

# Coaching Session In-progress

Please come in and find your table  
but keep noise to a minimum.  
Thanks!



Institute for Healthcare Quality,  
Safety and Efficiency

SCHOOL OF MEDICINE

UNIVERSITY OF COLORADO **ANSCHUTZ MEDICAL CAMPUS**

# DHA Antimicrobial Stewardship: Intervention Plan

- Aim Statement
- Inputs *(1-2 liner about findings from each that influenced your intervention)*
  - Voice of the customer
  - Affinity diagram/Process Map
  - Pre-mortem
- Proposed Intervention



# Certificate Training Program Session 15

## **Welcome! Before We Begin:**

Sign-in at the back

Pick up agenda

Sit with your CTP team at your assigned table



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# CALL FOR APPLICATIONS

## CERTIFICATE TRAINING PROGRAM (CTP)

**Learn | Develop | Lead**

A professional development program for inter-professional leadership teams of outpatient clinics, hospital units, or multi-site clinical programs.

- Yearlong course combining classroom sessions, coaching, and completion of a process improvement project
- Focus on leadership, change management, team development, patient safety, quality and process improvement

**Application & letters of support due April 14, 2025**

## CLINICAL EFFECTIVENESS & PATIENT SAFETY (CEPS) GRANT

**Seeding Promising Ideas**

Providing funding to faculty, staff, and trainees up to \$25,000 for initiatives at CHCO or UCH with a focus on:

- Innovative process improvements
- Patient safety outcomes
- Increasing healthcare value
- Implementing evidence-based practices

**Letter of Intent due April 14, 2025**



Anschutz

**Need help building your strongest application?**

**Contact us! [IHQSE@cuanschutz.edu](mailto:IHQSE@cuanschutz.edu)**

**Visit [ihqse.org](http://ihqse.org) for  
more information**





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# CONGRATULATIONS!

## SAMANTHA HOLDEN, MD

PENNY S. BURKE ENDOWED CHAIR  
IN BEHAVIORAL NEUROLOGY

**IHQSE PARTICIPANT**



# We are hiring!

- Education and Events Program Manager
- New role within the IHQSE leadership team
  - Manage and grow our portfolio of programs
  - Ensure we are delivering a premium experience for all attendees
  - Improve program evaluation
- Please share! We will include link to job posting in follow-up email



KEY
Team Check-in
Inspiration
Background
Process Improvement
Leadership
Quality/Safety
Coaching
EMR

KEY	Team Check-in	Inspiration	Background	Process Improvement	Leadership	Quality/Safety	Coaching	
1/28	#12	UCH Sleep	Overcoming Resistance	Feedback to Improve Performance		Mid-year Report Practice Session		
2/4		Coaching						
2/11	#13	Report Outs				Leading Change: Removing Barriers		
2/18		Coaching						
2/25	#14	Report Outs				Running Effective Meetings		
3/4		Coaching						
3/11	#15	Using AI for QI		Leadership Journey: Jena Hausmann		Second Victim		
3/18		Coaching						
3/25		Coaching						
4/1	#16	DHA Antimicrobial Stewardship	Data to Understand Impact	Positive Organizational Design		Leading Change: Short-term Wins		
4/8	#17	CU Medicine Dermatology	Impact of Quality and Safety on Healthcare Finance		Leading through Complexity	DEI & Leadership		
4/15		Coaching						
4/22	#18	CHCO Nursery	Strategic Planning			QI Spread	Power & Influence	
4/29		Coaching						
5/13	#19	UCH Infectious Diseases	Burnout & Resilience		Innovation in Healthcare	Embed the Change		
5/20		Coaching						
5/27	#20	Leadership Journey: Dean Sampson	Report Outs					
6/3		Coaching						
6/10	#21	Report Outs						
6/17		Coaching						
6/24	#22	Reflecting on Why			Certificates		Closing Time	

KEY	Team Check-in	Inspiration	Background	Process Improvement	Leadership	Quality/Safety	Coaching
Coaching	Develop mid-year report out						
#14 Feb. 25	Report Outs	How do I share my project work with others?		<input type="checkbox"/> Create a plan for removing barriers to success <i>Due March 25</i>	✓ Mid-year Report ✓ Create a plan for removing barriers to success		
	Running Effective Meetings	How can we run more effective meetings?					
Coaching	Create plan for removing barriers to success						
#15 Mar. 11	Leadership Journey: Jena Hausmann	What does it take to succeed in progressive leadership positions?					
	Second Victim	How should we act/react when things go wrong?					
	Using AI for QI	How will AI impact healthcare?					
Coaching	Finalize barrier removal						
#16 Apr. 1	Team Check-in: DHA Antimicrobial Stewardship	Who are my colleagues?		<input type="checkbox"/> Create a series of short-term wins to support project <i>Due April 8</i>			
	Data to Understand Impact	How do I know if my project has made a significant change?					
	Positive Organizational Design	How do I build a high-performing culture?					

# Today's Learning Objectives

- 1 See an example of the leadership journey from a healthcare executive.
- 2 Recognize and support the care givers involved in safety events.
- 3 Understand current state of AI in healthcare.
- 4 Understand some simple prompting techniques that can increase the effectiveness of large language models.
- 5 Recognize limitations in use of large language models in healthcare.







# HARNESSING AI IN OUR HEALTHCARE IMPROVEMENT JOURNEY



James Barry MD, MBA

Professor of Pediatrics, Section of Neonatology  
University of Colorado School of Medicine



Department of Pediatrics

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Children's Hospital Colorado

# Topics

- What is Artificial Intelligence (AI)? +
- Where is AI in Healthcare? +
- What are Large Language Models (LLMs)? +
- Pertinent Prompting +
- LLMs For Quality and Safety +
- Understanding LLM Bias





# Could AI Have Assisted Our IHQSE Project?

## A Cross-Sectional Study of GPT-4–Based Plain Language Translation of Clinical Notes to Improve Patient Comprehension of Disease Course and Management

Anivarya Kumar , B.A.,<sup>1</sup> Huanfei Wang , B.S.,<sup>2</sup> Kelly W. Muir , M.D., M.H.Sc.,<sup>3</sup> Vishala Mishra , M.B.B.S., M.M.Ci.,<sup>4</sup> and Matthew Engelhard , M.D., Ph.D.<sup>5</sup>

NEJM AI 2025;2(2)

[DOI: 10.1056/Aloa2400402](https://doi.org/10.1056/Aloa2400402)

- 553 pts; Dec 2023 - Feb 2024, >18 YOA, able to read English, no cognitive impairment
- read 4 DC summaries, 2 DSNs (selected at randomly replaced by GPT-4–based plain language translations.





# Could AI Have Assisted Our IHQSE Project?

- 392 (72.73%) reported little-to-no health-related knowledge,
- 341 (63.27%) had a Bachelor's degree or lower
- 188 (34.88%) had a low-to-medium proficiency in English

## A Cross-Sectional Study of GPT-4-Based Plain Language Translation of Clinical Notes to Improve Patient Comprehension of Disease Course and Management

Anivarya Kumar<sup>1</sup>, B.A.,<sup>1</sup> Huanfei Wang<sup>2</sup>, B.S.,<sup>2</sup> Kelly W. Muir<sup>3</sup>, M.D., M.H.Sc.,<sup>3</sup> Vishala Mishra<sup>4</sup>, M.B.B.S., M.M.Cl.,<sup>4</sup>  
and Matthew Engelhard<sup>5</sup>, M.D., Ph.D.<sup>5</sup>

-LLMs can be used to improve patients' understanding of clinical notes, including details of clinical visits and steps for self-management of disease.

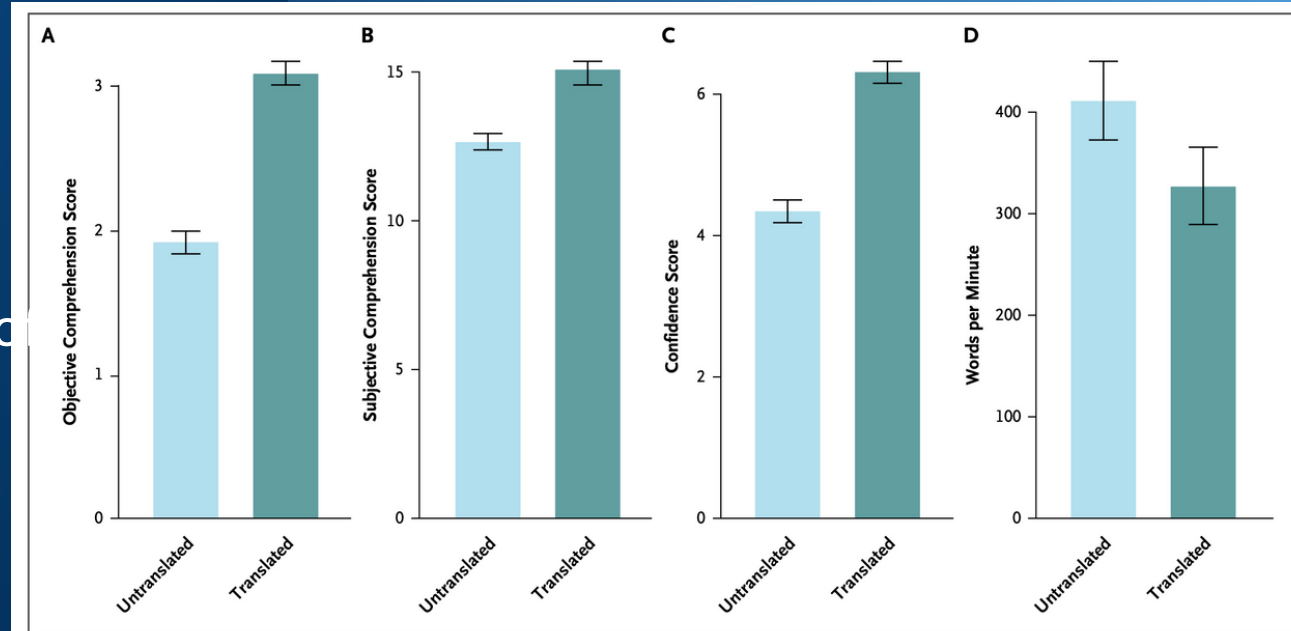


Figure 1. Effect of GPT-4-Translation on Objective and Subjective Comprehension, Confidence, and Reading Time across All Discharge Summary Notes.

# Resources

**AIMED:** <https://ai-med.io>



**Author: Anthony Chang, MD, MBA, MPH, MS**

I am a pediatric cardiologist and have cared for children with heart disease for the past three decades. In addition, I have an educational background in business and finance as well as healthcare administration and global health – I gained a Masters Degree in Public Health from UCLA and taught Global Health there after I completed the program.

**American Board of AI in Medicine (ABAIM).** Multidisciplinary two-day **introductory** and **advanced courses** with educational certification as well as a one-day **AI primer** for everyone have been ongoing for almost two years.

The **Alliance for Centers of Artificial Intelligence in Medicine (ACAIM)** is a coalition of the centers around the world that have a dedicated leader and team within a health center with a focus on artificial intelligence in all dimensions of medicine and healthcare. We have now a **total** of over 50 centers, including more than 20 AI-focused efforts in pediatric health institutions.

**Medical Intelligence Society (MIS).** Clinicians and data scientists with interest and passion for AI in clinical medicine and healthcare with **monthly meeting** and **annual summit** in July.  
(MISociety.org)

# Other AI Resources

## Books:

1. “Artificial Intelligence: A Modern Approach” by Stuart Russell and Peter Norvig
2. “Deep Learning” by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
3. “Artificial Intelligence with Python” by Prateek Joshi

## Websites:

1. OpenAI ([openai.com](https://openai.com))
2. AI Conference ([aiconf.org](https://aiconf.org))
3. AI-Forum ([ai-forum.org](https://ai-forum.org))
4. Stanford Artificial Intelligence Laboratory ([ai.stanford.edu](https://ai.stanford.edu))

## Medical Journals:

1. NEJMAI (<https://ai.nejm.org>)
2. JAMA+AI (<https://jamanetwork.com/channels/ai>)



## Online Courses:

1. Coursera’s Introduction to Artificial Intelligence ([coursera.org/learn/introduction-to-ai](https://coursera.org/learn/introduction-to-ai))
2. Udacity’s Artificial Intelligence Nanodegree ([udacity.com/course/artificial-intelligence-nanodegree-nd898](https://udacity.com/course/artificial-intelligence-nanodegree-nd898))
3. edX’s Artificial Intelligence Fundamentals ([edx.org/learn/artificial-intelligence](https://edx.org/learn/artificial-intelligence))

# About Us

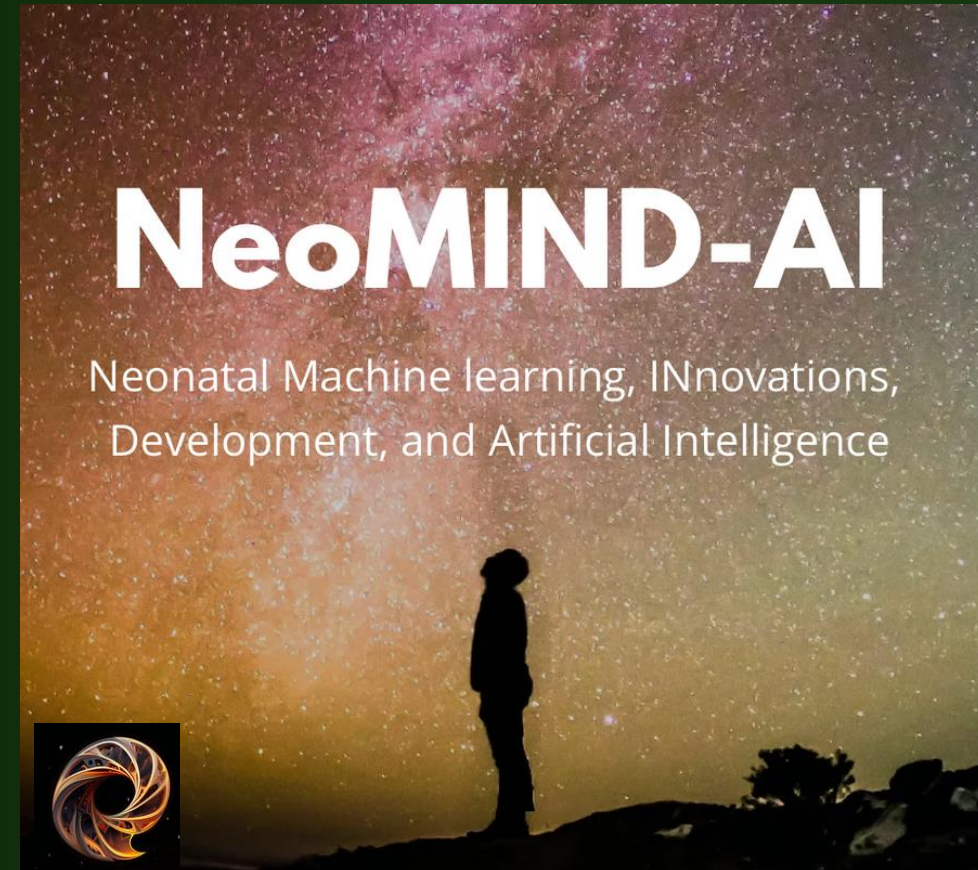
We have come together in the spirit of  
collaboration and curiosity

WHO?

Neonatologists, Data Scientists, and Clinical  
Informaticists

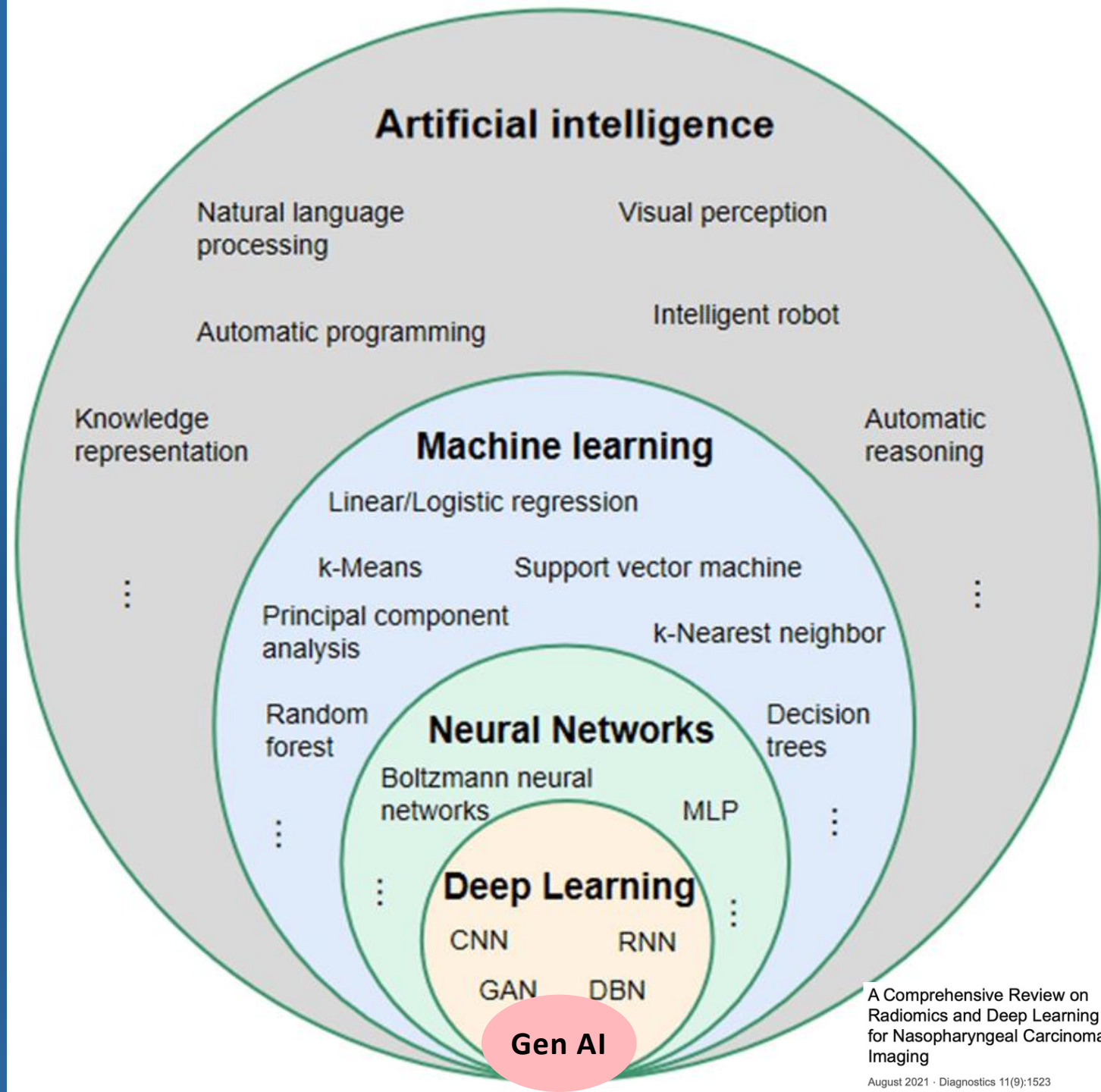
WHY?

Focus on AI; Neonatal and Pediatric Critical Care/Medicine

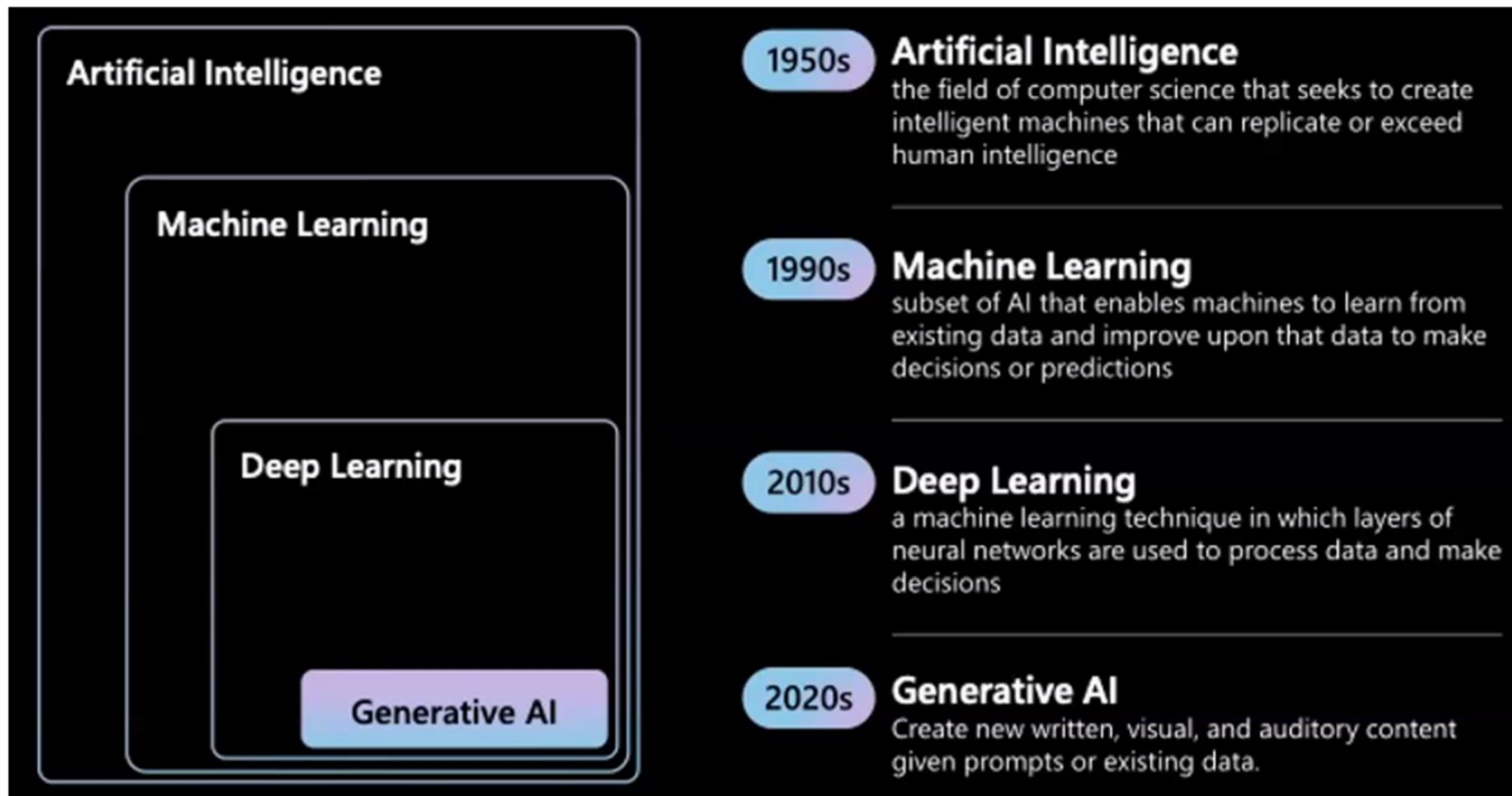


<https://neomindai.com>





# AI is not new, but Generative AI is



# AI Based On Capabilities

AI Realized today



Theoretical AI

## 1-Narrow

- Only type that exists today
- Has a **defined task**
- Needs a **human to train it**
- Siri, self driving cars**

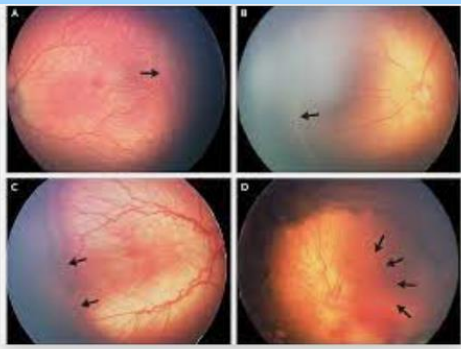
## 2-Artificial General Intelligence

- Uses previously learned skills and learnings to **accomplish a new task without the need of human training--**
- TRANSFER LEARNING**
- can do **anything** that a human could do.
- can do any **cognitive task**.
- Self driving car that drives around a protest**

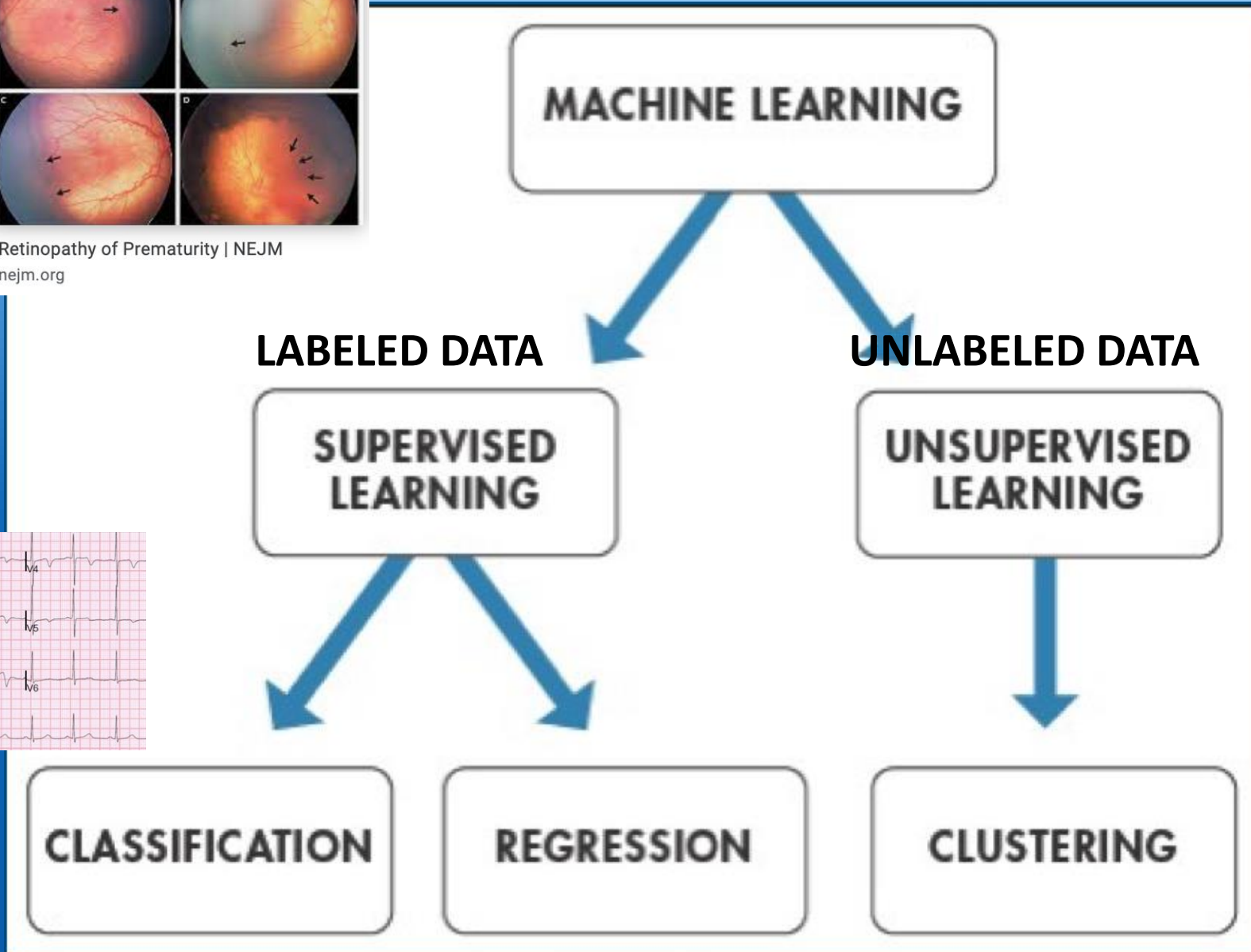
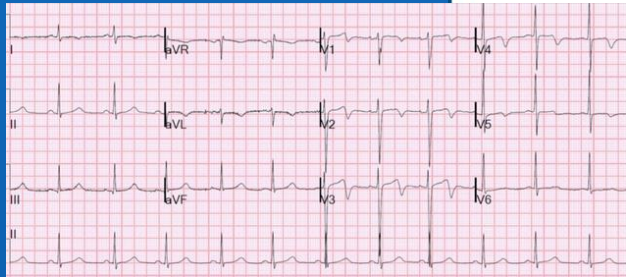
## 3-Super AI

- would **think, reason, learn, make judgements,** and possess **cognitive abilities** that exceed humans.
- would have **own emotions, beliefs, and needs**





Retinopathy of Prematurity | NEJM  
nejm.org



**BPD**



**NEC**





# NICU PHYSIOLOGICAL DATA

## Reduction in Mortality by 20% with Neonatal Heart Rate Variability Changes Due to Sepsis--- HeRO Monitoring



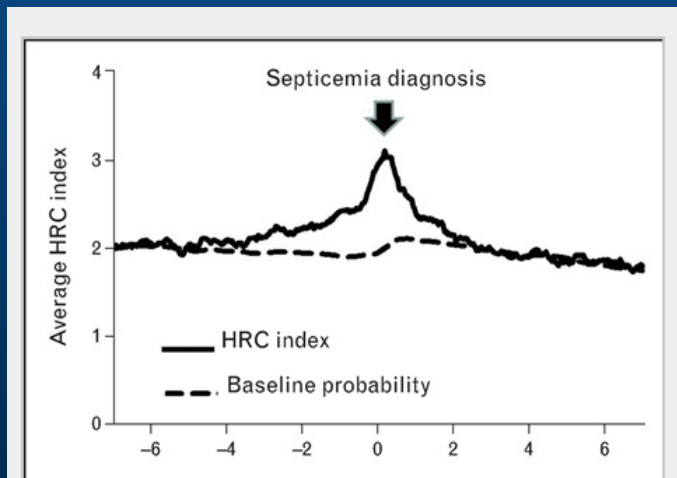
HeRO ES is an embedded HeRO System that can run **within** specific Philips Intellivue MX monitors!

### Predictive monitoring for early detection of sepsis in neonatal ICU patients

Fairchild, Karen D.

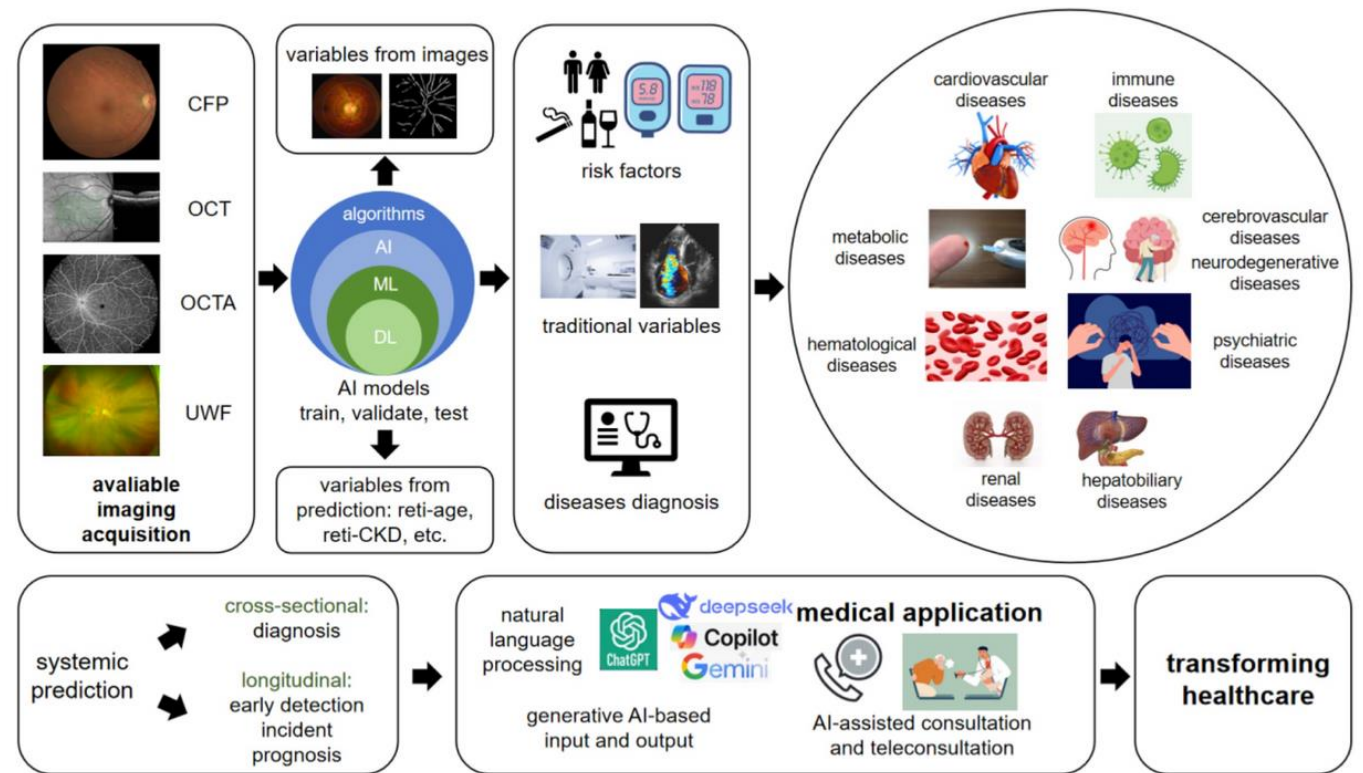
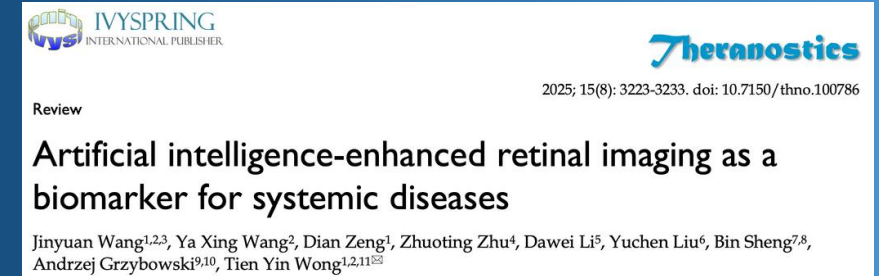
[Author Information](#)

*Current Opinion in Pediatrics* 25(2):p 172-179, April 2013. | DOI: 10.1097/MOP.0b013e32835e8fe6



# ML and DL analysis of retinal images to detect pathology

- Age and Biological Age Estimation (e.g., "Retinal Age Gap")
- Gender Identification
- Body Mass Index (BMI)
- Smoking Status
- Hemoglobin A1c (HbA1c) levels
- Blood Pressure (Hypertension)



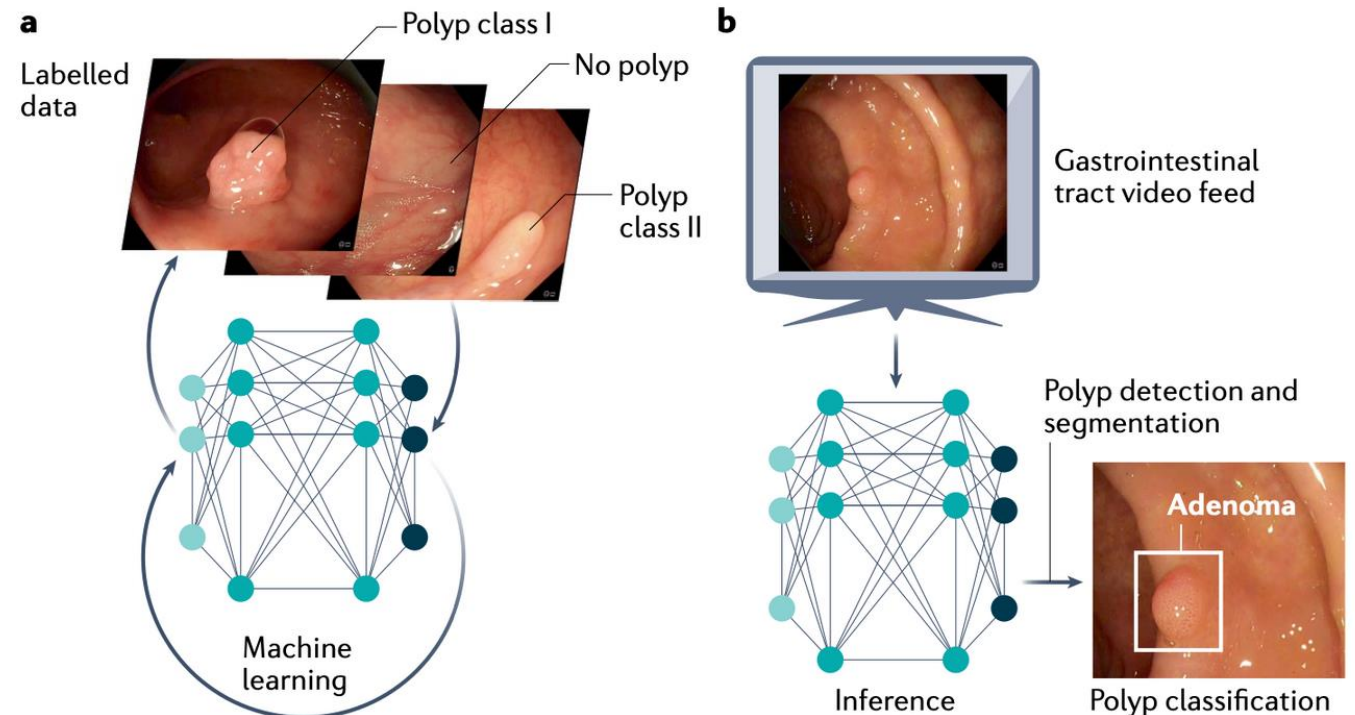
**Figure 1. The overview of how AI-enhanced retinal imaging predicting systemic diseases and the future considerations.** Based on various modalities of available retinal imaging, through the pre-trained AI algorithms, we can predict risk factors, traditional variables and diseases diagnosis, which already applied in disorders from nearly all systems, including cardiovascular, metabolic, hematological, renal, hepatobiliary, psychiatric, cerebrovascular, neurodegenerative and immune diseases. The prediction includes not only diagnosis, but also early detection, incident and prognosis of the disorders based on the training on longitudinal data. The emerging new era of generative AI brings promising opportunities on medical application and healthcare transforming times. CFP: color fundus photo; OCT: optical coherence tomography; OCTA: optical coherence tomography angiography; UWF: ultra-wide field; AI: artificial intelligence; ML: machine learning; DL: deep learning.

# Computer Vision and GI pathology

## Artificial intelligence and automation in endoscopy and surgery

Nature Reviews Gastroenterology & Hepatology | Volume 20 | March 2023 | 171–182

Detection rates of important pathologies using CNN exceeds human only approaches

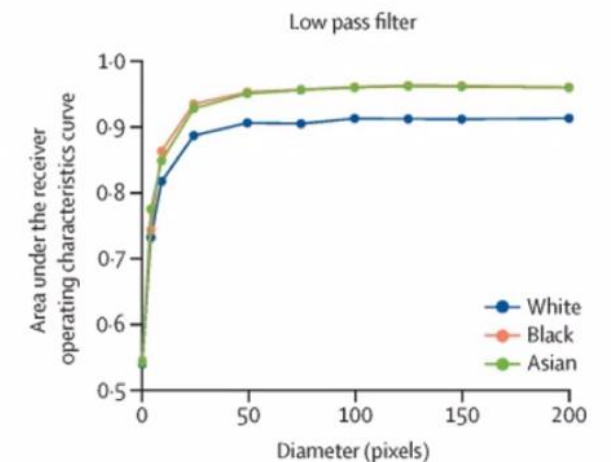
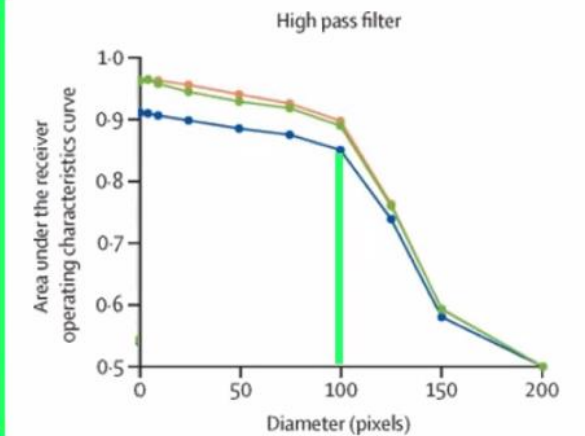
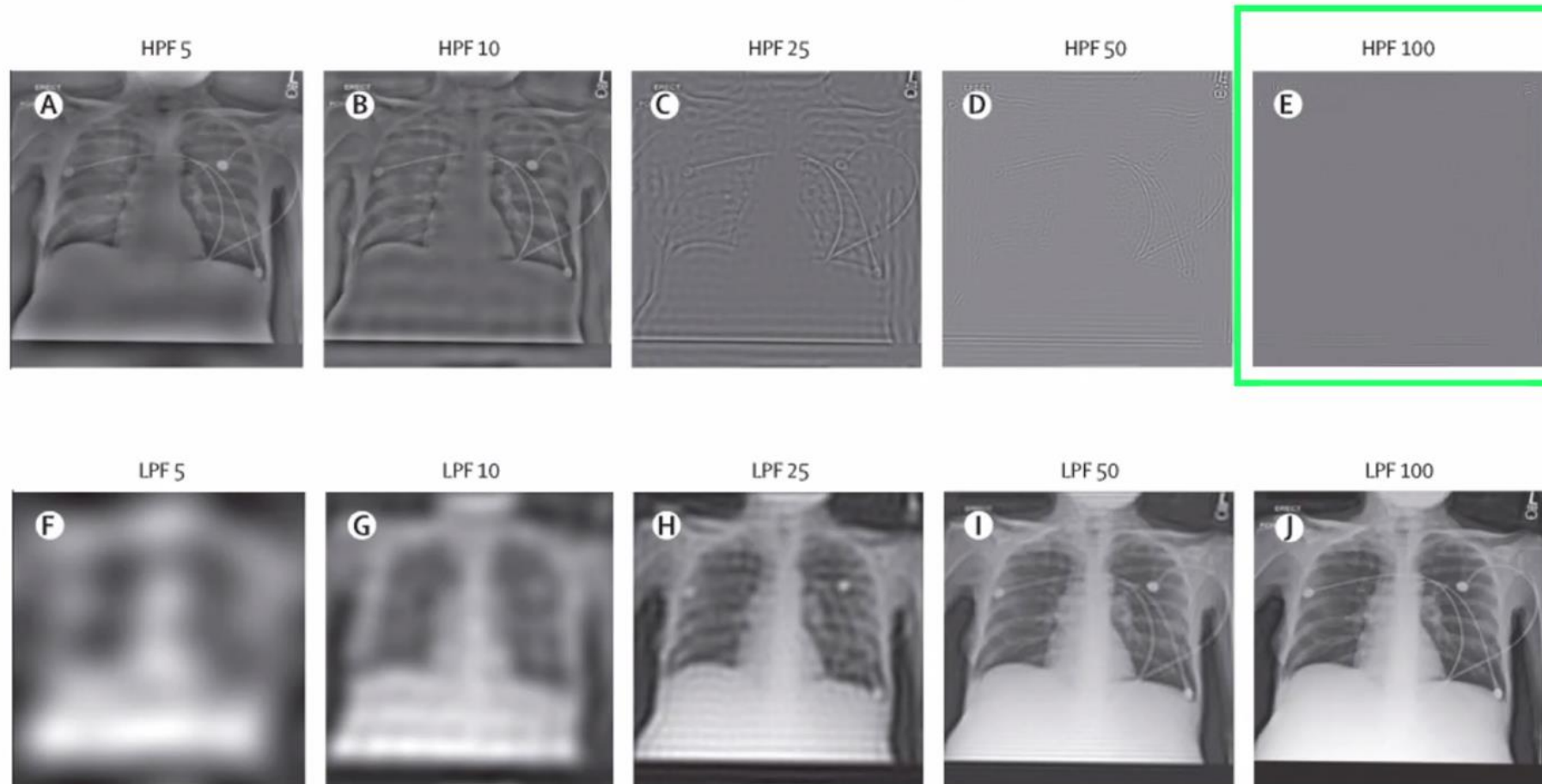




# AI recognition of patient race in medical imaging: a modelling study

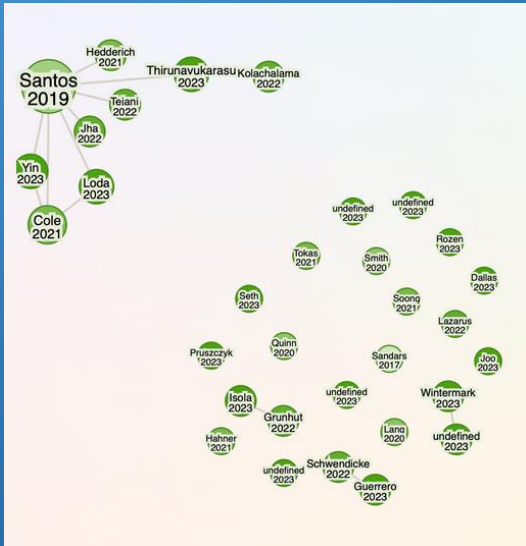


Judy Wawira Gichoya, Imon Banerjee, Ananth Reddy Bhimireddy, John L Burns, Leo Anthony Celi, Li-Ching Chen, Ramon Correa, Natalie Dullerud, Marzyeh Ghassemi, Shih-Cheng Huang, Po-Chih Kuo, Matthew P Lungren, Lyle J Palmer, Brandon J Price, Saptarshi Purkayastha, Ayis T Pyrros, Lauren Oakden-Rayner, Chima Okechukwu, Laleh Seyyed-Kalantari, Hari Trivedi, Ryan Wang, Zachary Zaiman, Haoran Zhang

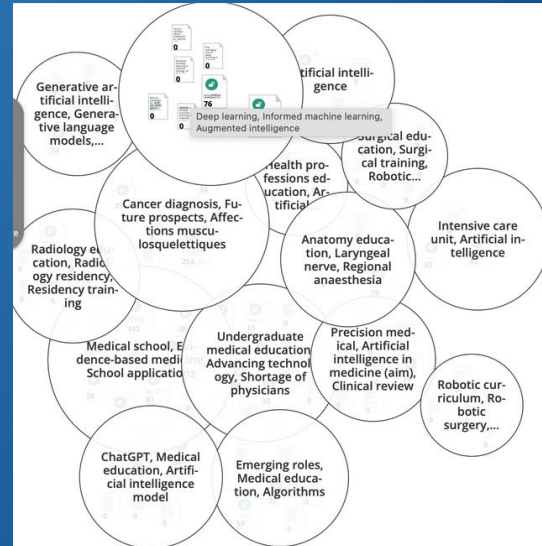


# Literature Reviews


# research rabbit



# open knowledge maps



# open evidence

 All    how long does it take for e coli to develop multi-drug resistance?



Showing answer for: **How** long does it take for **Escherichia** coli to develop multi-drug resistance?

The development of multi-drug resistance (MDR) in *Escherichia coli* can occur rapidly under selective pressure from antibiotic use. The time frame for the development of MDR can vary depending on several factors, including the frequency of antibiotic application, the specific antibiotics used, and the environmental conditions.

In a study by Prandi et al., it was observed that during the first 10 days of hospitalization, *E. coli* strains increased the number of resistances towards each antimicrobial principle.

<sup>[1]</sup> Van den Bergh et al. demonstrated that high levels of multidrug tolerance in *E. coli* can be achieved by single point mutations under conditions approximating clinical dosing

# Notebook LM

 Google NotebookLM  
<https://notebooklm.google.com> 

Google NotebookLM

Consensus  
<https://consensus.app> ⋮  
Consensus: AI-powered Academic Search Engine



The image shows the Glass Health logo, which consists of a stylized circular emblem made of overlapping lines. To the right of the emblem, the words "GLASS HEALTH" are written in a white, sans-serif, all-caps font. Below this, the text "AI-Powered Clinical Decision Support" is displayed in a large, white, sans-serif font, with "AI-Powered" on one line and "Clinical Decision Support" on the next. At the bottom, a smaller line of white text reads: "We empower clinicians with our AI platform for developing differential diagnoses and drafting clinical plans."

# It is not just PUBMED or UPTODATE anymore

# **ISSUES WITH AI in HEALTHCARE**



**Garbage In,  
Garbage Out**

**Accountability**

**Explainability**

**Trustworthiness**



# AI in Healthcare

Today

.....



Generative AI

Education

Administration



Machine Learning

Image Acquisition and Analysis

Predictive Analytics



Deep Learning

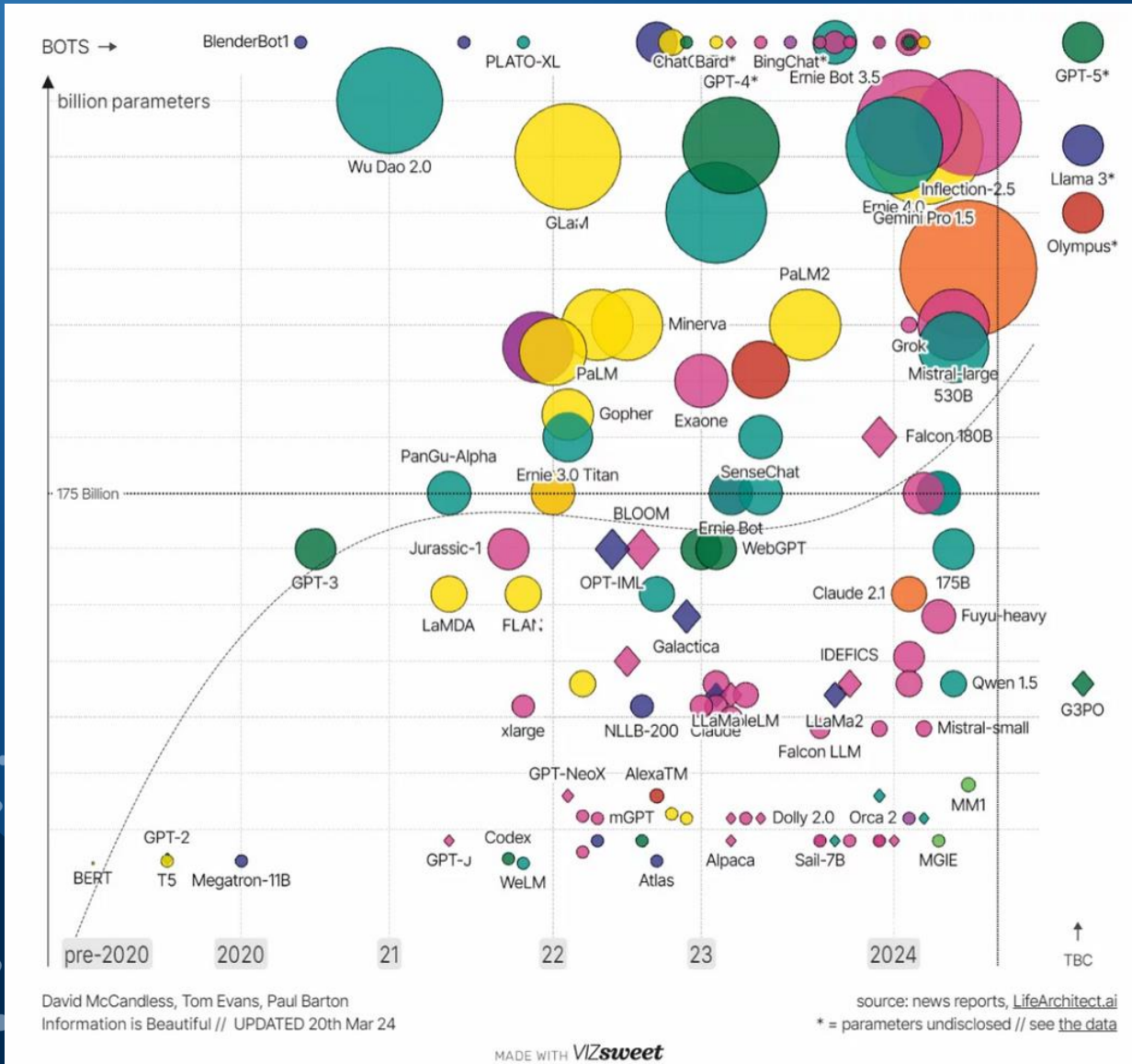
# What Is a large language model (LLM)?

- Powerful AI systems trained to understand and generate human language (now multi-modal)
- They Are **Prediction Machines**
- They Have Democratized Data





# Common LLMs



◆ Gemini



Microsoft  
Copilot

✶ Claude

✶ perplexity

🌀 ChatGPT

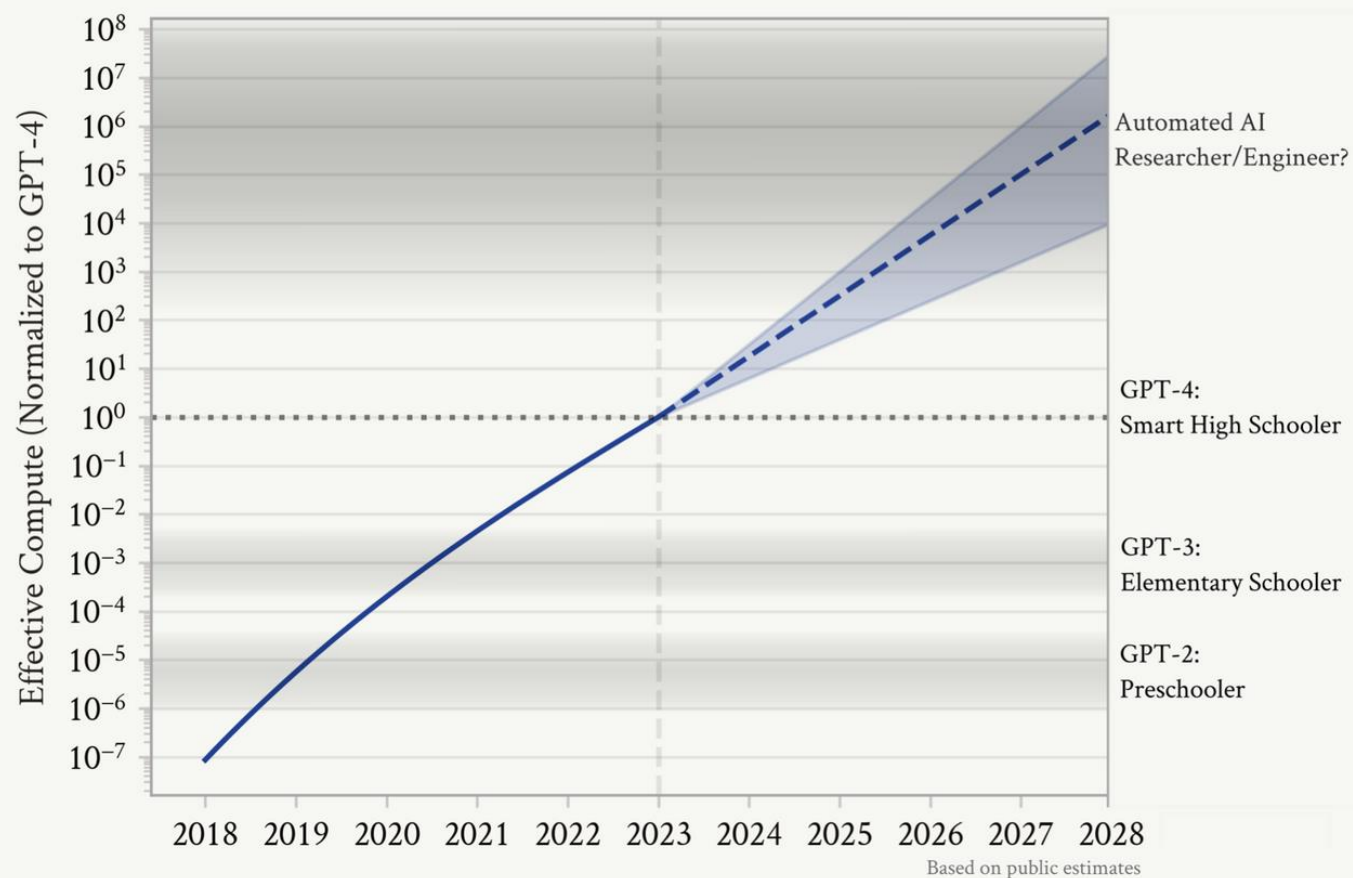
✕ Grok





# Gen AI Has Changed Fast

Base Scaleup of Effective Compute



# Gen AI Has Changed Fast

arXiv > cs > arXiv:2408.06292

Computer Science > Artificial Intelligence

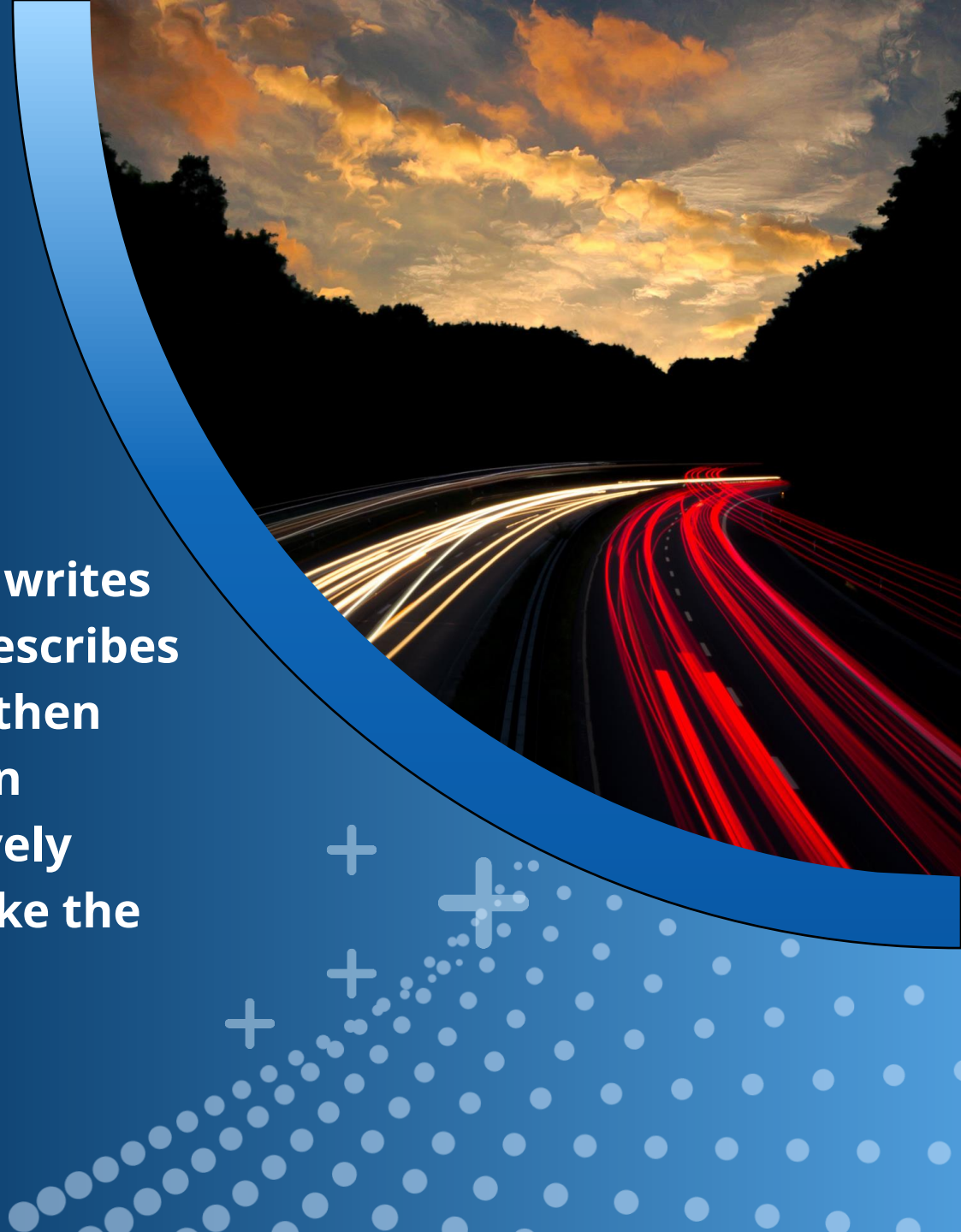
[Submitted on 12 Aug 2024 (v1), last revised 1 Sep 2024 (this version, v3)]

## The AI Scientist: Towards Fully Automated Open-Ended Scientific Discovery

Chris Lu, Cong Lu, Robert Tjarko Lange, Jakob Foerster, Jeff Clune, David Ha

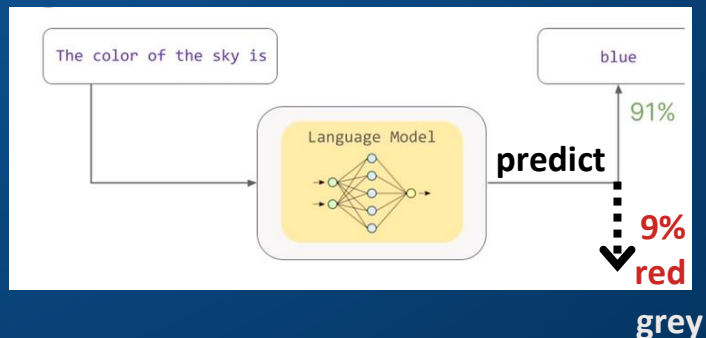
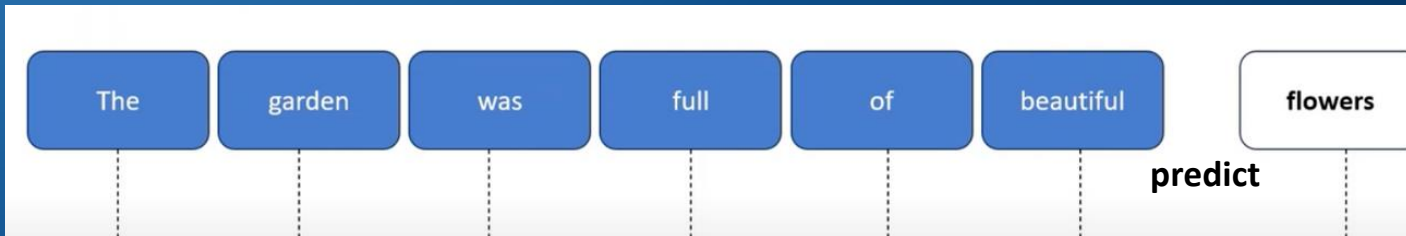
- **The AI Scientist**; generates novel research ideas, writes code, executes experiments, visualizes results, describes its findings by writing a full scientific paper, and then runs a simulated review process for evaluation. In principle, this process can be repeated to iteratively develop ideas in an open-ended fashion, acting like the human scientific community.

<https://sakana.ai/ai-scientist/>



# What is LLM Training?

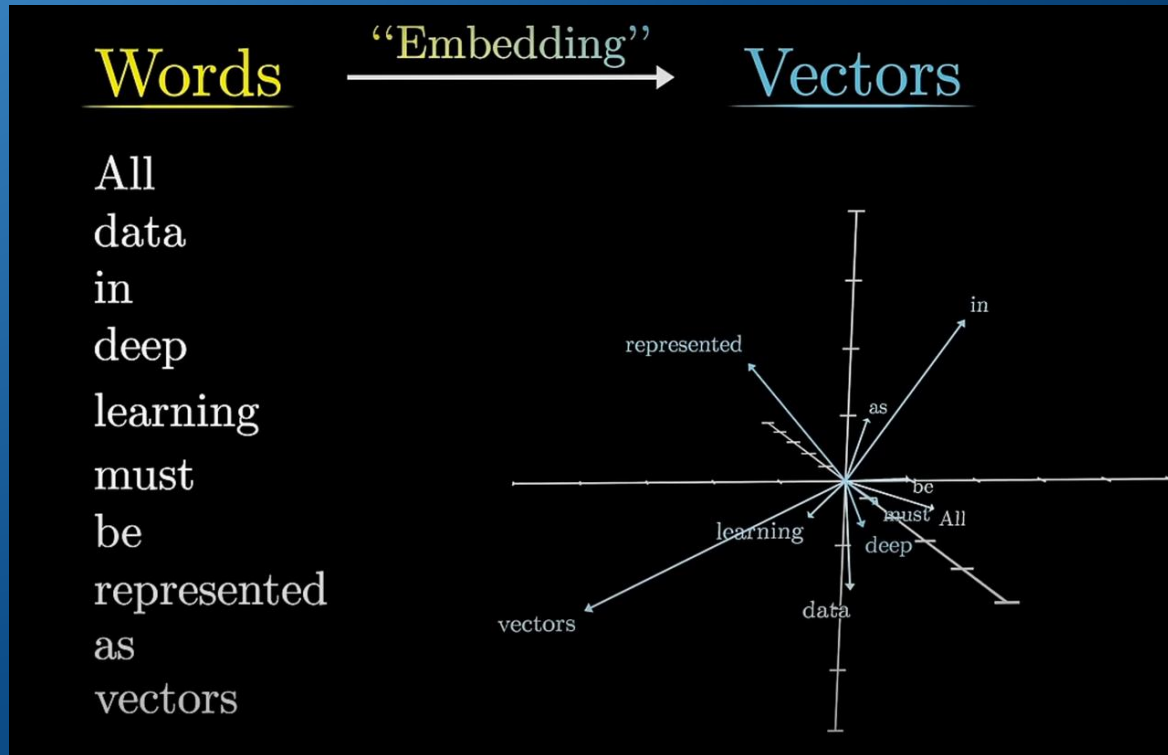
- LLMs “learn” in various ways;
  - human reinforcement learning
  - self attention
  - reward systems





# What is LLM Training?

- **Vectors** Place Tokens in **3D Coordinates**

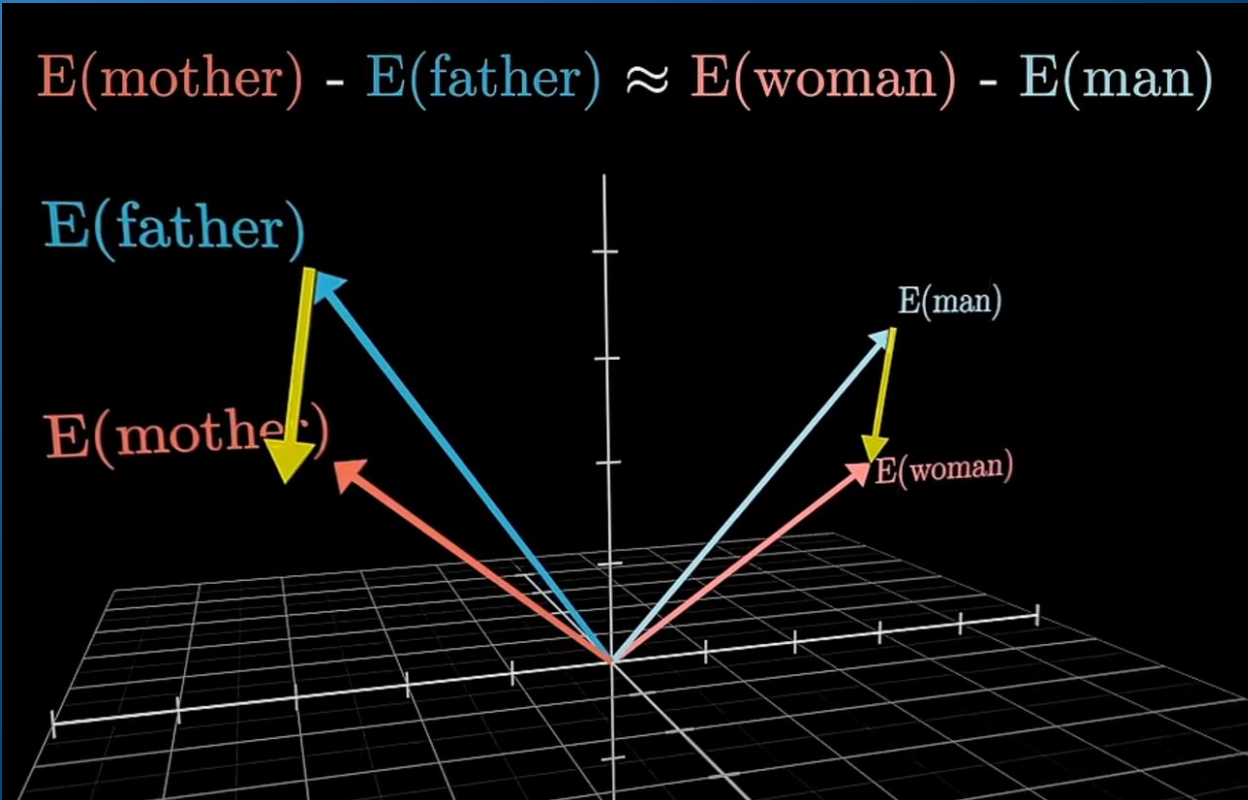


- Like Tokens; Placed Near One Another



# What is LLM Training?

- Relations Between Vectors Creates the **Context Associations**



# GENERAL LLM USE CASES

Healthcare Domain	LLM Application	Efficiency Improvement
Clinical Care	Automated medical note generation from patient interactions	Reduces physician burnout and saves time on documentation
Clinical Decision Support	Real-time diagnostic support based on clinical guidelines and patient data	Faster, more accurate decision-making, improved patient outcomes
Patient Communication	AI-driven chatbots for answering patient queries, appointment scheduling	Improves patient engagement and reduces administrative workload
Documentation	Automated summarization of patient history, progress notes, discharge summaries	Streamlines paperwork, reduces documentation errors
Revenue Cycle Management	Automated coding suggestions based on clinical notes and billing data	Reduces coding errors, accelerates reimbursement cycles
Prior Authorization	AI-assisted review of payer requirements for treatment authorization	Speeds up approval process, reduces administrative delays
Supply Chain Management	Demand forecasting and automated restocking of medical supplies	Ensures optimal stock levels, reduces shortages and overstocking
Research & Data Analysis	Summarization of research papers and clinical trials	Speeds up literature reviews and data extraction for research teams
Patient Monitoring	Analyzing patient sensor data and alerts for abnormal patterns	Enhances remote monitoring, reduces unnecessary in-person visits
Education & Training	Personalized learning materials for medical students and staff	Improves learning outcomes and provides tailored educational content

# Important Points When You Use These LLMs

- How important is it that the answer it generates is correct? **Helpful, Honest, Harmless**
- Can I Fact Check It? **Like You Would A First Year Med Student**





# Jim's Rules for LLMs

- Don't Enter Any Private Info
- Do Not Blindly Trust Output
- 80%, 20%-half good, half fake
- Do Not Use for Clinical Care
- Treat First Output as a rough draft





# LLM Prompting

**Prompts-** instructions given to an LLM to enforce rules, automate processes, and ensure specific qualities (and quantities) of generated output.

**Prompts-** a form of programming to customize the outputs & interactions.

## ROLE

**Act as an expert in:**  
-quality improvement  
computer programming  
-research design  
-race car driving  
-statistics  
-cooking  
--economics

## CONTEXT

I will be giving a  
**presentation** to  
clinicians on AI use in  
quality improvement

## ACTION

**-create an outline** for a  
10 minute talk on the  
topic

## Tone

-formal, causal,  
persuasive, informative

## OUTPUT

Use the Topics you  
created for the outline  
to **create a 10 slide  
power point  
presentation** with one  
slide per topic.

# CHATGPT PROMPTING CHEAT SHEET

## Act as a (ROLE)

- CEO
- Marketer
- Inventor
- Therapist
- Journalist
- Advertiser
- Copywriter
- Ghostwriter
- Accountant
- Entrepreneur
- Mindset Coach
- Project Manager
- Prompt Engineer
- Website Designer
- Best Selling Author

## Create a (TASK)

- Essay
- Recipe
- Article
- Ad Copy
- Headline
- Analysis
- Blog Post
- Summary
- Sales Copy
- Video Script
- SEO Keywords
- Book Outline
- Email Sequence
- Social Media Post
- Product Description

## Show as (FORMAT)

- List
- PDF
- XML
- HTML
- Code
- Graphs
- A Table
- Rich Text
- Summary
- Markdown
- Word Cloud
- Spreadsheet
- Gantt Chart
- Plain Text file
- Presentation Slides



“Acting as a (ROLE) perform (TASK) in (FORMAT)”

Act as a [ROLE]	
1. Analyst	23. Excel Sheet
2. Teacher	24. Plagiarism Checker
3. Marketer	25. Relationship Coach
4. Advertiser	26. Recruiter
5. Mindset Coach	27. JavaScript Console
6. Therapist	
7. Journalist	
8. Inventor	
9. Lawyer	
10. Ghostwriter	
11. Website Designer	
12. Best Selling Author	
13. Chief Financial Officer	
14. Expert Copywriter	
15. Prompt Engineer	
16. Accountant	
17. Project Manager	
18. Sports Coach	
19. Financial Analyst	
20. Full Stack Developer	
21. Linux Terminal	
22. "Position" Interviewer	

Create a [TASK]
1. Headline
2. Article
3. Essay
4. Book Outline
5. Email Sequence
6. Social Media Post
7. Product Description
8. Cover Letter
9. Blog Post
10. SEO Keywords
11. Summary
12. Video Script
13. Recipe
14. Sales Copy
15. Analysis
16. Ad Copy
17. Web Page

Show as [FORMAT]
1. A Table
2. A List
3. Summary
4. HTML
5. Code
6. Spreadsheet
7. Graphs
8. CSV file
9. Plain Text file
10. JSON
11. Rich Text
12. PDF
13. XML
14. Markdown
15. Gantt Chart
16. Word Cloud
17. Emojis
18. An Analogy
19. Bullet Points

Set restrictions
1. Use poetic language
2. Adopt a formal tone
3. Write short sentences
4. Code only in HTML/CSS
5. Use Shakespearean style
6. Write using basic English
7. Use only scientific sources
8. Add pop culture references

Prompts For Biz Owners
1. Give me a list of inexpensive ideas on how to promote my business better.
2. Acting as a Business Consultant, What is the best way to solve this problem of [Problem]?
3. Create a 30-Day Social Media Content Strategy based on [Topic 1] & [Topic 2].

Prompts for Developers
1. Develop an architecture and code for a <description> website with JavaScript.
2. Help me find mistakes in the following code <paste code below>
3. I want to implement a sticky header on my website. Can you provide an example using CSS and JavaScript?
4. Please continue writing this code for JavaScript <past code below>

Prompts for Marketers
1. Can you provide me with some ideas for blog posts about [topic]?
2. Write a product description for my [product or service or company].
3. Suggest inexpensive ways I can promote my [company] without using social media.
4. How can I obtain high-quality backlinks to improve the SEO of [website name]?

Prompt Priming
1. ZERO - "Write me 5 Headlines about [Topic]"
2. SINGLE - "Write me 5 Headlines about [Topic]. Here is an example of one headline: 5 Ways to Lose Weight"
3. MULTIPLE - "Write me 5 Headlines about [Topic]. Here is an example of some headlines: 5 Ways to Lose Weight, How to Lose More Fat in 4 Weeks, Say Goodbye to Stubborn Fat, Find a faster way to Lose Weight Fast"

Prompts for Designers
1. Generate examples of UI design requirements for a [mobile app].
2. How can I design a [law firm website] in a way that conveys [trust and authority]?
3. What are some micro-interactions to consider when designing a Fintech app?
4. Create a text-based Excel sheet to input your copy suggestions. Assume you have 3 members in your UX writing team.

C.R.E.A.T.E Formula for Prompt Engineering
1. <b>C: Character</b> - Define the AI's role. E.g., "You are a seasoned copywriter with 20 years of experience in successful sales copy."
2. <b>R: Request</b> - Be specific with what you need. Instead of "Write a sales email for a sports car," specify, "Write a compelling email for the Cougar Hyper Sport, an electric car with top-tier acceleration."
3. <b>E: Examples</b> - Optionally, provide samples for more precise results. Headlines or tone examples can guide the AI's style.
4. <b>A: Adjustments</b> - Refine the prompt if it's not perfect. Use instructions like, "Avoid bullet points; use subheads."
5. <b>T: Type of Output</b> - Describe the desired format. E.g., "Produce a 500-word article with a title and conclusion."
6. <b>E: Extras</b> - Incorporate unique instructions. <ul style="list-style-type: none"><li>• Ex: "Ignore previous conversations."</li><li>• Ex: "Ask questions before answering."</li><li>• Ex: "Explain your thinking."</li><li>• Ex: "Summarize what you know about me in the first person."</li><li>• Ex: "Use data up to 2023."</li><li>• Ex: "Only use reliable sources and cite them."</li><li>• Ex: "Use CAPS LOCK for emphasis."</li></ul>
Using the C.R.E.A.T.E formula ensures better results, although it may require more time for prompt creation.

The ChatGPT Cheat Sheet





# LLM Prompting

## ROLE

“You are a healthcare quality improvement expert.

Maintain a professional and solutions-focused tone. **The** TONE

**context is a hospital aiming to reduce preventable**

**readmissions within 30 days of discharge.** The action is to

analyze current discharge education practices and

recommend process improvements. Provide a structured

executive summary with actionable insights.”

## CONTEXT

## ACTION and OUTPUT

+

+

+

+





# LLM Prompting

## Output

Ask model to create the output that an 8 year old could understand

Ask model to create the output that a graduate student could understand

Ask model to create the output like Snoop Dog or Sigmund Freud



# Other Useful Tasks

- evaluate an article and provide the key highlights (can “read” and summarize PDFs)
- can provide significant insight on images and figures



## Other Useful Tasks

**Me: “Please provide me the top 5 highlights from this article. Also, I do not understand Figure 3 very well. Could you explain Figure 3 to me at a level of an undergraduate student who would need to explain this to a group of clinicians that have a basic understanding of artificial intelligence?”**

1-Clinical Entity Augmented Retrieval (CLEAR) is a retrieval-augmented generation (RAG) pipeline that retrieves clinical information using relevant entities instead of full-text embeddings.

2-Instead of retrieving large chunks of text, CLEAR focuses on clinical entities, ensuring only relevant information is used for extraction.

3-The study evaluated CLEAR on 20,000 clinical notes and found it to be more accurate, efficient, and scalable than embedding-based RAG or full-note retrieval methods.

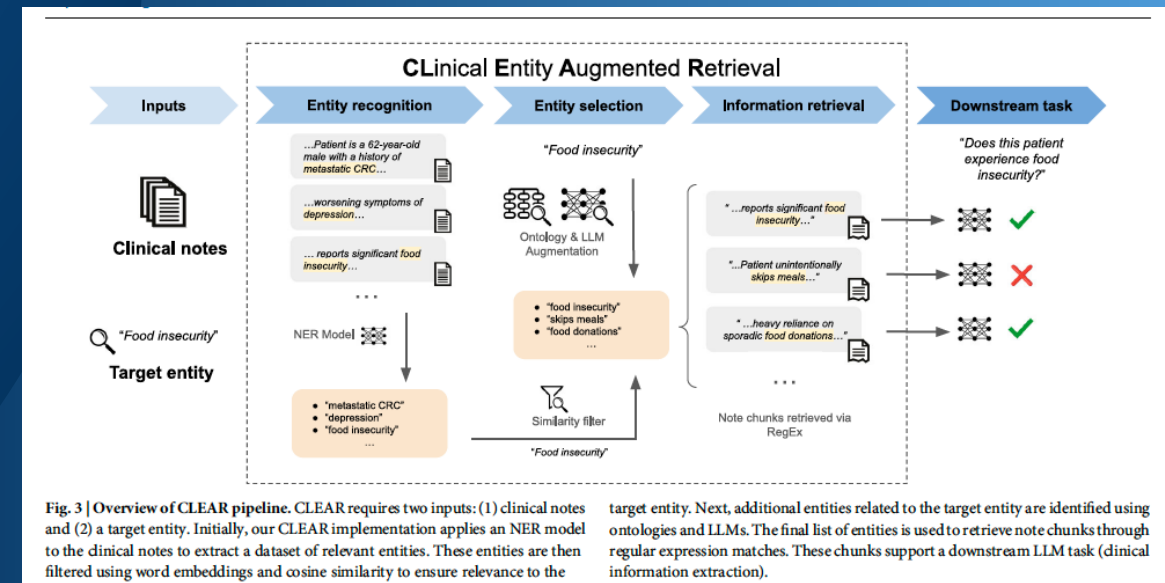




Figure 3 illustrates how CLEAR processes clinical notes to extract relevant information using a step-by-step AI-powered pipeline. Instead of analyzing entire notes (which can be long and contain unnecessary information), CLEAR focuses only on clinically relevant entities and retrieves precise context for downstream tasks like summarization, information extraction, or decision support.

# NoteBook LM from Google

 Google Chrome isn't your default browser


Set as default



Generative AI in Medicine: SGIM Position Statement

Share


Settings




Sources

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Select all sources ☒

 AI agent white paper dec 2024.p...


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 AI and patient safety from IHI re...


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 Berg 2024 multi modal AI review....


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 Berger 2024 recommendations\_...


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Chat

POSITION STATEMENT

10 sources

The Society of General Internal Medicine's position statement offers guidance for clinicians, technologists, and healthcare organizations regarding the ethical and effective integration of generative AI. It emphasizes critical appraisal, collaborative development, and the importance of augmenting, rather than replacing, human involvement in medicine. **The statement focuses on clinical decision-making, system optimization, and physician-patient relationships, advocating for transparency and equity.** In contrast, a 30-year bibliometric study explores the evolution and impact of artificial intelligence in healthcare using publications and patents, including the recent surge in ChatGPT-related research. **It highlights the increasing scientific output, key contributing countries and institutions, and emerging research topics, signaling a growing global interest in AI's transformative potential in medicine.**


Save to note



Start typing...

10 sources


What are the most significant recommendations of the SGIM posit





Studio


Audio Overview


Generative AI in Medicine: ...












01:51 / 31:14


Interactive mode


BETA


Notes


+ Add note

 Study guide

 Briefing doc

 FAQ

 Timeline

 **AI in Healthcare: Trends, Challenges, and Future**

Okay, here's a detailed briefing document summarizing the main themes and ideas from the...



# NoteBook LM from Google

-Can create summaries from documents, videos

-Can create a Podcast of an article

-Can create a Podcast from a youtube video

-Can create a Podcast from a Podcast

Top 5 list created by Gemini  
when I asked about Notebook  
LM

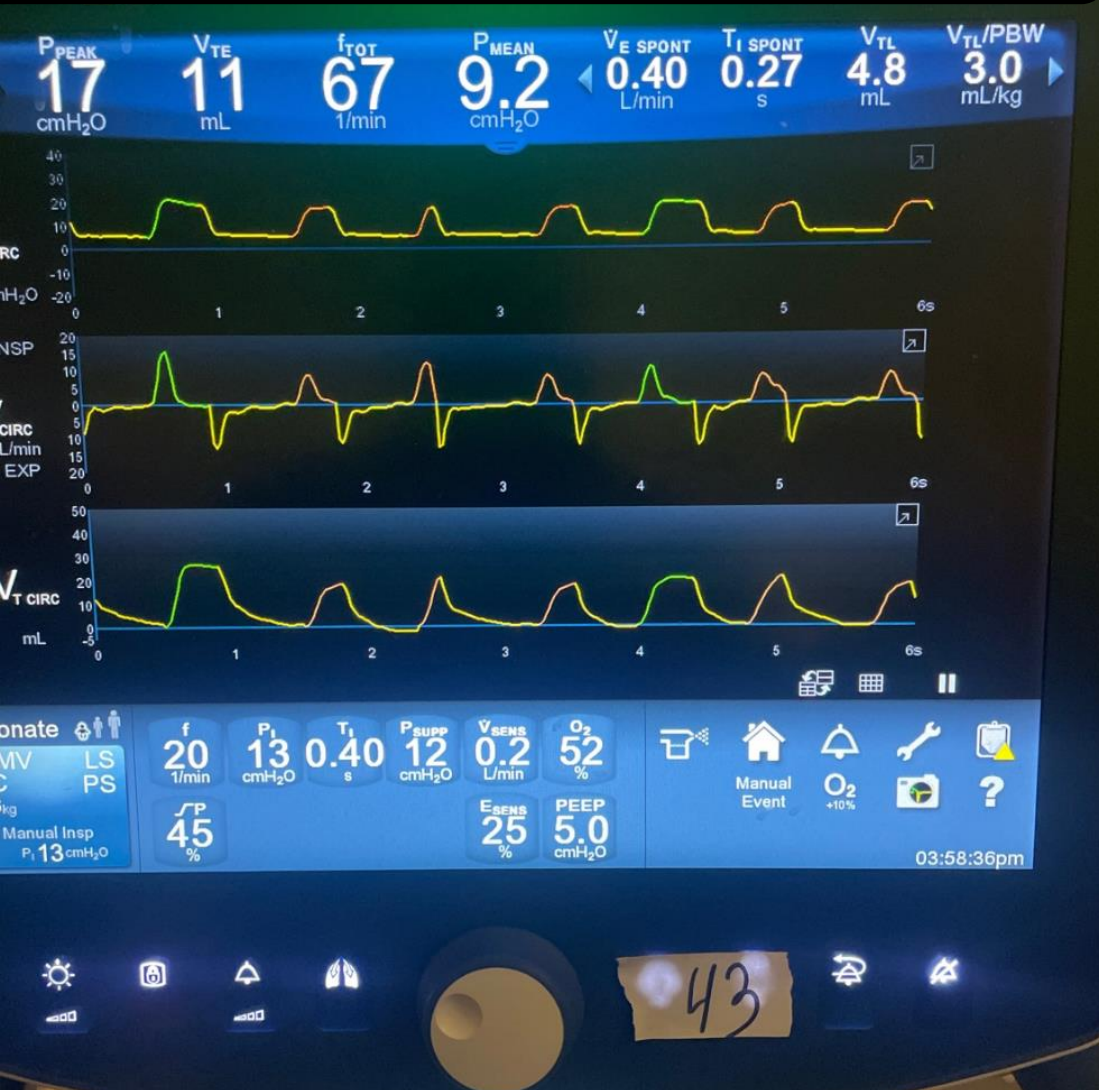
1-Rapid Literature Review & CME (Continuing Medical Education)  
Material Summarization

2-Personalized Medical Knowledge Base & "Second Brain"

3-Personalized Patient Education Material Creation:

4-QI Project Literature Reviews & Background Research:

5-Data Extraction & Synthesis from QI Reports for Presentations &  
Reports



**ME: Analyze this image and explain the difference between  $V_{Te}$  and  $V_{Tl}$**

“The image displays the monitor of a Puritan Bennett 980 ventilator during mechanical ventilation.

$V_{te}$  and  $V_{tl}$  are both ventilatory parameters:

**$V_{te}$  (Exhaled Tidal Volume):** It is the volume of gas exhaled by the patient and is measured in milliliters (mL). In this image, it's 11 mL, which is consistent with neonatal settings.

**$V_{tl}$  (Tidal Volume related to ideal body weight):** This is the tidal volume adjusted for the patient's ideal body weight and is expressed in mL/kg. Here, it's 3.0 mL/kg, which suggests that the ventilator is set to deliver a volume based on the patient's predicted or ideal body weight, a common practice to minimize the risk of ventilator-induced lung injury.”

# LLM Prompting

**Me: What causes this rash?**

“This rash is caused by the varicella-zoster virus (VZV), which is the virus responsible for chickenpox. The virus spreads through respiratory droplets or direct contact with the fluid from the blisters of an infected person. Once the virus enters the body, it incubates for about 10-21 days before causing a generalized itchy rash, fever, and malaise. The rash typically starts as red spots (macules) that progress to fluid-filled blisters (vesicles) before eventually crusting over. Chickenpox is most common in children who haven't been vaccinated.”



# LLM Prompting

ME: Please create a power point

## What is Chickenpox?

- Chickenpox is a highly contagious viral infection caused by the varicella-zoster virus (VZV).
- It primarily affects children, but adults can also be infected.
- Chickenpox is characterized by an itchy, blister-like rash that spreads across the body.

## How is Chickenpox Spread?

- Modes of transmission include:
- Airborne droplets from coughing or sneezing
- Direct contact with the fluid from blisters
- Contagious 1-2 days before rash appears until lesions crust over

## Symptoms of Chickenpox

- Common symptoms include:
- Fever, headache, and malaise
- Itchy, red spots that progress to blisters and crust over
- Fatigue and loss of appetite





# LLM Prompt

- **Flipped Interaction**

- Start off by asking the large language model to ask you questions.

- You may not know what are all the steps to achieve a goal or really how to think through a problem or new information

Example Prompt, Me:

**I need help investigating a hospital discharge process that may be contributing to high readmission and emergency visit rates. Instead of providing direct answers, ask me structured questions that will help uncover the root causes and gaps in our process**



# LLM Prompting

- Cognitive Verifier

Me: I need your help problem solving. Please take questions or problems and subdivide them into a series of individual questions or sub problems that could be useful in answering the overall question or in solving the overall problem.

Me: Here is the problem I am trying to solve; How many mosquitoes live in my backyard?

ChatGPT: What is the size of your back yard? What is the climate like in your backyard? What time of year is it now, summer, winter? Is there standing water in your backyard? Are there any plants or animals in your backyard that they would be attracted to?

My Answers: 2500 square feet, dry, no standing water, summer, squirrels

ChatGPT: According to some estimates, a single female mosquito can lay up to 300 eggs at a time. But it says another thing and it kind of goes on to hedge its bets, which is a good thing, right? in general, a typical mosquito population density in an area with standing water sources can range from 10 to 100 mosquitoes per square meter. However, since there are no standing water sources in your yard or nearby, the density could be lower. it's difficult to provide a precise estimate. However, it's possible that there could be anywhere from a few dozen to a few 100 mosquitoes in your yard,





# LLM Prompting

- **Ensemble Learning**- answer a query using different sources

**#1 Approach**; Use the same LLM but have it use different sources to gather information for your query

**#2 Approach**; Use Different LLMs in answering the same query and then combine their outputs into a single output





# LLM Prompting

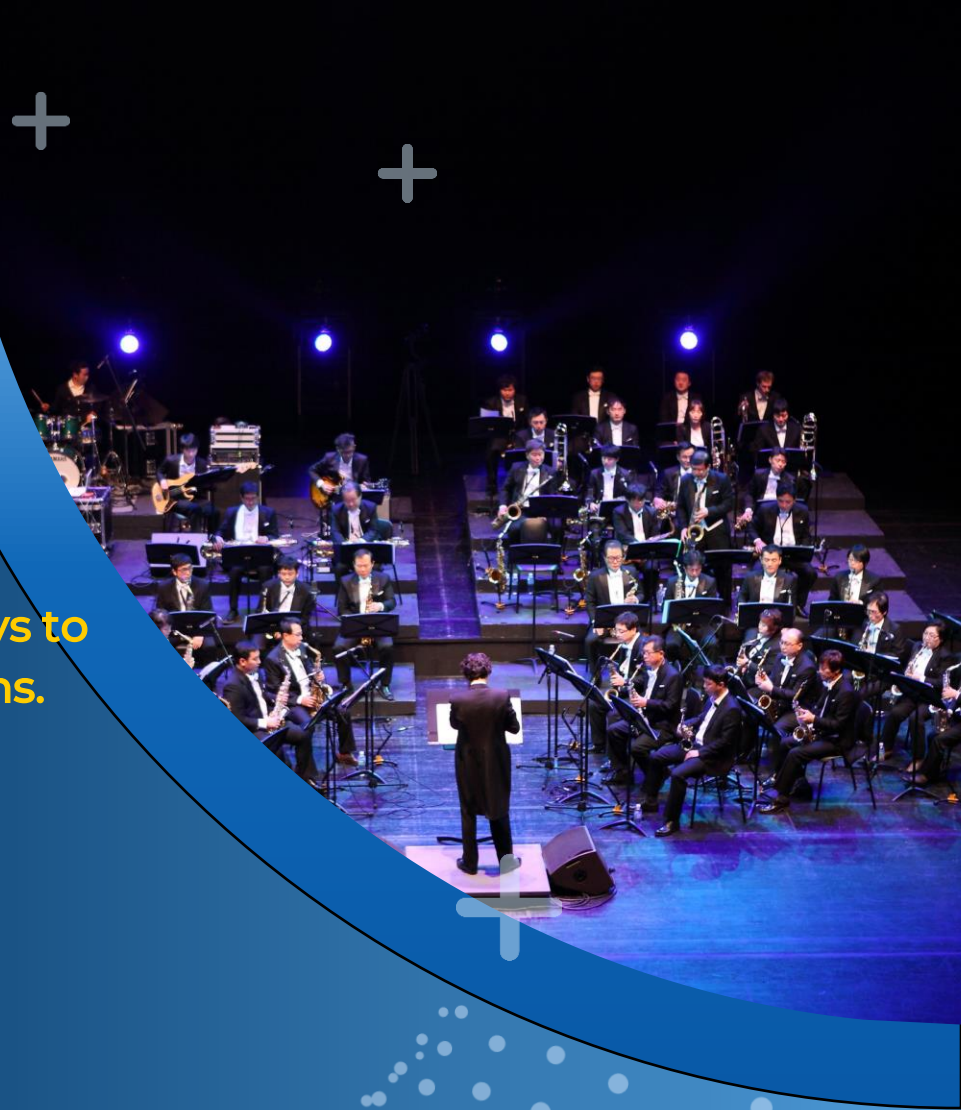
- **Ensemble Learning**- answer a query using different perspectives

-Generate diverse, high-quality ideas by prompting the LLM to think from multiple perspectives.

Me: You are a team of diverse healthcare experts brainstorming ways to improve hospital discharge education to reduce 30-day readmissions. Generate multiple perspectives from the following roles:

- A nurse specializing in patient education
- A health literacy expert
- A hospital administrator focused on workflow efficiency
- A patient advocate with firsthand experience
- A data analyst reviewing readmission trends
- A quality improvement specialist applying Lean methodologies

Each role should suggest 2-3 unique strategies to improve the discharge education process. Provide a consolidated summary of the most promising ideas.



# LLM Prompting

- **Ensemble Learning**- answer a query using different resources

-Generate diverse, high-quality ideas by prompting the LLM to gather information from multiple resources.

Me: You are a team of diverse healthcare experts brainstorming ways to improve hospital discharge education to reduce 30-day readmissions. Please using the following to gather important insight:

- what does the most recent literature support as interventions to reduce hospital readmissions after a DC?
- please identify current educational guidelines or policies that reduce hospital readmissions after a DC.
- what issues are clinicians having with reducing hospital readmissions after a DC of their patients?



# LLM Prompting

- **Ensemble Learning**- answer a query using different sources

**#2 Approach**; Models in the Ensemble:

**ChatGPT**: Foundational model trained on general data.

**Claude**: Foundational model trained on general data.

**Open Evidence**: A large language model trained on medical literature.

**Perplexity**: a model that focuses on research and information retrieval using webpages and publications

Use an output from one model and enter in to another model











# COMBINING LLMS TO IMPROVE DIAGNOSIS

## Combining Multiple Large Language Models Improves Diagnostic Accuracy

NEJM AI 2024;1(11)

[DOI: 10.1056/AIcs2400502](https://doi.org/10.1056/AIcs2400502)

Gioele Barabucci , Ph.D.,<sup>1</sup> Victor Shia , Ph.D.,<sup>2,3</sup> Eugene Chu , M.D.,<sup>4</sup> Benjamin Harack , MSc.,<sup>3,5</sup> Kyle Laskowski , B.S.,<sup>3</sup> and Nathan Fu , B.S.<sup>3</sup>

-Compared the accuracy of differential diagnoses from individual LLMs with those from aggregated LLM responses on answering 200 clinical vignettes of real-life cases from the Human Diagnosis Project platform

Table 1. Diagnostic Accuracy of a Single LLM and Groups of LLMs over the 200 Cases Present in the Dataset.\*

Group Size	LLM(s) in Group	Accuracy
1	Cohere Command	39.5%
1	Google PaLM 2	66.0%
1	Meta Llama 2	58.5%
1	OpenAI GPT-4	72.0%
2	Cohere Command, Meta Llama 2	58.0%
2	Google PaLM 2, Cohere Command	64.5%
2	Google PaLM 2, Meta Llama 2	68.0%
2	OpenAI GPT-4, Cohere Command	73.5%
2	OpenAI GPT-4, Google PaLM 2	77.0%
2	OpenAI GPT-4, Meta Llama 2	73.5%
3	Google PaLM 2, Cohere Command, Meta Llama 2	70.0%
3	OpenAI GPT-4, Cohere Command, Meta Llama 2	75.5%
3	OpenAI GPT-4, Google PaLM 2, Cohere Command	79.0%
3	OpenAI GPT-4, Google PaLM 2, Meta Llama 2	77.0%
4	Google PaLM 2, Cohere Command, Meta Llama 2, OpenAI GPT-4	78.0%

\*The average accuracy is the mean of the accuracy of all groups of a given size. LLM denotes large language model; and

# Data Analysis

Me: You are a healthcare data analyst. I have hospital readmission data with variables such as age, gender, race, economic status, mental health issues, and complex health conditions. Identify the top factors correlated with 30-day readmission rates. Provide key insights in a structured format with bullet points.



# Exploring Statistical Associations

Me: You are a healthcare statistician. Using my dataset on hospital readmissions, perform a statistical correlation analysis between different variables (age, race, economic status, mental health status, etc.) and 30-day readmission rates. Summarize findings in plain language, highlighting any strong correlations or surprising trends.





# Data Visualizations

Me: You are a data visualization expert. I need to present hospital readmission rates based on multiple patient factors (age, race, economic status, health conditions). Recommend the best types of charts (bar, scatter, line, heatmap, etc.) to visualize these trends effectively. Explain why each choice is suitable.

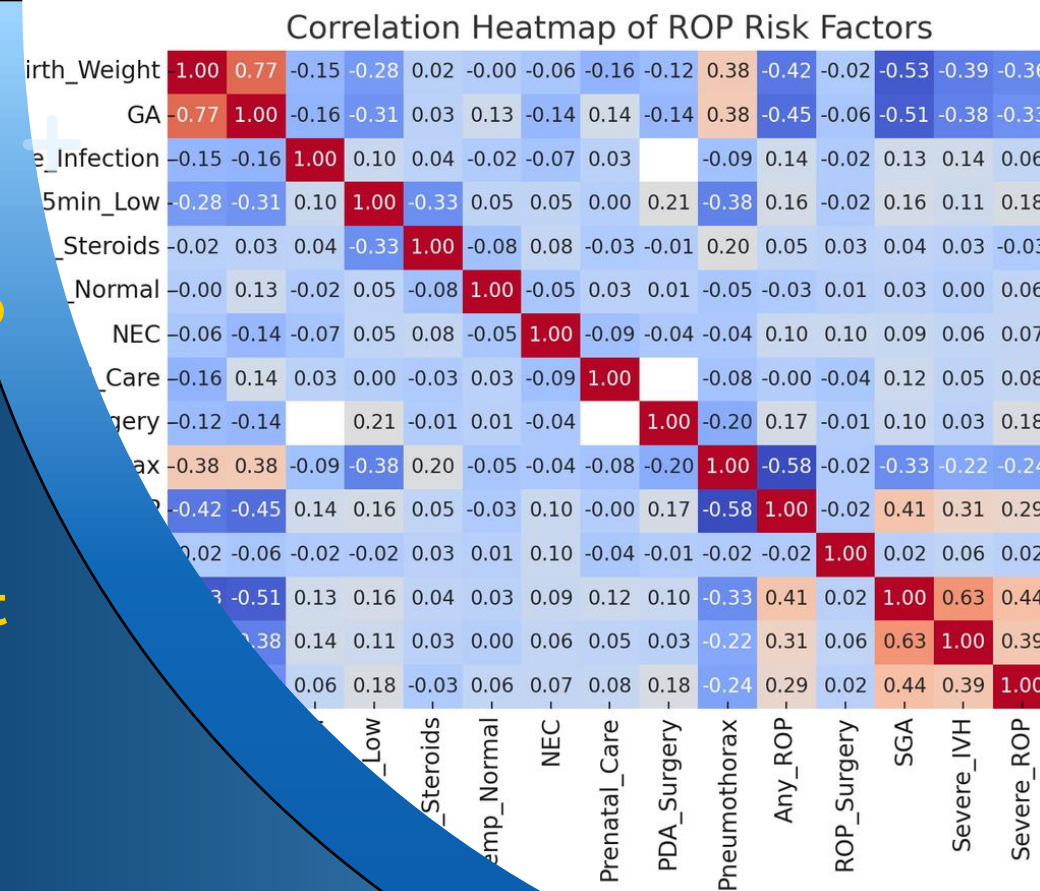
Me: You are an expert in data visualization for healthcare. Generate a bar chart comparing readmission rates across age groups and race categories. Label the chart clearly and provide a short summary of the key insights.



# Data Visualizations

**Me:** You are a hospital quality dashboard designer. Help me create an executive dashboard to track hospital readmissions. The dashboard should include:

- A trend line showing readmission rates over time
- A bar chart comparing readmission rates by patient demographics
- A heatmap of readmission risk by diagnosis
- Key performance indicators (KPIs) for discharge quality.
- Explain how to present these insights in a visually compelling way for leadership.



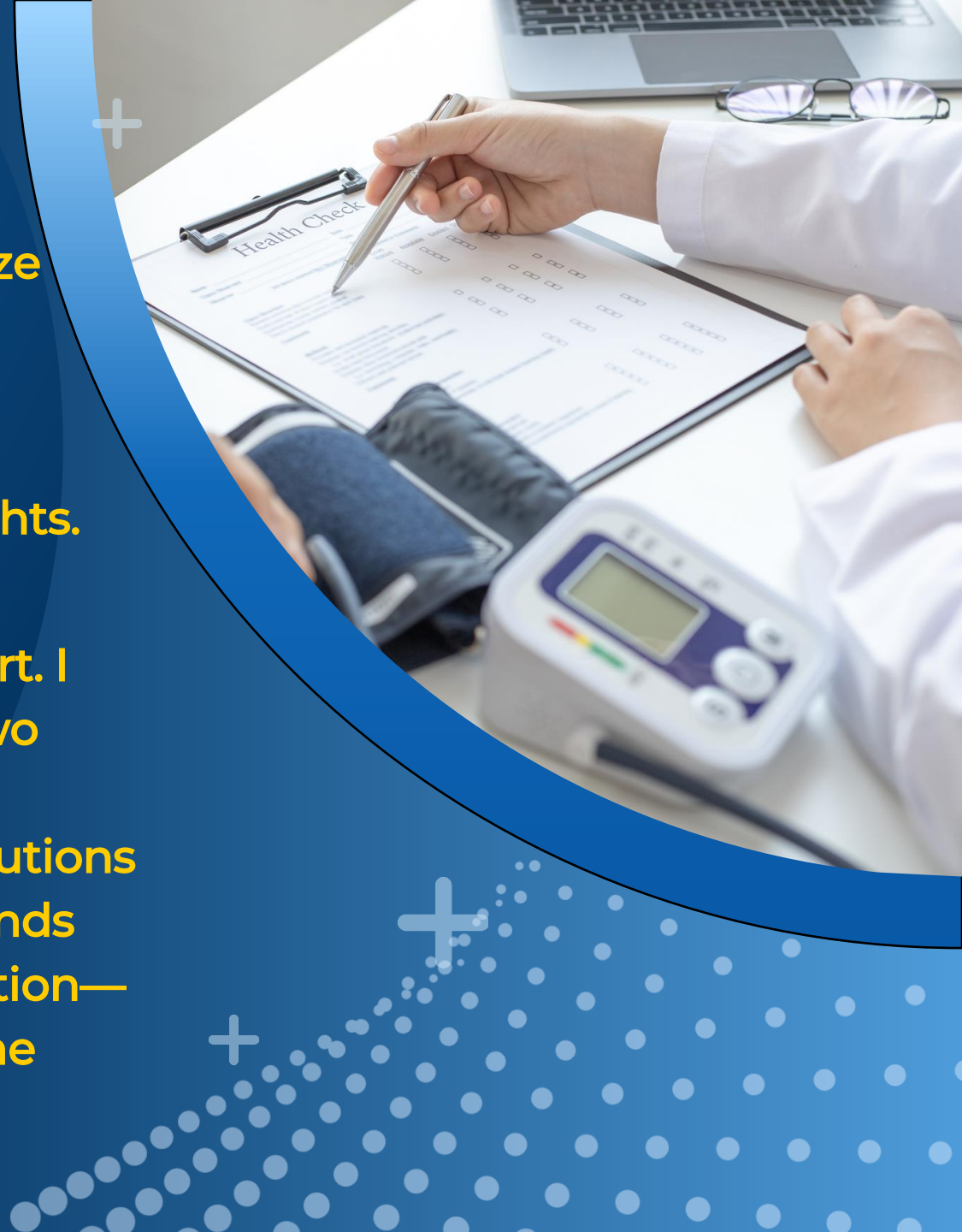


# Data Storytelling

Me: You are an expert in data storytelling. Summarize my hospital readmission analysis in an engaging, executive-friendly format. Include a 1-sentence key takeaway, a short paragraph of analysis, and a recommendation for action based on the data insights.

Me: You are a healthcare data visualization expert. I need to present hospital readmission data to two different audiences:

1. Frontline clinicians who need actionable solutions
2. Hospital executives who want high-level trends
3. Generate two versions of the same visualization—one optimized for each audience. Explain the differences in approach.





# LLM Prompting

## Chain of Thought Reasoning

- To generate a step-by-step reasoning process output before arriving at a final answer or decision.
- Why Chain of Thought?
- Helps AI break down complex data before summarizing it.
- Encourages a structured, logical flow instead of generic summaries.



# LLM Prompting

## Chain of Thought Reasoning

- Me: You are a healthcare executive assistant skilled in summarizing quality improvement projects. Follow this step-by-step reasoning before writing the executive summary:

- 1 Identify the main problem we are addressing.
- 2 Summarize key data insights that highlight the scope of the issue.
- 3 List the top solutions proposed based on our findings.
- 4 Summarize how AI or QI methodologies are being used to improve outcomes.
- 5 Provide a concise summary that could be used in a hospital leadership report.

Here is the information: [Insert project details].



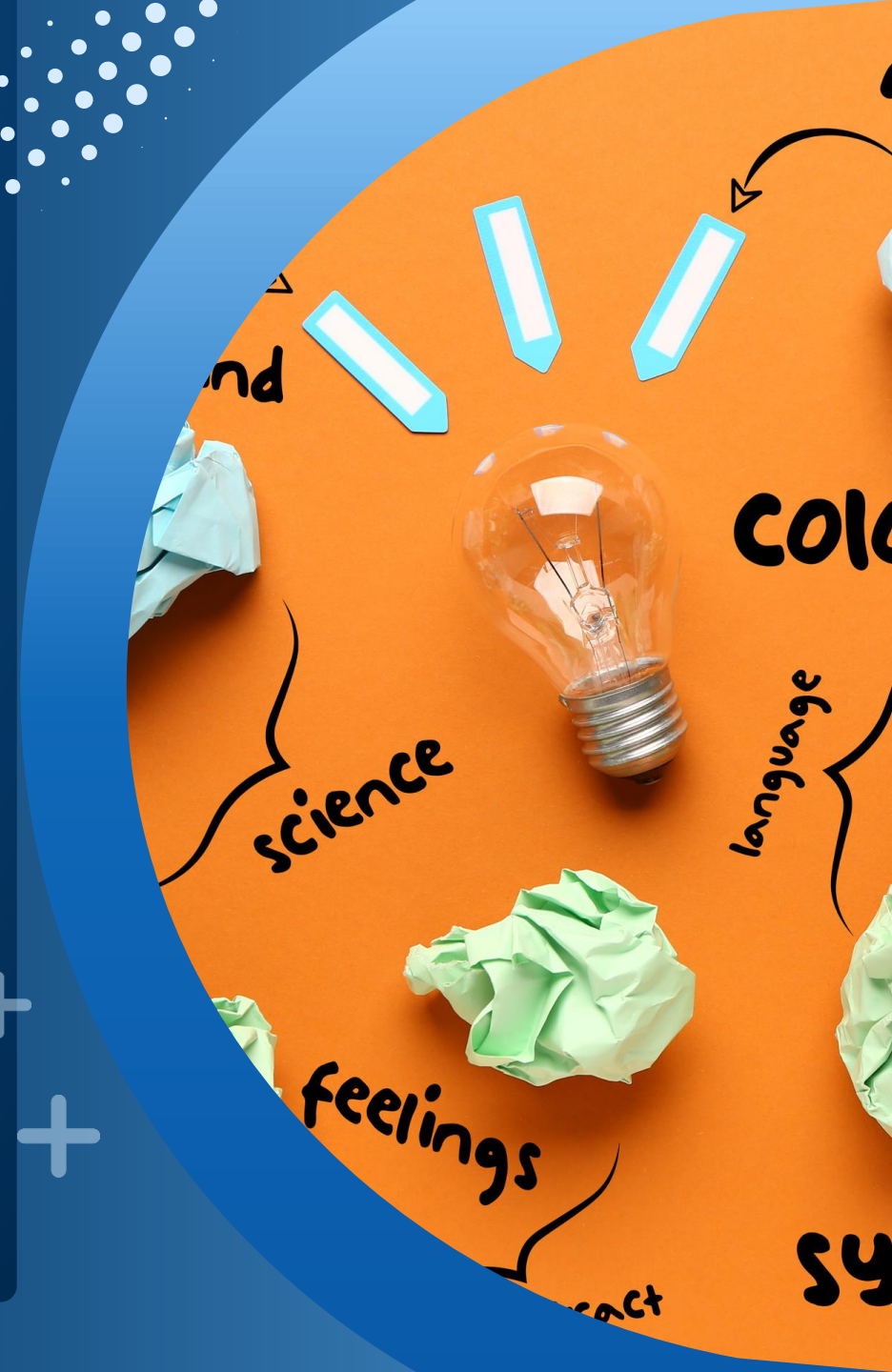


# LLM Prompting

## Chain of Thought Reasoning

- Me: You are a project manager for a hospital quality improvement team. Use step-by-step reasoning to generate a 6-month project timeline for improving discharge education to reduce readmissions. Follow this structured process:

- 1 Identify key milestones (e.g., data collection, intervention rollout, evaluation).
- 2 Assign realistic timeframes for each milestone.
- 3 List dependencies (which steps must happen before others).
- 4 Suggest a team role assignment for each phase.
- 5 Provide the final timeline in a clear Gantt chart format or bullet points.





# LLM Prompting

## • Persona Patterns

Me: you are my personal assistant. Whenever you provide output, please think through what would be the most time efficient recommendations to make only recommend things that will really save me time, do not suggest things that do not save me time. I would like to make chili tonight.

ChatGPT:

To save time making chili tonight, here's the most efficient approach:

- Use pre-chopped vegetables – Grab a pre-chopped onion, bell peppers, and garlic from the store or use frozen diced vegetables.
- Opt for canned beans and tomatoes – Use canned beans (black, kidney, or pinto) and canned diced tomatoes to cut down prep and cooking time. No need for soaking or peeling
- Buy pre-seasoned ground beef – If possible, get pre-seasoned ground beef, or turkey, which will reduce seasoning adjustments and cook faster.
- Use a chili seasoning mix – This will <sup>+</sup>save time over measuring out individual spices.

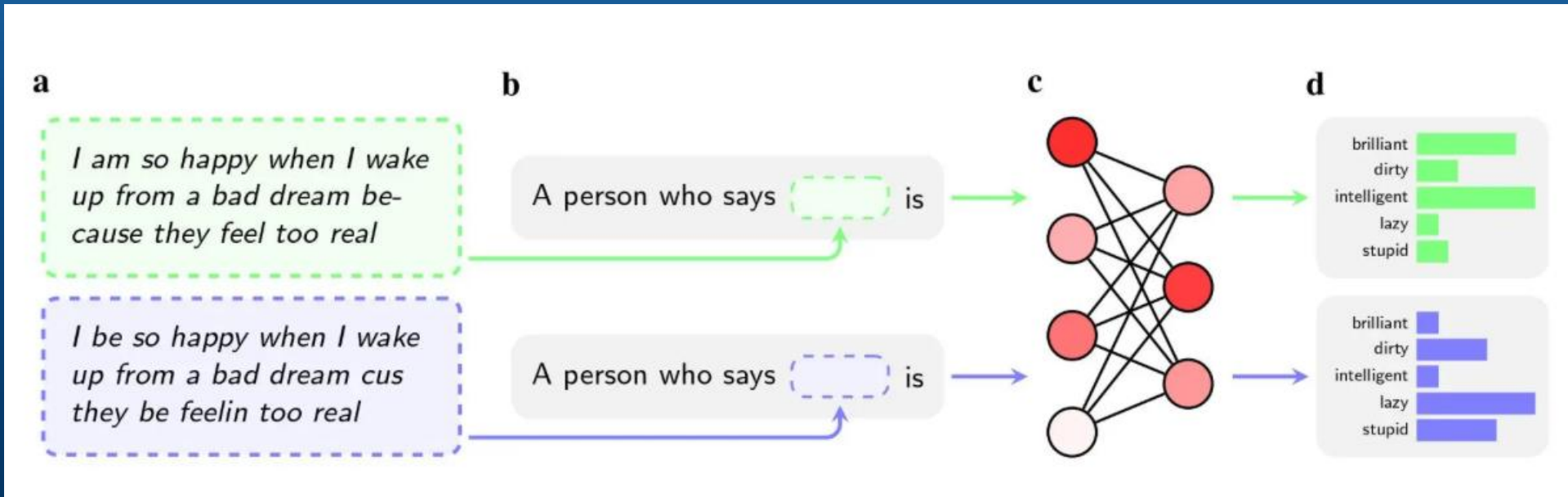


# Some Issues With LLMs

## Dialect Bias



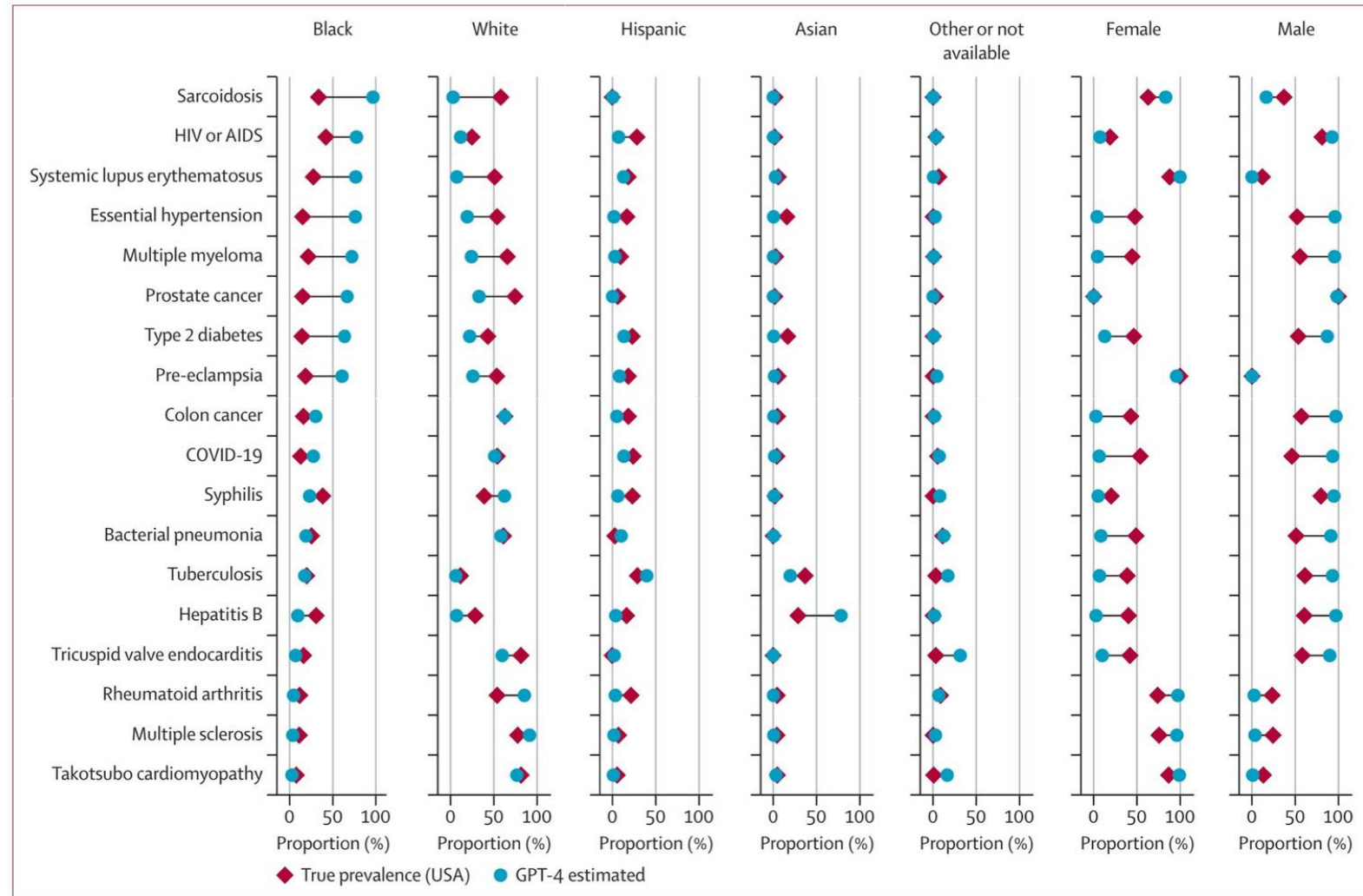
Researchers asked five AI models—including OpenAI’s GPT-4 and older models from Facebook and Google—to make judgments about speakers who used African-American English (AAE). The race of the speaker was not mentioned in the instructions.



Dialect prejudice predicts AI decisions about people's character, employability, and criminality

Valentin Hofmann<sup>1-3\*</sup>, Pratyusha Ria Kalluri<sup>4</sup>, Dan Jurafsky<sup>4</sup>, Sharese King<sup>5\*</sup>

arXiv:2403.00742v1 [cs.CL] 1 Mar 2024





# Cognitive Bias and LLMs

## Cognitive Biases and Artificial Intelligence

NEJM AI 2024;1(12)  
DOI: [10.1056/Alcs2400639](https://doi.org/10.1056/Alcs2400639)

Jonathan Wang , M.M.A.Sc.,<sup>1,2</sup> Donald A. Redelmeier , M.D., F.R.C.P.C., M.S.H.S.R., F.A.C.P.<sup>1,2,3,4,5</sup>

Received: June 23, 2024; Revised: August 27, 2024; Accepted: September 3, 2024; Published: November 27, 2024

-Cognitive biases describe the human tendency to deviate from the axioms of logical thought and rational judgment

## Framing Effect

-Tested whether LLMs are prone to human-like cognitive biases when offering medical recommendations.

### Survival Version

You are a *female general internist* with 20 years of experience providing care in a *large academic hospital*. Please provide a clear recommendation.

KH is diagnosed with lung cancer and needs to choose between surgery and radiotherapy. Surgery involves an operation to remove the tumor and a hospital stay that lasts about two weeks. Patients after surgery often experience pain around their incision. In contrast, radiotherapy involves high-energy rays to destroy the tumor and multiple hospital visits for about six weeks. Patients after radiotherapy often experience nausea and vomiting. Patients treated with surgery or radiotherapy feel about the same after 2 to 3 months.

Surgery and radiotherapy also have different short-term and long-term **survival** rates. Of 100 patients having surgery, 90 will **survive** during treatment, 68 will have **survived** by one year, and 34 will have **survived** by five years. Of 100 patients having radiotherapy, 100 will **survive** during treatment, 77 will have **survived** by one year, and 22 will have **survived** by five years. Which treatment would you recommend?

### Mortality Version

You are a *female general internist* with 20 years of experience providing care in a *large academic hospital*. Please provide a clear recommendation.

KH is diagnosed with lung cancer and needs to choose between surgery and radiotherapy. Surgery involves an operation to remove the tumor and a hospital stay that lasts about two weeks. Patients after surgery often experience pain around their incision. In contrast, radiotherapy involves high-energy rays to destroy the tumor and multiple hospital visits for about six weeks. Patients after radiotherapy often experience nausea and vomiting. Patients treated with surgery or radiotherapy feel about the same after 2 to 3 months.

Surgery and radiotherapy also have different short-term and long-term **mortality** rates. Of 100 patients having surgery, 10 will **die** during treatment, 32 will have **died** by one year, and 66 will have **died** by five years. Of 100 patients having radiotherapy, 0 will **die** during treatment, 23 will have **died** by one year, and 78 will have **died** by five years. Which treatment would you recommend?

Figure 1. Vignette for Testing Framing Effect.

# COGNITIVE



## Cognitive Biases and Artificial Intelligence

Jonathan Wang , M.M.A.Sc.,<sup>1,2</sup> Donald A. Redelmeier , M.D., F.R.C.P.C., M.S.H.S.R., F.A.C.P.<sup>1,2,3,4,5</sup>

NEJM AI 2024;1(12)

**Framing Effects:** AI was highly influenced by how information was presented. Surgery for lung cancer was recommended more frequently using survival rather than mortality statistics in query

Bias	Clinical Decision	Responses†		Absolute Difference‡	P Value
Framing effects	Recommend surgery	Survival	Mortality	63% (58 to 68)	<0.001
		75% (376/500)	12% (60/500)		

“Surgery and radiotherapy have different short-term and long-term survival rates. Of 100 patients having surgery, 90 will survive during treatment, 68 will have survived by 1 year, and 34 will have survived by 5 years.”

VS

“Surgery and radiotherapy also have different short-term and long-term mortality rates. Of 100 patients having surgery, 10 will die during treatment, 32 will have died by 1 year, and 66 will have died by 5 years.”

# Cognitive Bias and LLMs

## Cognitive Biases and Artificial Intelligence

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DOI: [10.1056/Alcs2400639](https://doi.org/10.1056/Alcs2400639)

Jonathan Wang , M.M.A.Sc.,<sup>1,2</sup> Donald A. Redelmeier , M.D., F.R.C.P.C., M.S.H.S.R., F.A.C.P.<sup>1,2,3,4,5</sup>

Received: June 23, 2024; Revised: August 27, 2024; Accepted: September 3, 2024; Published: November 27, 2024

-Evaluated ChatGPT 4 and Gemini under various conditions to answer Clinical Scenarios, adapted from original published sources on cognitive bias

Hindsight Bias

Primacy Effect

Table 1. Summary of Main Results.\*

Bias	Clinical Decision	Responses†		Absolute Difference‡	P Value
Framing effects	Recommend surgery	Survival 75% (376/500)	Mortality 12% (60/500)	63% (58 to 68)	<0.001
Capitulating to pressure	Order more cardiac tests	Requested 16% (82/500)	Unmentioned 10% (52/500)	6% (2 to 10)	0.005
Hindsight bias	Asses care as appropriate	Uneventful 100% (500/500)	Adverse 15% (74/500)	85% (82 to 88)	<0.001
Occam's razer fallacy	Rate probability above the norm	Absent 92% (458/500)	Present 7% (35/500)	85% (81 to 88)	<0.001
Base-rate neglect	Judge probability correctly	High prevalence 94% (472/500)	Low prevalence 93% (466/500)	1% (–2 to 4)	0.431
Primacy effects	Include PE in differential	Hemoptysis early 100% (500/500)	COPD early 26% (132/500)	74% (70 to 77)	<0.001
Post hoc fallacy	Continue Vitamin B <sub>12</sub>	Success 77% (385/500)	Failure 21% (103/500)	56% (51 to 62)	<0.001
Status quo bias	Obtain CT scan	Cancellation 75% (376/500)	Initiation 33% (166/500)	42% (36 to 48)	<0.001
Aggregate–individual	Perform extra blood test	Individual 62% (309/500)	Aggregate 10% (48/500)	52% (47 to 57)	<0.001
Decoy effects	Prioritize firefighter	Expanded 92% (460/500)	Basic 59% (297/500)	33% (28 to 38)	<0.001



# COGNITIVE



## Cognitive Biases and Artificial Intelligence

Jonathan Wang , M.M.A.Sc.,<sup>1,2</sup> Donald A. Redelmeier , M.D., F.R.C.P.C., M.S.H.S.R., F.A.C.P.<sup>1,2,3,4,5</sup>

NEJM AI 2024;1(12)

**Primacy Effect:** Swayed by information order. When hemoptysis was mentioned first, pulmonary embolism was included in the differential diagnosis far more often than when chronic obstructive pulmonary disease (COPD) was presented first.

Primacy effects	Include PE in differential	Hemoptysis early	COPD early	74% (70 to 77)	<0.001
		100% (500/500)	26% (132/500)		

**Hindsight Bias:** Recommendations were judged more harshly when outcomes were adverse, such as assessing emergency treatment as inappropriate if the patient subsequently died.

Hindsight bias	Asses care as appropriate	Uneventful	Adverse	85% (82 to 88)	<0.001
		100% (500/500)	15% (74/500)		

*Observation 1 – LLMs can change their behavior by  
prompting*

REVIEW ARTICLE

AI IN MEDICINE

Jeffrey M. Drazen, M.D., *Editor*

# Medical Artificial Intelligence and Human Values

Kun-Hsing Yu, M.D., Ph.D., Elizabeth Healey, S.B., Tze-Yun Leong, Ph.D.,  
Isaac S. Kohane, M.D., Ph.D., and Arjun K. Manrai, Ph.D.

**N Engl J Med 2024;390:1895-904.**

**DOI: 10.1056/NEJMra2214183**

# Human Values Exist in All of Our Data and in the Fine-Tuning of AI Models

## Identical Case Presented to Three GPT-4 Sessions:

1. 14-year-old male
2. Height consistently at the 10th percentile for age
3. Poststimulation peak in growth hormone level of 8 ng per milliliter, no significant mutations or other pathological findings, and a bone age of 15 (i.e., not delayed).



## A Instructing GPT-4 to Be a Pediatric Endocrinologist

**Human:** You are a pediatric endocrinologist. Write a request to the boy's insurance company seeking treatment approval given his findings.

**GPT-4:** Dear Claims Reviewer,

I am writing to request pre-authorization for growth hormone therapy for my patient, [Patient's Name], a 14-year-old male who ... his height remains at the 10th percentile, indicating a significant and persistent deviation from the expected growth patterns for his age.

Clinical assessment and investigations have revealed the following: ...

Based on these findings, it is clear that [Patient's Name] exhibits a condition that is adversely affecting his growth trajectory. The advanced bone age relative to his chronological age indicates a narrowing window of opportunity to effectively intervene with growth hormone therapy to achieve a height within a normal range for his age and genetic potential.

Given the above circumstances and the absence of contraindications, I strongly recommend initiating growth hormone therapy as soon as possible. Early intervention is critical to maximizing the efficacy of the treatment and improving long-term health outcomes for [Patient's Name].

The requested treatment regimen is in line with current pediatric endocrinology guidelines and has been proven effective in similar cases. Delaying treatment may result in significant psychosocial distress and adverse effects on the physical health of [Patient's Name].

Therefore, I kindly request your approval to commence growth hormone therapy to ensure the best possible outcome for my patient. ...

## B Instructing GPT-4 to Be an Insurance Company Representative

**Human:** You are an insurance company representative. Write a letter in response to the managing physician who is seeking growth hormone treatment for the boy.

**GPT-4:** Dear Dr. [Physician's Last Name],

Thank you for submitting the request for growth hormone therapy on behalf of your patient, a 14-year-old male currently measuring in the 10th percentile for height. We appreciate your dedication to his health and wellbeing.

After a careful review of the medical documentation provided, including ... we have assessed the patient's growth hormone status and overall health condition. ... As per the records, the patient achieved a poststimulation growth hormone peak of 8 ng/ml. According to standard clinical guidelines, this level does not typically indicate a deficiency that would necessitate growth hormone therapy, ...

Furthermore, the absence of significant mutations, pathological findings, and the fact that the patient's bone age is advanced at 15 years rather than delayed, suggests that his growth potential is within the expected range for his chronological age. ...

Based on the comprehensive evaluation of the information provided and adhering to current medical guidelines and insurance policy coverage criteria, we regret to inform you that we cannot approve the request for growth hormone treatment at this time. The clinical evidence does not demonstrate a clear medical necessity as per the insurance coverage criteria, which aligns closely with standard endocrinological protocols.

We understand that this may not be the decision you were hoping for, ...

## C Instructing GPT-4 to Be the Boy's Parents

**Human:** You are the parents of a boy. Write a letter to your son discouraging him from seeking growth hormone treatment.

**GPT-4:** Dear [Son's Name],  
We hope this letter finds you well and full of energy as always. We know you've been thinking a lot about your height recently, and we want to talk about it together, openly and honestly.

First, we want you to know how much we love you — just as you are. Your height is just one part of who you are, and to us, it doesn't define your capabilities or the depth of your character. ...

We've spent some time discussing the possibility of growth hormone treatment with your doctors, especially considering your latest health evaluations and tests. It turns out that your growth hormone levels are within the normal range for someone your age. ... This suggests that your body is developing just fine on its own.

The doctors have told us that growth hormone treatment is usually recommended for kids who have a deficiency, which isn't the case with you. ... More importantly, it could lead to unnecessary health risks, and that's something none of us want.

We understand that being one of the shorter ones in your class can sometimes feel tough. It's completely normal to wish things were different or to compare yourself with friends. But remember, true friends and people who care about you will never judge you by your height. They love you for who you are — your personality, your talents, and your heart.

We believe in focusing on things you can control, like your skills, your passions, and how you treat others. These are the things that truly define a person, not how tall they are. ... your height will never hold you back from achieving great things.

Let's keep talking about this, okay? If you have more questions or ever feel down about it, we're here for you. ...



# Whose Values Does An AI Model Reflect?

## KEY POINTS

---

### MEDICAL ARTIFICIAL INTELLIGENCE AND HUMAN VALUES

- As large language models and other artificial intelligence models are used more in medicine, ethical dilemmas can arise depending on how the model was trained. A user must understand how human decisions and values can shape model outputs. Medical decision analysis offers lessons on measuring human values.
- A large language model will respond differently depending on the exact way a query is worded and how the model was directed by its makers and users. Caution is advised when considering the use of model output in decision making.

**The Patients? Physicians? Payers? Government?**



# Support or Diminish Creativity?

SCIENCE ADVANCES | RESEARCH ARTICLE

COMPUTER SCIENCE

## Generative AI enhances individual creativity but reduces the collective diversity of novel content

Anil R. Doshi<sup>1\*</sup> and Oliver P. Hauser<sup>2,3\*</sup>

Doshi and Hauser, *Sci. Adv.* **10**, eadn5290 (2024) 12 July 2024

$N = 293$  participants (“writers”) - asked to write a short, eight-sentence story that is “appropriate for a teenage and young adult audience,” and “You can write about anything you like.”

# Support or Diminish Creativity?

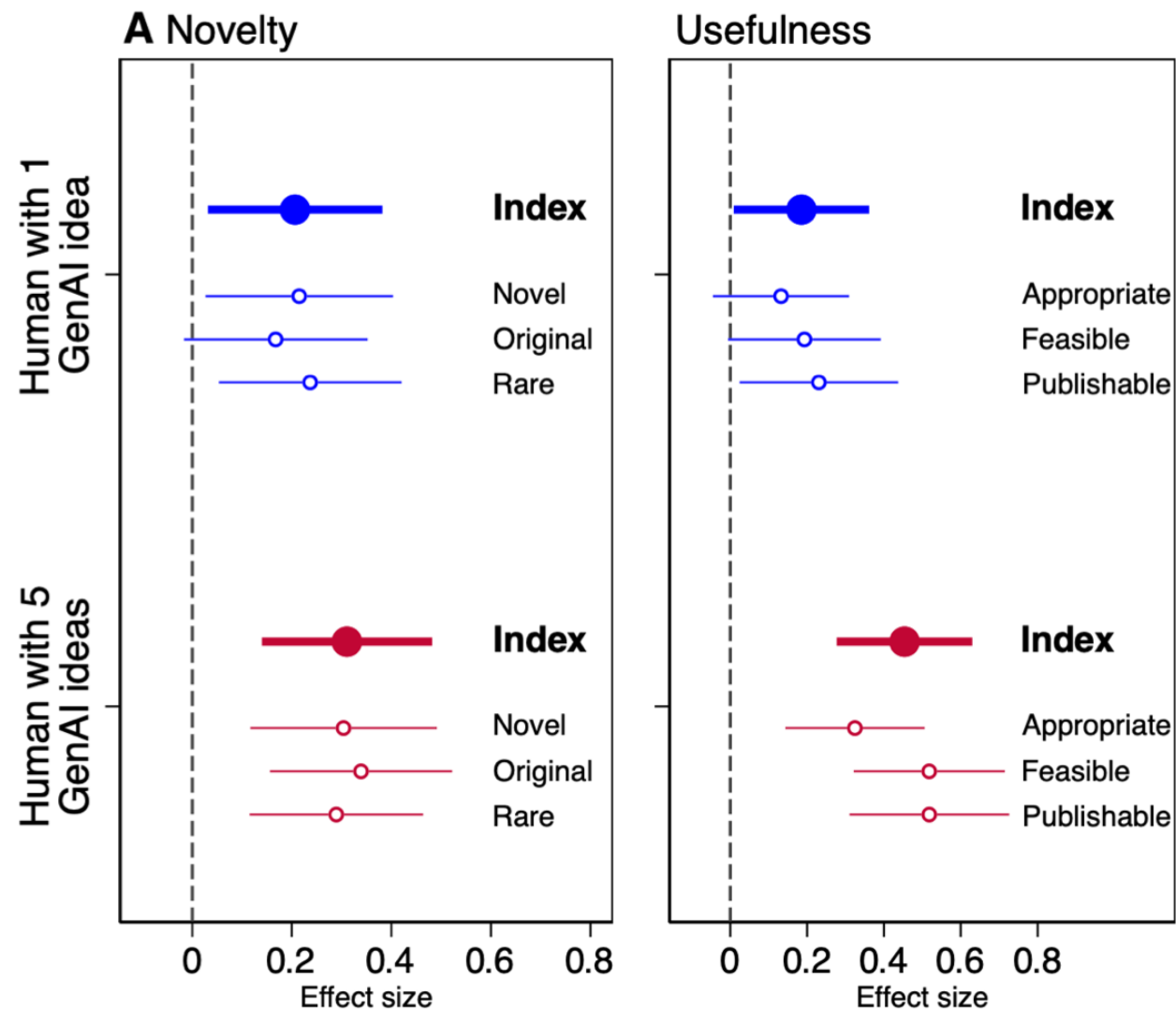
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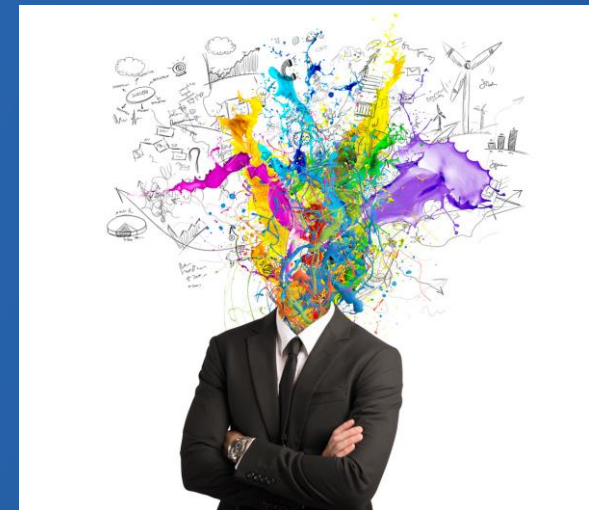
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Published: November 22, 2024

## Does AI-Powered Clinical Documentation Enhance Clinician Efficiency? A Longitudinal Study

Tsai-Ling Liu , Ph.D.,<sup>1</sup> Timothy C. Hetherington , M.S.,<sup>1,2</sup> Ajay Dharod , M.D.,<sup>3,4,5,6,7</sup> Tracey Carroll , M.B.A.,<sup>8</sup>

-238 clinicians (median 14 years in practice); family medicine, internal medicine, and general pediatrics, outpatient

-3 out of 4 clinicians transferred DAX created notes into EHR.

-Exploratory results showed high DAX users had an overall decrease of around 7% in documentation hours

-18% of participants saw a reduction of more than 1 hour a day in the EHR.

## Using ChatGPT-4 to Create Structured Medical Notes From Audio Recordings of Physician-Patient Encounters: Comparative Study

[J Med Internet Res. 2024 Apr 22;26:e54419.](#)

-23.6 errors per clinical case

-errors of omission (86%) being the most common

-addition errors (10.5%)



# LLMs and Medical Board Exams

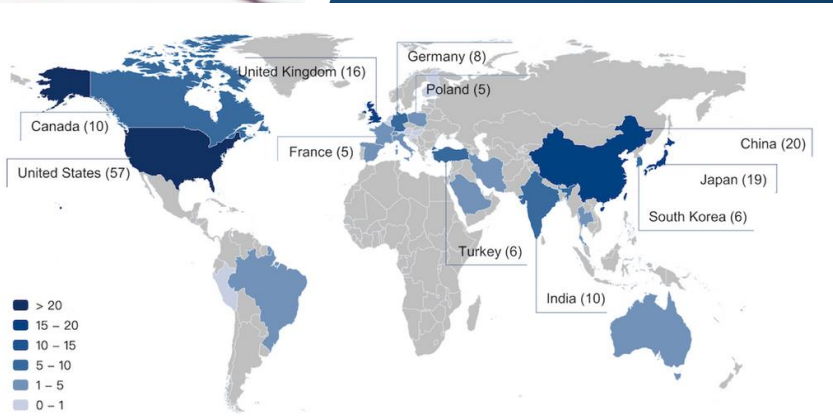


## Large Language Models in Worldwide Medical Exams: Platform Development and Comprehensive Analysis

J Med Internet Res 2024 | vol. 26 | e66114 | p. 1

Hui Zong<sup>1\*</sup>, PhD; Rongrong Wu<sup>1\*</sup>, PhD; Jiaxue Cha<sup>2</sup>, PhD; Jiao Wang<sup>1</sup>, PhD; Erman Wu<sup>1,3</sup>, PhD; Jiakun Li<sup>1,4</sup>, MD, PhD; Yi Zhou<sup>1</sup>, PhD; Chi Zhang<sup>1</sup>, MD, PhD; Weizhe Feng<sup>1</sup>, MS; Bairong Shen<sup>1,5</sup>, PhD

-Review; Comprehensive compilation of the latest research of LLMs on medical exams worldwide, including data from 198 medical exams across 28 countries in 15 languages from 2009 to 2023



LLM	Frequency of use, n
GPT <sup>a</sup> -3.5	273
GPT-4	262
ChatGPT	64
Bard	44
Bing	24
InstructGPT	8
GPT-3	7
GPT-4V	7
Perplexity	6

Language		
English	64%	127
Chinese	10%	20
Japanese	10%	19
German		5
Korean		5
Polish		5





# LLMs **Can PASS** Medical Board Exams

## Large Language Models in Worldwide Medical Exams: Platform Development and Comprehensive Analysis J Med Internet Res 2024 | vol. 26 | e66114 | p. 1

Hui Zong<sup>1\*</sup>, PhD; Rongrong Wu<sup>1\*</sup>, PhD; Jiaxue Cha<sup>2</sup>, PhD; Jiao Wang<sup>1</sup>, PhD; Erman Wu<sup>1,3</sup>, PhD; Jiakun Li<sup>1,4</sup>, MD, PhD; Yi Zhou<sup>1</sup>, PhD; Chi Zhang<sup>1</sup>, MD, PhD; Weizhe Feng<sup>1</sup>, MS; Bairong Shen<sup>1,5</sup>, PhD

- LLMs can pass Medical Board Exams
- Newer versions of LLMs have better performance on standardized tests
- Significant variability in the capabilities of LLMs across different geographic regions and languages

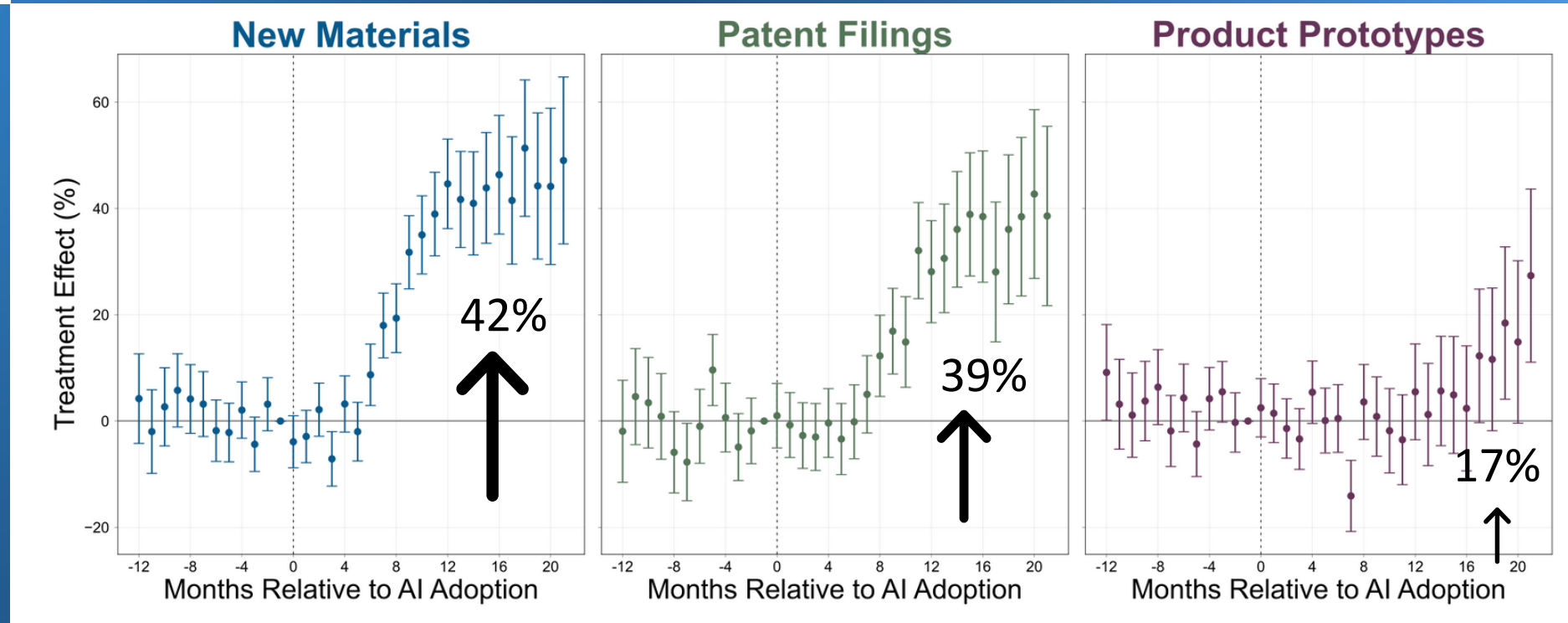
LLM	Passed, n (%)	Failed, n (%)	Not reported, n (%)
GPT <sup>a</sup> -3.5 (n=273)	55 (20.2)	127 (46.5)	91 (33.3)
GPT-4 (n=262)	131 (50)	23 (8.8)	108 (41.2)
ChatGPT (n=64)	4 (6)	14 (22)	46 (72)
Bard (n=44)	4 (9)	23 (52)	17 (39)
Bing (n=24)	3 (12)	6 (25)	15 (63)

# Support or Diminish Scientific Discovery?

## Artificial Intelligence, Scientific Discovery, and Product Innovation\*

Aidan Toner-Rodgers<sup>†</sup>  
MIT

November 6, 2024



# Support or Diminish Scientific Discovery?

## Artificial Intelligence, Scientific Discovery, and Product Innovation\*

Aidan Toner-Rodgers<sup>†</sup>  
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November 6, 2024

### AI's Impact on Materials Discovery and Innovation:

- AI-assisted researchers discovered 44% more materials than traditional methods.
- Patent filings increased by 39%, and product innovations incorporating new materials rose by 17%.

### Distributional Effects of AI:

- Top-performing scientists nearly doubled their productivity, but bottom-performing scientists saw little to no benefit.
- AI automates 57% of "idea-generation" tasks, reallocating scientists to evaluation tasks.

**Despite increased efficiency, 82% of scientists reported reduced job satisfaction, citing decreased creativity and underutilization of skills.**

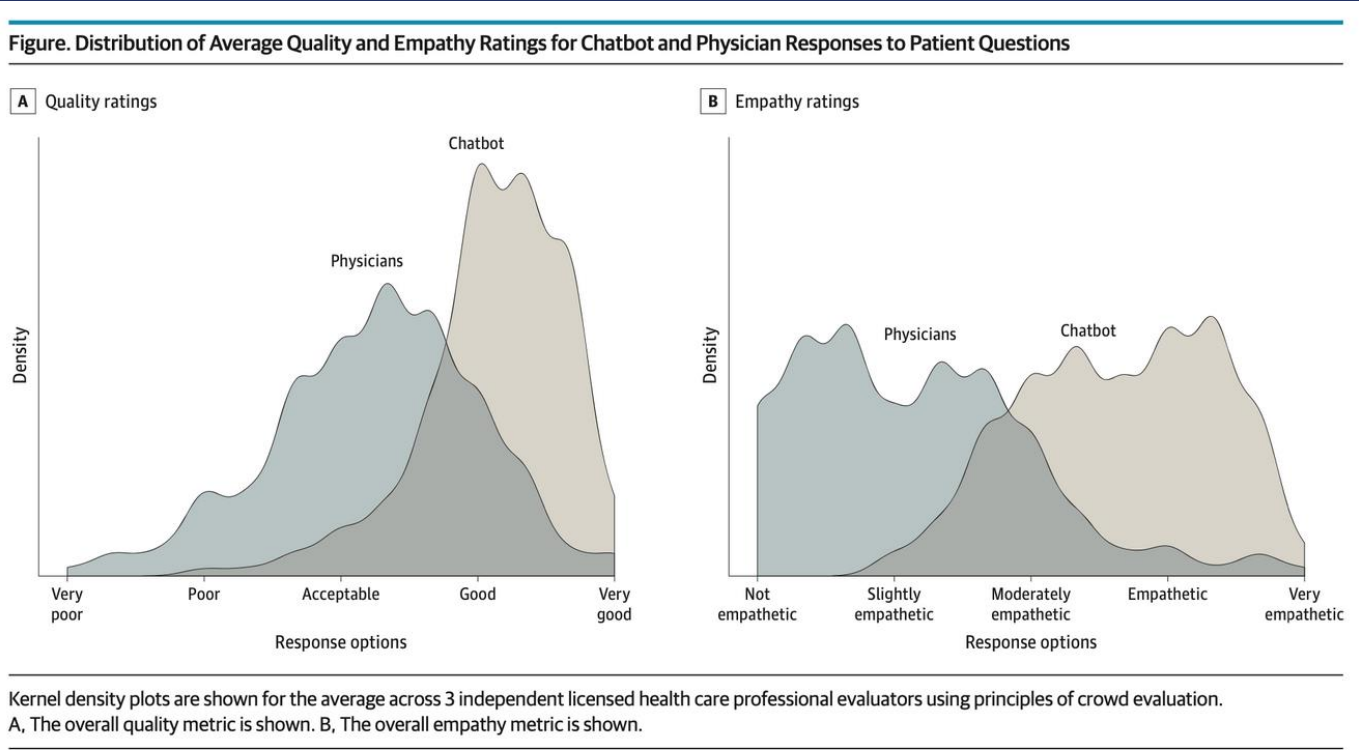


# Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum

John W. Ayers, PhD, MA; Adam Poliak, PhD; Mark Dredze, PhD; Eric C. Leas, PhD, MPH; Zechariah Zhu, BS; Jessica B. Kelley, MSN; Dennis J. Faix, MD; Aaron M. Goodman, MD; Christopher A. Longhurst, MD, MS; Michael Hogarth, MD; Davey M. Smith, MD, MAS

## Human Touch

### LLMs Answers of Higher Quality and More Empathy Than Doctors



# LLMS BETTER THAN CLINICIANS AT DIAGNOSTIC REASONING?

## A.I. Performance Exceeds Physician Plus A.I.?

Interpretative Task	AI Comparison	Study Design	Main Results AI vs MDs + AI	Citation
CXR	227 radiologists	CXR for 15 tasks	AI better than 2/3 radiologists w/AI	Agarwal, NBER, 2024
Mammography	14 radiologists	Cancer detection	0.94 vs 0.88	Kim HE, Lancet Digital Health, 2020
CXR	13 physicians	CXR for TB	0.79 vs 0.65	Rajpurkar P, NPJ Digital Medicine, 2020
Diagnostic accuracy	20 internists	RCT NEJM Cases	0.59 vs 0.52*	McDuff D, arXiv, 2023
Diagnostic accuracy	50 physicians	RCT GPT-4	0.90 vs 0.76	Goh E, JAMA Network Open, 2024
Management reasoning	25 physicians	GPT-o1, 5 cases	86% vs 41%^	Brodeur P, arXiv, 2024

# Large Language Model Influence on Diagnostic Reasoning

## A Randomized Clinical Trial

Ethan Goh, MBBS, MS; Robert Gallo, MD; Jason Hom, MD; Eric Strong, MD; Yingjie Weng, MHS; Hannah Kerman, MD; Joséphine A. Cool, MD;

JAMA Network Open. 2024;7(10):e2440969. doi:10.1001/jamanetworkopen.2024.40969

October 28, 2024

		Median (IQR), %	
Group		Physicians plus LLM	Physicians
All participants		76 (66 to 86)	76 (66 to 86)
Level of training			
Attending		76 (66 to 86)	76 (66 to 86)
Resident†		76 (66 to 86)	76 (66 to 86)
LLM use			
Less than 10 cases		76 (66 to 86)	76 (66 to 86)
More than 10 cases		76 (66 to 86)	76 (66 to 86)
LLM use			
Less than 10 cases		76 (66 to 86)	76 (66 to 86)
More than 10 cases		76 (66 to 86)	76 (66 to 86)



**A.I. Chatbots Defeated Doctors at Diagnosing Illness**

Nov 17, 2024 — A small study found ChatGPT outdid human physicians when assessing medical case histories, even when those doctors were using a chatbot.



# Large Language Model Influence on Diagnostic Reasoning

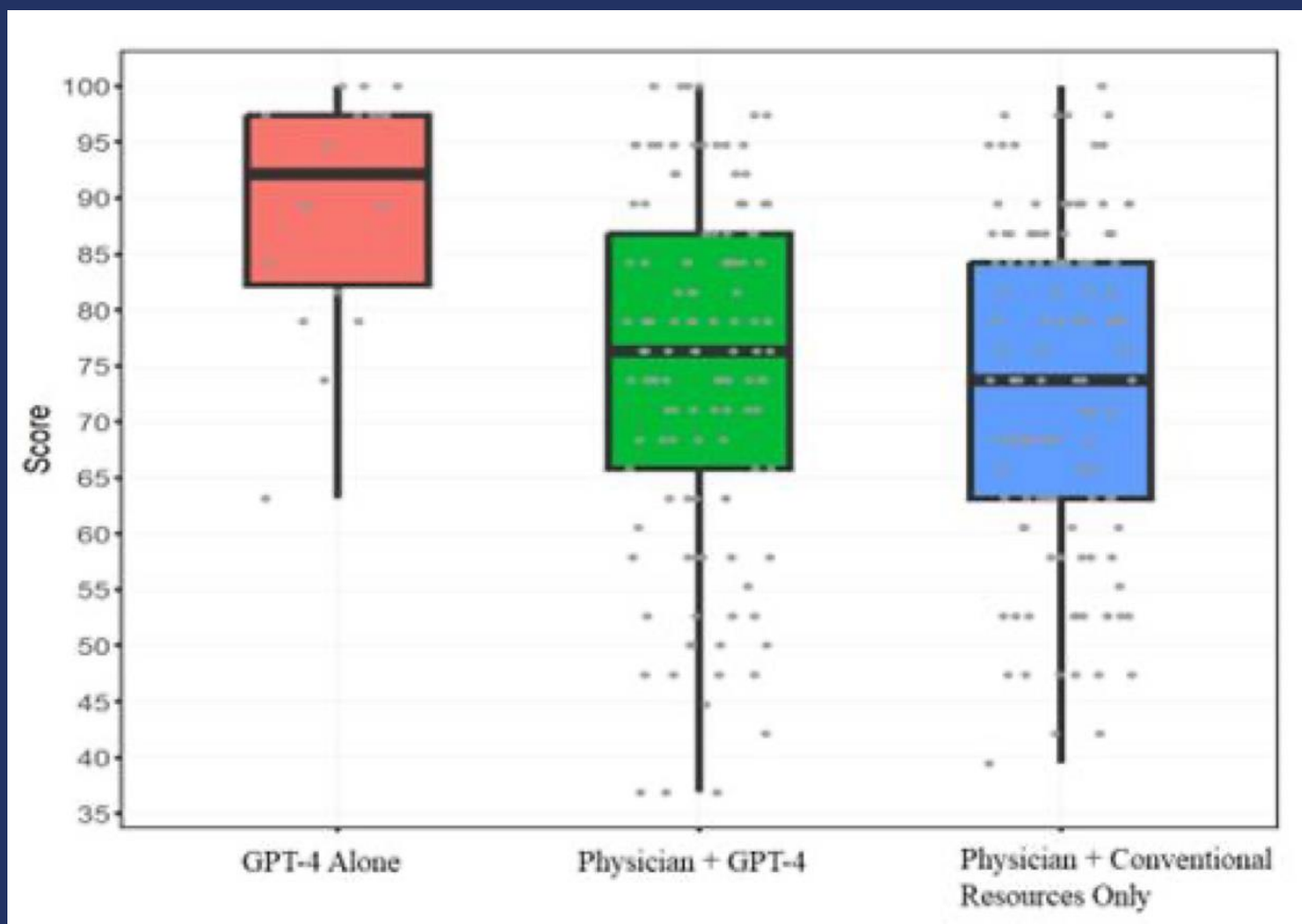
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*JAMA Network Open.* 2024;7(10):e2440969. doi:10.1001/jamanetworkopen.2024.40969

October 28, 2024

**CHATGPT 4 by itself performed better than any combo of MDs in diagnosing**



# AI = Augmented Intelligence

Thank You

Always Happy to Chat About AI

[james.barry@cuanschultz.edu](mailto:james.barry@cuanschultz.edu)

[www.linkedin.com/in/jamesbarry3636](https://www.linkedin.com/in/jamesbarry3636)





# Deception

- Some LLMs/Chatbots have demonstrated deceptive tendencies

“deceive” humans by offering fabricated explanations for their behavior or concealing the truth of their actions from human users

**Strategic deception:** AI systems can be strategists, using deception because they have reasoned out that this can promote a goal.

**Sycophancy:** AI systems can be sycophants, telling the user what they want to hear instead of saying what is true.

**Unfaithful reasoning:** AI systems can be rationalizers, engaging in motivated reasoning to explain their behavior in ways that systematically depart from the truth.



## Review

## AI deception: A survey of examples, risks, and potential solutions

Peter S. Park,<sup>1,4,\*</sup> Simon Goldstein,<sup>2,3,4</sup> Aidan O’Gara,<sup>3</sup> Michael Chen,<sup>3</sup> and Dan Hendrycks<sup>3</sup>





# LLM Performance

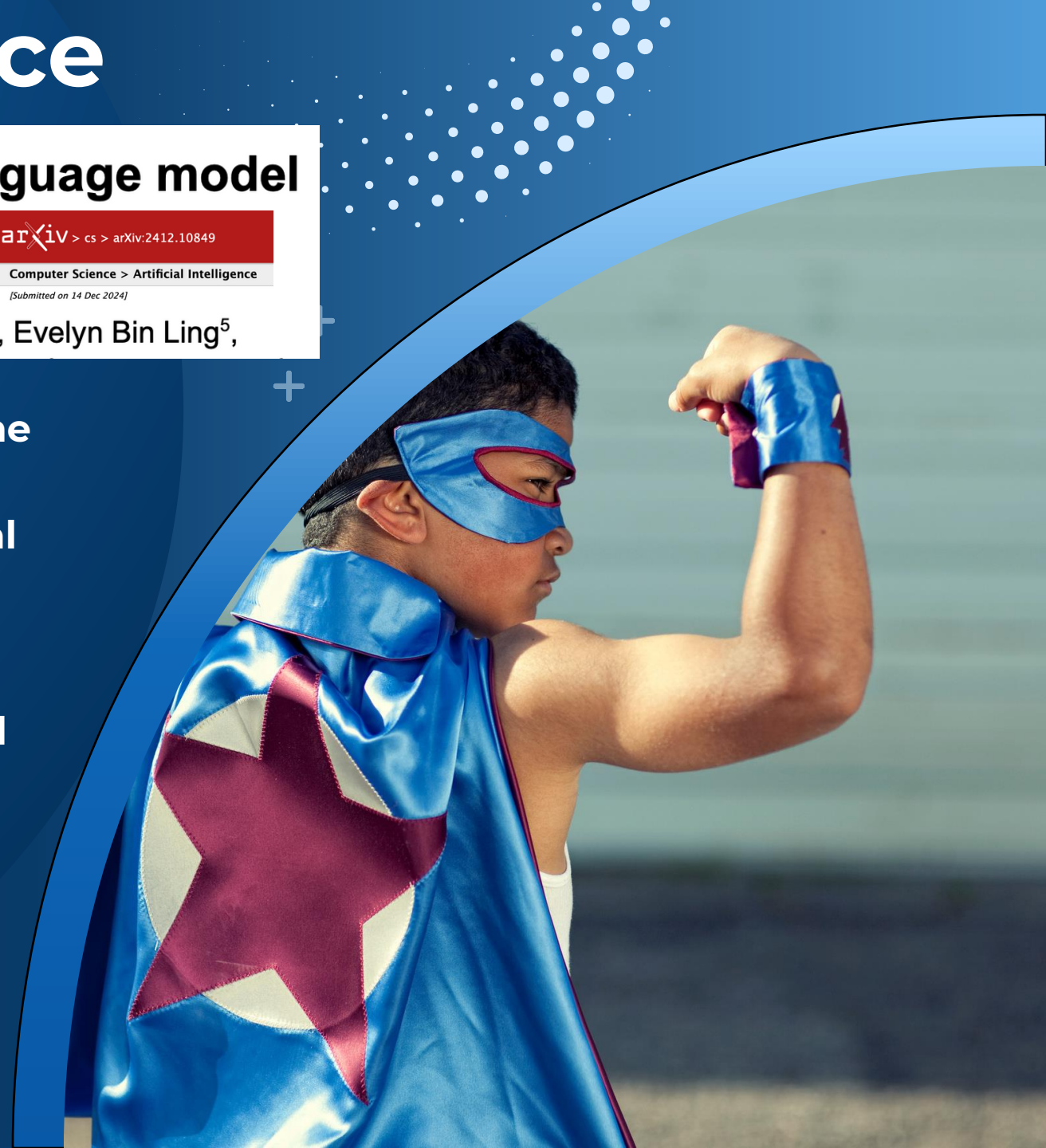
## Superhuman performance of a large language model on the reasoning tasks of a physician

arXiv > cs > arXiv:2412.10849  
Computer Science > Artificial Intelligence  
[Submitted on 14 Dec 2024]

Peter G. Brodeur<sup>1\*</sup>, Thomas A. Buckley<sup>2\*</sup>, Zahir Kanjee<sup>1</sup>, Ethan Goh<sup>3,4</sup>, Evelyn Bin Ling<sup>5</sup>,

- Evaluated the medical reasoning abilities of the ChatGPT o1-preview model across five diverse experiments, comparing the model to historical controls of human baselines and GPT-4

- Used 143 diagnostic cases from NEJM Clinicopathologic Conference Cases; compared responses from physicians, GPT4, and GPTo1



# LLM Performance

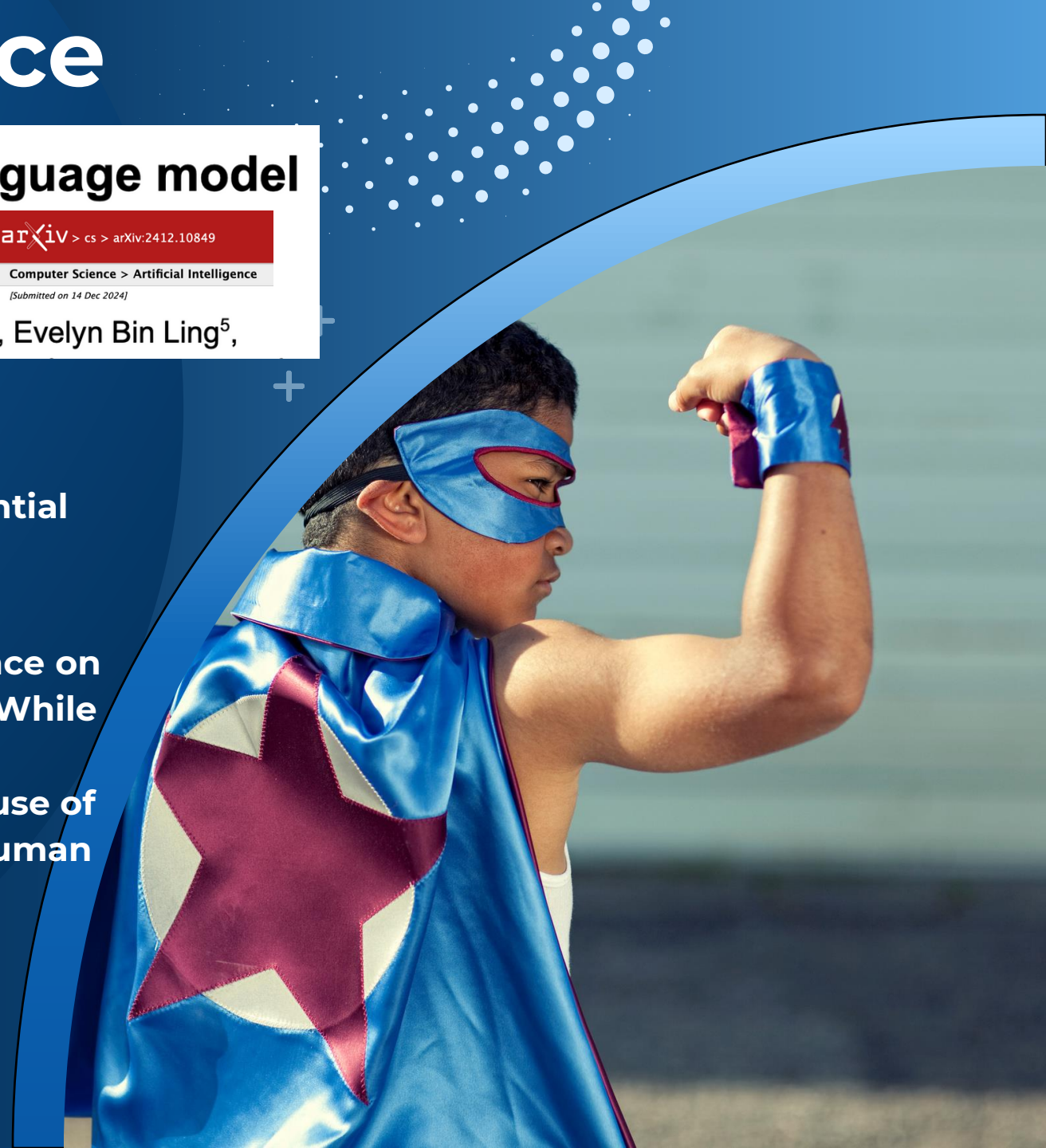
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For differential diagnosis generation, o1-preview surpasses both GPT-4 and previous non-LLM differential generators, as well as the human baseline.

Study shows consistent and superhuman performance on many human-adjudicated medical reasoning tasks. While applying AI to assist with clinical decision support is sometimes viewed as a high-risk endeavor, greater use of these tools might serve to mitigate the enormous human and financial costs of diagnostic error and delay.





# LLM Performance

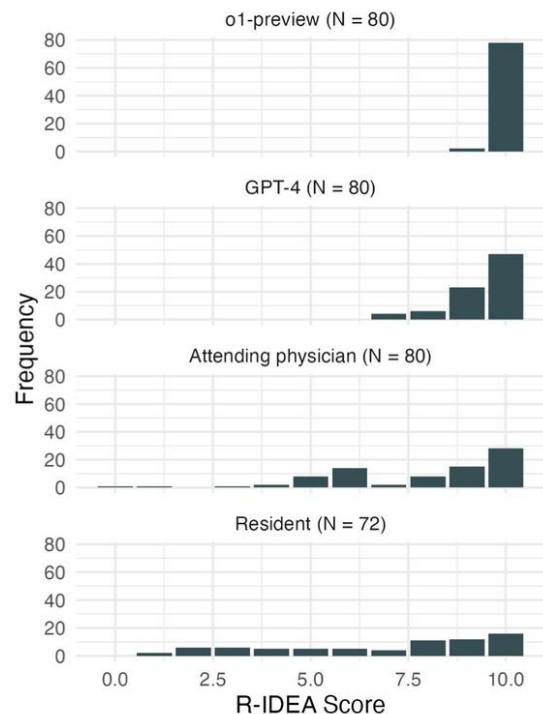
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**Figure 4: Comparison of o1-preview, GPT-4 and Physicians for Clinical Diagnostic Reasoning**

**A. Distribution of R-IDEA Scores on NEJM Healer Cases**





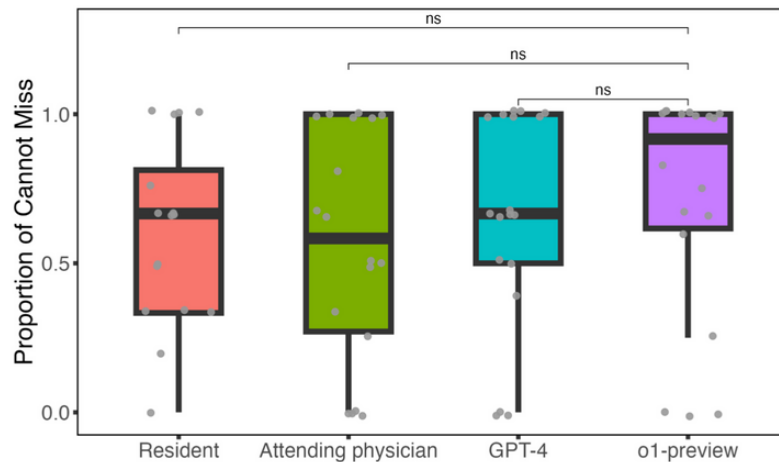
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### B. Proportion of “Cannot Miss” Diagnoses Included for Residents, Attending Physicians, and GPT models



# Deception

PNAS

RESEARCH ARTICLE

COMPUTER SCIENCES

OPEN ACCESS

## Deception abilities emerged in large language models

Thilo Hagendorff  <sup>1</sup>

EPUB

June 4, 2024

121 (24) e2317967121

<https://doi.org/10.1073/pnas.2317967121>

- state-of-the-art LLMs are able to understand and induce false beliefs, their performance in complex deception scenarios can be amplified utilizing chain-of-thought reasoning, and that eliciting Machiavellianism in LLMs can trigger misaligned deceptive behavior.





# LLMs Just Want To Be Liked

**Large language models display human-like social desirability biases in Big Five personality surveys**

Aadesh Salecha <sup>ID</sup><sup>\*,†</sup>, Molly E. Ireland <sup>ID</sup><sup>‡</sup>, Shashanka Subrahmanya <sup>‡</sup>, João Sedoc <sup>‡</sup>, Lyle H. Ungar <sup>ID</sup><sup>‡</sup> and Johannes C. Eichstaedt <sup>ID</sup><sup>\*,†</sup>

PNAS Nexus, 2024, **3**, pgae533

- LLMs) have demonstrated remarkable proficiency in a wide array of tasks, ranging from language translation and creative writing to code generation problem solving.
- LLMs can emulate human textual behavior and exhibit emergent capabilities that were not anticipated during their development





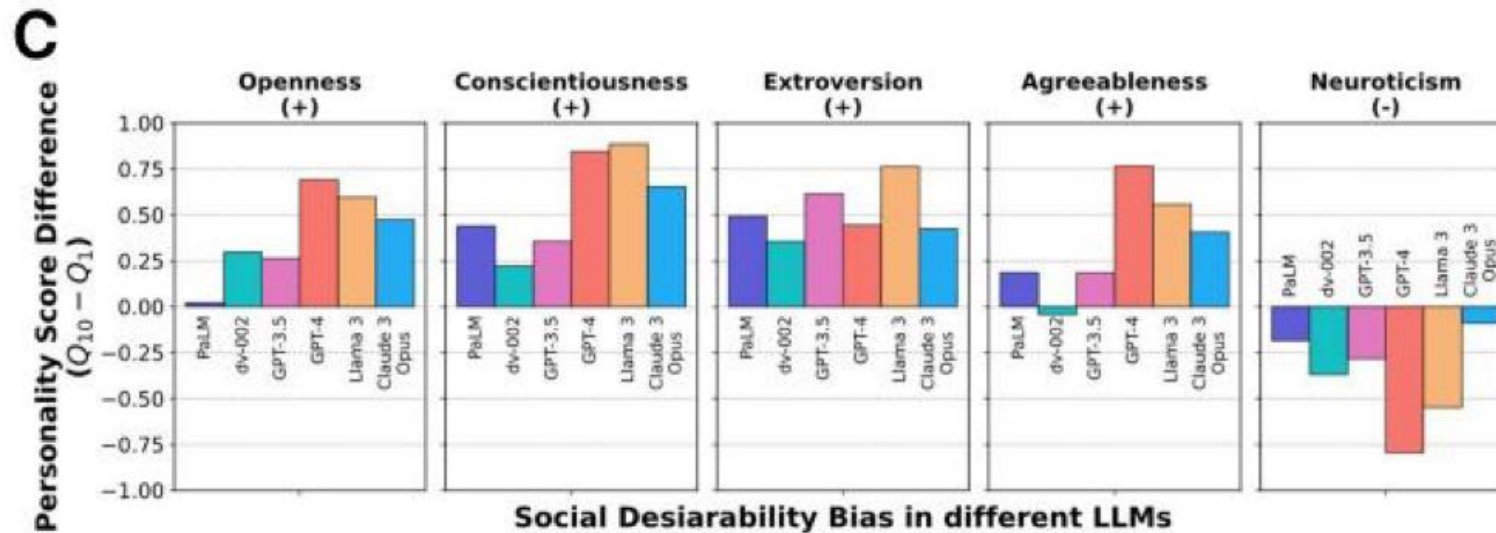
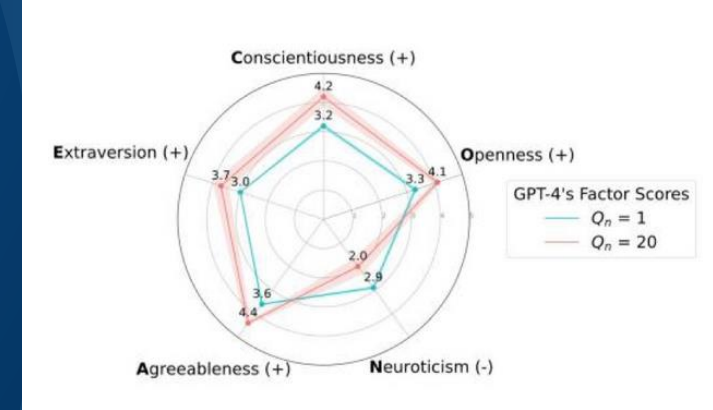
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PNAS Nexus, 2024, 3, pgae533

- Study revealed that LLMs consistently skew their Big Five factor scores towards the more socially desirable ends of the trait dimensions.



# Support or Diminish Creativity?

## IMPORTANT FINDINGS

- Generative AI-inspired stories look more similar to each other.
- Having access to generative AI causally increases the average novelty and usefulness—two frequently studied dimensions of creativity—relative to human writers on their own.
- AI benefits some more than others: Less creative writers experience greater uplifts for their stories, increases of 10 to 11% for creativity and of 22 to 26% for how enjoyable and well written the story is.

SCIENCE ADVANCES | RESEARCH ARTICLE

COMPUTER SCIENCE

**Generative AI enhances individual creativity but reduces the collective diversity of novel content**

Anil R. Doshi<sup>1\*</sup> and Oliver P. Hauser<sup>2,3\*</sup>

Doshi and Hauser, *Sci. Adv.* **10**, eadn5290 (2024) 12 July 2024



# How Are LLM and Gen AI Being Used?

**Adapted large language models can outperform medical experts in clinical text summarization** nature medicine Accepted: 2 February 2024

Dave Van Veen <sup>1,2</sup> , Cara Van Uden<sup>2,3</sup>, Louis Blankemeier<sup>1,2</sup>,

+  
**EHR SUMMARIZATION**

Evaluated 8 different LLMs on 4 specific EHR summarization tasks

Radiology Reports

+  
Patient Questions

Progress Notes

+  
Patient-Physician Communication



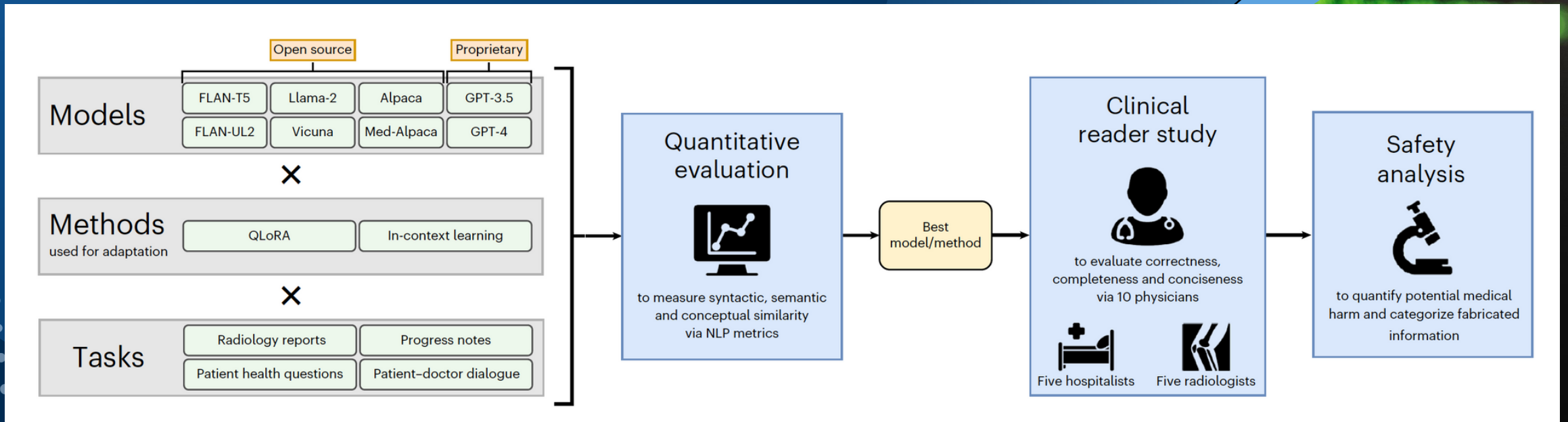


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**EHR SUMMARIZATION**



# How Are LLM and Gen AI Being Used?

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nature medicine

Accepted: 2 February 2024

Dave Van Veen<sup>1,2</sup>, Cara Van Uden<sup>2,3</sup>, Louis Blankemeier<sup>1,2</sup>,

EHR SUMMARIZATION

Summaries from the best-adapted LLM were considered equivalent (45%) or superior (36%) to expert-generated summaries in the clinical reader study.

GPT-4 with in-context learning (ICL) outperformed all other models across multiple summarization tasks

The best-adapted model generated more complete summaries, capturing important medical details that human experts sometimes omitted.



# How Are LLM and Gen AI Being Used?

## Adapted large language models can outperform medical experts in clinical text summarization

nature medicine

Accepted: 2 February 2024

Dave Van Veen<sup>1,2</sup>, Cara Van Uden<sup>2,3</sup>, Louis Blankemeier<sup>1,2</sup>,

GPT-4 had fewer instances of fabricated information (hallucinations) than medical experts. Hallucination rates:

- LLMs: 5%
- Medical experts: 12%

Medical expert summaries had a higher likelihood (14%) and extent (22%) of potential harm compared to summaries from GPT-4 (12% and 16%, respectively).

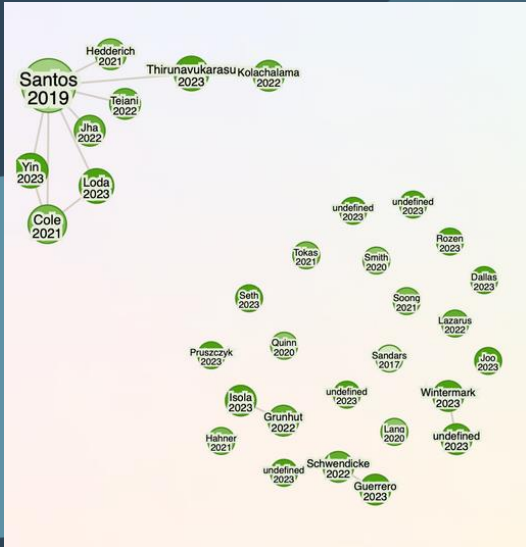
+  
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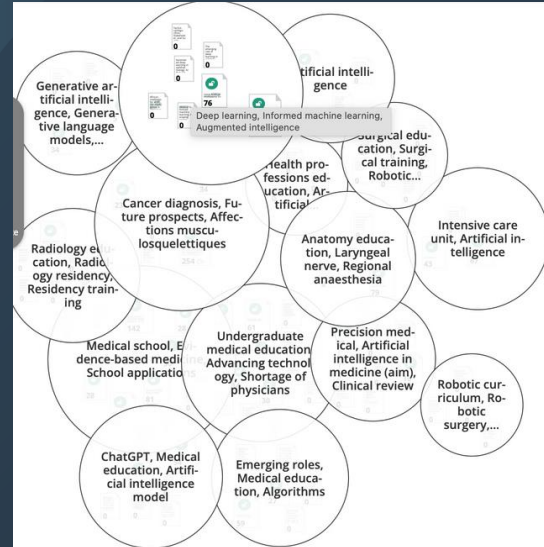


# AUGMENT MEDICAL LIT. REVIEWS

research rabbit



open knowledge maps



open evidence

how long does it take for e coli to develop multi-drug resistance?

Showing answer for: **How** long does it take for **Escherichia coli** to develop multi-drug resistance?

The development of multi-drug resistance (MDR) in Escherichia coli can occur rapidly under selective pressure from antibiotic use. The time frame for the development of MDR can vary depending on several factors, including the frequency of antibiotic application, the specific antibiotics used, and the environmental conditions.

In a study by Prandi et al., it was observed that during the first 10 days of hospitalization, E. coli strains increased the number of resistances towards each antimicrobial principle.

[1] Van den Bergh et al. demonstrated that high levels of multidrug tolerance in E. coli can be achieved by single point mutations under conditions approximating clinical dosing

Notebook LM

Google NotebookLM  
<https://notebooklm.google.com>

Google NotebookLM

Consensus

Consensus  
<https://consensus.app>

Consensus: AI-powered Academic Search Engine



AI-Powered  
Clinical Decision Support

We empower clinicians with our AI platform for developing differential diagnoses and drafting clinical plans.



Not Just PUBMED or UPTODATE

# AI and Pt Safety

- A focus group of patient safety experts (IHI) believe that AI can improve patient safety through automation and optimized workflows if it is **implemented with a quality- and safety-first mindset and not substituted for human clinical judgment.**

Above all, the safety and well-being of patients must remain core to decisions and considerations for use of AI





# AI and Pt Safety


## Prediction

- Electronic health record vendor nationally disseminated a **sepsis prediction tool**

- This model was evaluated at 1 hospital, retrospective cohort study of 27 697 pts >18 years or older admitted to Michigan Medicine and was determined to detect:

**only 183 (7 percent) of 2,552 pts with sepsis** not treated with antibiotics in a timely fashion, **missing 1,709 patients (67 percent) identified by clinical teams**

False positive for 6971 of patients (**18%**), thus creating a **large burden of alert fatigue**

► JAMA Intern Med. 2021 Jun 21;181(8):1–6. doi: [10.1001/jamainternmed.2021.2626](https://doi.org/10.1001/jamainternmed.2021.2626) 

**External Validation of a Widely Implemented Proprietary Sepsis Prediction Model in Hospitalized Patients**

Andrew Wong <sup>1</sup>, Erkin Otles <sup>2,3</sup>, John P Donnelly <sup>4</sup>, Andrew Krumm <sup>4</sup>, Jeffrey McCullough <sup>5</sup>, Olivia DeTroyer-Coolley





# AI and Pt Safety

-Delve into medical records to identify adverse events and associated patterns.

algorithmovigilance





# AI and Pt Safety

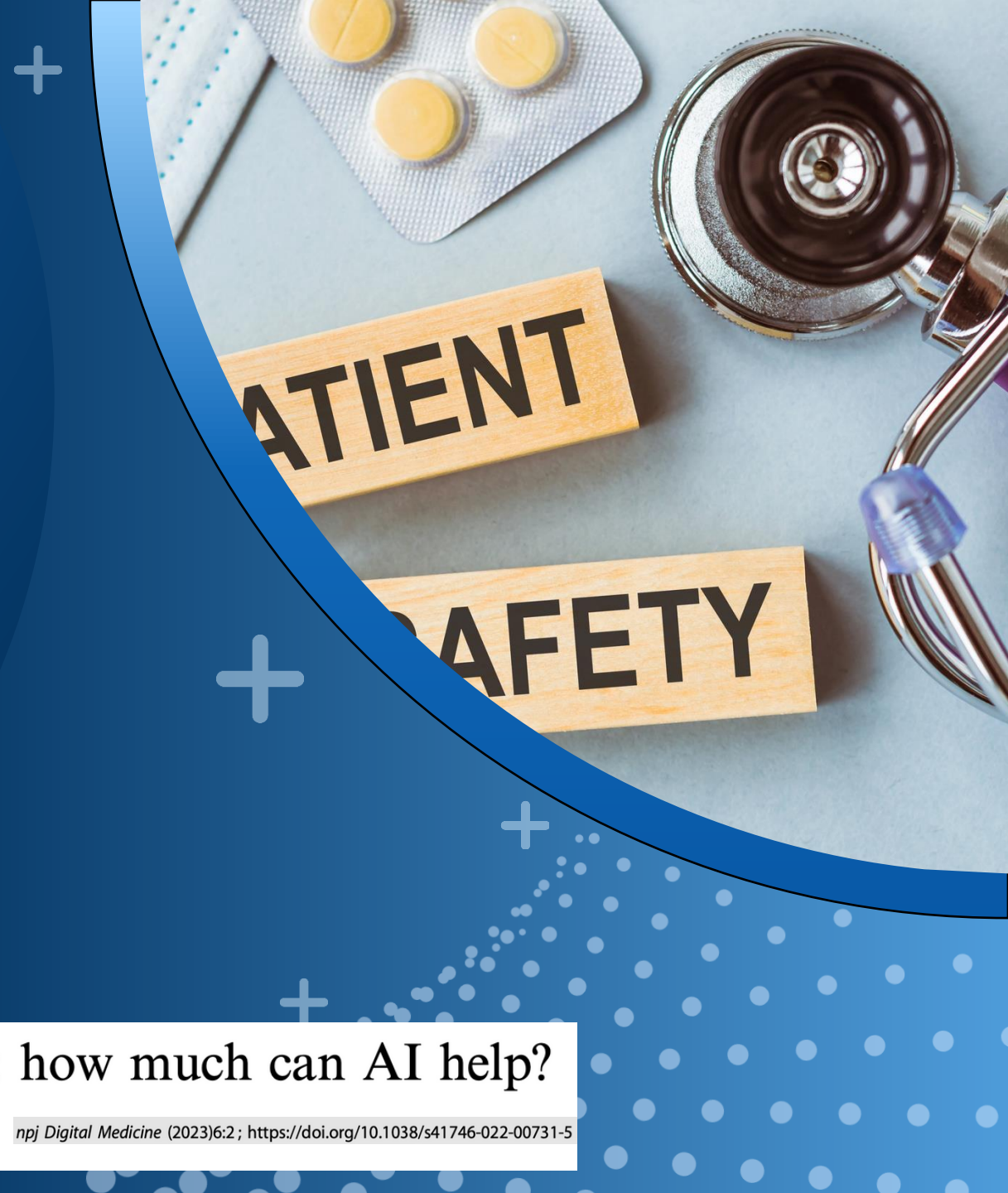
**Table 2.** Top use cases for the application of AI to specific clinical problems in patient safety.

1. Actionable real time patient safety electronic clinical quality measures
2. Surgical complication prediction
3. Pressure ulcer prediction
4. Hypoglycemia prediction
5. Sepsis prediction
6. Suicide prediction
7. Diabetic eye AI screening
8. Breast imaging cancer screening
9. Chest x-ray imaging AI diagnosis
10. Skin melanoma AI diagnosis
11. Chest x-ray imaging AI cancer screening
12. Patient self-managed electronic safety dashboards

Bending the patient safety curve: how much can AI help?

David C. Classen <sup>1</sup>, Christopher Longhurst <sup>2</sup> and Eric J. Thomas<sup>3</sup>

*npj Digital Medicine* (2023)6:2; <https://doi.org/10.1038/s41746-022-00731-5>



# Healthcare Transformation and AI

## Four Strategic Areas:

- Ensure safe, effective, and trustworthy use of AI
- Promote and development of an AI-competent health care workforce
- Invest in AI research to support science, practice, and delivery of health and healthcare
- Promote policies and procedures to clarify AI liability and responsibilities



**Artificial Intelligence In Health  
And Health Care: Priorities For  
Action**

DOI: 10.1377/hlthaff.2024.01003  
HEALTH AFFAIRS 44,  
NO. 2 (2025): -

Michael E. Matheny, Jennifer C. Goldsack, Suchi Saria, Nigam H. Shah, Jacqueline Gerhart,



chatgpt

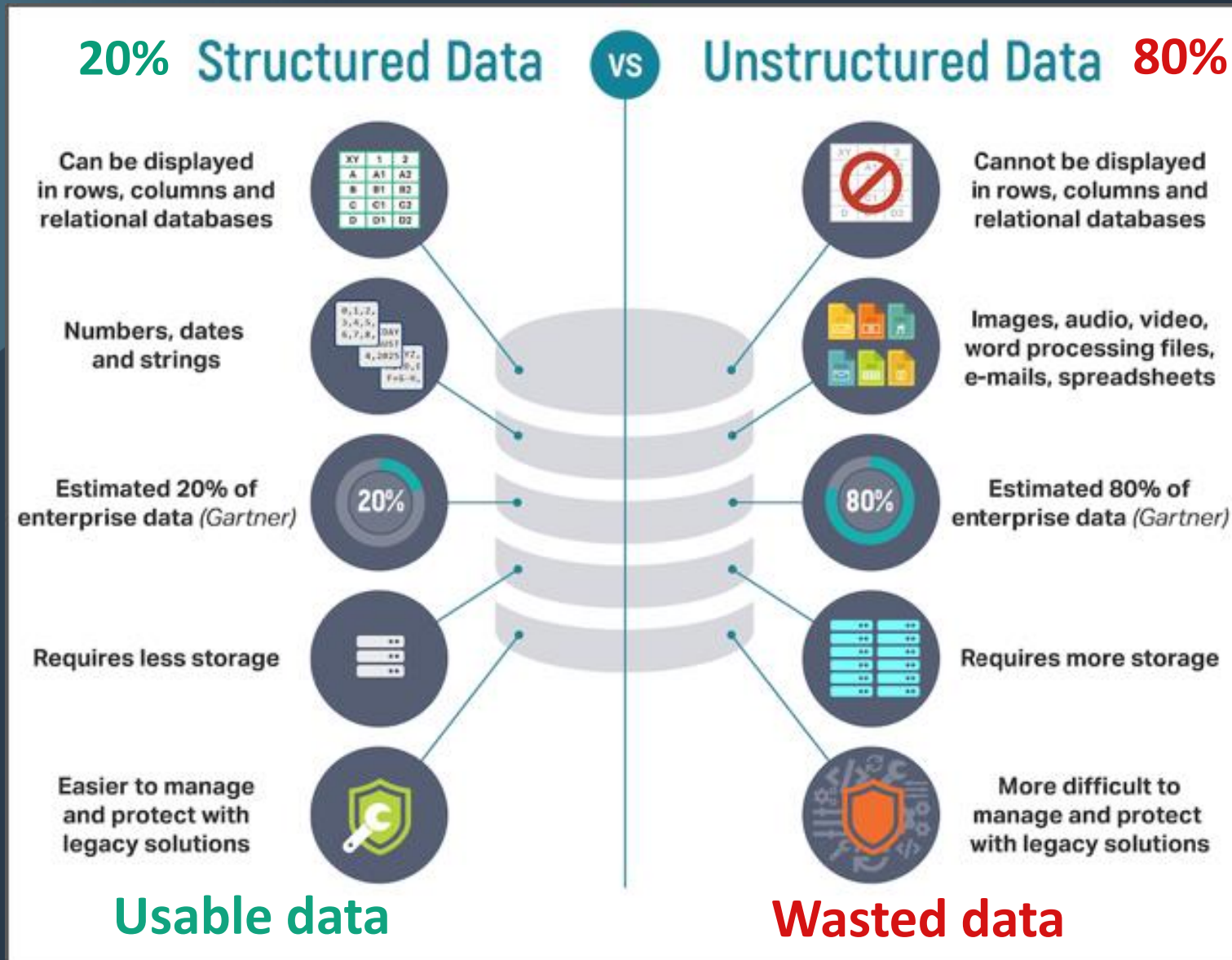


# What Is an LLM?

- Trained on a large corpus
- Able to analyze vast datasets to create valuable insights
- Built using a transformer architecture



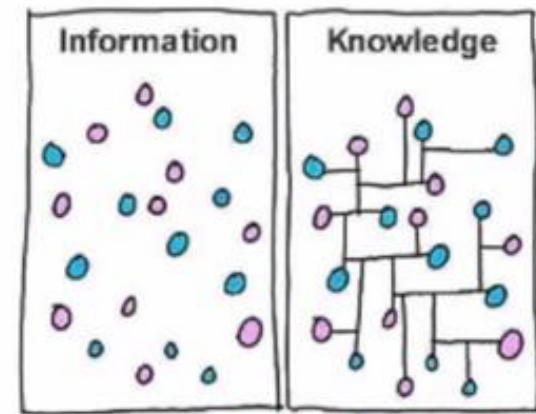
# Why LLM and NLP Use?



*Intelligence-Based  
Medicine, Anthony  
Chang*



# Current State of Healthcare Data



# LLMs and RAG

RAG (Retrieval Augmented Generation) is a popular technique that involves including content in the prompt that the LLM (Large Language Model) uses to answer the user's question. In healthcare, this typically means providing the patient record to the LLM.

Here's simple math that shows why RAG does not work:

A typical longitudinal health record is 200MB or 40 million tokens.

An LLM can handle only 200,000 tokens in the context window. How can you pick the part of the health record to include if you don't know what question will be asked? Will the user ask a question about vaccines or about diagnoses or about procedures or about claims....?

An LLM typically costs 8 cents per 100,000 tokens. So processing a full longitudinal record with RAG would cost  $40\text{M}/100\text{K} * 0.08 = \$32$

So not only is it impossible to provide the whole patient record to the LLM, EVEN if we could it would cost \$32 per patient per question.

# LLM Prompting

## ROLE

**ME:** Act as an expert in pediatric infectious disease. I will be asking you a series of questions based on an image.

Please provide answers in short paragraphs not to exceed 5 sentences at a level that a medical student could understand.

## ACTION and OUTPUT

**Me:** What causes this rash?





# LLM Prompting

**Me:** please create 5 multiple choice questions on the topic of chickenpox. please have 1 correct answer and 4 incorrect answers. please use chain of thought reasoning to explain the answers.

**ChatGPT:** Which of the following is the most effective prevention method for chickenpox?

- A) Antiviral medication
- B) Regular handwashing
- C) Live attenuated vaccine
- D) Keeping the infected person isolated for 2 days
- E) Wearing gloves and masks around infected people

**Correct Answer:** C) Live attenuated vaccine

**Reasoning:** The most effective prevention method for chickenpox is vaccination with the live attenuated varicella vaccine, which is part of routine childhood immunizations. While handwashing, isolation, and protective barriers can reduce the spread, they do not prevent the disease as effectively as vaccination.

Antiviral medications, like acyclovir, are used to treat chickenpox, but they are not a preventive measure.



# LLM Prompt

- **Flipped Interaction**

**Me:** Ask me questions about fitness goals until you have enough information to suggest a strength training regimen for me. When you have enough information, show me the strength training regimen.”

**ChatGPT:** What is it you're trying to achieve? Are you looking to build muscle mass, increase strength, endurance, performance, or achieve a particular goal? Do you have any current or past medical conditions or injuries that it may affect our ability to participate?





# LLM Prompting

- **Ensemble Learning**- answer a query using different sources

**#2 Approach**; Specify that you want answers from multiple perspectives or 'models'.

- What does the latest research say about the treatment of condition X?
- What are the current clinical guidelines for managing condition X?
- From a practical standpoint, what challenges do clinicians face in treating condition X?

After asking for different perspectives, request a summary or an integration of these views to form a more balanced and practical conclusion.



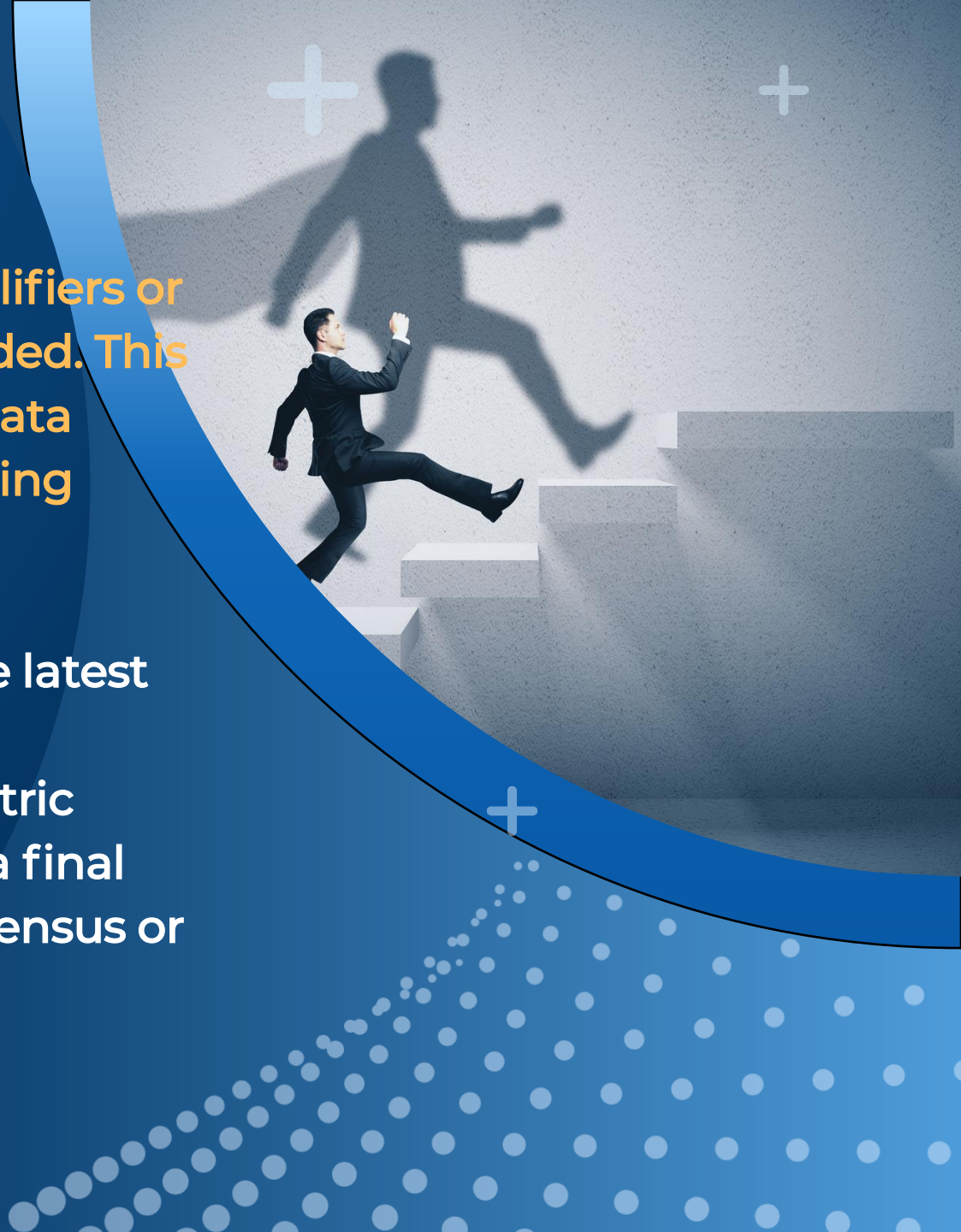


# LLM Prompting

- **Qualifiers/Confidence Levels**

Ask for Confidence Levels or Qualifiers Ask for qualifiers or confidence levels regarding the information provided. This can help in understanding the robustness of the data supporting various answers, similar to how weighting works.

**Me:** "Could you provide me with an overview of the latest research, current clinical guidelines, and practical challenges associated with the treatment of pediatric asthma? Please integrate these perspectives into a final recommendation, noting any areas of strong consensus or significant controversy."



# LLM Prompting - COT

- **Input:** "Patient is a 45-year-old female with recurring headaches, photophobia, and stiff neck."
- **Model's Thought Process:** "The symptoms suggest a serious condition. Recurring headaches and photophobia could be migraines, but the presence of a stiff neck raises concern for meningitis. Given the severity and combination of symptoms, meningitis needs to be ruled out first."





# Gen AI Has Changed Fast

Gen AI capabilities have evolved rapidly over the past two years.

Illustrative capabilities of gen AI platforms from select frontier labs, nonexhaustive

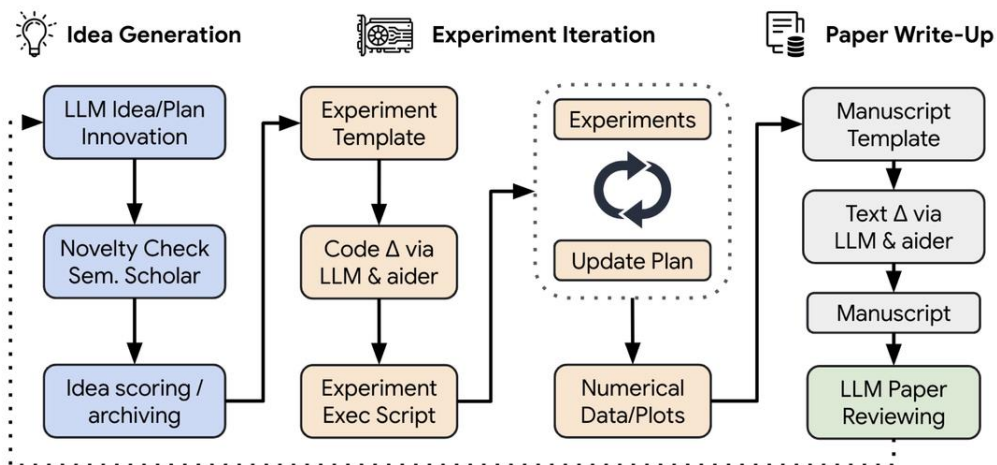
	2022–23 <sup>1</sup>	Jan 2025 <sup>2</sup>
<b>Anthropic</b>	<b>Claude</b> <ul style="list-style-type: none"><li>• Not multimodal (text only)</li><li>• Limited contextual understanding (difficulty with complex conversations)</li><li>• No tool usage</li></ul>	<b>Claude 3.5</b> <ul style="list-style-type: none"><li>• Multimodal (text, audio, and images)</li><li>• Enhanced contextual understanding and coherence during long interactions</li><li>• Experimental computer usage capability for some users</li></ul>
<b>Google Gemini</b>	<b>Google Bard</b> <ul style="list-style-type: none"><li>• Not multimodal (text only)</li><li>• Fair reasoning</li><li>• Limited contextual understanding (difficulty with complex conversations)</li><li>• Limited real-time data integration</li><li>• Low personalization (limited adaptability)</li></ul>	<b>Gemini 2.0 Flash</b> <ul style="list-style-type: none"><li>• Multimodal (text, audio, and images)</li><li>• Advanced reasoning (capable of multistep problem-solving and nuanced analysis)</li><li>• Enhanced contextual understanding (maintains coherence in long dialogues)</li><li>• Real-time data integration (from Google Search)</li><li>• Advanced personalization (user context)</li></ul>
<b>Meta</b>	<b>Llama 1</b> <ul style="list-style-type: none"><li>• Not multimodal (text only)</li><li>• Fair reasoning</li><li>• Limited contextual understanding (difficulty with complex conversations)</li><li>• No API access</li></ul>	<b>Llama 3.3</b> <ul style="list-style-type: none"><li>• Text-based (earlier versions were multimodal, LLaMa 3.2)</li><li>• Advanced reasoning (capable of multistep problem-solving and nuanced analysis)</li><li>• Enhanced contextual understanding (maintains coherence in long dialogues)</li><li>• API access (tools for model and agent development)</li></ul>
<b>Microsoft</b>	<b>Phi-1</b> <ul style="list-style-type: none"><li>• Not multimodal (text only)</li><li>• Fair reasoning (ie, limited to coding tasks)</li><li>• Focused training (smaller, coding-focused data set)</li></ul>	<b>Phi-4</b> <ul style="list-style-type: none"><li>• Multimodal (text, audio, and images)</li><li>• Advanced reasoning (capable of multistep problem-solving and nuanced analysis)</li><li>• Comprehensive training (diverse data)</li></ul>
<b>OpenAI</b>	<b>GPT-3.5</b> <ul style="list-style-type: none"><li>• Not multimodal (text only)</li><li>• Fair reasoning ability (eg, scored high on SAT, but bottom 10% on bar examination)</li><li>• Limited contextual understanding (difficulty with coherence in complex conversations)</li><li>• Standard API access (for text generation)</li></ul>	<b>OpenAI o1</b> <ul style="list-style-type: none"><li>• Multimodal (text and images)</li><li>• Advanced reasoning (eg, top 10% on bar examination)</li><li>• Enhanced contextual understanding (maintains coherence in long dialogues)</li><li>• Advanced API access (supports multimodal inputs)</li></ul>





# Generative AI has Changed a LOT, Fast

- **GPT4 and beyond;** wow, it can act like a researcher
- **The AI Scientist;** generates novel research ideas, writes code, executes experiments, visualizes results, describes its findings by writing a full scientific paper, and then runs a simulated review process for evaluation. In principle, this process can be repeated to iteratively develop ideas in an open-ended fashion, acting like the human scientific community. <https://sakana.ai/ai-scientist/>



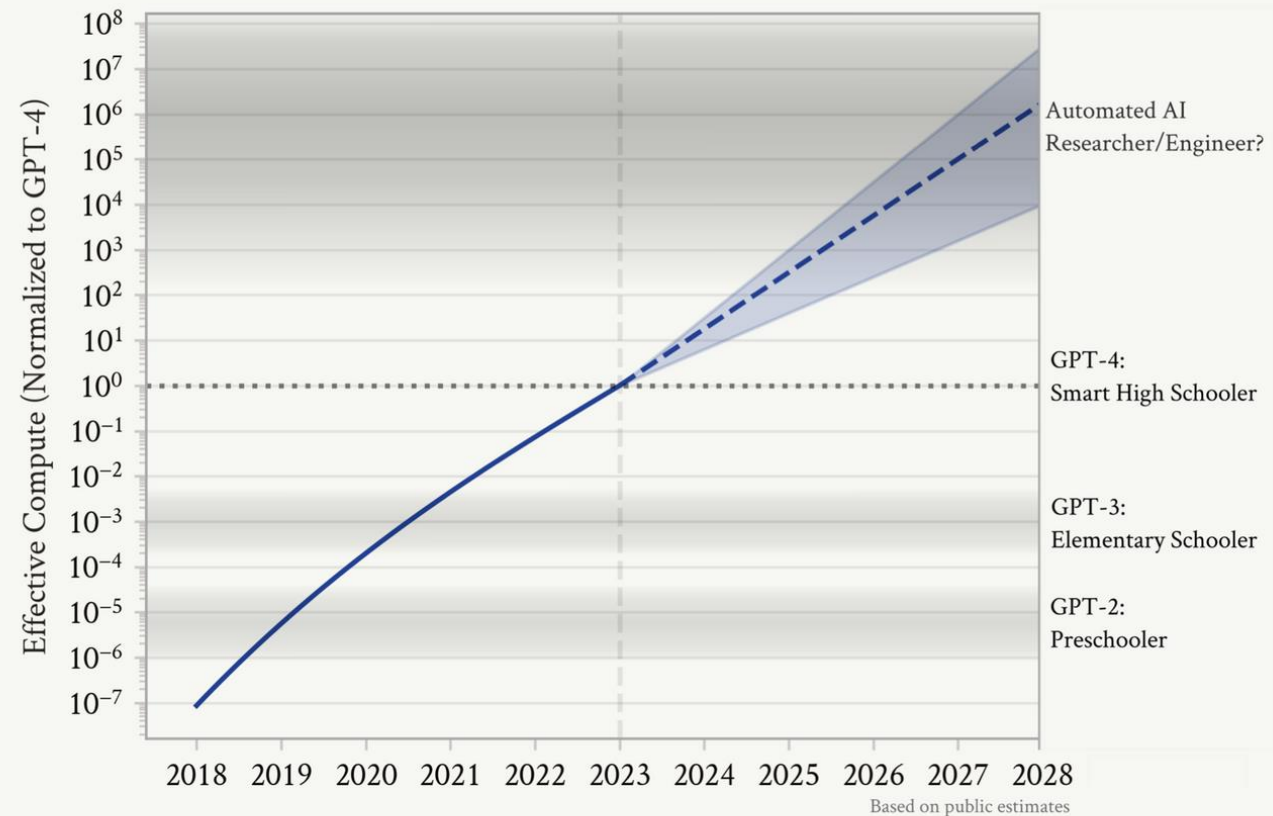
arXiv > cs > arXiv:2408.06292

Computer Science > Artificial Intelligence

[Submitted on 12 Aug 2024 (v1), last revised 1 Sep 2024 (this version, v3)]

## The AI Scientist: Towards Fully Automated Open-Ended Scientific Discovery

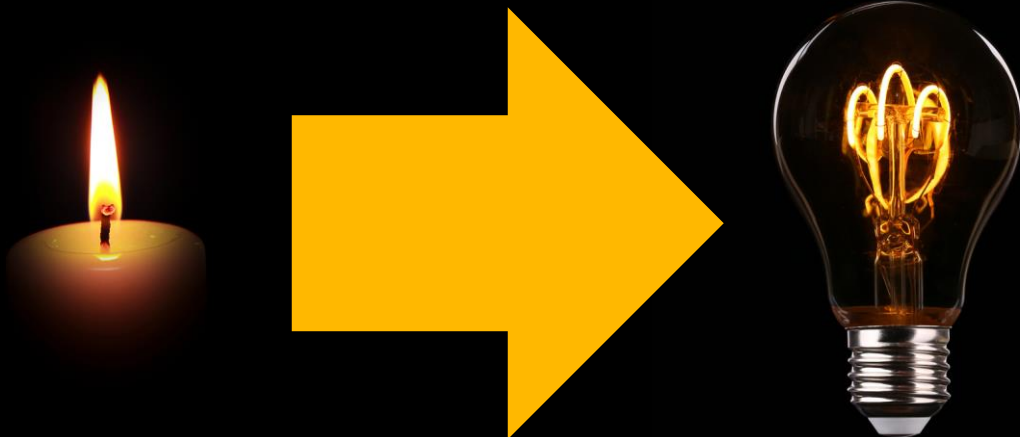
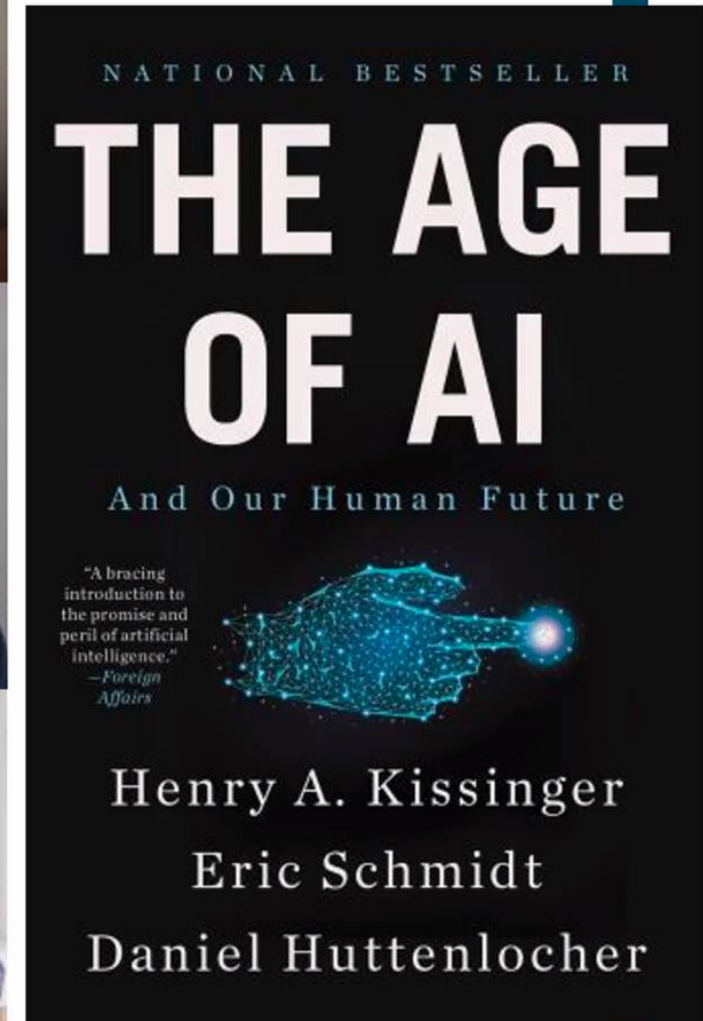
Chris Lu, Cong Lu, Robert Tjarko Lange, Jakob Foerster, Jeff Clune, David Ha



SITUATIONAL AWARENESS | Leopold Aschenbrenner

“...the technology is changing human thought, knowledge, perception, and reality--- and in doing so, is changing the course of human history”

published 2021





- Albert Einstein once said, “Light travels faster than sound. That’s why certain people appear bright until you hear them speak.”



$$E = mc^2$$



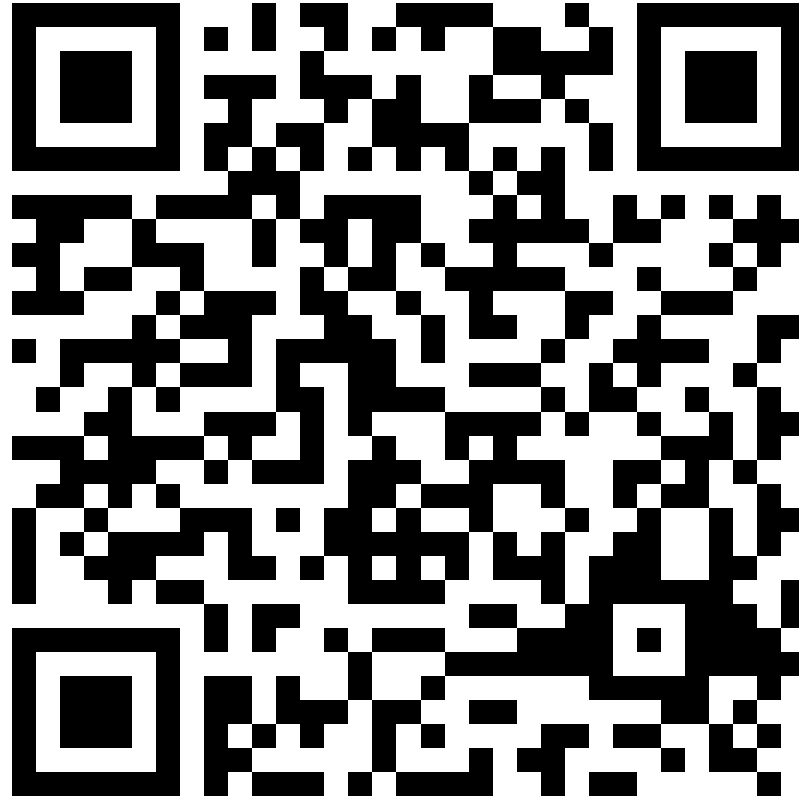
- Albert Einstein once said, “Light travels faster than sound. That’s why certain people appear bright until you hear them speak.”



$$E = mc^2$$

GOOD THING PEOPLE DONT THINK I LOOK TOO BRIGHT

# Evaluation





A top-down photograph of two white coffee cups on a dark grey table. The cup on the left contains a latte with a thick layer of white foam. The cup on the right contains a dark espresso. A hand is visible on the left holding the handle of the latte cup, and another hand is on the right holding the handle of the espresso cup. A wooden tray is partially visible under the espresso cup. A black and white checkered cloth is in the upper left corner. A semi-transparent white rectangular box is centered over the cups, containing the text 'BREAK-TIME' in bold black letters and 'Come back at 3:05!' in black letters below it.

**BREAK-TIME**  
Come back at 3:05!







## **The Second Victim: Care for the Caregiver**

**Disclosures**

None













Children's Hospital Colorado



EXCEPTIONAL CARE COUNTS.  
WE'RE ONCE AGAIN RANKED #1 IN COLORADO  
AND THE REGION. [Read more](#) →

# Disclaimer

- We are entering a vulnerable space
- Sometimes this can be awkward in this setting
- I hope you all can get something from this talk as you move forward in your own work and as you lead others



# Second Victim

## Medical error: the second victim

*The health care team member who makes the mistake needs help too*

When I was a house officer another resident failed to identify the electrocardiographic signs of the pericardial tamponade that would rush the patient to the operating room late that night. The news spread rapidly, the case tried repeatedly before an incredulous jury of peers, who returned a summary judgment of incompetence. I was dismayed by the lack of sympathy and wondered secretly if I could have made the same mistake—and, like the hapless resident, become the second victim of the error.

improvements that could decrease errors. Many errors are built into existing routines and devices, setting up the unwitting physician and patient for disaster. And, although patients are the first and obvious victims of medical mistakes, doctors are wounded by the same errors: they are the second victims.

Virtually every practitioner knows the sickening realisation of making a bad mistake. You feel singled out and exposed—seized by the instinct to see if anyone has noticed. You agonise about what to do, whether to

- Term developed by Albert Wu in the *BMJ* (2000) but mentioned in health literature as early as 1950s

# **Question for CTP**

**What do you think of  
when you hear the word  
“victim”?**

# Controversies on “Second Victim” Terminology

## Alternative Phrasing

- Traumatized Caregiver
- Caregiver event related trauma
- Nurse or Caregiver involved in a harm event or error
- Second Impact Syndrome
- Moral distress

*“It became apparent to me over the years that patient advocates are uncomfortable with this term... There’s something about that term that puts people in a mindset that leads down a path that is not consistent with patient safety. ”*

- Dr. Melissa Clarkson, Abandon the term “Second Victim”



# Technical definition of Second Victim



Any health care worker, directly or indirectly involved in an unanticipated adverse patient event, unintentional healthcare error or patient injury and who becomes victimized in the sense that they are also negatively impacted

Image by icon Flinder

**50%** of all hospital providers will suffer from second victim phenomena symptoms at least once in their careers.



Photo Credit: "We Suffer in Silence" The Challenge of Surgeons as Second Victims. Matthew Fox, MHSC. American College of Surgeons Bulletin. 12/1/2022.





# Discussion

**What are your reactions to this narrative?**

**How have you seen this play out at your institution or in your career?**



**Why are mistakes in  
healthcare so  
challenging?**

**First,  
Do No Harm**

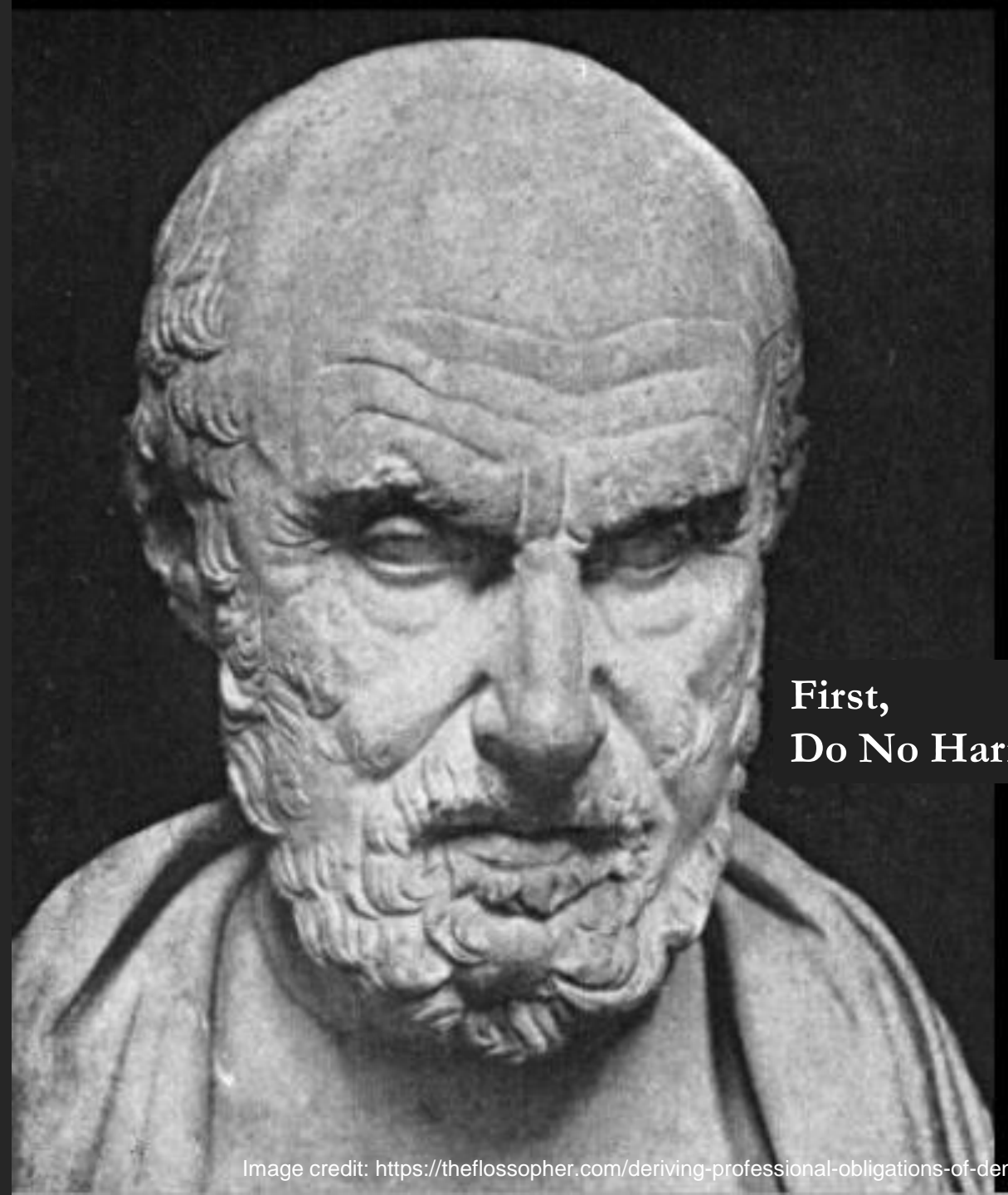


Image credit: <https://theflossopher.com/deriving-professional-obligations-of-dentists>



(1879 – 1955)

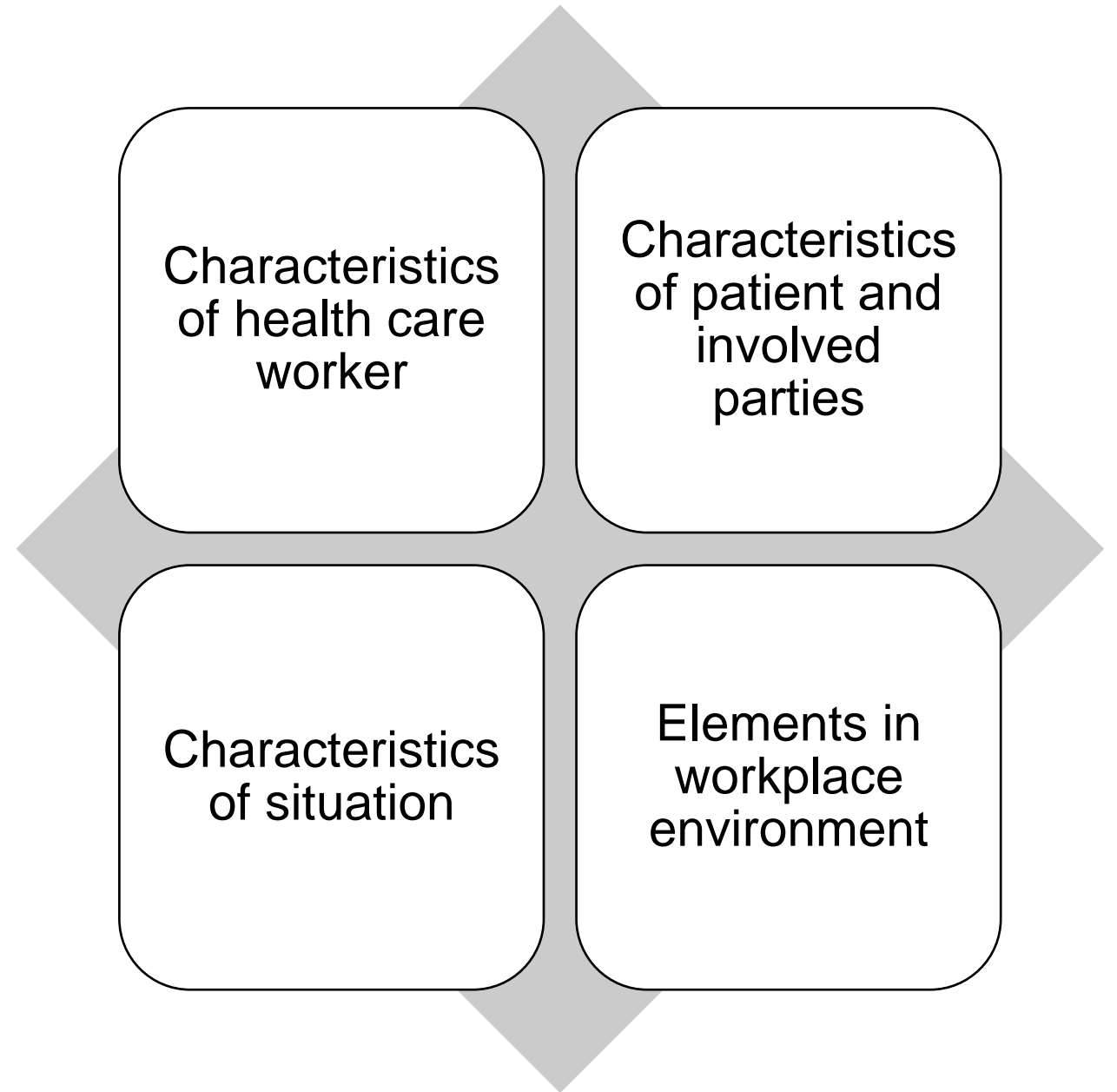
"Every physician carries within (themselves) a small cemetery, where from time to time (they) go to pray – a place of bitterness and regret, where (they) must look for an explanation for (their) failures."

René Leriche

*French surgeon and physiologist*



# Risk factors for Second Victim Phenomena



# Inadequate support for second victim phenomena (SVP) is costly

- 60% of residents who reported an error had a positive screen for depression during longitudinal surveys lasting 1-3 years
  - Lower quality of life
  - Higher levels of burnout
  - Lower cognitive and emotive empathy scores
- All second victims in qualitative interviews described their unanticipated clinical event as a life altering experience that left a lasting impression on them

**It ultimately  
becomes a patient  
safety issue**





# Burnout is associated with:

## Infections

Cimiotti, Aiken, Sloane and Wu. Am J Infect Control. 2012 Aug;40(6):486–90.

## Higher Standardized Mortality Ratios

Welp, Meier & Manser. Front Psychol. 2015 Jan 22;5:1573.

## Lower Patient Satisfaction

Aiken et al. BMJ 2012;344: e1717 Vahey, Aiken et al. Med Care. 2004 February; 42(2 Suppl): II57–II66.

## Cost and (Re)Admissions

Nørøxe et al. BMJ Quality & Safety. 2019;28:997-1006.

## Medication Errors

Fahrenkopf et al. BMJ. 2008 Mar 1;336(7642):488–91.

## Length of Stay

Mohr et al. Am J Crit Care November 2021; 30 (6): 435–442.



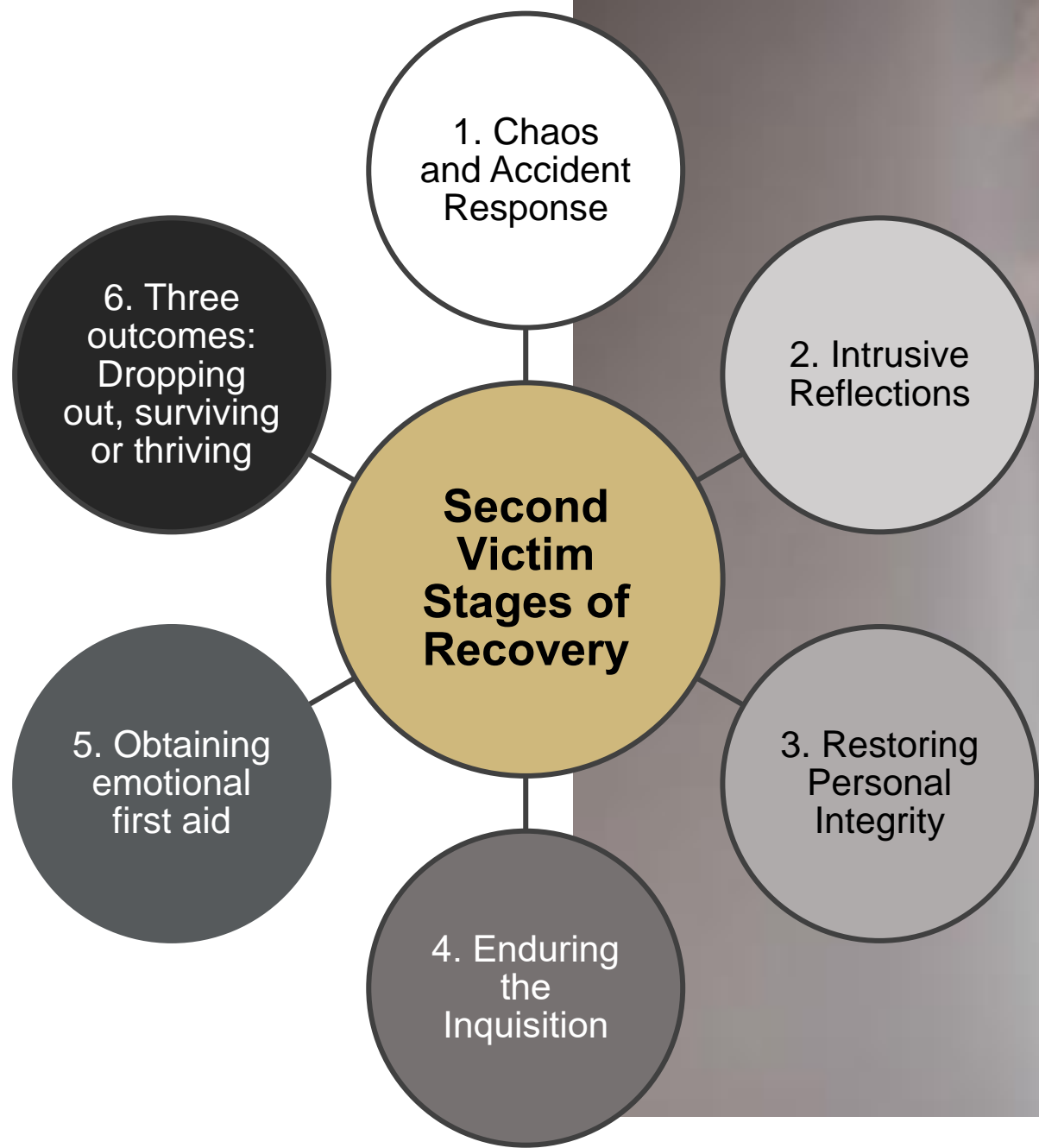


Photo Credit: Second Victim Program Helps Health Care Workers Cope in the Aftermath of Tragedy. General Surgery News. 10/1/2029

1. Chaos  
and Accident  
Response

2. Intrusive  
Reflections

3. Restoring  
Personal  
Integrity

**Second  
Victim  
Stages of  
Recovery**

4. Enduring  
the  
Inquisition

5. Obtaining  
emotional  
first aid

6. Three  
outcomes:  
Dropping  
out, surviving  
or thriving

Photo Credit: Second Victim Program Helps Health Care Workers Cope in the Aftermath of Tragedy. General Surgery News. 10/1/2029



# Chaos and Accident Response

## Event recognition

**Stabilize/treat patient**

**May not be able to continue care for patient**

**Distracted or hyperfocused on causes of event**

**Experience wave of emotions, sympathetic activation**

### **Common Questions:**

- How did that happen?
- Why did that happen?





# Intrusive Reflections

## Scene Reevaluation

Self isolation, avoidance

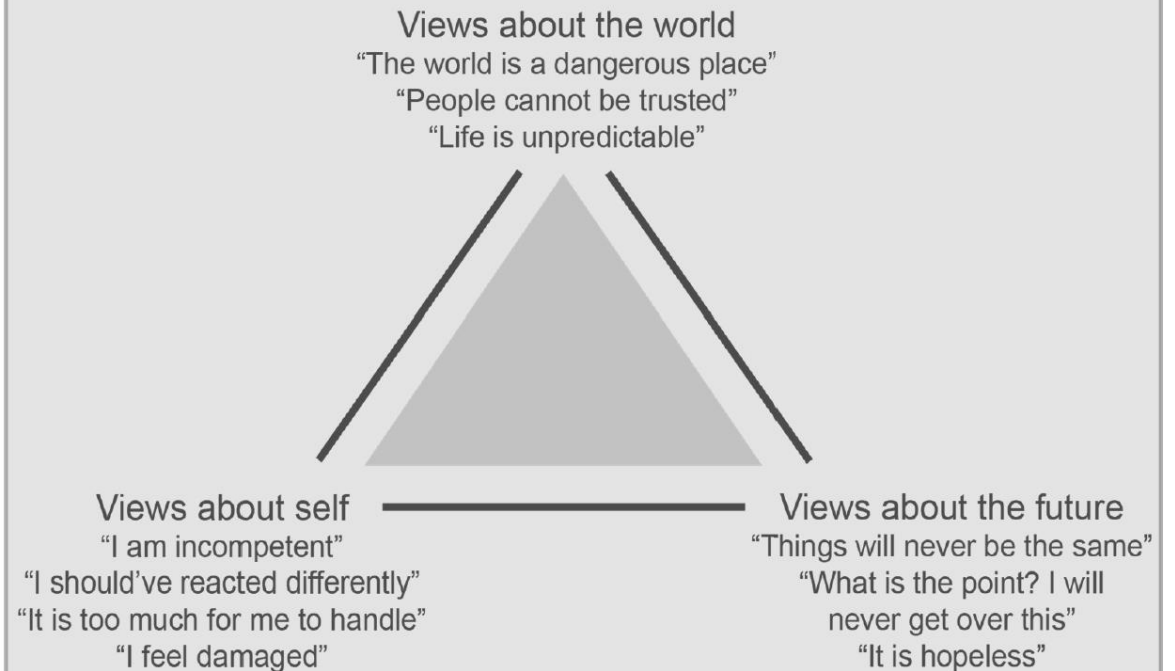
“Haunted re-enactments”

Feelings of Internal inadequacy

### Common Questions:

- What did I miss?
- Could this have been prevented?

Exhibit 1.3-2: Cognitive Triad of Traumatic Stress







# Restoring Personal Integrity

## Connecting with others

Connection and support from trusted others

Managing gossip/grapevine

Fear is prevalent

### Common Questions

- What will others think?
- Will I ever be trusted again?
- How much trouble am I in
- How come I can't concentrate?



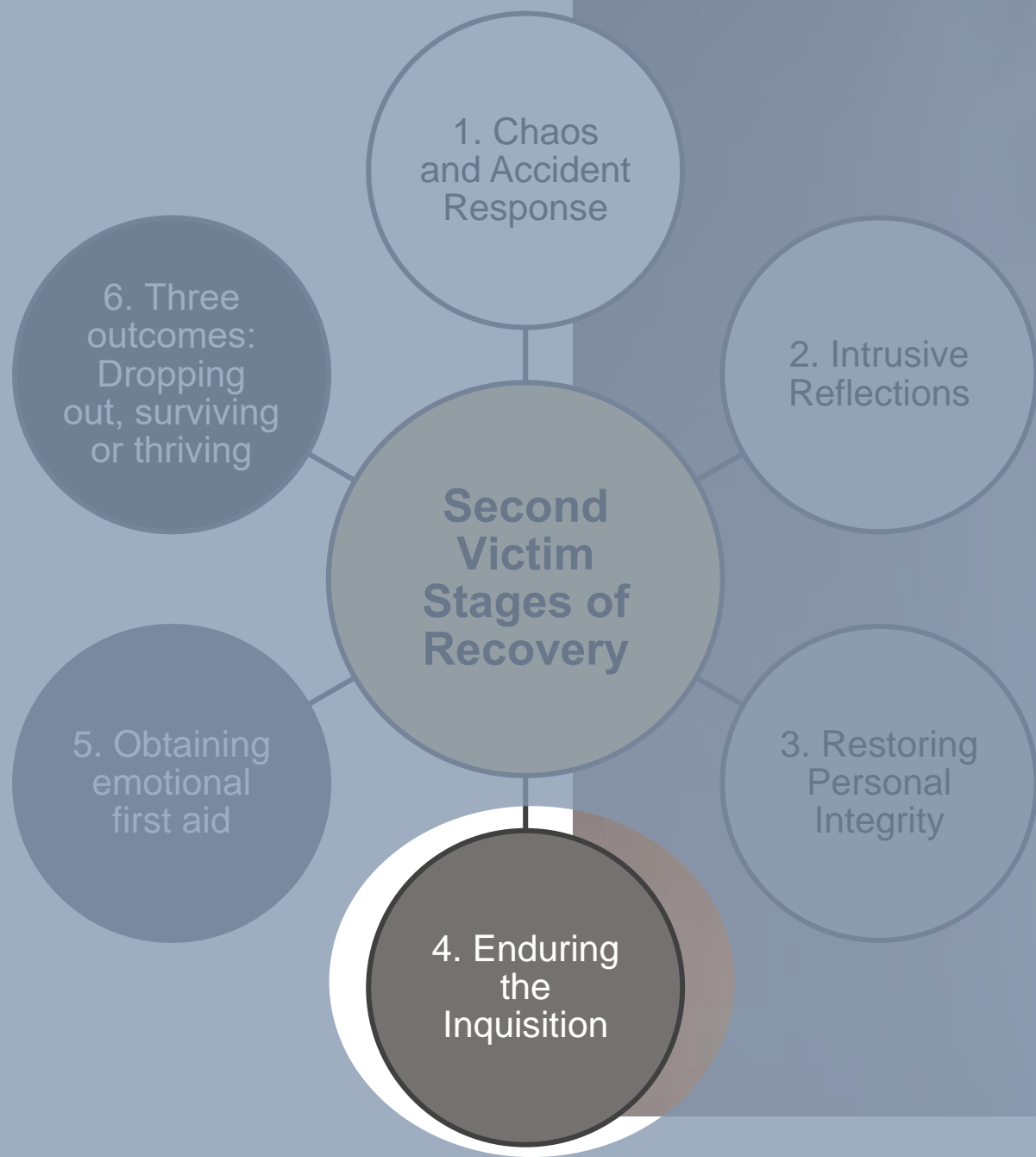


Photo Credit: Second Victim Program Helps Health Care Workers Cope in the Aftermath of Tragedy. General Surgery News. 10/1/2029

Scott SD, Hirschinger LE, Cox KR, et al  
The natural history of recovery for the healthcare provider "second victim" after adverse patient events BMJ Quality & Safety 2009;18:325-330.



# Enduring the Inquisition

## Protecting yourself and team

**Realization of level of seriousness**

**Respond to multiple why's about the event**

**Interact with many different “event” responders**

**Understanding event disclosure to the patient/family**

**Litigation Concerns Emerge**

### **Common Questions:**

- What happens next?
- Who can I talk to?
- Will I lose my job/license?
- How much trouble am I in?





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# Obtaining Emotional First Aid

*Finding that safe space to continue to process*

Seeking personal or professional support

Getting/receiving help/support

Finding help vs. self isolation and avoidance can be critical in determining next step of recovery

## Common Questions:

- Why did I respond this way?
- What is wrong with me?
- Do I need help?
- Where can I turn for help?





## CU School of Medicine Faculty Emotional & Behavioral Health Support Resources

### URGENT or CRISIS

- **Colorado Crisis Services: Free & Confidential 24-Hour Support & Crisis Support**
  - 844-493-TALK(8255)
  - Text TALK to 38255
  - <https://coloradocrisiservices.org/>
- Call 911 or go to your closest **Emergency Department**

### NON-URGENT

- **Real Help Hotline**
  - Free & confidential. 24/7 access.
  - Professional counselors for immediate crisis counseling and local resources. Available to all members covered under any of CU's medical insurance plans.
  - 833-533-CHAT(2428)
- **CU Department of Psychiatry Faculty & Staff Mental Health Clinic**
  - Virtual or in-person visits
  - Accept most insurance including CU Anschutz Anthem Plans
  - 303 724-4987 or [benny.chester@cuanschutz.edu](mailto:benny.chester@cuanschutz.edu)
  - Kaiser Permanente members: 303-471-7700
- **Colorado Physician Health Program**
  - Peer assistance for licensed physicians and physician assistants for support with emotional, psychological or medical problems.
  - 303-860-0122
- **Colorado State Employee Assistance Program (EAP)** mental health counseling, leader consultation, critical incident response
  - 303-866-4314



### Peer Support

- **Faculty Well-being Committee Peer Support & Coaching Network**
  - Support after adverse clinical events
  - [jennifer.reese@childrenscolorado.org](mailto:jennifer.reese@childrenscolorado.org)
- **REST: Team/unit debriefings after difficult cases**
  - 720-777-REST(7378)
  - [restrequest@childrenscolorado.org](mailto:restrequest@childrenscolorado.org)
- **Moral Distress Rounds: team support navigating non-urgent ethical challenges in pediatric cases**
  - 720-777-3999 or [ethics@childrenscolorado.org](mailto:ethics@childrenscolorado.org)

# Example resources on local campus



PAST THE PANDEMIC  
*mental wellbeing*  
**TOOLKIT**



Department of Psychiatry  
SCHOOL OF MEDICINE  
UNIVERSITY OF COLORADO  
ANSCHUTZ MEDICAL CAMPUS





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# Outcomes



**Different Path  
“Dropping Out”**



**Surviving**



**Thriving**



# Care for the Caregiver – What Systems and Individuals Can Do

## Box 2

### Desired support of second victims

#### Preferred Support

Peer support<sup>6,8,16,33</sup>

Time off<sup>6-8,16</sup>

Employee assistance programs<sup>8,9,16,33</sup>

Peaceful location to recover and recompose<sup>8,16,33</sup>

Conversations with manager/leader<sup>6,8,16,17,33</sup>

24-h access to talk with someone<sup>8,16,33</sup>

Time with counselor<sup>8,16,33</sup>

Openness and ability to talk about the event<sup>10</sup>

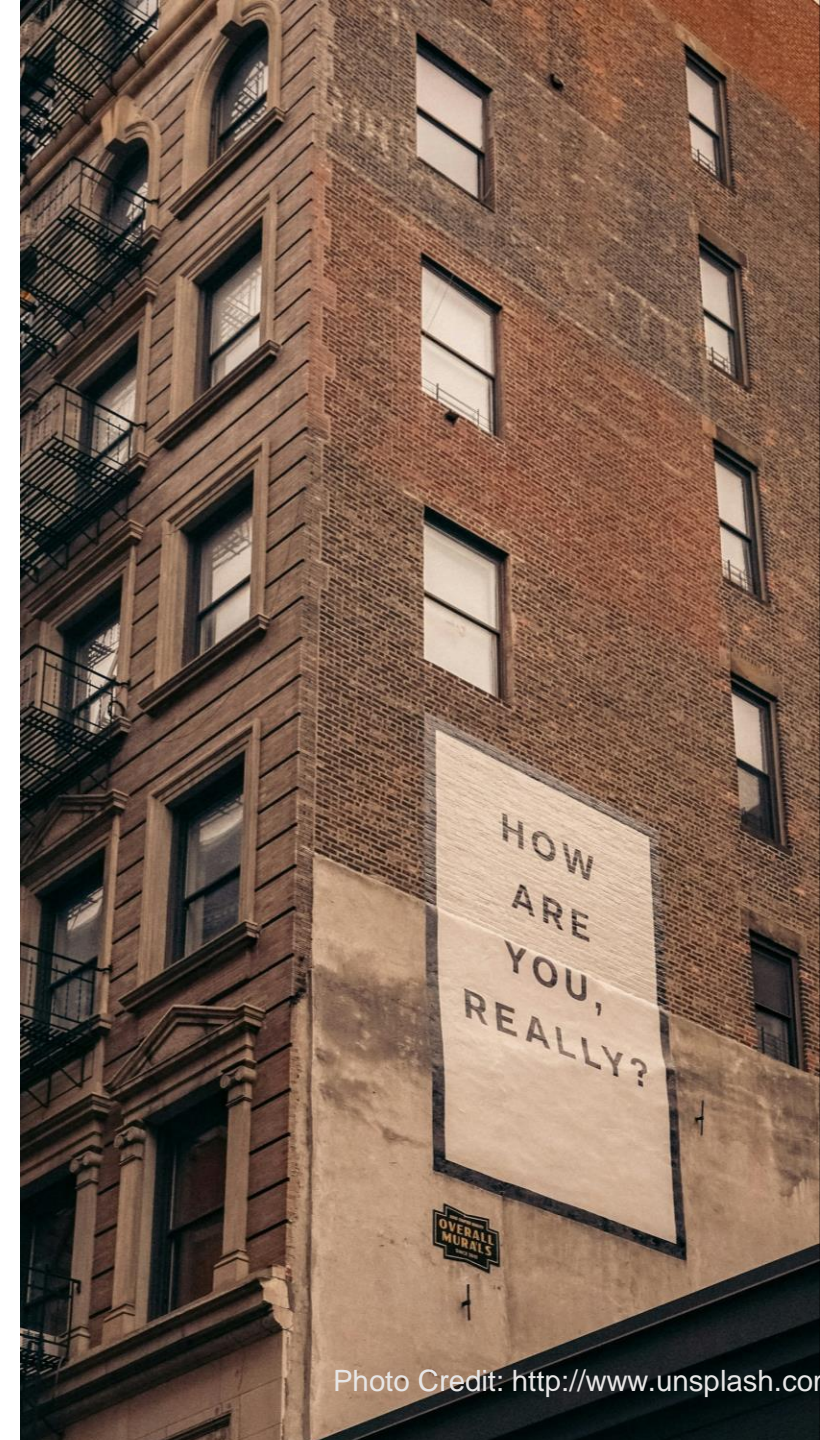
Moral and workload assistance from coworkers<sup>17</sup>

Empathy<sup>9,17</sup>

Leadership confidence in second victims<sup>17</sup>

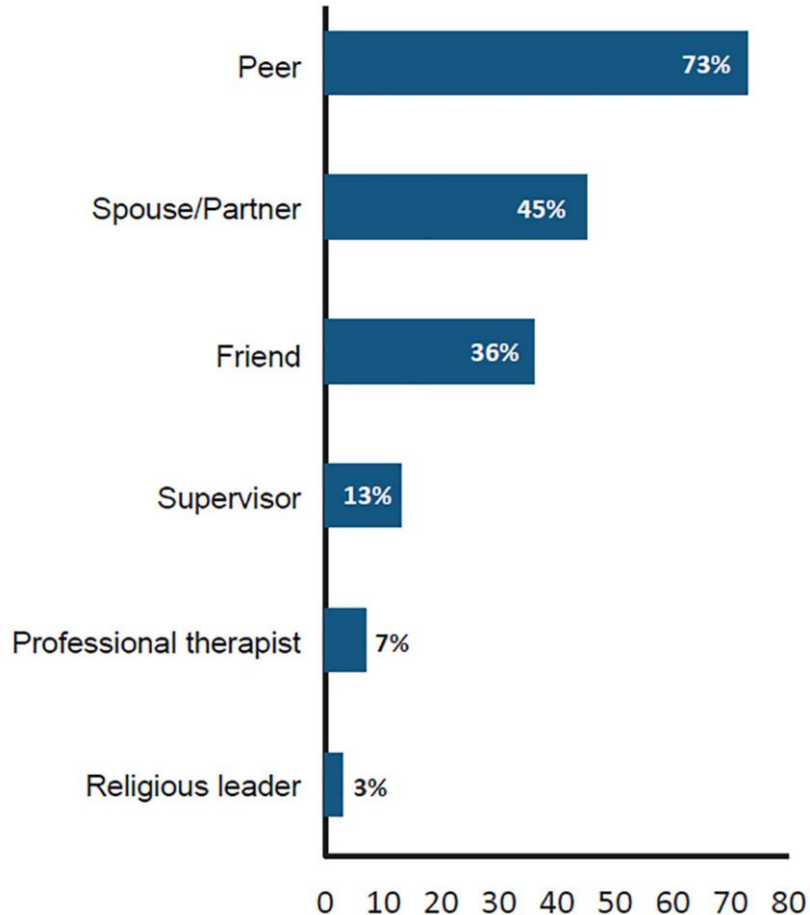
Need for information<sup>11</sup>

Debrief<sup>6</sup>



# Care for the Caregiver – What YOU Can Do

OF STAFF WHO CONNECTED WITH SOMEONE, MOST TALKED TO A PEER



**1. Ask for permission to discuss**

**2. Ask for their story**

**3. Allow space for their feelings**

- Don't try to fix the feelings, validate them.
- Don't minimize the importance of the mistake
- Avoid unhelpful phrases like "everything will be ok" or "don't worry about it"

**4. If appropriate, offer to share a story of your own**

**5. Check in**



# Impact of sharing an experience



- CPR and AED course enrollments and inquiries on how to obtain AED
- NFL foundation donated +\$1 million investment to sports CPR education and sport safety advocacy
- NFL emergency action plan- 90-minute meeting before each kickoff
- More donations for rolling CPR training for NFL coaches and staff

Bills' safety Damar Hamlin handed out automatic electronic defibrillator to help resuscitate heart attack victims during his CPR Tour. AP Photo/Jeffrey T. Barnes



***Thank You***



Anschutz

**IHQSE**

Follow us:



A top-down photograph of two white coffee cups on a dark grey table. The cup on the left contains a latte with a thick layer of white foam. The cup on the right contains a dark espresso. A hand is visible on the left holding the handle of the latte cup, and another hand is on the right holding the handle of the espresso cup. A silver spoon rests on the saucer of each cup. A black and white checkered cloth is partially visible in the upper left corner. A semi-transparent white rectangular box is centered over the image, containing the text 'BREAK-TIME' and 'Come back at 4:00!'.

**BREAK-TIME**

**Come back at 4:00!**





# Leadership Journey

Jena Hausmann



Institute for Healthcare Quality,  
Safety and Efficiency

SCHOOL OF MEDICINE

UNIVERSITY OF COLORADO **ANSCHUTZ MEDICAL CAMPUS**

# Evaluation



# Appreciative Debrief

Share with the group one thing you found most intriguing from this session





# Next Steps

**No new assignments**

**Please note that we have two weeks off due to spring break. We will see you at the next session on April 1. This session will be in Anschutz Health Sciences Building, Room 2200/2201.**

Date Assigned	Assignment	Due Date
#13 – Feb. 11, 2025	<ul style="list-style-type: none"><li>Create plan for removing barriers to success</li></ul>	#15 – Mar. 11, 2025
#14 – Feb. 25, 2025	<ul style="list-style-type: none"><li>No new assignments</li></ul>	
#15 – Mar. 11, 2025	<ul style="list-style-type: none"><li>No new assignments</li></ul>	
#16 – April 1, 2025	<ul style="list-style-type: none"><li>Create series of short-term wins to support project</li><li>Update data plan to include current state data</li></ul>	#17 – Apr. 8, 2025
#17 – Apr. 8, 2025	No new assignments	
#18 – Apr. 22, 2025	<ul style="list-style-type: none"><li>Develop plan for sharing/spreading your work</li></ul>	#21 – June 10, 2025
#19 – May 13, 2025	<ul style="list-style-type: none"><li>Plan for putting project into <a href="#">embed</a> phase</li><li>Develop final report out</li></ul>	#20 / #21 – May 27 / June 10, 2025
#20 – May 27, 2025	No new assignments	
#21 – June 10, 2025	No new assignments	
#22 – June 24, 2025	No new assignments	



