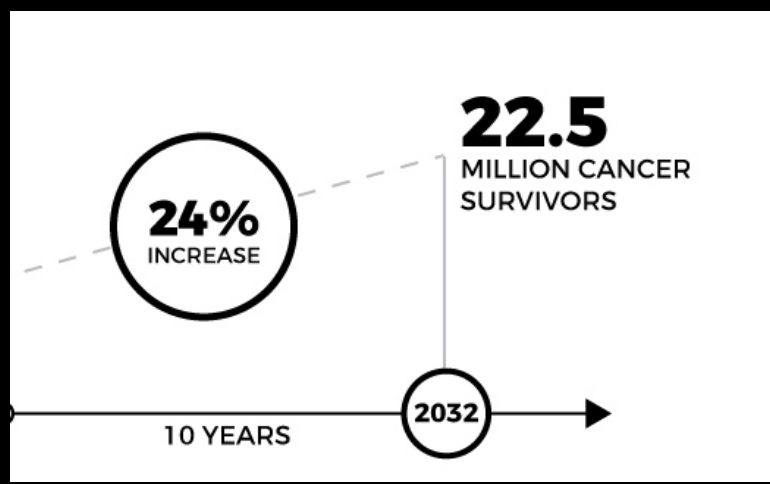
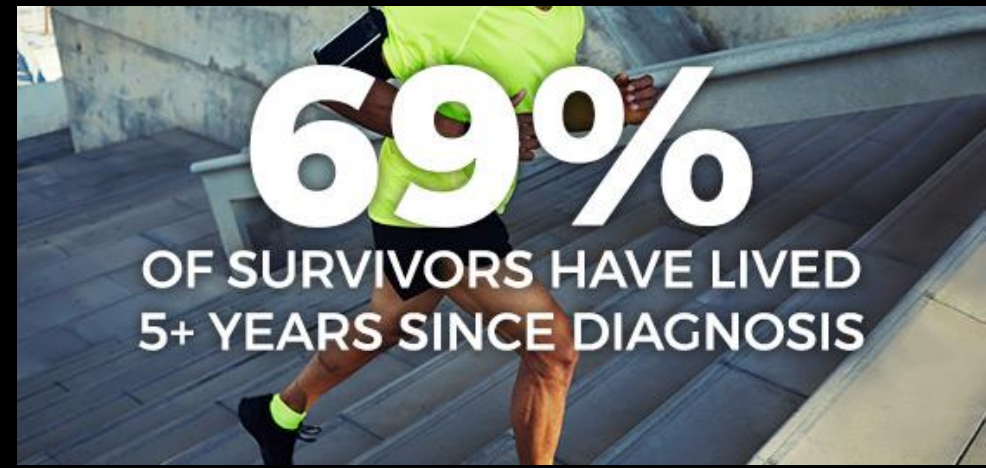
Cancer mortality is declining at an accelerating rate.



The racial, socioeconomic, and geographic disparities for preventable cancers are alarming.

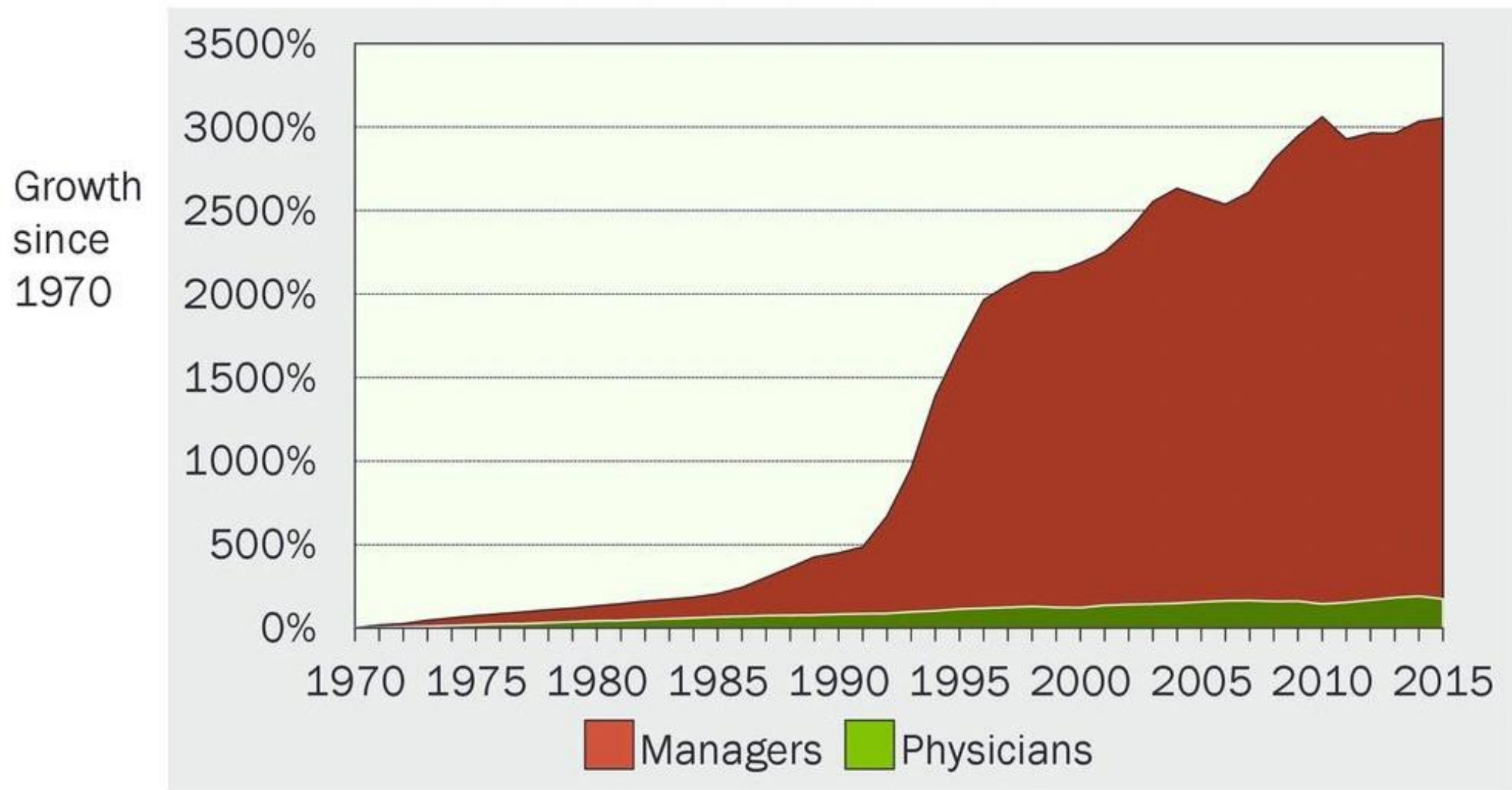


The rate of advanced-stage prostate cancer diagnosis increased by 4%-6% each year from 2014 -2018.



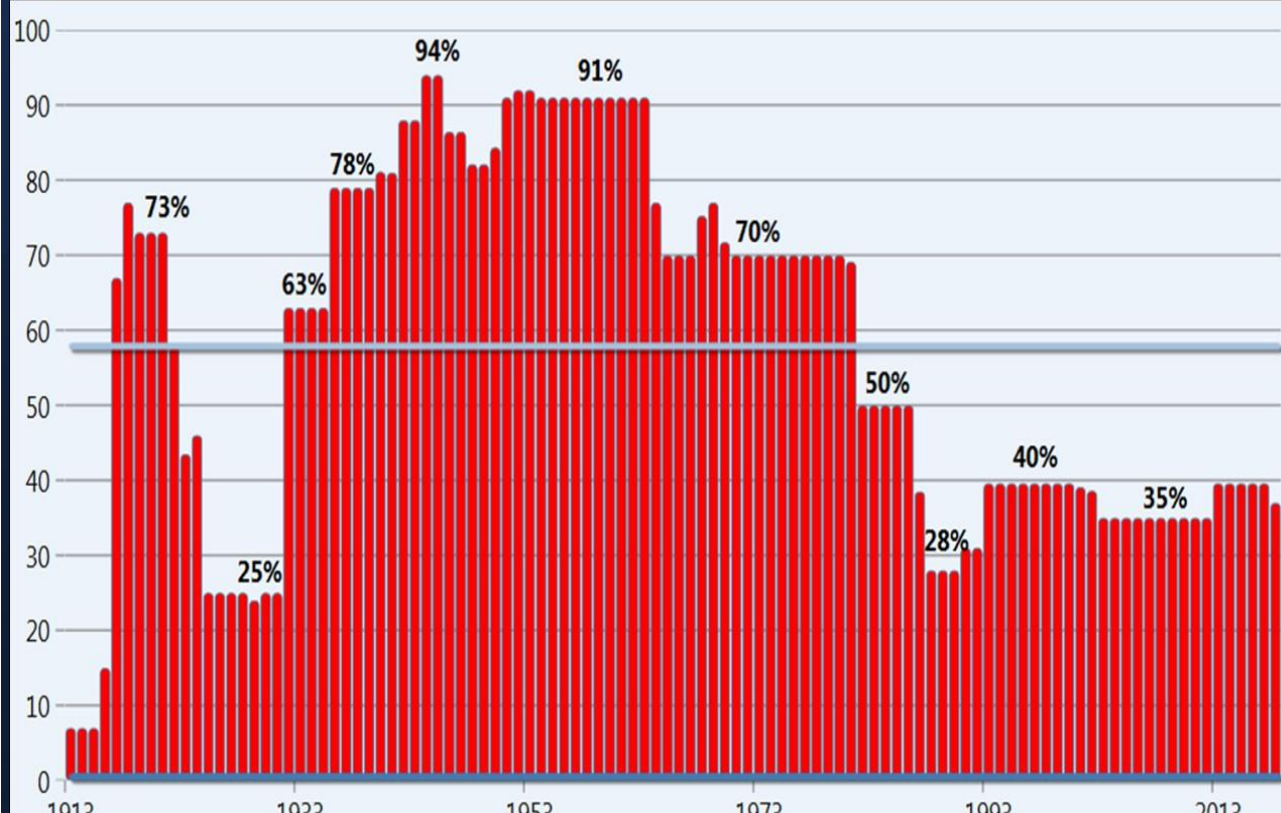
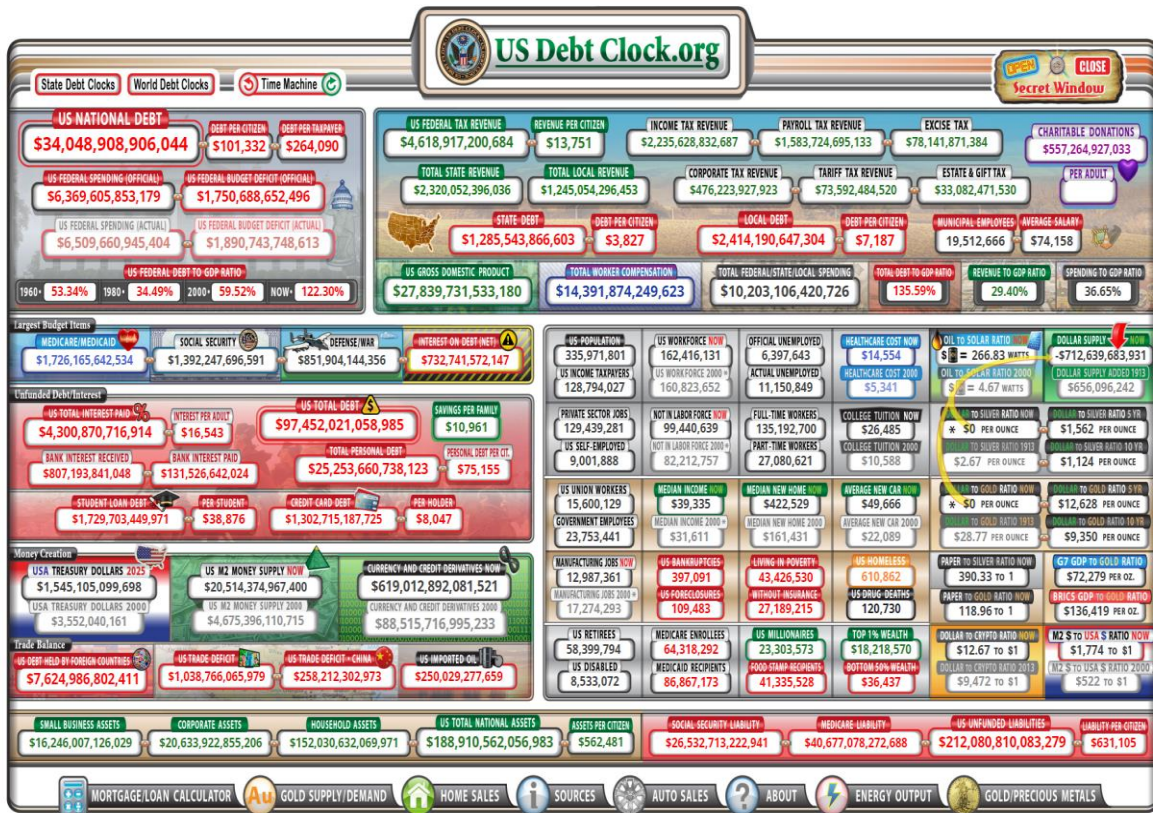
Source: [Statistics and Graphs | Division of Cancer Control and Population Sciences \(DCCPS\)](#) accessed 2/1/24

# Growth of Physicians and Administrators in U.S.



Bureau of Labor Statistics; NCHS; Himmelstein/Woolhandler analysis of CPS  
Managers shown as moving average of current year and two previous years

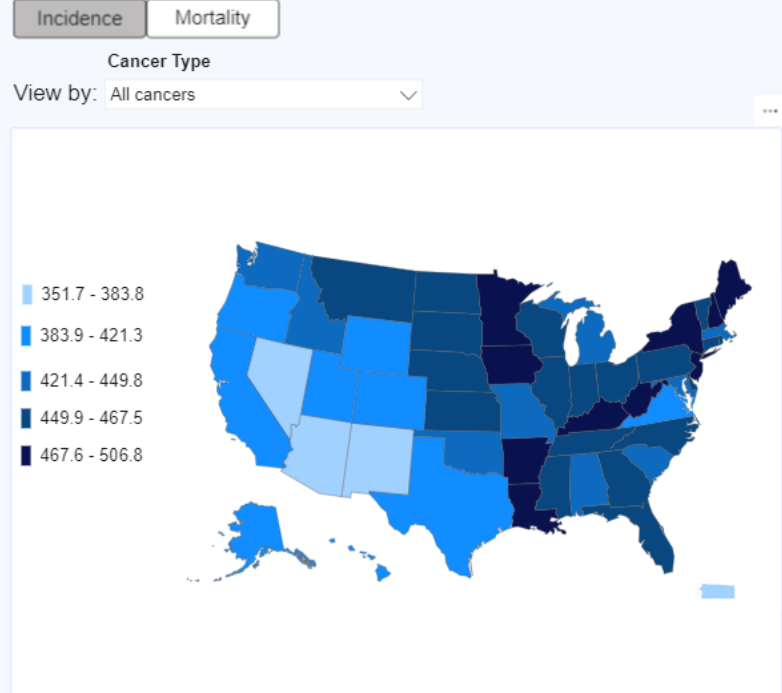
# US Debt and Taxes



National debt \$35T and counting  
[www.usdebtclock.org](http://www.usdebtclock.org)

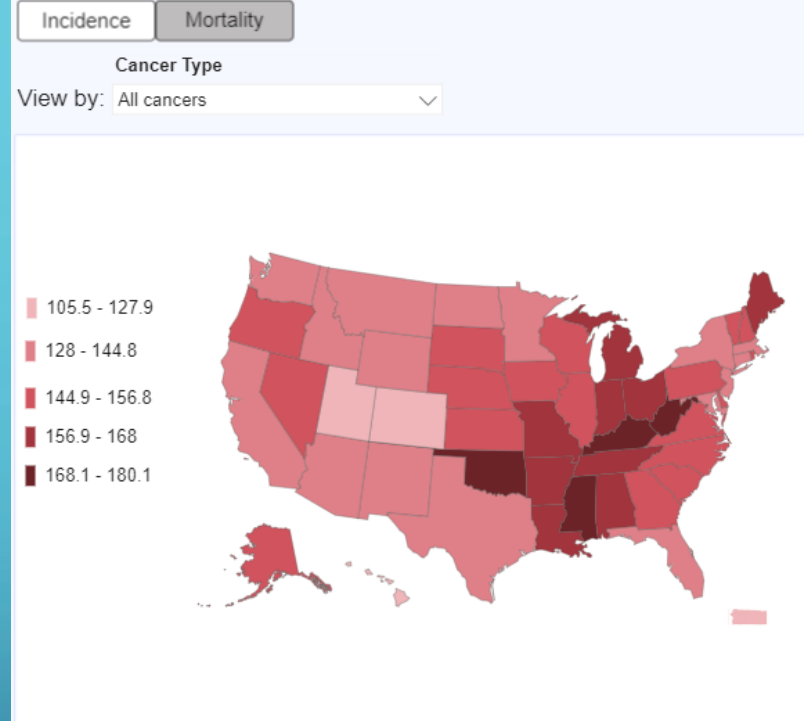
# US CANCER INCIDENCE AND MORTALITY

## Incidence Rates By State (sexes combined, 2016-2020)

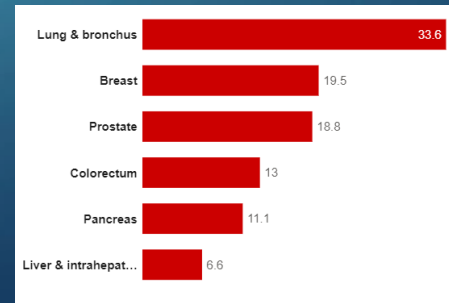
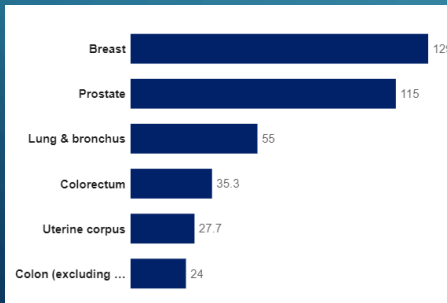


©American Cancer Society, 2024  
 Data source: North American Association of Central Cancer Registries, 2023  
 Rate per 100,000, age-adjusted to the 2000 US standard population. Incidence is adjusted for delays when possible.

## Mortality Rates By State (sexes combined, 2017-2021)



©American Cancer Society, 2024  
 Data source: National Center for Health Statistics, Centers for Disease Control and Prevention,  
 Rate per 100,000, age-adjusted to the 2000 US standard population.





What about  
the future?



# THE MEDICAL LITERATURE TSUNAMI

## Pubmed

Daily: ~4,000 Weekly: ~28,000 Monthly: ~120,000

Annually: ~1.44 million articles

## 10% oncology related

Daily - ~400 Weekly - ~2800 Monthly - ~12,000

Annually- ~144,000

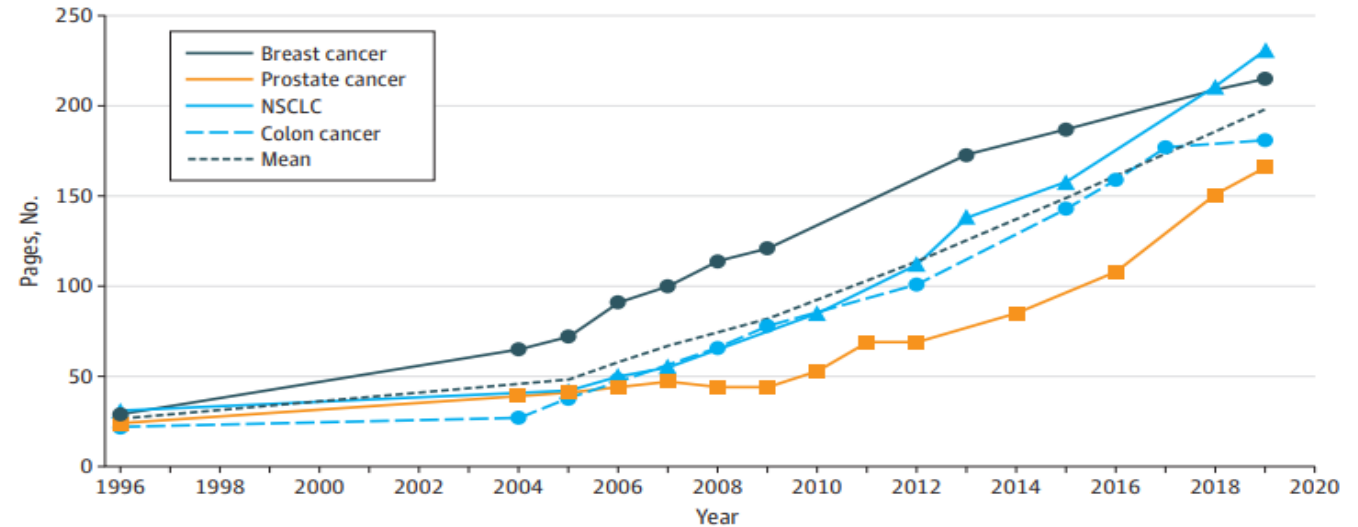
These figures only represent a fraction of the medical information being generated, as they do not account for other sources like clinical trials, patents, guidelines, conference proceedings, and more. Additionally, the growth of data in fields like genomics and digital health is further accelerating the expansion of medical information.



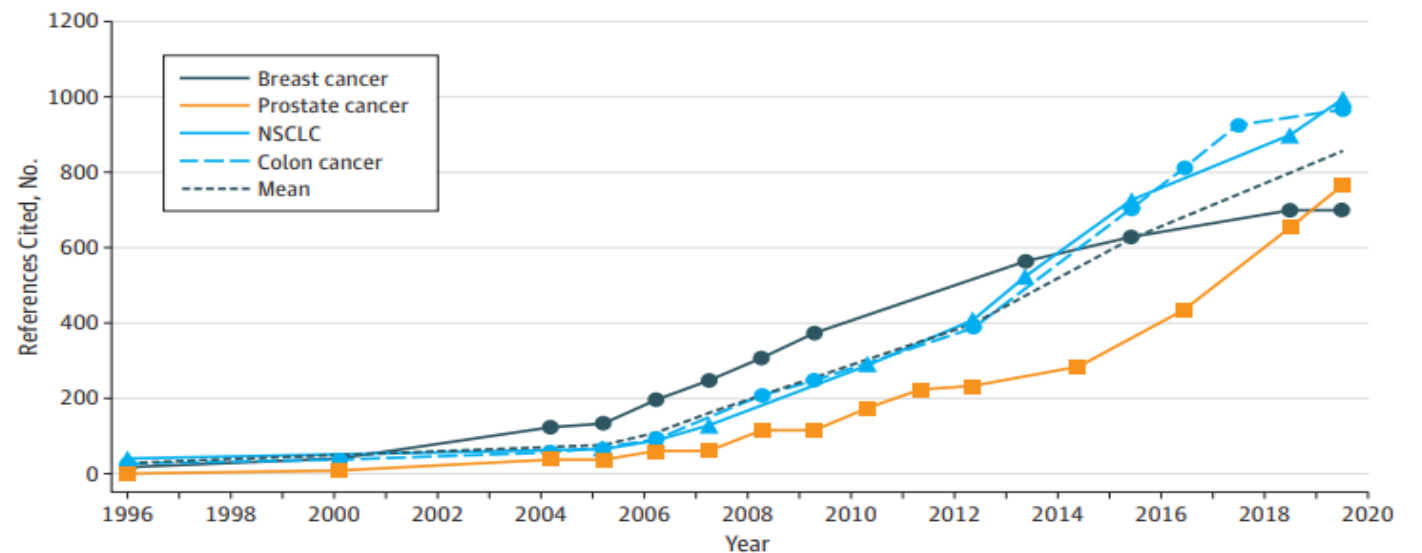
# Growth of Guidelines

“Further approaches, including guideline stratification by evidence level and the use of artificial intelligence for decision support, should be investigated as ways to synthesize data and improve cancer decision-making.”

**Figure 1. Page Volume of National Comprehensive Cancer Network Clinical Practice Guidelines by Disease Site, 1996-2019**

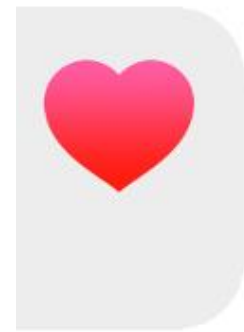


**Figure 2. References Cited in National Comprehensive Cancer Network Clinical Practice Guidelines by Disease Site, 1996-2019**

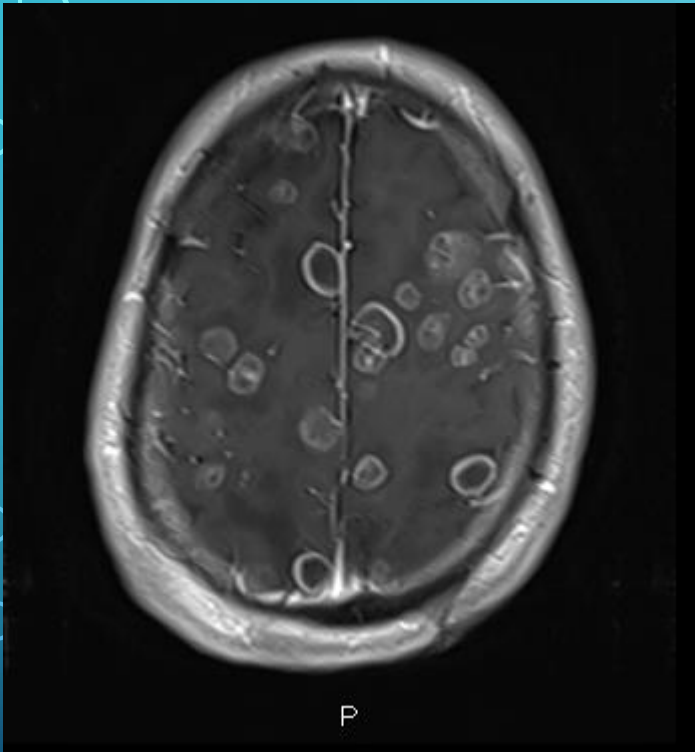




# Google HEALTH



# FEEL GOOD CASE



Test Name: Histology Analysis Multiple Marker Panel  
Specimen type: Lymph Node, Station 4R  
Performed at: NeoGenomics Laboratories

#### Results

PD-L1 22C3 FDA for NSCLC: **HIGH PD-L1 EXPRESSION**  
Tumor Proportion Score: 100%  
Intensity: 3+

#### Reference Ranges

High PD-L1 Expression	TPS $\geq$ 50%
PD-L1 Expression	TPS 1-49%
No PD-L1 Expression	TPS < 1%

#### Pan-TRK

Not Expressed

#### Electronic Signature

Scott Bourne, M.D., Pathologist

See attached report for further details.

Test Name: NeoTYPE Analysis Lung Tumor Profile  
Specimen type: Lymph Node, Station 4R  
Performed at: NeoGenomics Laboratories

#### Results Summary

SNVs/Indels: ERBB2 Y772\_A775dup; TERT promoter C-124C>T

Alterations Detected By FISH: FISH report is not yet completed, see subsequent report

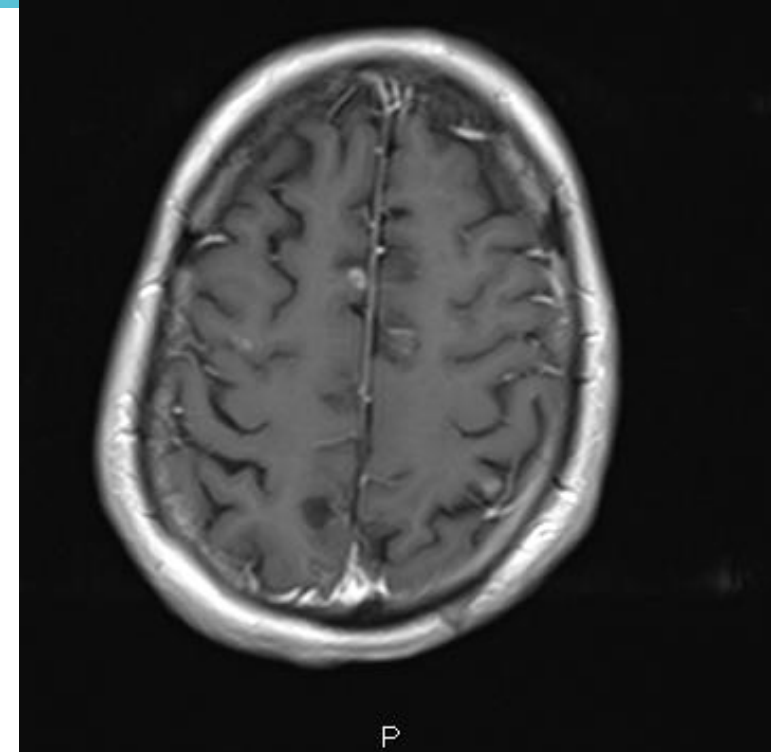
Immuno-Oncology Biomarkers: Microsatellite Instability: MSI - Stable (MSS); PD-L1 22C3: HIGH PD-L1 EXPRESSION; Tumor Mutation Burden: Intermediate

Additional Studies: MET Exon 14 Deletion Analysis: Not Detected; Pan-TRK: Not Expressed

Pertinent Negatives: NO alterations detected in the following genes: BRAF, EGFR, KRAS

#### Interpretation

- FLUORESCENCE IN SITU HYBRIDIZATION (FISH): Please refer to separate report for FISH details once results are available.
- The expression of PD-L1 suggests response to immunotherapy with anti-PD-1 or anti-PD-L1, which are FDA-approved for diverse solid tumor types.
- The VAF of the ERBB2 variant suggests ERBB2 (HER2) amplification. Clinical correlation with immunohistochemistry and/or FISH is recommended.



Her2 Exon 20 insertion mutation for which there is an FDA approved indication - (Traztuzumab deruxtecan)

\*also did HER2 IHC and FISH testing, IHC reported 2+ equivocal, a distractor for someone who also treats breast cancer

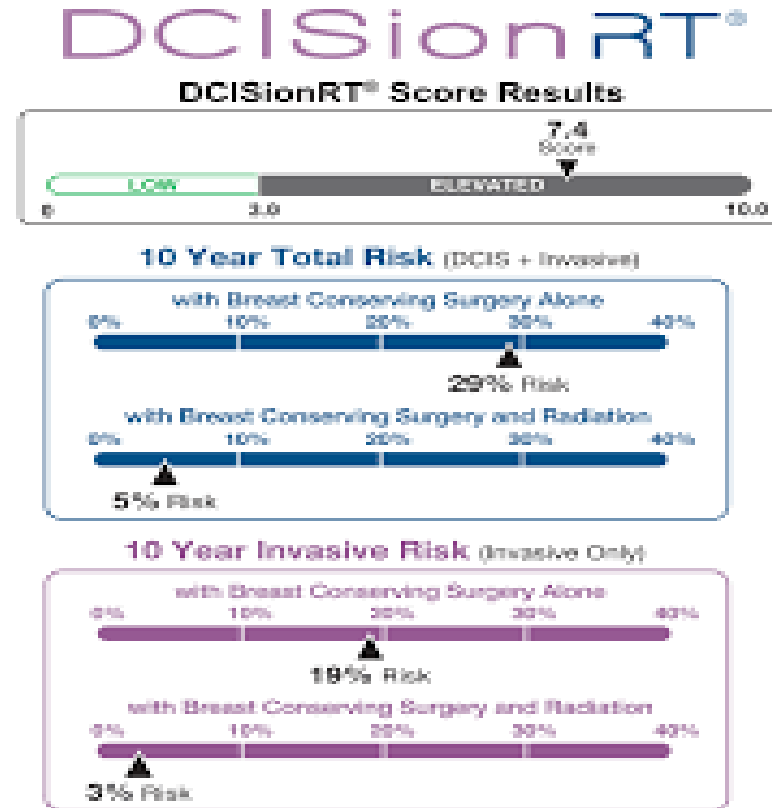
# Examples from Exact Sciences and PreludeDX

<p><b>Recurrence Score® (RS) Result</b></p>	<p><b>Distant Recurrence Risk at 9 Years</b></p>	<p><b>Group Average Absolute Chemotherapy (CT) Benefit*</b></p>
<p style="text-align: center;"><b>32</b></p>	<p>With AI or TAM Alone</p> <p style="text-align: center;"><b>20%</b></p> <p>95% CI (15%, 27%)</p> <p><b>NSABP B-14</b></p>	<p>RS 26-100 All Ages</p> <p style="text-align: center;"><b>&gt;15%</b></p> <p>95% CI (9%, 37%)</p> <p><b>NSABP B-20</b></p>

Decision on individual treatment especially around the RS 25 cutoff may consider other clinical factors.

AI = Aromatase Inhibitor / TAM = Tamoxifen  
CI = Confidence Intervals

\*For estimated CT benefit for individual RS results, see page 2



“It is often easier  
**(and faster)** to make  
something 10x better  
than it would be to  
make it 10% better.”

— Astro Teller



# AI IN PRECISION ONCOLOGY



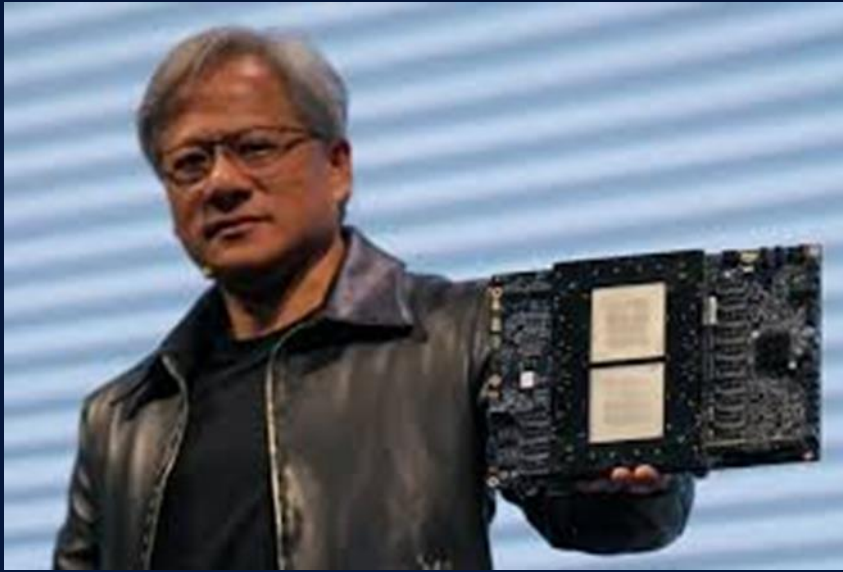


# WHAT IS THIS?







- Bell Labs scientists invented the transistor in 1947, and won the 1956 Nobel Prize in Physics
  - John Bardeen
  - Walter Brattain
  - William Shockley
- John McCarthy coined the term “artificial intelligence” in 1956



# ...AND NOW



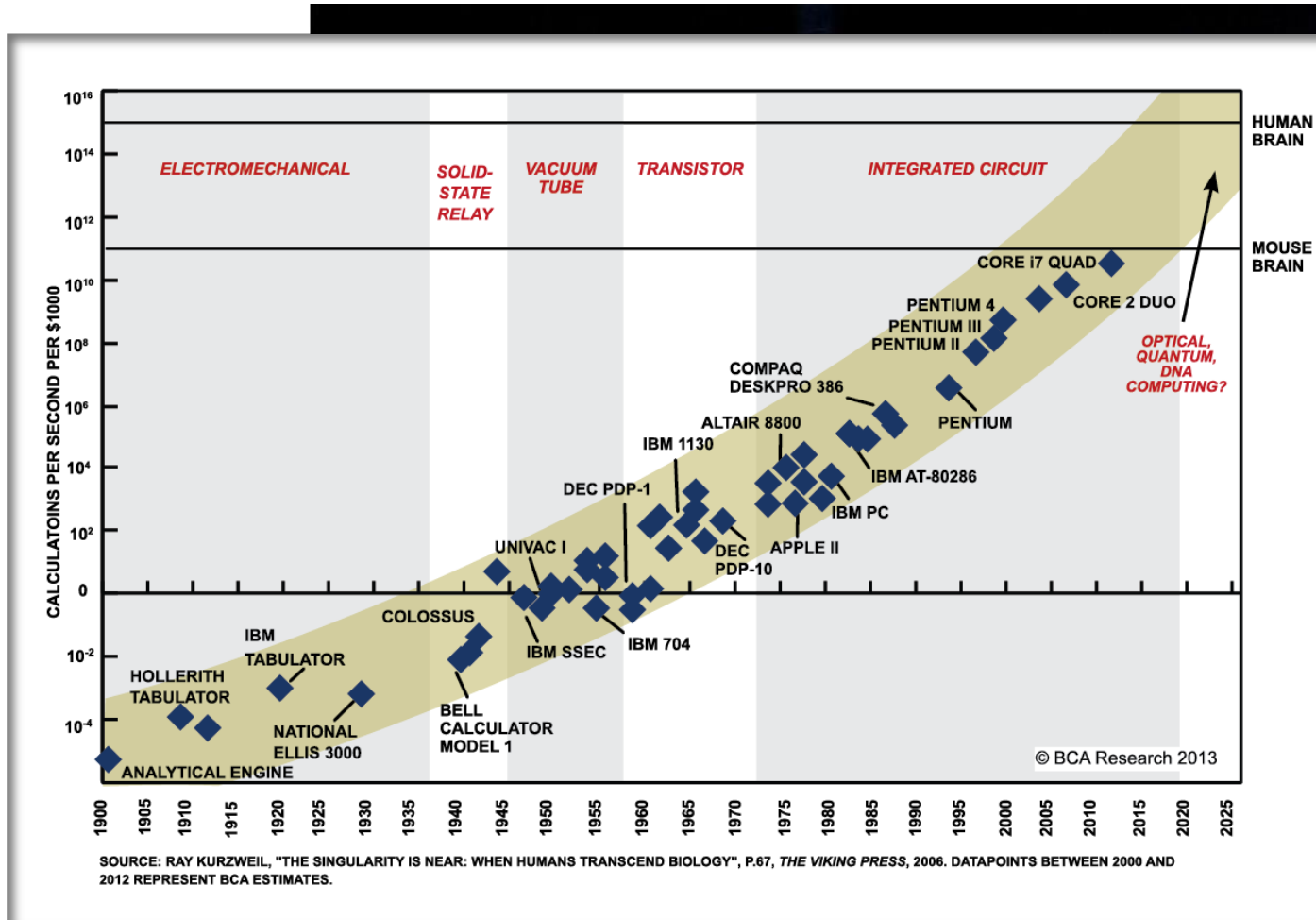
ANNOUNCING NVIDIA BLACKWELL PLATFORM FOR TRILLION-PARAMETER SCALE GENERATIVE AI

-  AI SUPERCHIP  
208B Transistors
-  2<sup>nd</sup> GEN TRANSFORMER ENGINE  
FP4/FP6 Tensor Core
-  5<sup>th</sup> GENERATION NVLINK  
Scales to 576 GPUs
-  RAS ENGINE  
100% In-System Self-Test
-  SECURE AI  
Full Performance Encryption & TEE
-  DECOMPRESSION ENGINE  
800 GB/sec

A small figure of Jensen Huang is visible on the stage in the bottom right corner of the slide, holding a device.

# The robots are coming.

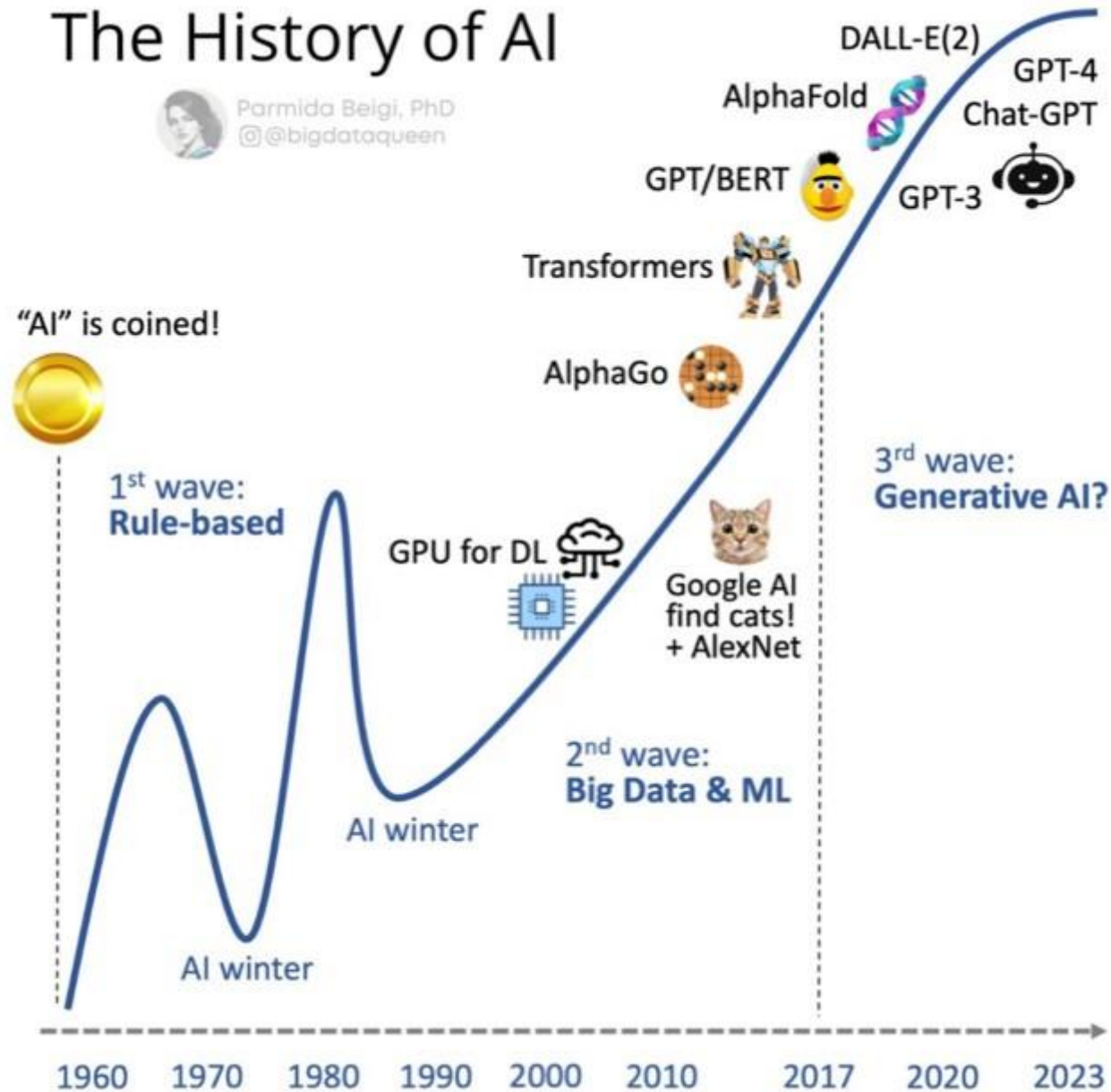
Ray Kurzweil c. 2006

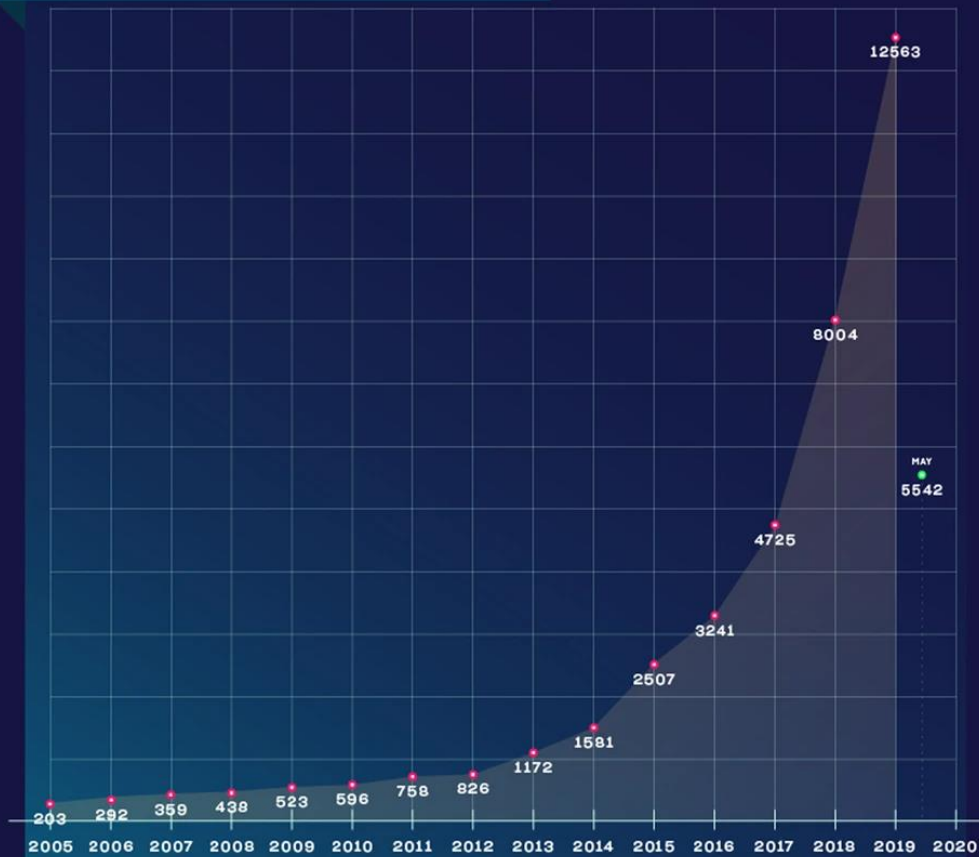
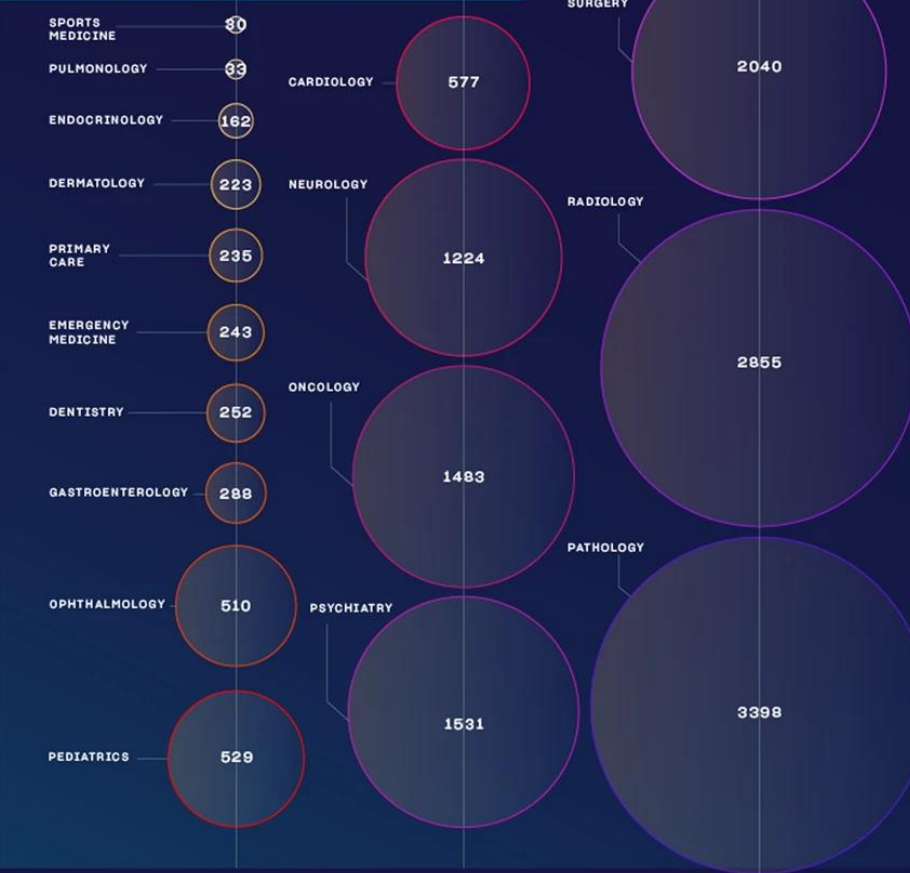


# The History of AI



Parmida Beigi, PhD  
@bigdataqueen



**a****MACHINE AND DEEP LEARNING STUDIES ON PUBMED.COM****TOTAL NUMBER OF STUDIES****b****STUDIES PER SPECIALTY**Source: [https://www.reddit.com/r/appliedatahoarding/comments/14ok07m/number\\_of\\_medical\\_ai\\_studies\\_by\\_year\\_from\\_2010\\_to/](https://www.reddit.com/r/appliedatahoarding/comments/14ok07m/number_of_medical_ai_studies_by_year_from_2010_to/)

Accessed 2/1/24

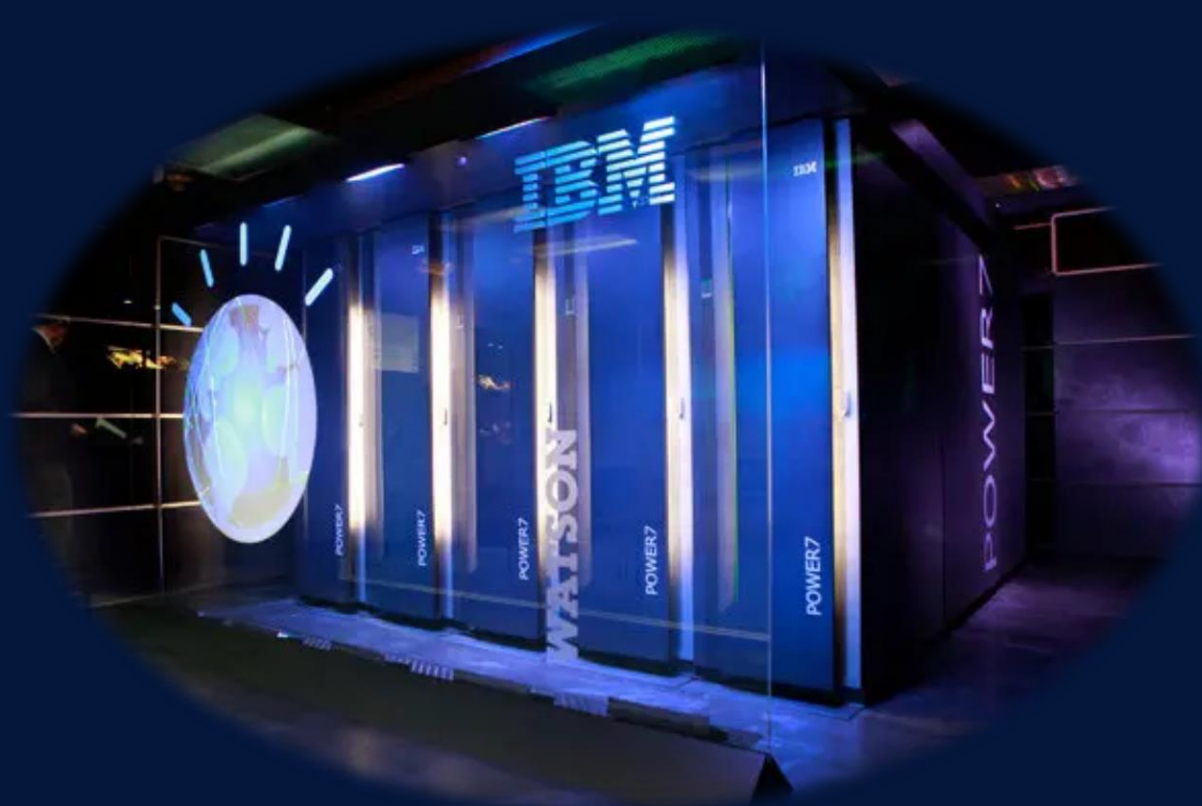
# DEEP BLUE – HOW AI BEAT THE WORLD CHAMPION



May 11, 1997



# HOW AI “WATSON” BEAT TWO CHAMPIONS



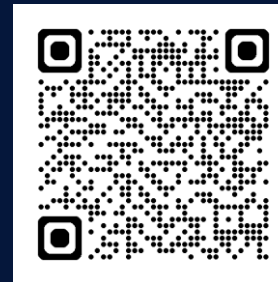
February 16, 2011

# ALPHAGO BEAT LEE SEDOL





# AI VIDEO GENERATION NOW SORA | OPENAI



AI WON'T REPLACE YOU. SOMEONE USING AI WILL.

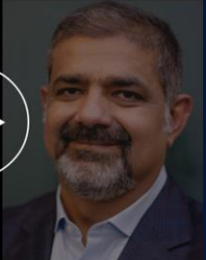


Business And Society

### AI Won't Replace Humans — But Humans With AI Will Replace Humans Without AI

August 04, 2023

The New World of Work  
**Karim R. Lakhani**,  
Harvard Business School Professor



Harvard Business Review

Original image created using beautiful ai

# IS THIS A GUTENBERG MOMENT?



The future is bright!



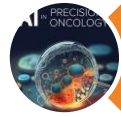


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THANK YOU!



dp4j@uvahealth.org



<https://home.liebertpub.com/publications/ai-in-precision-oncology/679>



David R. Penberthy, MD MBA



David Penberthy



@drpenberthy



@drpjkp

# IS THIS A GUTENBERG MOMENT?

## Envisioning the Healthcare Landscape with ChatGPT

New York Medical College Explores The Opportunities And Risks Of AI On The Healthcare Industry In The Following Article Written Entirely Using ChatGPT

February 13, 2023

Opinion > Kevin, M.D.

## AI in Healthcare: Meeting HIPAA Standards With ChatGPT

— Patients deserve a commitment to privacy

by Harvey Castro, MD, MBA February 11, 2023

## ChatGPT Passes US Medical Licensing Exam Without Clinician Input

ChatGPT achieved 60 percent accuracy on the US Medical Licensing Exam, indicating its potential in advancing artificial intelligence-assisted medical education.

## ChatGPT AND HEALTHCARE

THE KEY TO THE NEW FUTURE OF MEDICINE



HARVEY CASTRO MD, MBA

THE LANCET  
Digital Health

COMMENT | ONLINE FIRST

## ChatGPT: the future of discharge summaries?

Sajan B Patel • Kyle Lam

Open Access • Published: February 06, 2023 • DOI: [https://doi.org/10.1016/S2589-7500\(23\)00021-3](https://doi.org/10.1016/S2589-7500(23)00021-3)

## New and surprising evidence that ChatGPT can perform several intricate tasks relevant to handling complex medical and clinical information

Download PDF Copy



By Neha Mathur

Reviewed by Danielle Ellis, B.Sc.

Feb 13 2023

FORBES > INNOVATION > HEALTHCARE

EDITORS' PICK

## 5 Ways ChatGPT Will Change Healthcare Forever, For Better

Robert Pearl, M.D. Contributor

Follow

April 28, 2023

# Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum

John W. Ayers, PhD, MA<sup>1,2</sup>; Adam Poliak, PhD<sup>3</sup>; Mark Dredze, PhD<sup>4</sup>; [et al](#)

**Results** Of the 195 questions and responses, evaluators preferred chatbot responses to physician responses in 78.6% (95% CI, 75.0%-81.8%) of the 585 evaluations. Mean (IQR) physician responses were significantly shorter than chatbot responses (52 [17-62] words vs 211 [168-245] words;  $t=25.4$ ;  $P<.001$ ). Chatbot responses were rated of significantly higher quality than physician responses ( $t=13.3$ ;  $P<.001$ ). The proportion of responses rated as *good* or *very good* quality ( $\geq 4$ ), for instance, was higher for chatbot than physicians (chatbot: 78.5%, 95% CI, 72.3%-84.1%; physicians: 22.1%, 95% CI, 16.4%-28.2%). This amounted to 3.6 times higher prevalence of *good* or *very good* quality responses for the chatbot. Chatbot responses were also rated significantly more empathetic than physician responses ( $t=18.9$ ;  $P<.001$ ). The proportion of responses rated *empathetic* or *very empathetic* ( $\geq 4$ ) was higher for chatbot than for physicians (physicians: 4.6%, 95% CI, 2.1%-7.7%; chatbot: 45.1%, 95% CI, 38.5%-51.8%; physicians: 4.6%, 95% CI, 2.1%-7.7%). This amounted to 9.8 times higher prevalence of *empathetic* or *very empathetic* responses for the chatbot.

**Conclusions** In this cross-sectional study, a chatbot generated quality and empathetic responses to patient questions posed in an online forum. Further exploration of this technology is warranted in clinical settings, such as using chatbot to draft responses that physicians could then edit. Randomized trials could assess further if using AI assistants might improve responses, lower clinician burnout, and improve patient outcomes.

## Patient-Facing

### AI Chatbots



### Wearables & Devices



### Personalized Genetics



### Mental Health



### Women's Health



### Skin



## Telehealth

### Telemedicine



### Lifestyle Management



### Disease Management



# AI in Healthcare

## Doctor-Facing

### Medical Records



### Data Analytics



### Medical Imaging



## Research

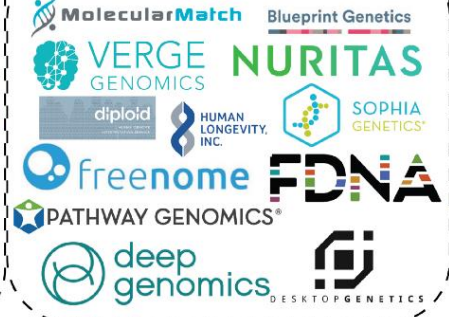
### Drug Discovery



### Information & Clinical Trials



### Genetic Research



### Hospital







OCTOBER 30, 2023

# FACT SHEET: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence

[BRIEFING ROOM](#)[STATEMENTS AND RELEASES](#)

Today, President Biden is issuing a landmark Executive Order to ensure that America leads the way in seizing the promise and managing the risks of artificial intelligence (AI). The Executive Order establishes new standards for AI safety and security, protects Americans' privacy, advances equity and civil rights, stands up for consumers and workers, promotes innovation and competition, advances American leadership around the world, and more.

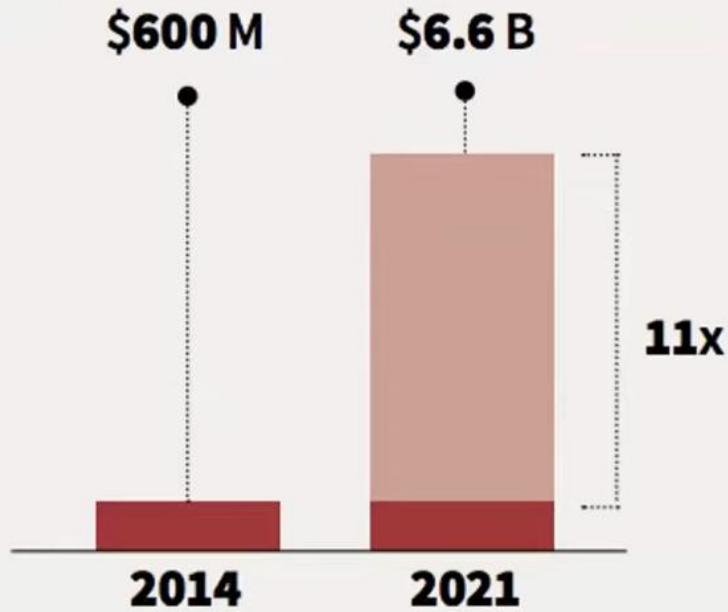
As part of the Biden-Harris Administration's comprehensive strategy for responsible innovation, the Executive Order builds on previous actions the President has taken, including work that led to voluntary commitments from 15 leading companies to drive safe, secure, and trustworthy development of AI.

<https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/30/fact-sheet-president-biden-issues-executive-order-on-safe-secure-and-trustworthy-artificial-intelligence/>

Name this country...



## Health AI Market Size 2014 - 2021



Acquisitions of AI startups are rapidly increasing while the health market is set to register an explosive CAGR of 40% through 2021.

**Source:** Accenture (December 2017). Artificial Intelligence in Healthcare.

## GLOBAL ARTIFICIAL INTELLIGENCE IN HEALTHCARE MARKET

### ARTIFICIAL INTELLIGENCE (AI) IN HEALTHCARE Market

OPPORTUNITIES AND FORECAST, 2021-2030

Artificial Intelligence (AI) in Healthcare Market is expected to reach **194.14 Billion** by 2030.

Growing at a **CAGR of 38.1%** (2021-2030)

Growing at a **CAGR of 48.7%** (2017-2023)

## GLOBAL ARTIFICIAL INTELLIGENCE IN HEALTHCARE MARKET BY GEOGRAPHY



**Asia-Pacific** region would exhibit the highest **CAGR of 53.4%** during 2017-2023.

[Source: Artificial Intelligence in Healthcare Market | Global Report – 2030 \(alliedmarketresearch.com\)](#)

**Shanghai 1990**



**Shanghai 2020**



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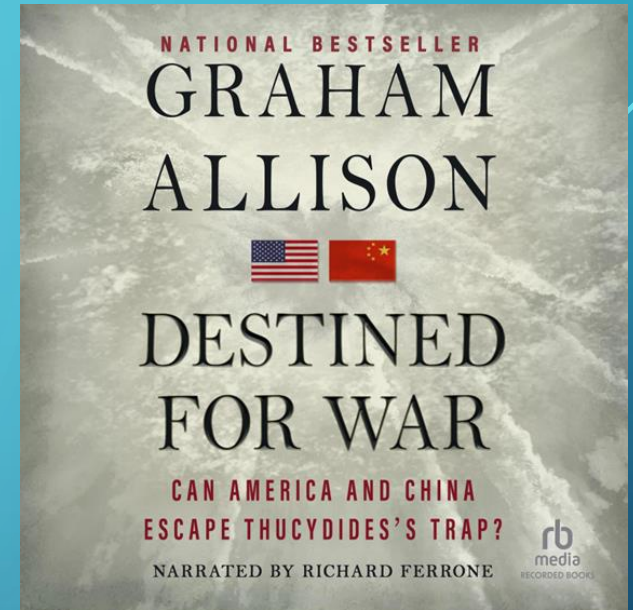
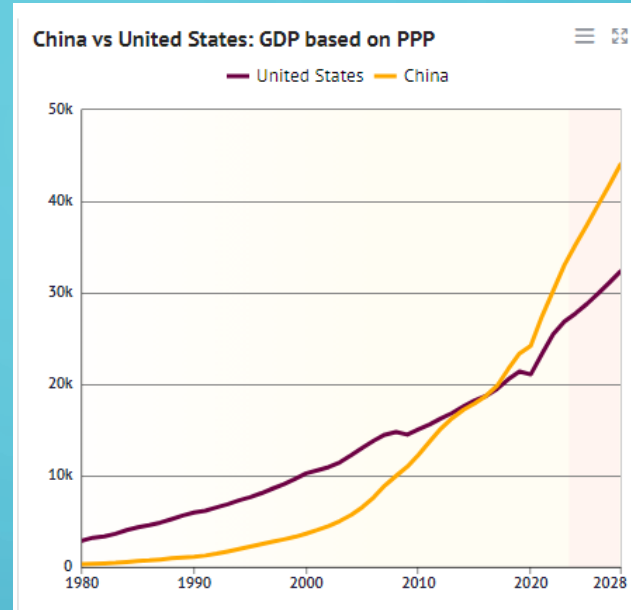
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SPACE & PHYSICS

# China Reaches New Milestone in Space-Based Quantum Communications

The nation's Micius satellite successfully established an ultrasecure link between two ground stations separated by more than 1,000 kilometers

By Karen Kwon on June 25, 2020 [أعرض هذا باللغة العربية](#)



### What is China's GDP as per PPP?

Economy of China

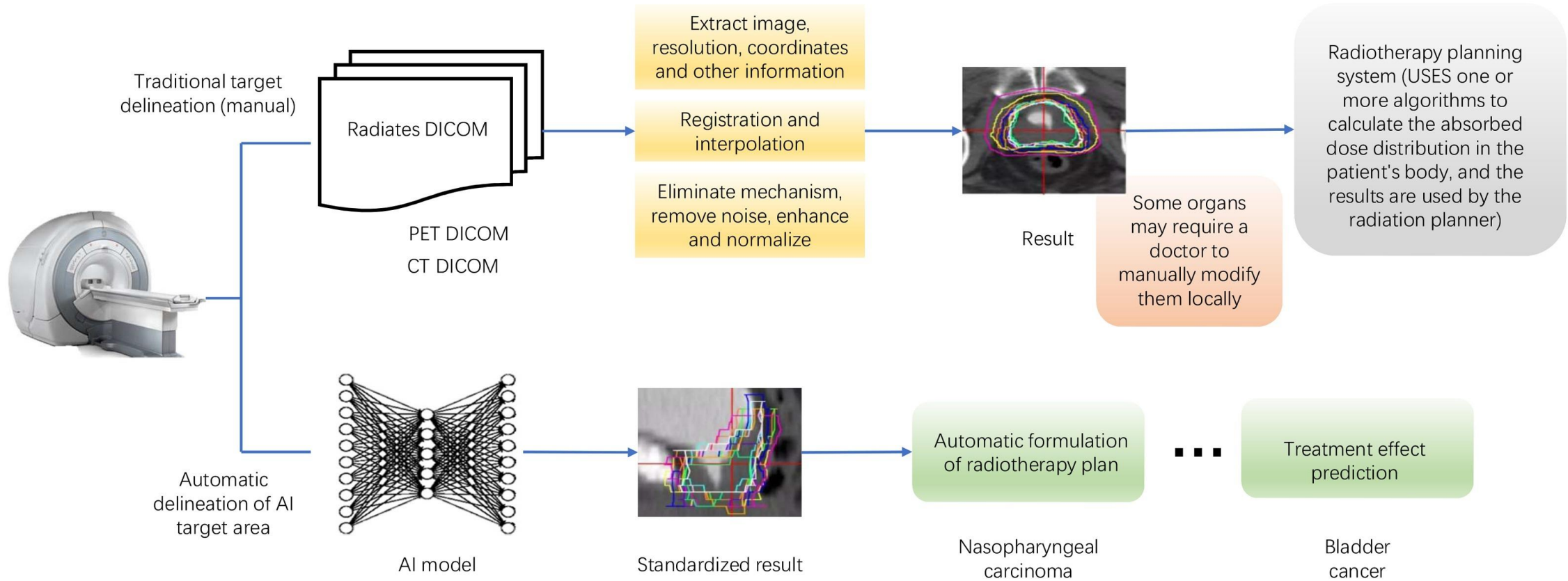
Statistics	
GDP	\$19.373 trillion (nominal; 2023 est.) <b>\$33.014 trillion (PPP; 2023 est.)</b>
GDP rank	2nd (nominal; 2023) 1st (PPP; 2023)
GDP growth	8.4% (2021) 3.0% (2022) 5.2% (2023f) 4.5% (2024f)

Central Intelligence Agency (.gov)  
<https://www.cia.gov/field/country-comparison>

Rank	Country		Date of Information
1	<u><a href="#">China</a></u>	\$31,227,000,000,000	2023 est.
2	<u><a href="#">United States</a></u>	\$24,662,000,000,000	2023 est.
3	<u><a href="#">India</a></u>	\$13,104,000,000,000	2023 est.

# AI IN RADIATION ONCOLOGY

## Automatic delineation of tumors and organs at risk



Comparison of sketch speed of target area:

AI takes 10-20 minutes

Manual work takes 4-5 hours

# CAPACITY MANAGEMENT

## LeanTaaS Overview

Silicon Valley, Charlotte and Boston based software company

- PhDs in Mathematics, Software Engineers, Product Managers, Operations Experts, Hospital Executives

\$350+ Million invested in predictive analytics platform “iQueue”

**Mission: Unlock capacity of scarce assets using predictive and prescriptive analytics:**

- Improve patient access
- Increase volumes and revenues
- Reduce wait time for patients
- Reduce operating costs
- Defer the need for facility expansion

6 Patents Pending

Awards & 3rd Party Validation



Gartner



# 605

Leading Hospitals

# 14 of top 20

Health Systems

# 175

Health Systems

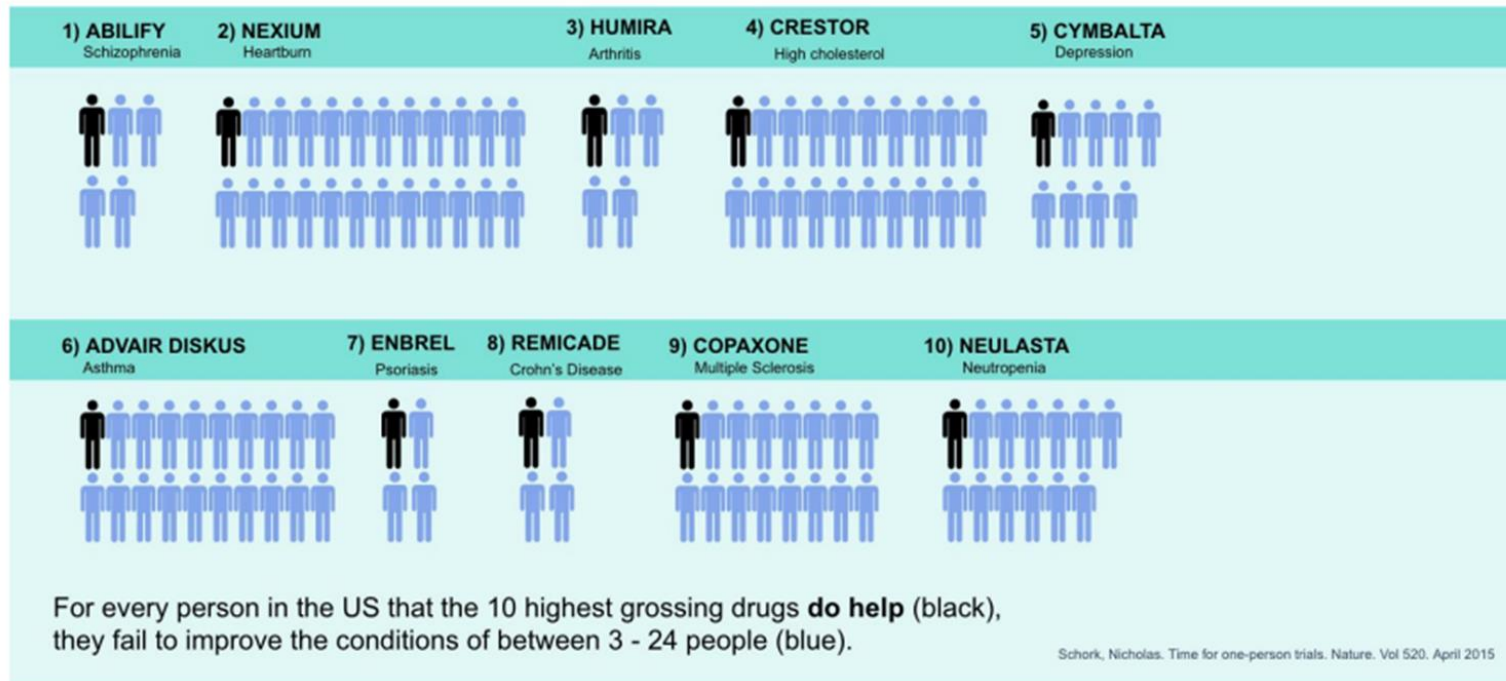
# 46

States in the U.S.

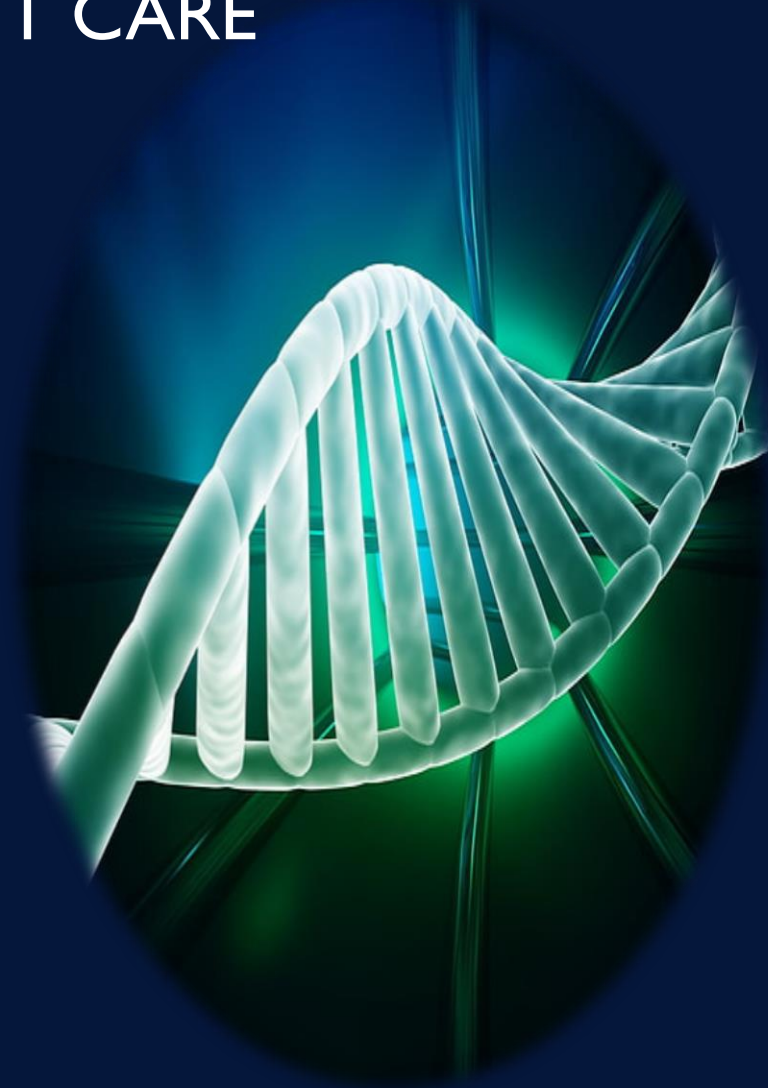


# BRIDGING SCIENCE & PRECISION PATIENT CARE

Phenome (WGS + LPR) cohorts can *stratify* diseases, from first principles.

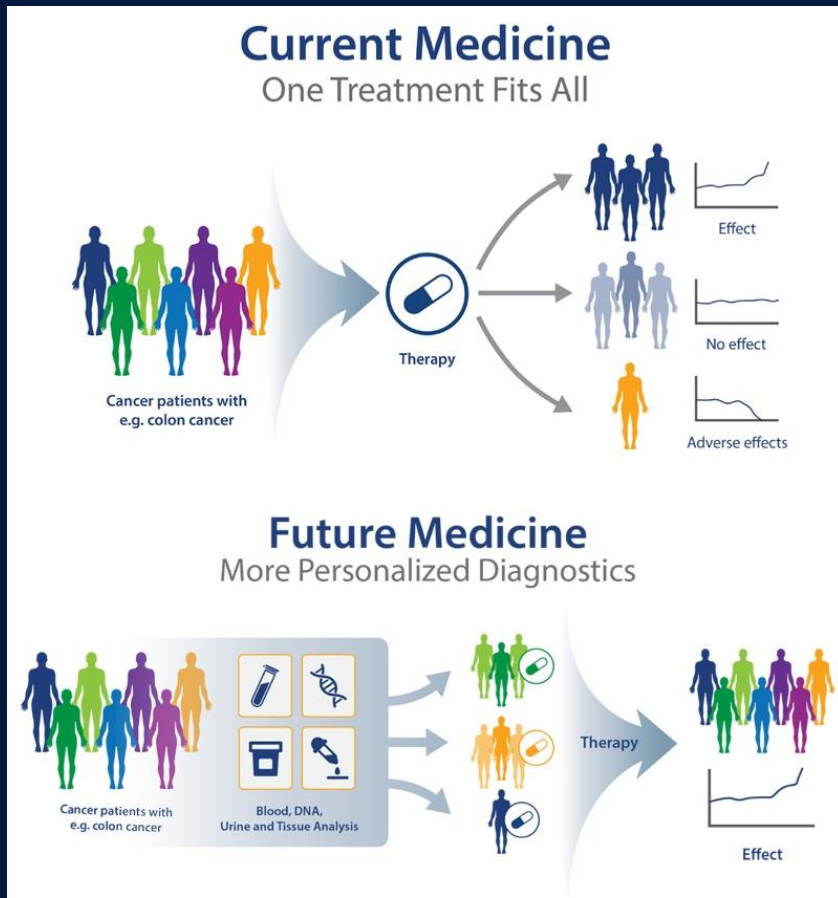


Source:  Schork, Nicholas. [Personalized Medicine: Time for one-person trials.](#) Nature. Vol 520, April 2015.





# BRIDGING SCIENCE & PRECISION PATIENT CARE



# CHANGING THE HEALTHCARE LANDSCAPE

Streamlining Workflows

Reducing Costs

Improving Collaboration

Advancing Research

Empowering Patients



Technology  
changes.....

# What Can A Quantum Computer Do Better?

Quantum computing will solve a class of problems that are unsolvable today, opening up a new realm of applications.



SEARCHING BIG DATA



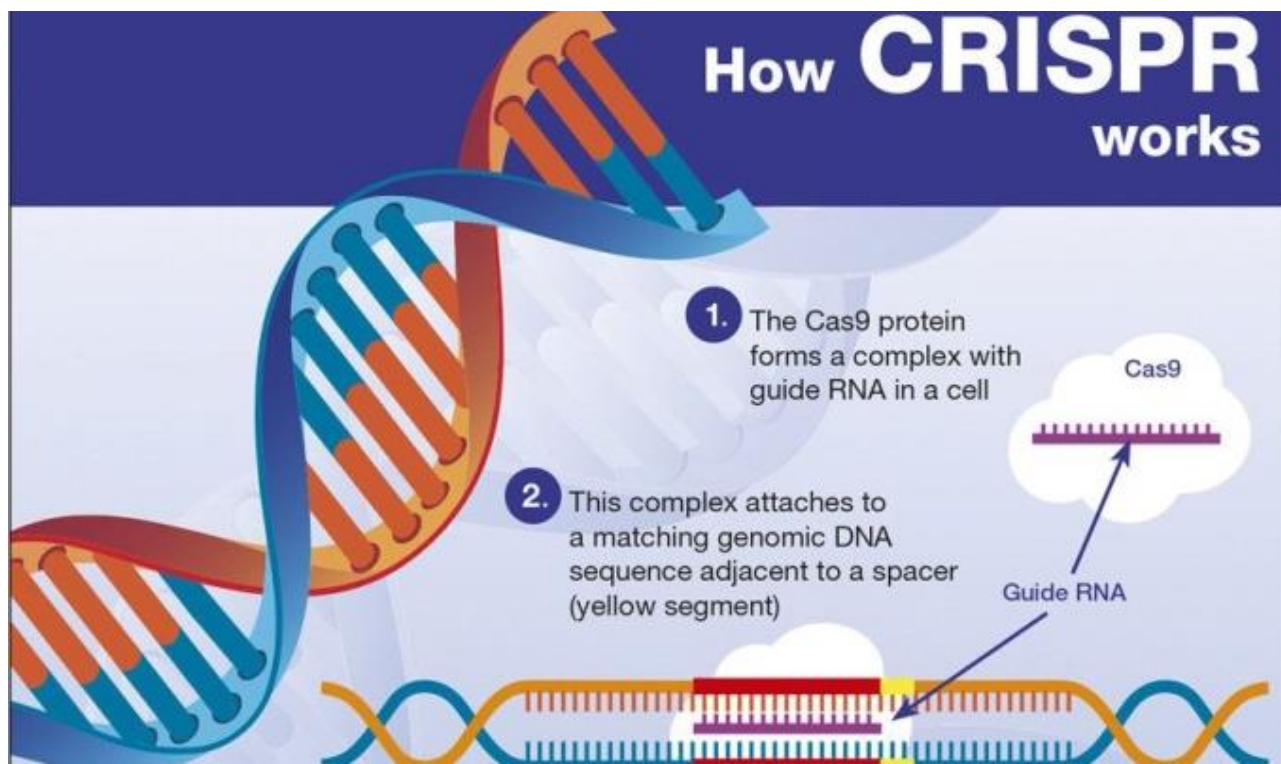
DESIGNING BETTER DRUGS & NEW MATERIALS



MACHINE LEARNING



## How CRISPR works



### illumina

#### bioinformatics

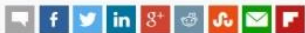
#### genetics

#### Bio

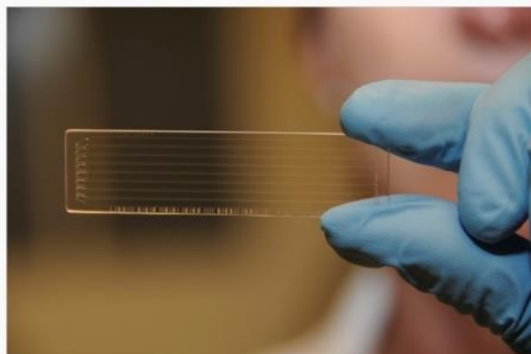
#### Popular Posts

## illumina wants to sequence your whole genome for \$100

Posted Jan 10, 2017 by Sarah Buhr (@sarahbuhr)



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AdChoices

### Crunchbase

illumina

FOUNDED

1998

OVERVIEW  
At illumina, their goal is to apply innovative technologies and revolutionary assays to the analysis of genetic variation and function, making studies

The first sequencing of the whole human genome in 2003 cost roughly \$2.7 billion, but DNA sequencing giant illumina has now unveiled a new machine that the company says is "expected one day" to order up your whole genome for less than \$100.

Buttcrup is a risque image site that pays creators

Snap CEO Evan Spiegel got a \$637 million bonus last year

Blockchain is entering the valley of despair phase, and that's a m...

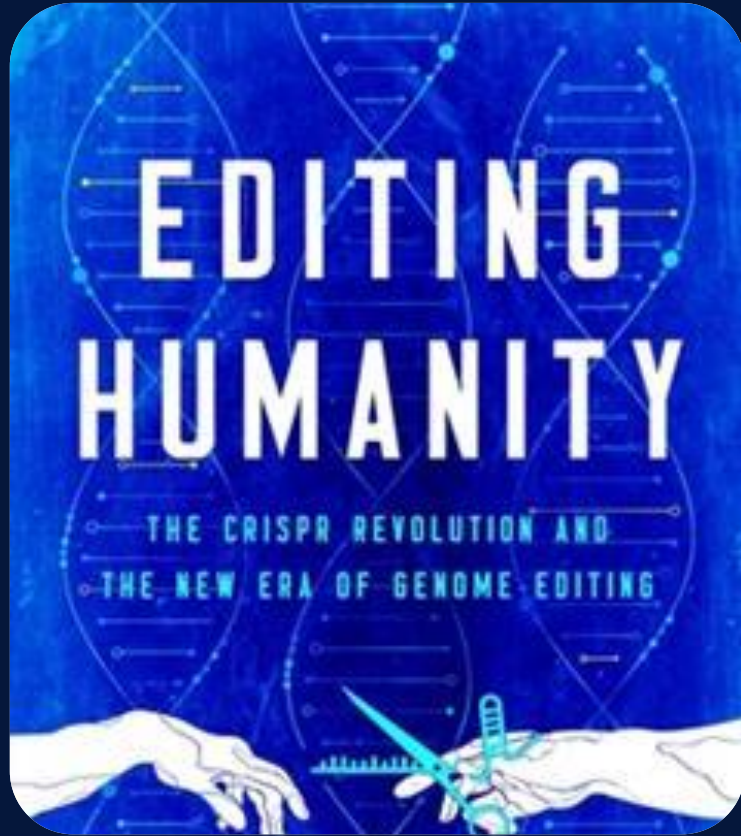
SpaceX misses catching Falcon 9 rocket fairing with a giant net on a big ship

03



*In 2012, scientists at the University of Leicester decided to print out a complete version of the human genome. When they were done, they had a 130-volume monument to humanity's essence—a seemingly endless sequence of As, Ts, Cs, and Gs in four-point type. Curiously, the printing project's costs already exceeded the costs of actually sequencing the genome anew. Since then, the price differential has only grown. Cas Kramer (Univ. Leicester) »*

# THE CRISPR REVOLUTION



*“The term ‘Holy Grail’ is overused in science,” Davies writes, “but if fixing a single letter in the genetic code of a fellow human being isn’t the coveted chalice of salvation, I don’t know what is.”*

# INNOVATION THAT BENEFITS PROVIDERS AND PATIENTS

MEDTECH

## FDA clears Paige's AI as first program to spot prostate cancer in tissue slides

By **Conor Hale** • Sep 22, 2021 11:59am

JAMA | **Original Investigation** | INNOVATIONS IN HEALTH CARE DELIVERY

## Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs

EDITORIAL

## Deep Learning Algorithms for Detection of Lymph Node Metastases From Breast Cancer Helping Artificial Intelligence Be Seen

Jeffrey Alan Golden, MD

## AI Partnership to Advance Brain Tumor Research, Treatment

Hackensack Meridian Health and Neosoma, Inc. have announced a collaboration aimed at tackling difficult-to-treat brain tumors through the use of artificial intelligence.

Radiology: Artificial Intelligence

## Improving Breast Cancer Detection Accuracy of Mammography with the Concurrent Use of an Artificial Intelligence Tool

Serena Pucil, PhD • January Lopes, MD • Pauline Chone, MPhil • Thomas Bertinotti, MS • Joao Marie Grouin, PhD • Pierre Fillard, PhD

NEJM  
Evidence

Published March 28, 2022

NEJM Evid 2022; 1 (5)

DOI: 10.1056/EVID00a2100058

ORIGINAL ARTICLE

## AI Estimation of Gestational Age from Blind Ultrasound Sweeps in Low-Resource Settings

Teeranant Pokaprakarn, Ph.D.,<sup>1</sup> Juan C. Prieto, Ph.D.,<sup>2</sup> Joan T. Price, M.D., M.P.H.,<sup>3,4</sup> Margaret P. Kasaro, M.D., M.P.H.,<sup>3,5</sup> Ntazana Sindano, B.Sc.,<sup>3</sup> Hina R. Shah, M.S.,<sup>2</sup> Marc Peterson, M.S.,<sup>4</sup> Mutinta M. Akapelwa, B.Sc.,<sup>3</sup> Filson M. Kapilya, B.Sc.,<sup>3</sup> Yuri V. Sebastião, Ph.D.,<sup>4</sup> William Goodnight III, M.D., M.S.,<sup>4</sup> Elizabeth M. Stringer, M.D., M.Sc.,<sup>4</sup> Bethany L. Freeman, M.P.H., M.S.W.,<sup>4</sup> Lina M. Montoya, Ph.D.,<sup>1</sup> Benjamin H. Chi, M.D., M.Sc.,<sup>3,4</sup> Dwight J. Rouse, M.D., M.S.P.H.,<sup>6</sup> Stephen R. Cole, Ph.D.,<sup>7</sup> Bellington Vwalika, M.D., M.Sc.,<sup>4,5</sup> Michael R. Kosorok, Ph.D.,<sup>1</sup> and Jeffrey S. A. Stringer, M.D.<sup>3,4</sup>

JAMA Guide to Statistics and Methods

## Using Free-Response Receiver Operating Characteristic Curves to Assess the Accuracy of Machine Diagnosis of Cancer

Chaya S. Moskowitz, PhD

JAMA | **Original Investigation**

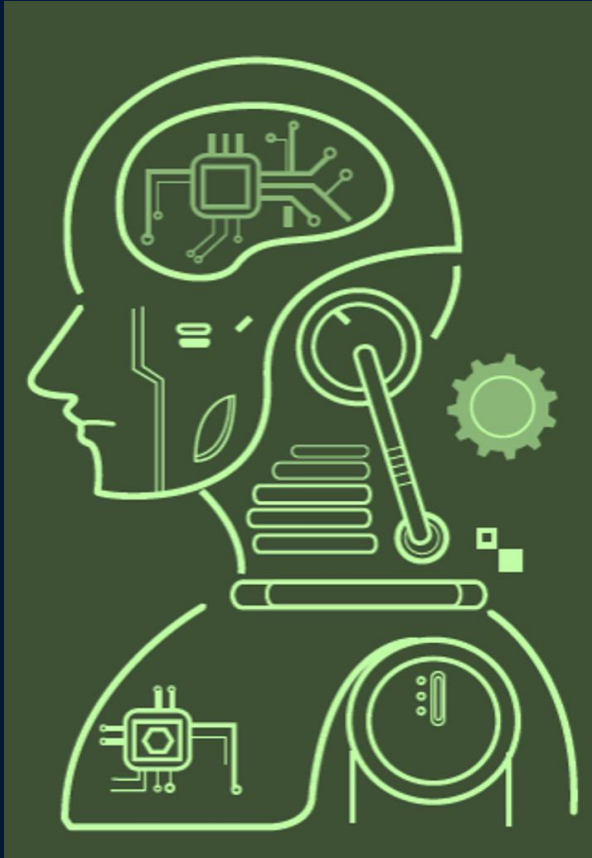
## Diagnostic Assessment of Deep Learning Algorithms for Detection of Lymph Node Metastases in Women With Breast Cancer

Babak Ehteshami Bejnordi, MS; Mitko Veta, PhD; Paul Johannes van Diest, MD, PhD; Bram van Ginneken, PhD; Nico Karssemeijer, PhD; Geert Litjens, PhD; Jeroen A. W. M. van der Laak, PhD; and the CAMELYON16 Consortium

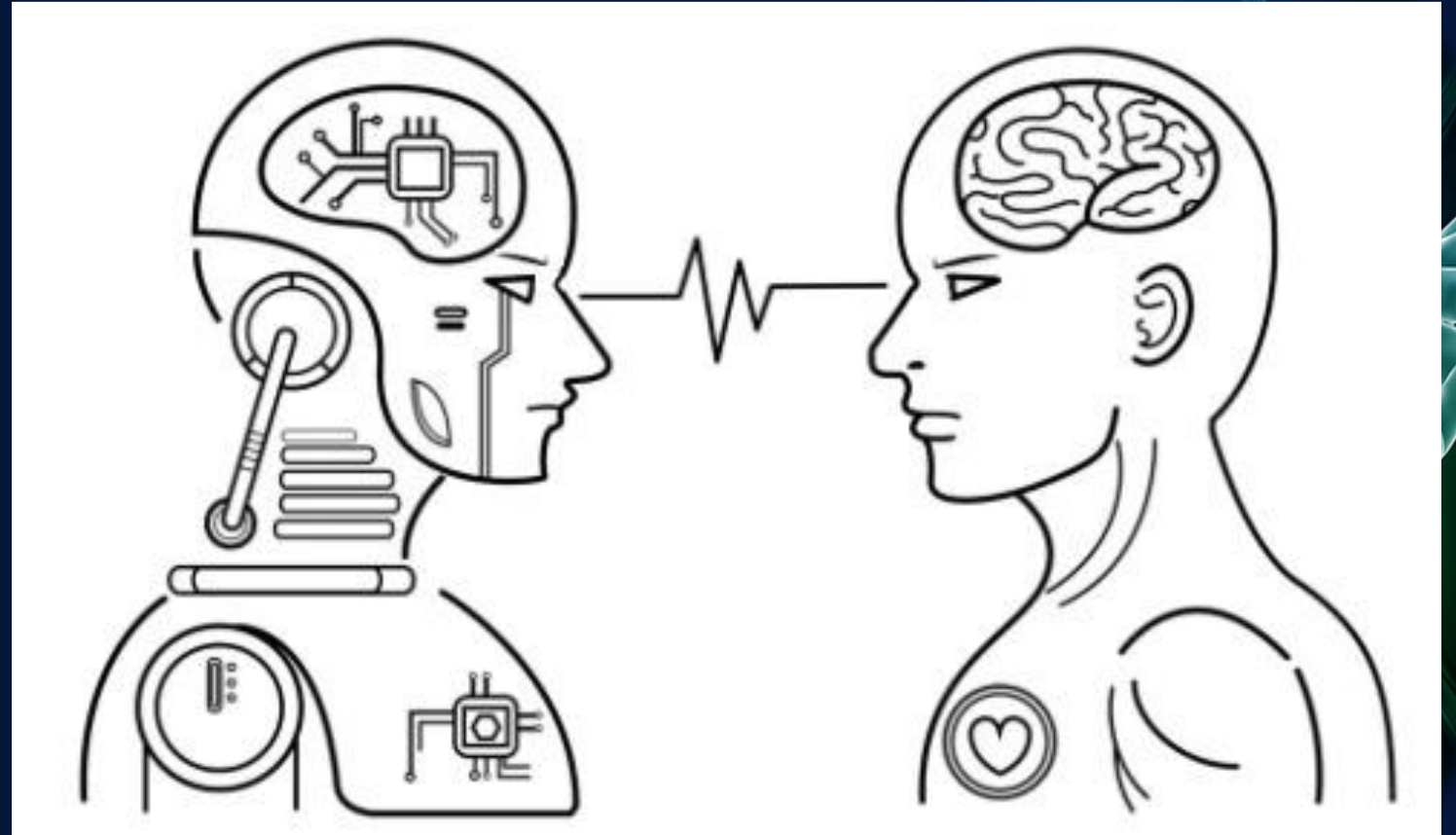
HEALTH TECH

## White House unveils CancerX innovation accelerator, new funding for cancer screenings on Moonshot anniversary

# WHAT IS AUGMENTED INTELLIGENCE?



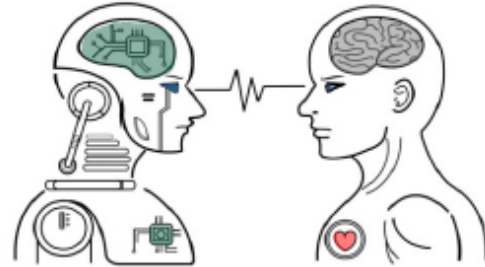
**ARTIFICIAL INTELLIGENCE (AI)**  
Incorporating human intelligence  
into machines



**AUGMENTED AI**  
Use of artificial intelligence  
to improve human performance



# GOALS OF AUGMENTED AI



**Accuracy**



**Precision  
Standardization**



**Efficiency**



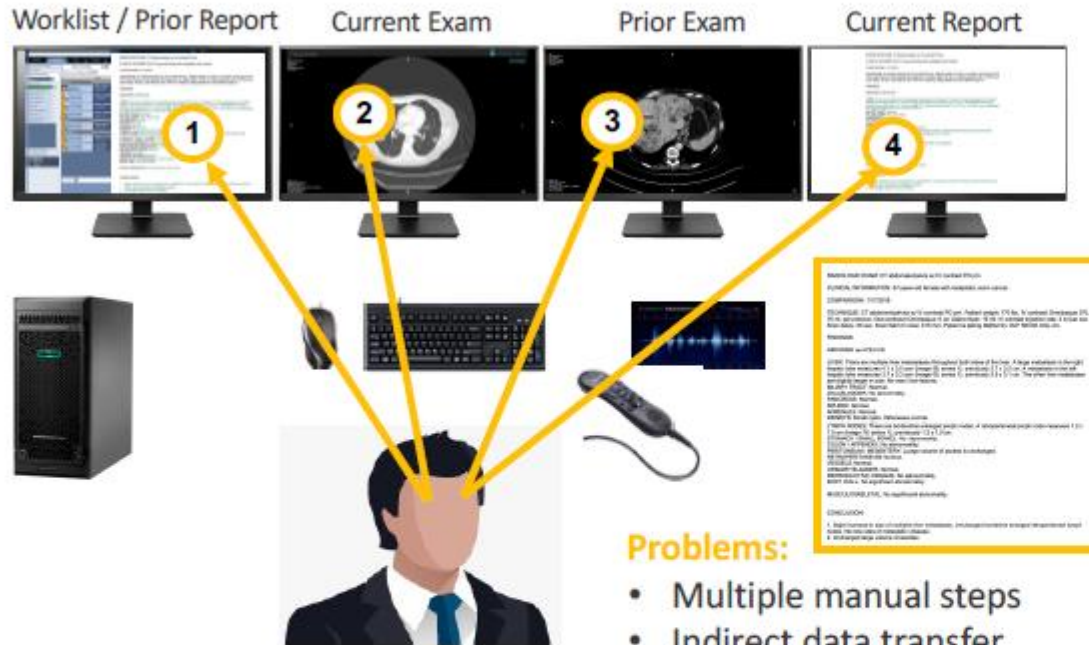
**Major Errors  
Omissions**



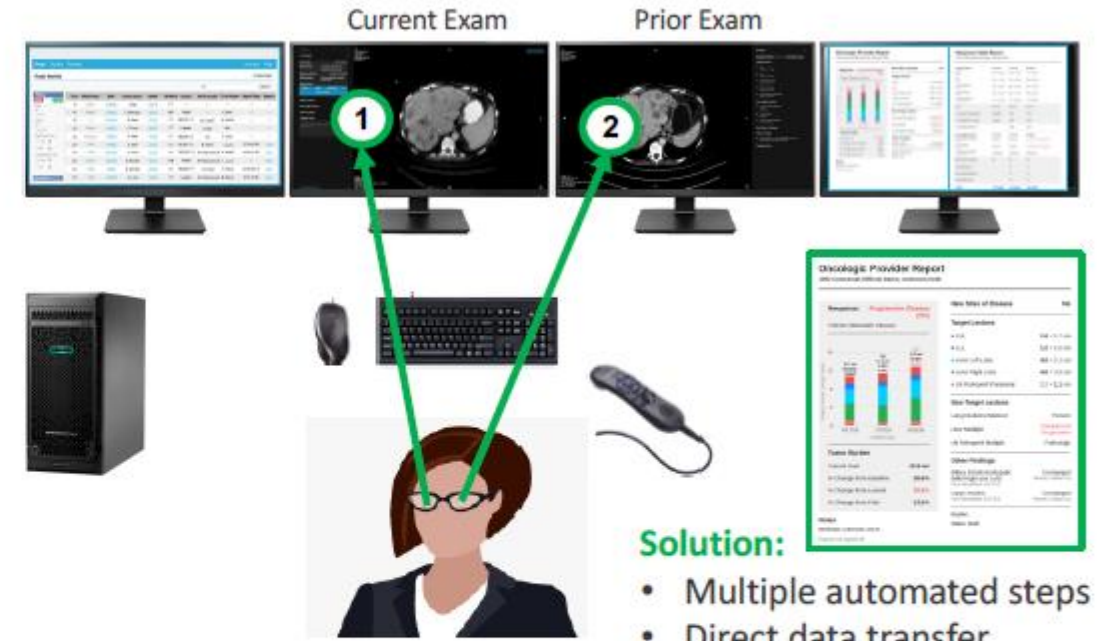
**Clarity of  
Communication**

# STANDARD OF CARE VS AUGMENTED INTELLIGENCE

## Standard of Care

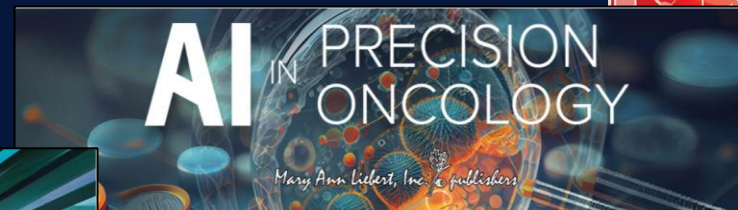
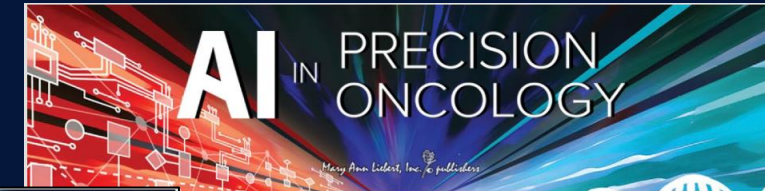


## Augmented Intelligence



# AI IN PRECISION ONCOLOGY JOURNAL

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- Submit a Feature Paper
- Submit Research and Review Papers
- Seeking National & International Board Members



FOR IMMEDIATE RELEASE  
FROM MARY ANN LIEBERT, INC., PUBLISHERS

Contact: Kathryn Ryan  
Mary Ann Liebert, Inc., publishers  
914-740-2100  
kryan@liebertpub.com

## Evaluating AI-Based Nodal Contouring in Head and Neck Cancer

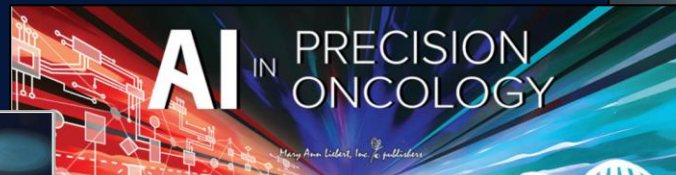
New Rochelle, NY, February 8, 2024—A new study evaluates an artificial intelligence (AI)-based algorithm for autocontouring prior to radiotherapy in head and neck cancer. Manual contouring to pinpoint the area of treatment requires significant time, and an AI algorithm to enable autocontouring has been introduced. The study is published in the peer-reviewed journal *AI in Precision Oncology*. [Click here to read the article now.](#)

Sushil Beriwal, from Allegheny Health Network, and Varian, and coauthors, analyzed 108 patients with head and neck cancers. The automated nodal contours were evaluated using a 4-point scale: a score of 4 was clinically usable with no edits; a score of 3 required minor edits; a score of 2 required major edits; and a score of 1 required complete re-contouring of the region."

The mean score for autocontouring was 3.56 +/- .40.

"Overall, the AI segmented autocontouring performed well with significant time saving and were clinically usable with no or minor edits the majority of times," concluded the investigators."

"The recent findings underscore the efficiency and reliability of AI in enhancing radiotherapy planning for head and neck cancer. With autocontouring algorithms demonstrating clinically usable results in the majority of cases, we're at the brink of a major shift in treatment preparation. This advancement not only promises significant time savings for healthcare professionals but also opens the door to potentially more precise and patient-specific treatments. As we move forward, the integration of AI into oncological care represents a pivotal step towards more streamlined and effective patient care," says Douglas Flora, MD, Editor-in-Chief of *AI in Precision Oncology*.



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From cutting-edge research and reviews to dynamic commentary and perspectives, *AI in Precision Oncology* provides the tools to enable AI's responsible and effective use in oncology for the benefit of healthcare providers and patients.

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*AI in Precision Oncology* is more than a scientific or medical journal; it is a mission-driven initiative to harness the power of AI in improving oncology care. We aim to shape an AI-enabled health care system that is equitable, efficient, and patient centered – making health care more human."  
— Douglas Flora, Editor-in-Chief



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FOR IMMEDIATE RELEASE  
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Contact: Kathryn Ryan  
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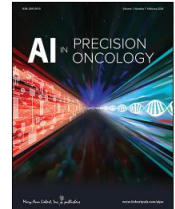
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Issue Now Available

Douglas Flora, MD

*AI in Precision Oncology* is more than a scientific or medical journal; it is a mission-driven initiative to harness the power of AI in improving oncology care. We aim to shape an AI-enabled health care system that is equitable, efficient, and patient centered – making health care more human." – Dr. Douglas



**Announce the publication of the inaugural issue of *AI in Precision Oncology*, with free access available until February 28th:**

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Nikhil G. Thaker [Read Now](#)

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Chaamy [Read Now](#)

[AI Papers: Ethics and Regulation of AI in Precision Oncology](#)  
Hills Grois [Read Now](#)

“If you’re teaching today what you were five years ago;  
either the field is dead or you are.”



-- Noam Chomsky

## 21<sup>st</sup> century curricular emphasis

- **Knowledge capture and curation:** Teaching students to distinguish between information and knowledge. Stresses knowledge capture and curation not information retention.
- **Deep understanding of probabilistic reasoning:** understanding probabilities and communicating and applying them meaningfully
- **Collaboration with and management of AI applications**
- **Cultivation of empathy and compassion**

# CURRENT LIMITATIONS AND CHALLENGES

## Healthcare Algorithms Are Biased, and the Results Can Be Deadly

Deep-learning algorithms suffer from a fundamental problem: They can adopt unwanted biases from the data on which they're trained. In healthcare, this can lead to bad diagnoses and care recommendations.

### How Bias Can Creep into Health Care Algorithms and Data

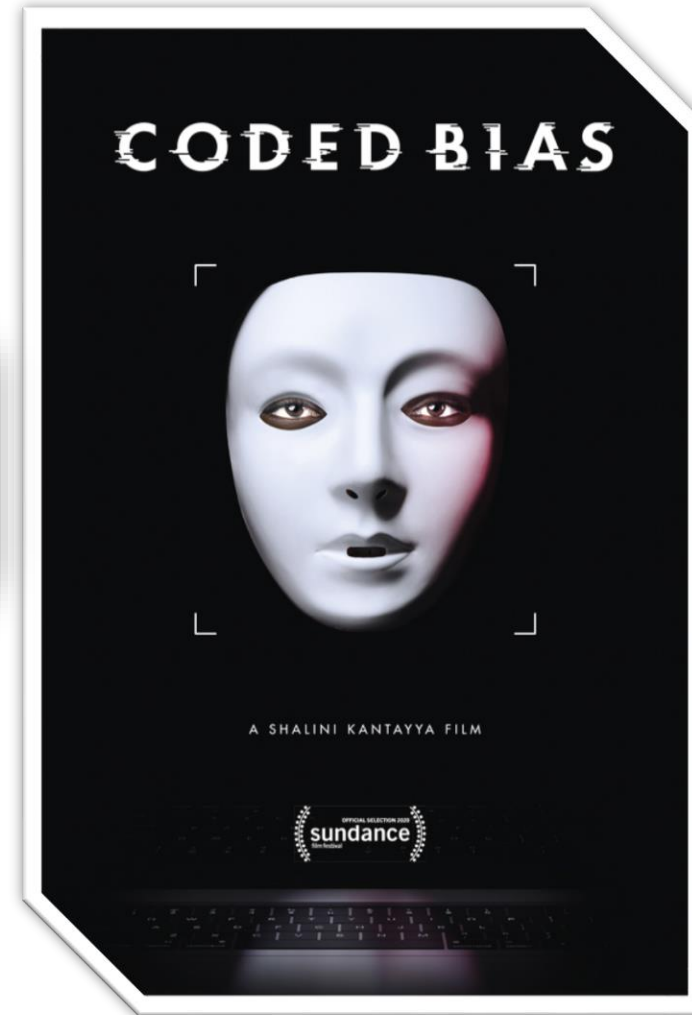
Health care is rife with bias. Without careful attention, AI will perpetuate those inequities.

Amazon Still Pushing Biased Facial-Recognition Software To Law Enforcement, MIT Researcher Contends

**Biases in Artificial Intelligence Led to Healthcare Disparities**  
Researchers from the US and China note that several biases found in artificial intelligence design perpetuate healthcare disparities.

**Racial bias in a medical algorithm favors white patients over sicker black patients**

**A US government study confirms most face recognition systems are racist**



# Easter Parades in New York City

Year 1900: One Motor Vehicle

Year 1913: One Horse & Carriage



2529-9

**Change is accelerating**  
**Stay alert & engaged**  
**Be open to possibilities**  
**...and buckle up!**







Thank you!

# Q & A



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