

Artificial Intelligence in Healthcare: Same Great Flavor You Have Come to Expect from Regular Intelligence Without Those Unwanted Calories!

Faculty: David Whiting, MD; Eric Zacharias, MD

Activity Date: October 21, 2024

Activity Location: Live, In-Person Denver, CO

Activity Time: 2:45pm

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- Planner/Faculty: **David Whitting, MD**
- Reviewer: **Dennis Boyle, MD**
- Planner: **Alan Lembitz, MD**
- Planner: **Susan Sgambati, MD**

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For MDs & DOs the number of credits designated is the number of credits awarded

COPIC is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

COPIC designates this LIVE activity for a maximum of **1.0 hour AMA PRA Category 1 Credit(s)[™]**.

Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Process for Claiming Credit

In order to earn CME/CE credit learners should complete the evaluation questions that will assess if practitioners have learned the most important recommendations and conclusions from this course. Each LIVE CME activity consists of the full participation of the learner, and a course evaluation. The assessment/evaluation remain locked until the learning activity is completed.

Process for Completing the Activity:

1. Read the Financial Disclosures.
2. Read the target audience, learning objectives, and financial disclosures.
3. Complete the LIVE educational activity.
4. Complete the activity evaluation/assessment on COPIC's LMS platform.

It is estimated that this activity will take approximately **1.0 hours** to complete.

Levels of Evidence

All planners/reviewers must document the evidence for patient care recommendations made in any CME/CE activity.

COPIC has adopted the following American Academy of Family Physicians Rating:

Level B (Other Evidence):

A well-designed, nonrandomized clinical trial. A nonquantitative systematic review with appropriate search strategies and well-substantiated conclusions. Includes lower quality RCT's, clinical cohort studies and case-controlled studies with nonbiased selection of study participants and consistent findings. Other evidence, such as high-quality, historical, uncontrolled studies, or well-designed epidemiological studies with compelling findings, is also included.

Goals & Purpose

This activity describes the use of Artificial Intelligence in the healthcare environment, including risks and benefits, and highlights the role of the interprofessional team in the management of their patients.

Target Audience

This **LIVE** activity is designed to meet the educational needs of healthcare professionals who diagnose and treat patients including nurses, residents, student nurses, and physicians' assistants.

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Accreditation & Designation Statements

For nursing the number of credits designated is the number of credits awarded

COPIC is accredited as a provider of Continuing nursing education (CNE) by the American Nurses Credentialing Center's Commission on Accreditation (ANCC). This activity was designated for 1 nursing contact hours.

Process for Claiming Credit

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Process for Completing the Activity:

1. Read the target audience, learning objectives, and financial disclosures.
2. Complete the LIVE educational activity.
3. Complete the activity evaluation on COPIC's LMS platform and/or Survey Monkey

It is estimated that this activity will take approximately **1 hours** to complete.

Course Learning Objectives

1. **Describe** selected, current and emerging applications of AI in healthcare, and some wider implications for society.
2. **Identify** key risks and limitations of using AI for medical tasks, such as communication, documentation and decision-support.
3. **Evaluate** trends and implications of AI for patient safety, professional liability and regulatory policy.

Important Disclaimer for this Presentation:

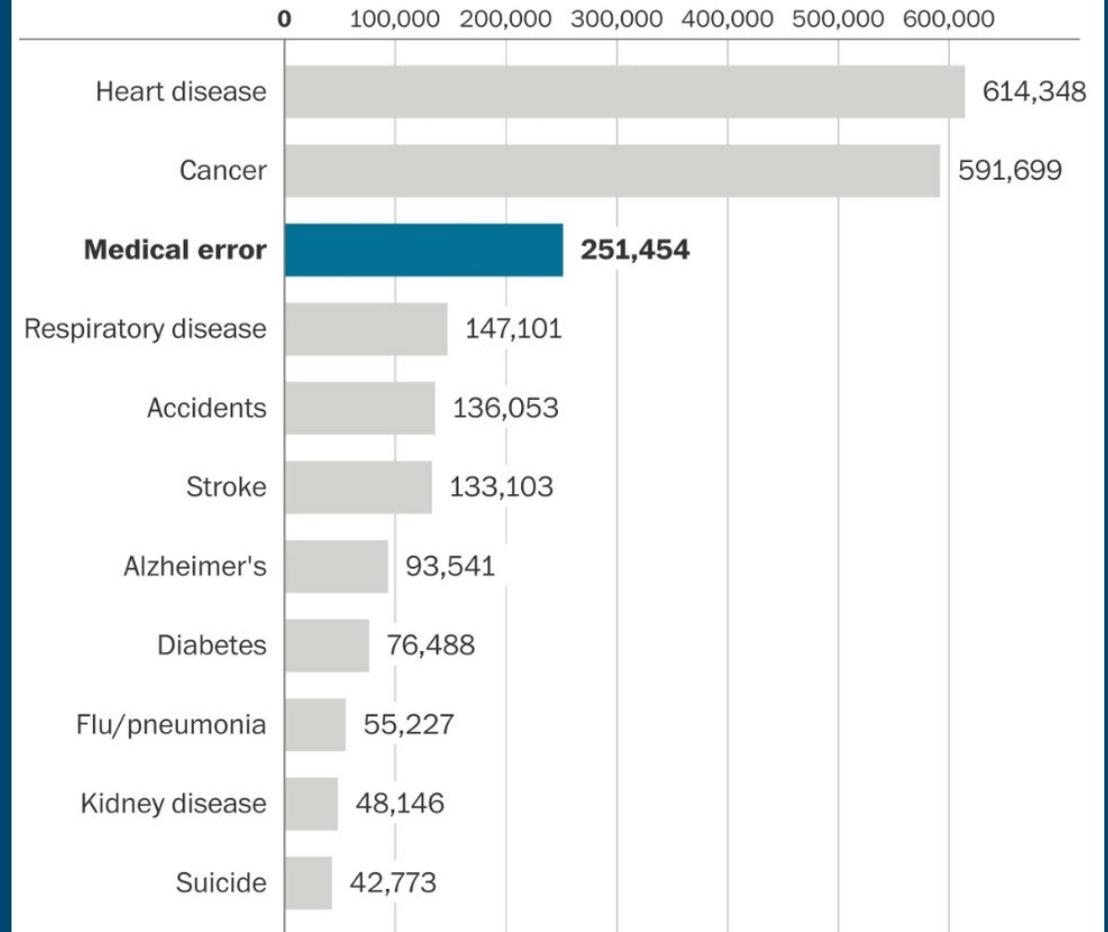
- The information provided in this presentation (including these slides) does not, and is not intended to, constitute legal, medical, or other professional advice; instead, it is for informational purposes only. Information provided in this presentation should not be relied upon for personal, medical, legal, or financial decisions and you should consult an appropriate professional for specific advice that pertains to your situation. You should not act or refrain from acting based on information in this presentation without first seeking legal advice from counsel in the relevant jurisdiction. Only your attorney can provide assurances that the information contained herein – and the interpretation of it – is applicable or appropriate to your particular situation.
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Maybe we could try to kill fewer people?

- A pretty good reason for Patient Safety and Risk Management to go to work every day!
- Will AI help us accomplish this?

Death in the United States

Johns Hopkins University researchers estimate that medical error is now the third leading cause of death. Here's a ranking by yearly deaths.



Source: National Center for Health Statistics, BMJ

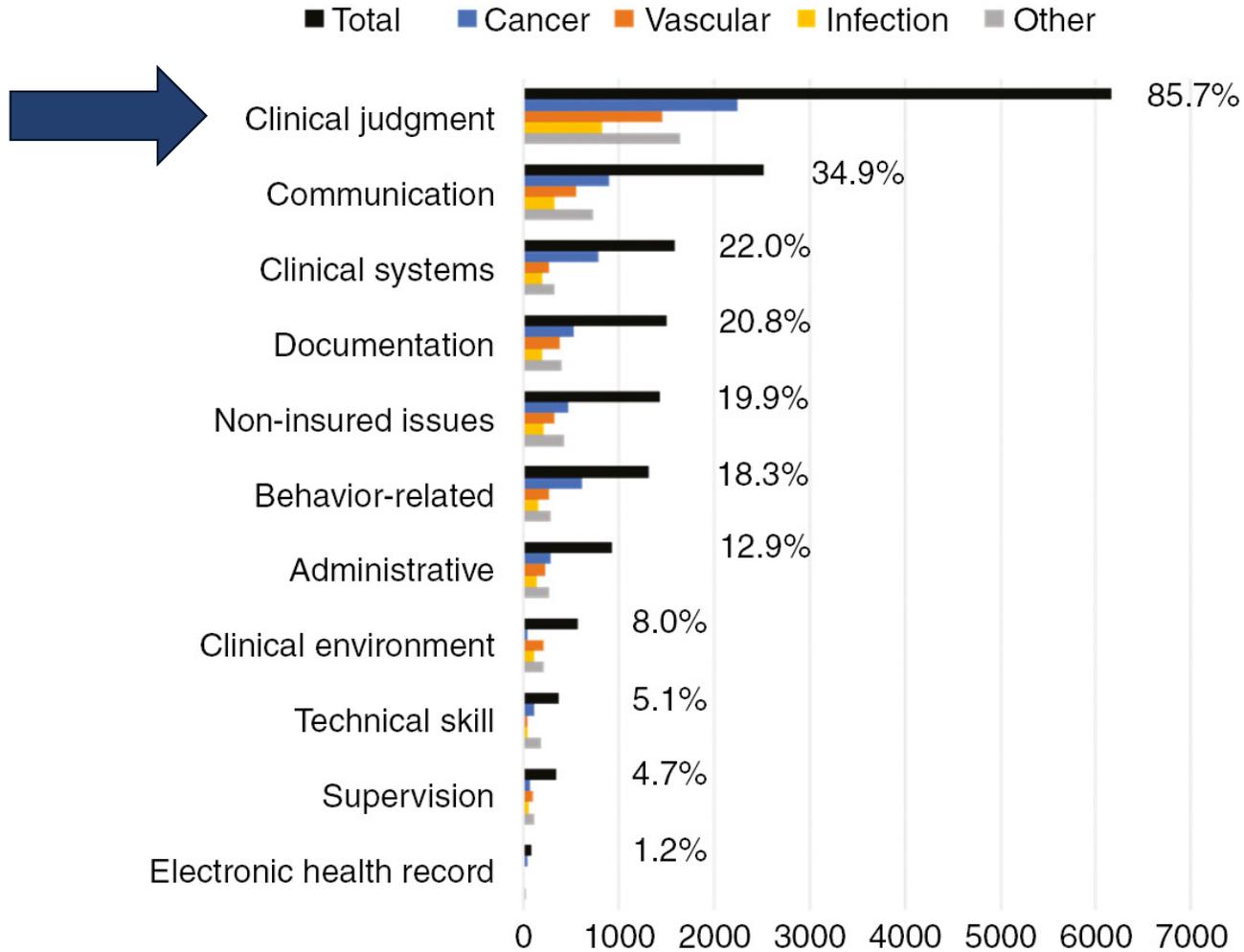
THE WASHINGTON POST

Will the Recurrent Causes of Patient Harm and of Lawsuits Decrease and the Burdens to Providing Care Improve?

- Neurologic
- Chest Symptoms
- Abdominal Pain
- Infections
- Cancer
- Incidental Findings and Missed Reports
- Medication Errors
- Technical Performance
- Recognition and Rescue



Aspects Present in Medical Errors Causing Harm



Agenda:

- What Is AI and Why Is This All Happening Now?
- Current Uses of AI in Medicine
 - Diagnostic
 - Generative
- Legal Issues Related to AI



First, about me...

Things I am:

- Practicing Emergency Medicine Physician
- Chief Medical Informatics Officer, Boulder Community Health
- COPIC Consultant

Things I am not:

- An AI Data Scientist
- Particularly good at math
- An attorney
- A cleverly designed cyborg, sent back in time from the future to pacify this audience*

- (*or am I?)



What is AI and Why Is This All Happening Now?

It's just math.

Really, really, really complex math that is used to make predictions.

Head 1:

$$Q_1 = K_1 = V_1 = \text{Input Matrix}$$

$$A_1 = Q_1 \cdot K_1^T$$

$$A_1 = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$$

$$A_1 = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 5 & 0 \\ 7 & 8 & 9 \end{bmatrix} \quad (\text{Masked})$$

$$W_1 = \text{softmax}(A_1)$$

$$O_1 = W_1 \cdot V_1$$

Head 2:

$$Q_2 = K_2 = V_2 = \text{Input Matrix}$$

$$A_2 = Q_2 \cdot K_2^T$$

$$A_2 = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 5 & 6 \\ 0 & 0 & 9 \end{bmatrix} \quad (\text{Masked})$$

$$W_2 = \text{softmax}(A_2)$$

$$O_2 = W_2 \cdot V_2$$

Concatenate and Linear Transformation:

$$\text{Concatenate}([O_1, O_2])$$

(Apply Learnable Linear Transformation)

Consider your mobile phone keyboard

- Output: THE
- How does it do this?
 - There are approximately 1000 words in the dictionary that start with “th”
 - 247 words that start with “the”
 - 14 words that start with “thw”
 - ~17x more likely you meant “the”
- (This is what made the iPhone possible)
- Now scale that by trillions of calculations



Remember: AI isn't looking for the truth, it is looking for what it has determined is the most likely correct answer.

- A journalist used ChatGPT and asked it who he was.
 - **GPT-3:** *Harry Guinness is a freelance writer and journalist based in Ireland. He has written for a variety of publications, including The New York Times, The Guardian, The Huffington Post, and Popular Mechanics.*
- Problem: He has never written for the last three.
- The New York Times is grouped far more often with The Guardian and The Huffington Post than it is with the magazines he did write for: Wired, Outside, The Irish Times
- So AI chose the option it thought was most likely.
- Who's fact-checking AI?

But Why Now?

- You need three key things:
 - The Data
 - The Math
 - The Computing Power

The Magic of Three

Your Audience can only
remember three to four items
use Three and be sure



2. The Math

- Chat GPT= Generative Pre-trained Transformer
- Transformer Architecture proposed in research paper in 2017
- Vastly increases speed, efficiency of AI engine by allowing computer to “read” whole sentence at once.
- What does the word “bank” mean in this sentence?
- *“I arrived at the bank after crossing the...”*
- You need to know if the sentence ends in “river” or “road.”
- Older math was like reading left to right. Newer reads all the words at once. Much faster!

3. The Computing Power



AI in Diagnostics

AI in Diagnostics

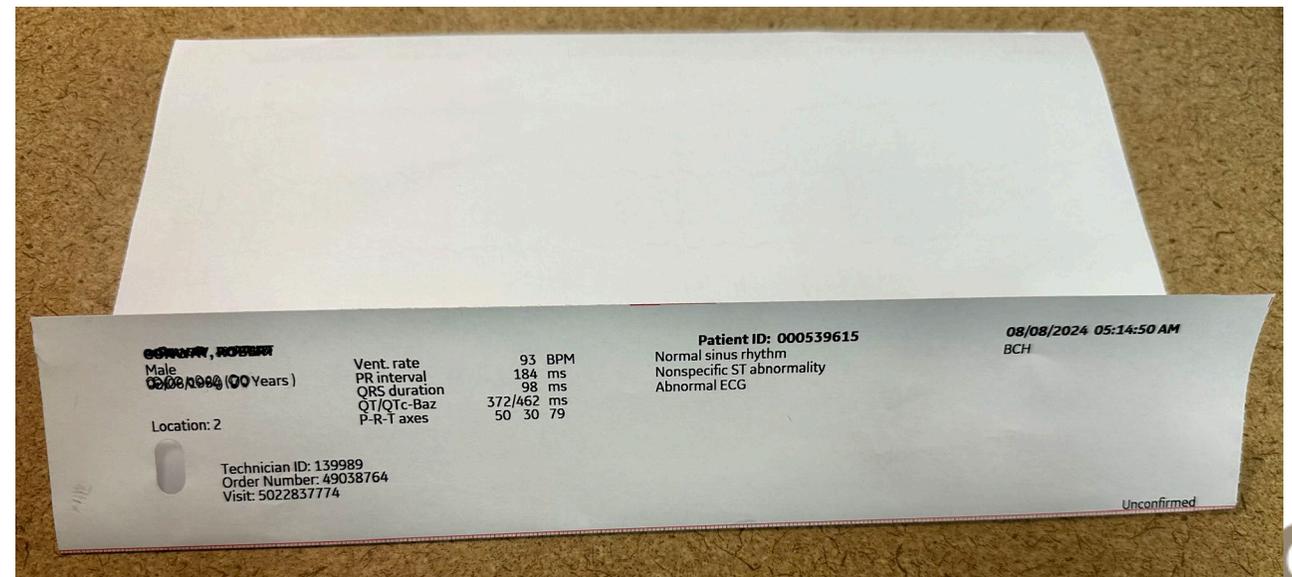
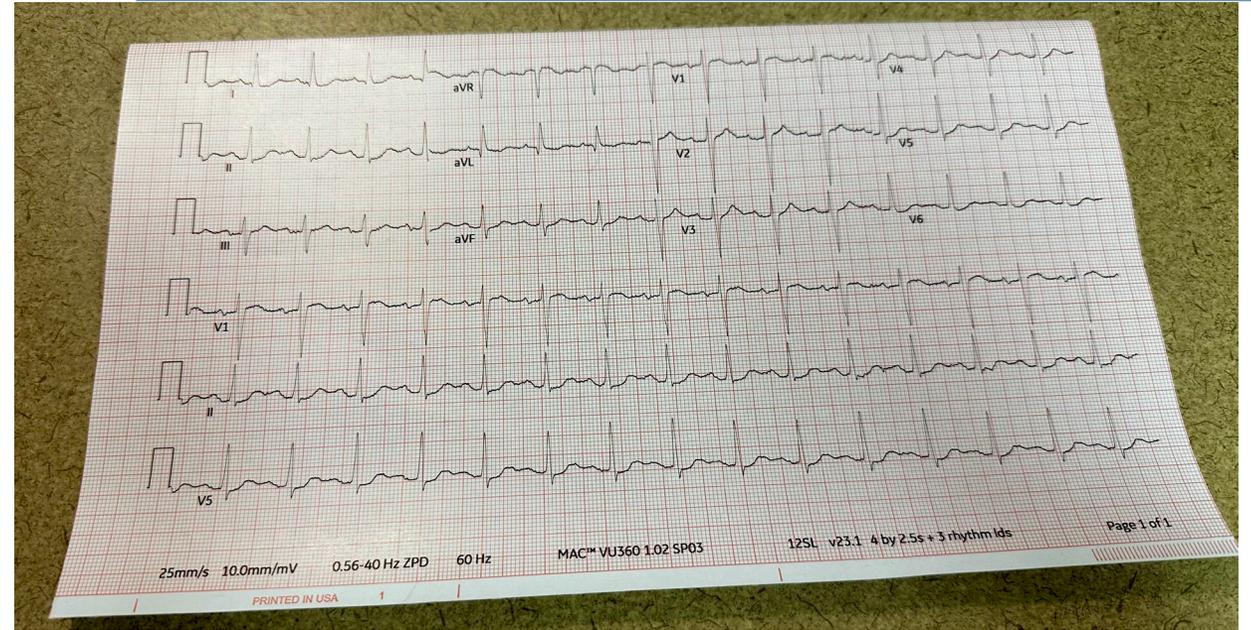
- This is not new. We are just doing it better and faster.
- Same pros, same cons, same legal issues



A Joke (*not really*):

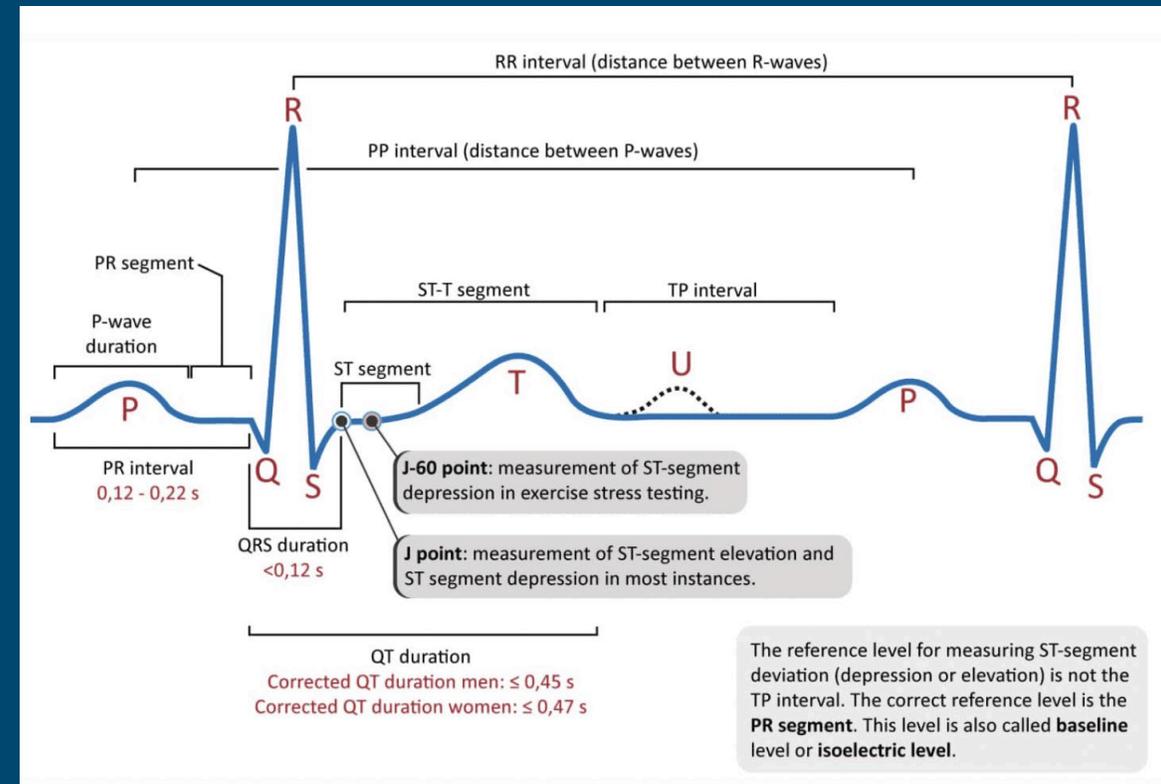
How does a cardiologist read an ECG?

How does a [insert other specialist here] read an ECG?



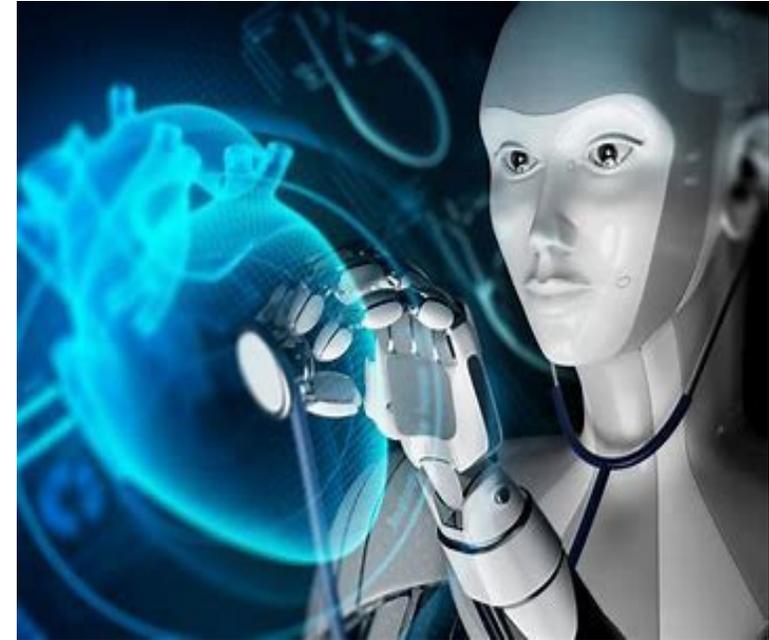
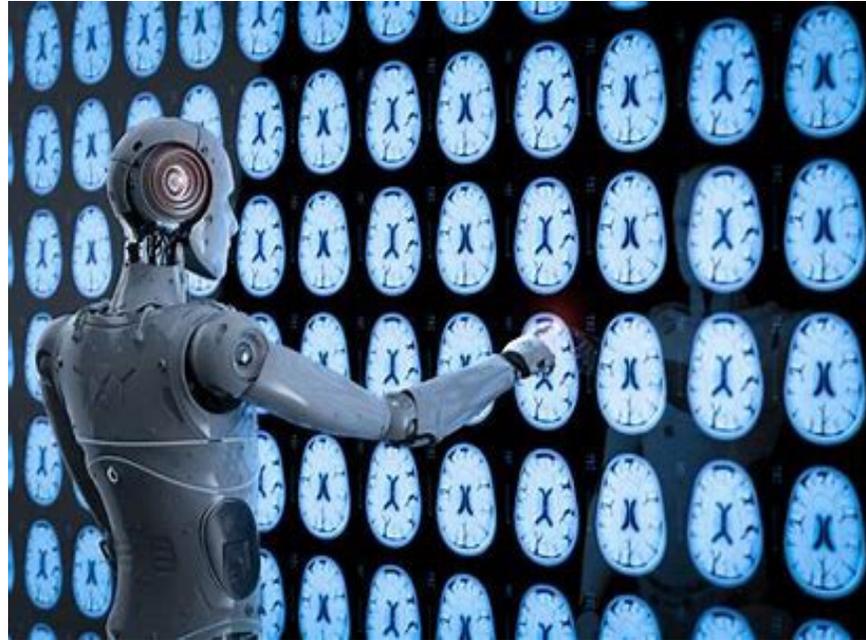
How to detect atrial fibrillation if you are an EKG machine, (since the 1980-90s):

- Measure fiducial points
- Compute the average variance in the R-R interval. Does it pass a certain threshold? If yes, proceed.
- Detect atrial activity.
- Are p-waves present? If no, proceed.
- Are high-frequency fibrillatory waves present? If yes, result “atrial fibrillation.”



FDA has approved over 700 AI algorithms

- Growing at about 125 per year
- 80% in radiology
- 10% in cardiology



AI for Dx Assistance

scientific reports

[nature](#) > [scientific reports](#) > [articles](#) > [article](#)

Article | [Open access](#) | [Published: 13 October 2023](#)

Differential diagnosis of neurodegenerative dementias with the explainable MRI based machine learning algorithm MUQUBIA

[Silvia De Francesco](#) , [Claudio Crema](#), [Damiano Archetti](#), [Cristina Muscio](#), [Robert I. Reid](#), [Anna Nigri](#), [Maria Grazia Bruzzone](#), [Fabrizio Tagliavini](#), [Raffaele Lodi](#), [Egidio D'Angelo](#), [Brad Boeve](#), [Kejal Kantarci](#), [Michael Firbank](#), [John-Paul Taylor](#), [Pietro Tiraboschi](#) & [Alberto Redolfi](#) for the ADNI, Frontotemporal Lobar Degeneration Neuroimaging; NIA Alzheimer's Disease Centers; and the RIN – Neuroimaging Network

[Scientific Reports](#) **13**, Article number: 17355 (2023) | [Cite this article](#)

-A machine learning algorithm (MUQUBIA) accurately distinguished *Alzheimer's disease, frontotemporal dementia, dementia with Lewy bodies, and cognitively normal controls* using routine MRI scans and basic clinical information.

-Overall accuracy was 87.5%. Features like white matter integrity, cortical volumes and thickness were most informative.



***This system detects subtle brain patterns beyond human visual assessment.**

AI Potentially Enhancing Procedures

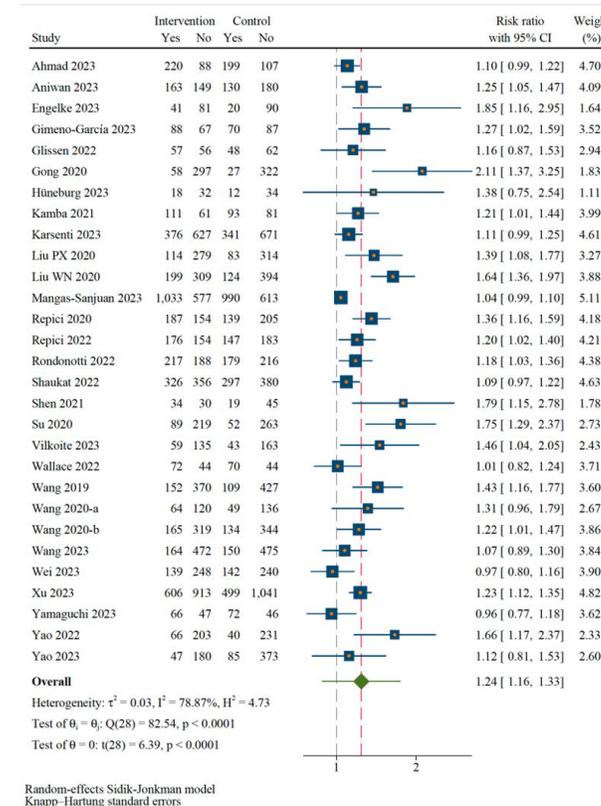
EClinicalMedicine
Published by THE LANCET

Artificial intelligence for colorectal neoplasia detection during colonoscopy: a systematic review and meta-analysis of randomized clinical trials

—33 randomized trials, 27,404 patients

—>50% reduction of missed polyps and adenomas

—Inspection time increase only 20 seconds



Lou S, 29 November 2023

Some Warning Signs: Is AI Plus Clinician *Always* Better?

> *Transl Psychiatry*. 2021 Feb 4;11(1):108. doi: 10.1038/s41398-021-01224-x.

How machine-learning recommendations influence clinician treatment selections: the example of the antidepressant selection

Maia Jacobs ¹, Melanie F Pradier ¹, Thomas H McCoy Jr ^{2 3}, Roy H Perlis ^{2 3}, Finale Doshi-Velez ¹, Krzysztof Z Gajos ⁴



- **Sophisticated explanations** *lowered* AI+clinician accuracy if the AI recommendation was incorrect.

AI has a Saliience Problem (something is more noticeable, but does it “matter” to the issue)

Which is more likely to be malignant?



AI has Bias from Saliience

- Age
- Race
- Gender
- Culture
- Sample
- Disability
- Historical
- Language
- Economic
- Geographic
- Confirmation
- Interpretability



In the algorithm—or in the world?

Algorithmic Bias.

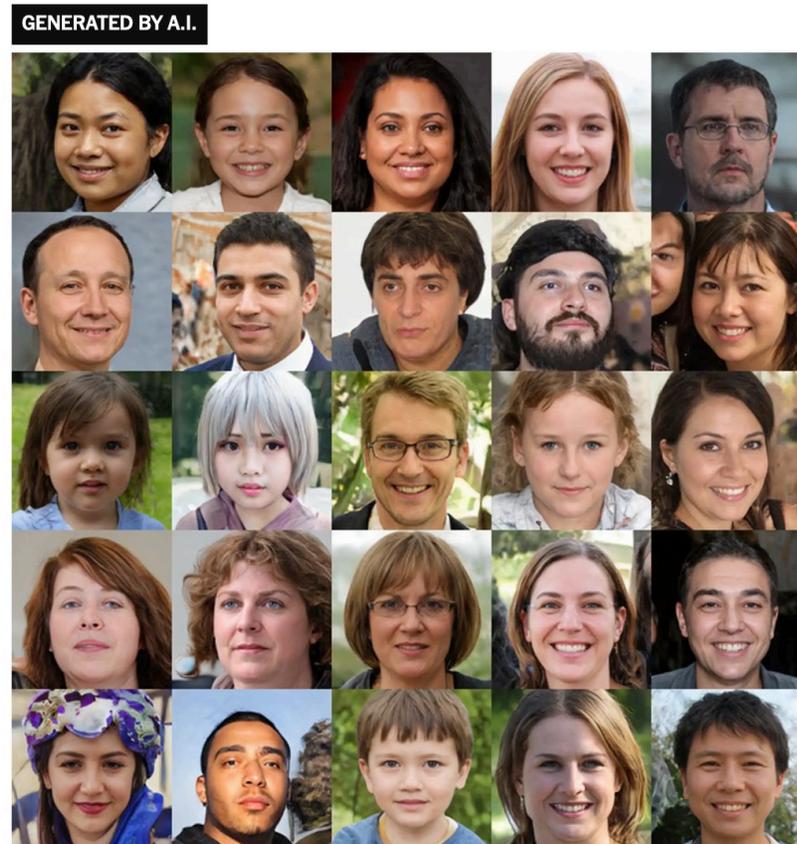
These images were all generated by AI. Notice anything wrong?



Image credits: New York Times (<https://www.nytimes.com/interactive/2024/08/26/upshot/ai-synthetic-data.html>)

Algorithmic Bias.

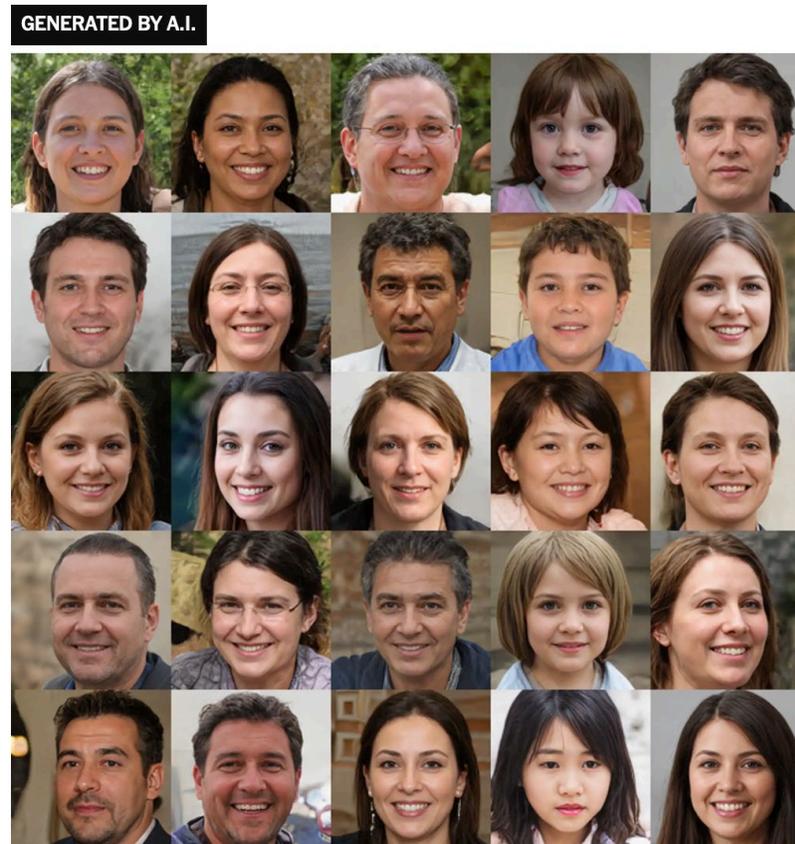
These images were generated using a model that was tweaked to avoid visual glitches.



A.I. images generated by [Sina Alemohammad](#) and others.

Algorithmic Bias

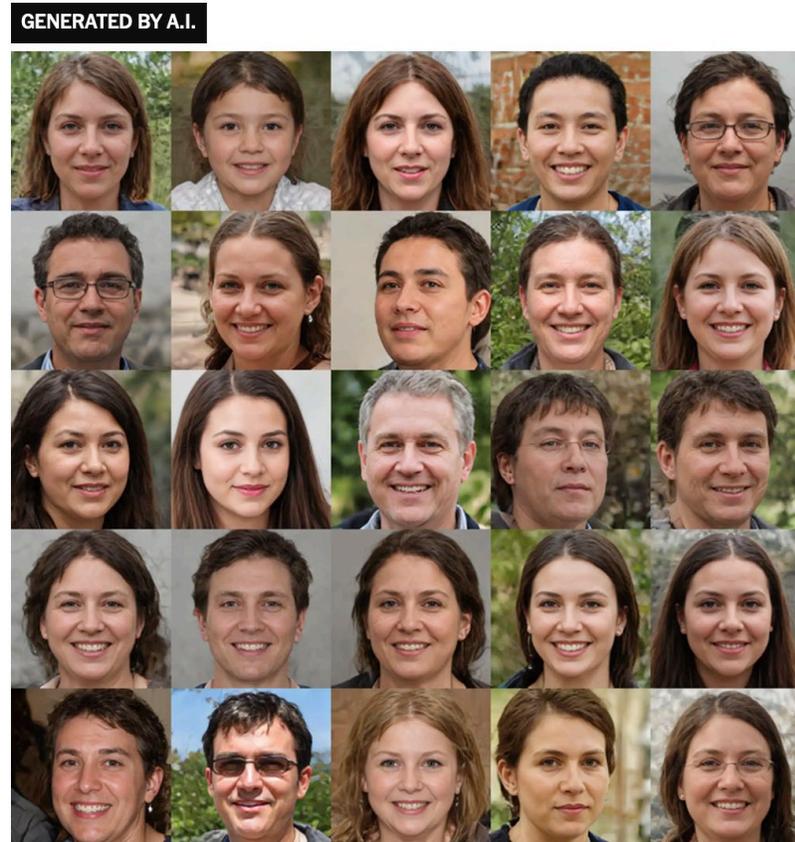
Second generation - AI "trained" on first set of faces, then outputs this:



A.I. images generated by [Sina Alemohammad and others](#).

Algorithmic Bias

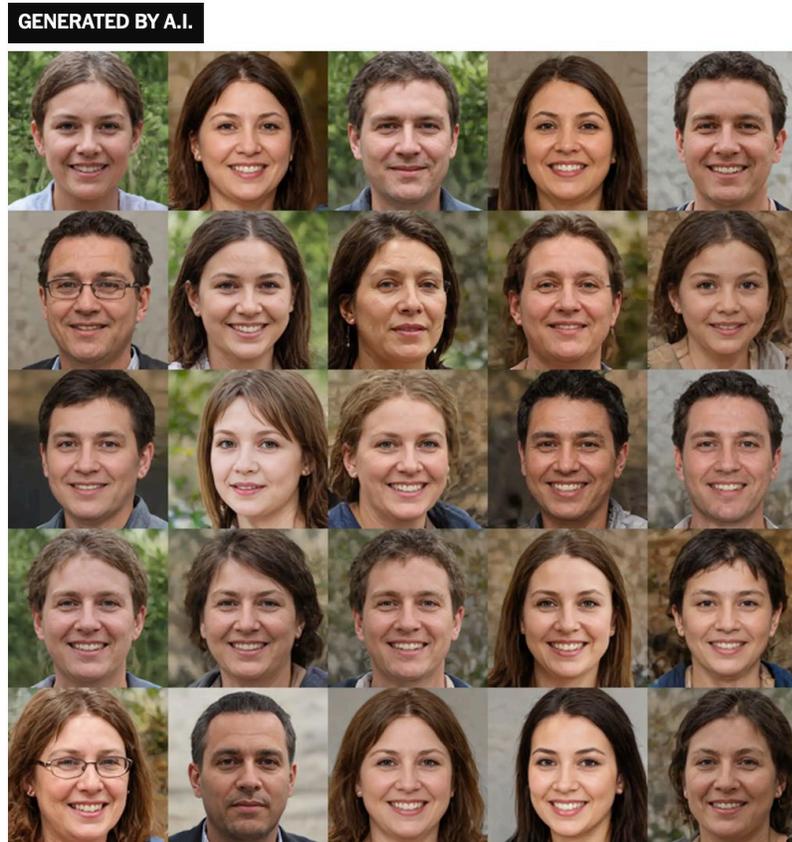
Third generation:



A.I. images generated by [Sina Alemohammad](#) and others.

Algorithmic Bias

Fourth generation:

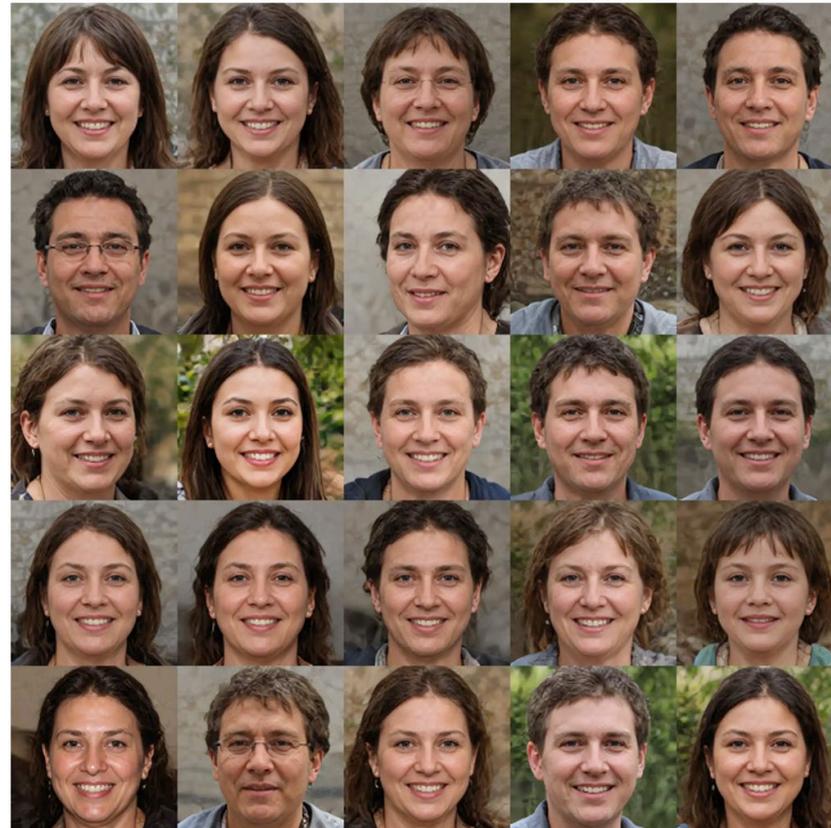


A.I. images generated by [Sina Alemohammad](#) and others.

Algorithmic Bias

Fifth generation. Uh oh.

GENERATED BY A.I.



A.I. images generated by [Sina Alemohammad and others](#).

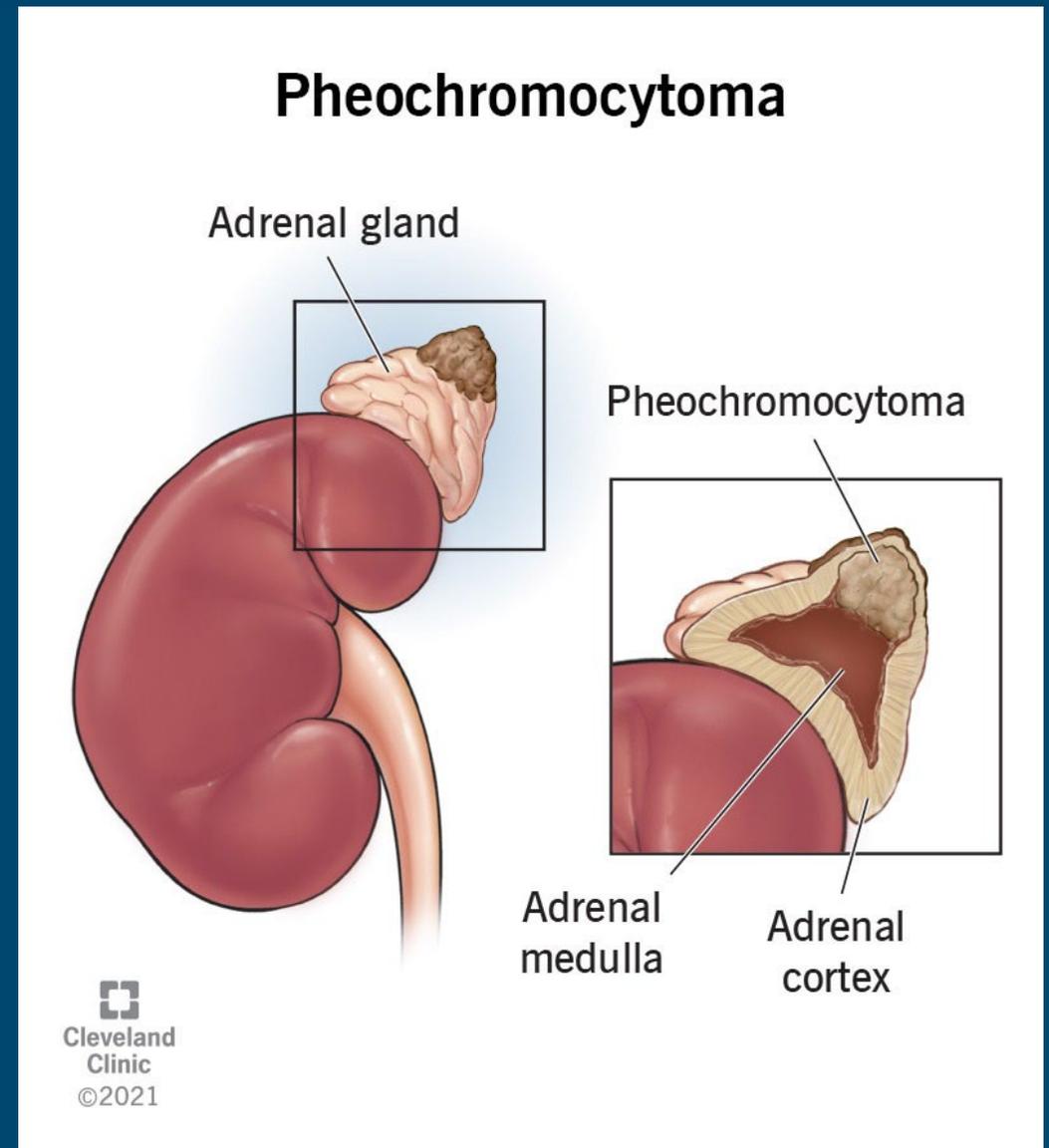
Then, AI Generates a God Figure*:



*Kristian Olson, MD

Sensitivity vs. Specificity

- What if we used AI to help pick up pheochromocytomas?
- Providers often don't have time during limited visit to scan enough data
- How many false positives before these alerts are ignored?
- Who will set the threshold?



Generative AI

AI as Virtual Physician Scribe

- Current focus of much of the attention in healthcare.
- Uses “ambient listening” technology similar to household Alexa/Google products
- AI engine then produces progress or visit note
- Benefits:
 - Huge potential time savings for clinicians.
 - Allows physician to focus on patient, eye-to-eye contact

2-7

Minutes less per visit

50%

Less time spent on documentation

13

hours per week saved

<https://www.aamc.org/news/can-artificial-intelligence-improve-doctor-patient-visits-and-reduce-burnout>



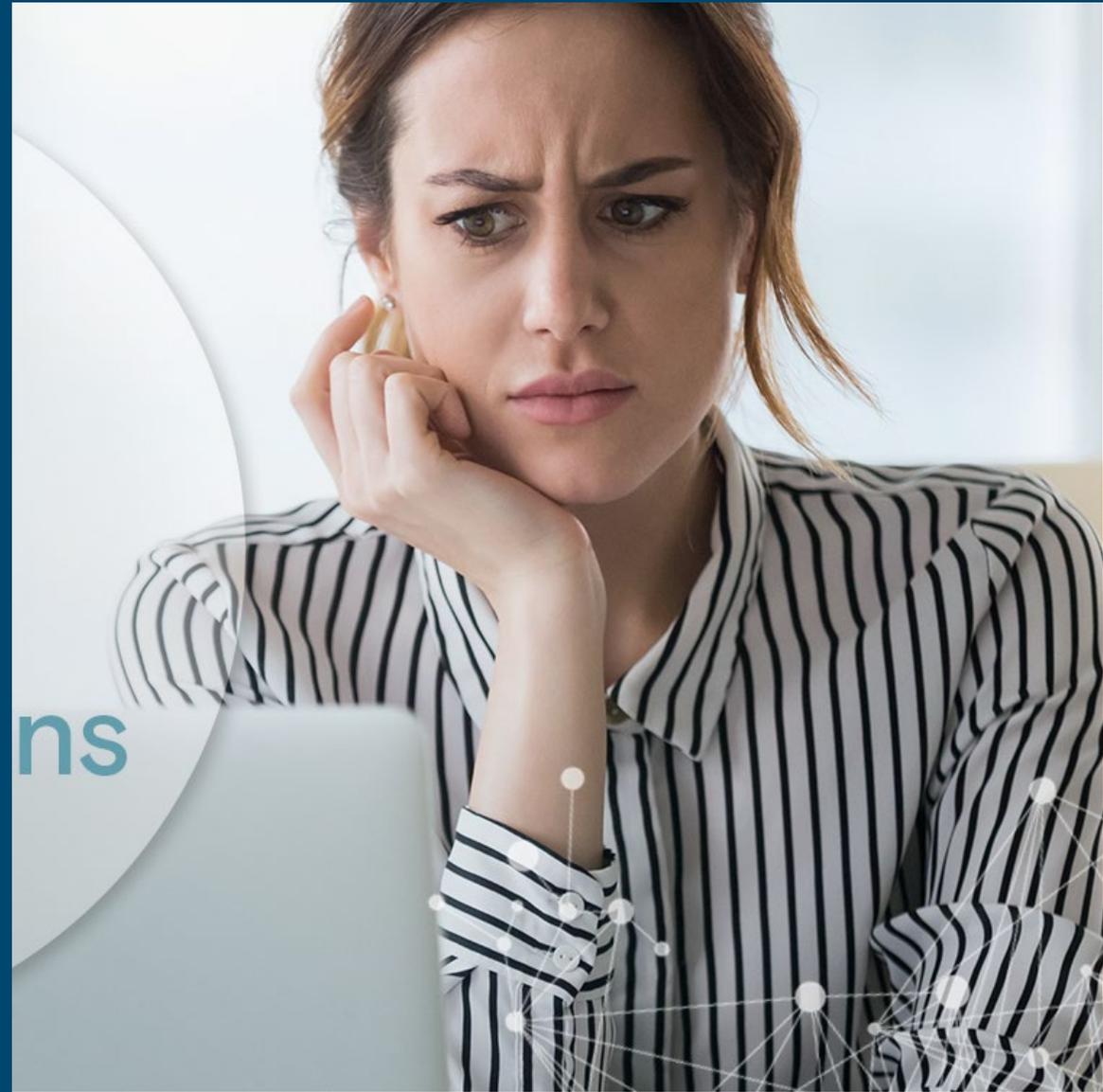
Better Medicine • Better Lives

AI Scribes: The Risks

- **Consent:**
 - State regulations vary.
 - Best Practice: Always obtain consent from patients
- **Privacy:**
 - Vendors vary
 - They own the audio recording and the data
 - How long do they store the information? Is it discoverable in the case of a lawsuit?
 - Some vendors use information to help train the AI engine

What is an AI “Hallucination?”

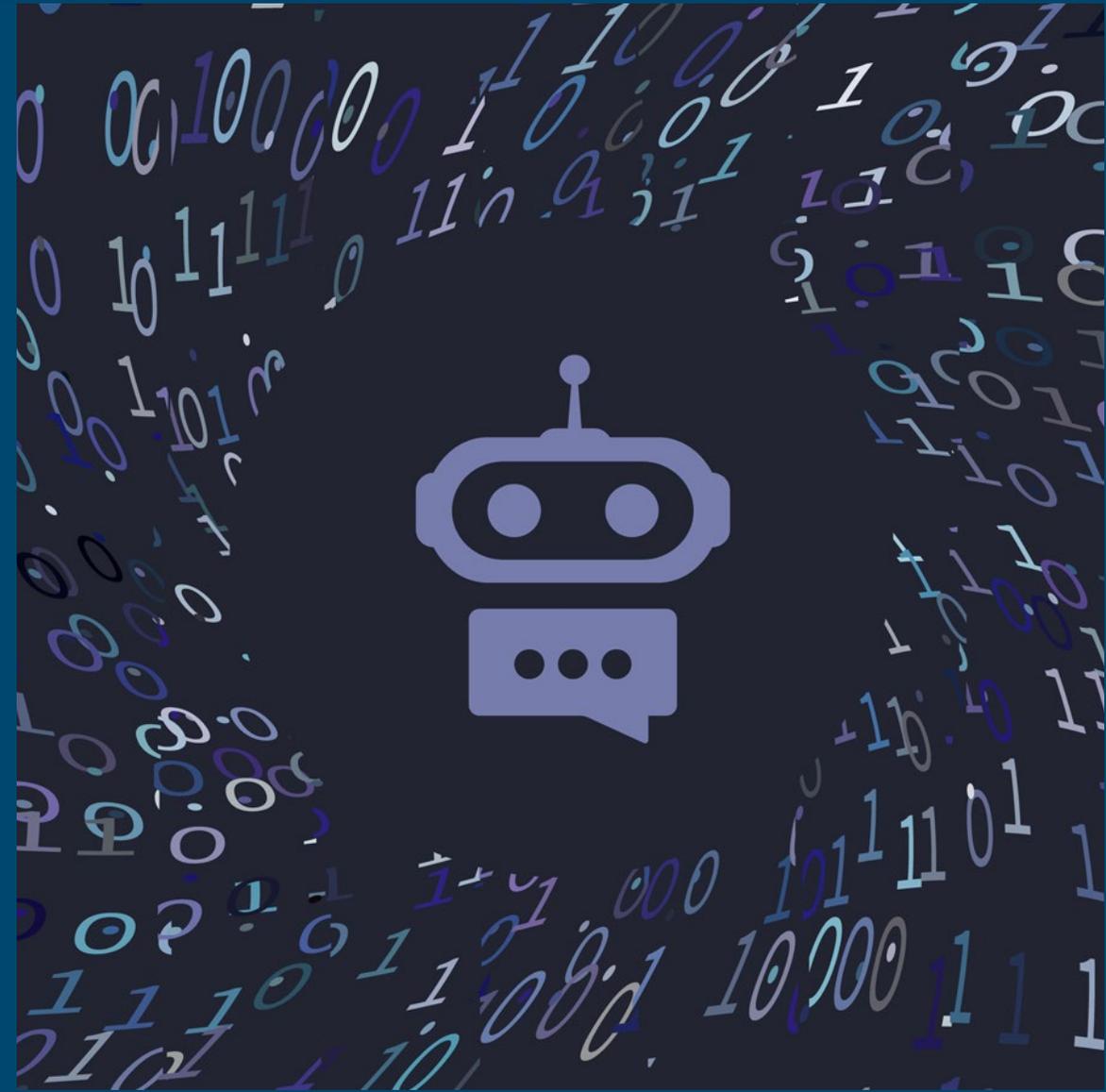
- When AI confabulates something
- Problem is that AI is very good at sounding convincing, and there are no cues to know when it is “confident” or not.



AI Scribes: The Risks (continued)

Hallucinations!

- Anecdotal example: AI scribe added information in progress note that patient was scheduled for open heart surgery, which was totally false.
- Looks pretty bad if patient reviews the note, potentially very dangerous if error propagated by other readers of note.
- The biggest risk that AI Scribe software currently poses comes from physicians not reading and correcting their note!



Voice Transcription Has Already Revealed How Often Some Providers Proofread Their Notes



- Fun examples:
 - “the patient has a 4cm renal mass oh yeah that was insane last night I can’t believe she picked Johnny in the rose ceremony.”
 - “this is a white lady sedating medicine” (Instead of “lightly sedating medication”)
 - “Nipples equal round reactive”
- Easy to tell that something has gone wrong here.
- But what about when AI says that a patient has a history of CABG?

AI Scribes: What about the IN Basket?

- Patient messages are an important source of burnout for physicians
- What if we let AI handle most of these?
- AI has been shown by multiple studies to produce longer messages that patients feel express more empathy than those written by actual physicians.
- But...you'd better review all responses before sending!



The effect of using a large language model to respond to patient messages

Lancet Digit Health 2024

It was felt by the assessing physicians that the LLM drafts posed a risk of severe harm in 11 (7.1%) of 156 survey responses, and death in one (0.6%) survey response. The majority of harmful responses were due to incorrectly determining or conveying the acuity of the scenario and recommended action.

What About Prior Authorizations?

In Constant Battle With Insurers, Doctors Reach for a Cudgel: A.I.

As health plans increasingly rely on technology to deny treatment, physicians are fighting back with chatbots that synthesize research and make the case.

 beckershospitalreview.com

Why prior authorization could become an AI 'arms race'

Legal Considerations

AI Virtual Scribes: What Should Patient Consent Include?

- Your encounter with the provider will be recorded electronically.
- This information will be processed by the computer system to help draft a note.
- I will review the note.
- All of your information will be kept secure.

- If patients have additional questions, probably not time-effective to use the tool

AI Virtual Scribes: What should provider attestation consist of?

- I am responsible for, and will review, all note content before signing.(!!!!)
- I agree to get a verbal consent from every patient prior to using AI-assisted clinical documentation.
- Might want to include:
 - I will watch training video etc.
 - I am aware that technology will only work on certain phones (iphone v. android, not older)

Regulatory/ Policy Questions

- Is AI “investigational?”
 - When?
- Is AI an “agent?”
 - Is it “Autonomous?”
 - “Subordinate?”
- Is AI a “medical device?”
- Is AI a “procedure, test or treatment?”
- Does it require certification, privileges, competency?
- Who sets the standards?
- Bottom Line: Uncertainty!



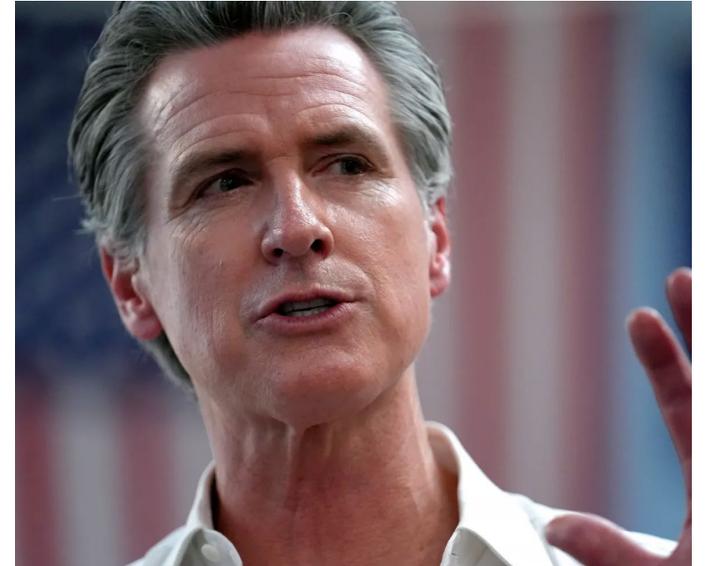
Regulatory Environment - Colorado

- Gov. Polis signed SB 24-205 “Concerning Consumer Protections in Interactions with AI Systems” May 2024.
- First state in US to enact broad restrictions on AI
- Rules take effect Feb 1, 2026
- Establishes rules for both developers and deployers of “high risk” AI systems.
- Must provide consumers with:
 - Information regarding opt-out
 - Publicly posted description on website of all AI systems they deploy, how risks are managed, as well as how info is collected and used
- Impact: Unclear.



Regulatory Environment - California

- Three Bills –Signed by Gov. Newsome Sept 2024
- AB-3030: requires healthcare providers to disclose use of generative AI for patient communications, display disclosure prominently throughout telehealth visit
- SB-942: requires entities with >1mil website visitors to disclose what content was generated by AI and provide free tool for detection.
- SB-1047: requires whistleblower protection, allows legal action against AI model developers, and requires developers to retain third-party auditors to perform compliance audit of model



Federal Level?

- Accordingly, in his signing statement, Governor Polis encourages the bill's sponsors “to significantly improve” their approach before SB 205 takes effect, and specifically calls on the federal government to enact federal legislation that would preempt the bill he just signed, replacing it “with a needed cohesive federal approach.”
- “...comprehensive federal AI legislation addressing employment issues is unlikely to materialize in the near term.”
- <https://www.seyfarth.com/news-insights/colorado-governor-signs-broad-ai-bill-regulating-employment-decisions.html>



The practitioner is still responsible

- Human accountability is not going away
- Assistive technology needs to be transparent, verifiable and reproducible
- The record must be credible
- Safety measures must be appropriate and auditable
- Privacy is complex and challenging



Adversarial Applications

Claim volume

- Document and evidence review; rapid ingestion and summarization
- Analytics; matching records against standards, policies, guidelines

Litigation efficiency

- Case evaluation
- Correspondence, filings, subpoenas
- Case prep, management, scheduling, literature review
- Client and court communication



Deposition Questions

- “Please explain exactly how this program works.”
- “Why did it make a mistake?”
- “What is this program’s error rate?”
- “What are it’s risks and biases?”
- “Is this the standard of care?”
- “What kind of review and testing did you do before deploying it?”
- “Please describe your monitoring and quality assurance process.”
- “How much time or money would you say this program saves/makes for you?”
- “Do you tell your patients that a computer is making decisions about their care?”
- “Who is responsible for what happened?”



Malpractice considerations using/not using

- Clinical error reduction and diagnostic accuracy (+)
- Documentation and info management (+)
- Clinical communication (+)
- Decision support (+/-)
- **Shared liability (+/-)**
- Standards of care (+/-)
- Privacy and data security (-)
- Informed consent (-)
- Algorithmic bias (-)
- Over-reliance, unrealistic expectations (-)
- Configuring, monitoring, updating (-)
- Changes in interdisciplinary collaboration (-)
- Training, education, certification (-)

Pro: Partnering with highly effective automated systems. **Con:** Bringing the deep pockets of developers and vendors into a malpractice case.

Malpractice considerations using/not using

- Clinical error reduction and diagnostic accuracy (+)
- Documentation and info management (+)
- Clinical communication (+)
- Decision support (+/-)
- Spreading liability (+/-)
- **Standards of care (+/-)**
- Privacy and data security (-)
- Informed consent (-)
- Algorithmic bias (-)
- Over-reliance, unrealistic expectations (-)
- Configuring, monitoring, updating (-)
- Changes in interdisciplinary collaboration (-)
- Training, education, certification (-)

Pro: Reset the standard of care. **Con:** Reset the standard of care.

Malpractice considerations using/not using

- Clinical error reduction and diagnostic accuracy (+)
- Documentation and info management (+)
- Clinical communication (+)
- Decision support (+/-)
- Spreading liability (+/-)
- Standards of care (+/-)
- **Privacy and data security (-)**
- Informed consent (-)
- Algorithmic bias (-)
- Over-reliance, unrealistic expectations (-)
- Configuring, monitoring, updating (-)
- Changes in interdisciplinary collaboration (-)
- Training, education, certification (-)

Loss of control of PHI. Consent issues.
Commercial use of PHI.

Malpractice considerations using/not using

- Clinical error reduction and diagnostic accuracy (+)
- Documentation and info management (+)
- Clinical communication (+)
- Decision support (+/-)
- Spreading liability (+/-)
- Standards of care (+/-)
- Privacy and data security (-)
- **Informed consent (-)**
 - Algorithmic bias (-)
 - Over-reliance, unrealistic expectations (-)
 - Configuring, monitoring, updating (-)
 - Changes in interdisciplinary collaboration (-)
 - Training, education, certification (-)

New theories and standards for informed consent.

Malpractice considerations using/not using

- Clinical error reduction and diagnostic accuracy (+)
- Documentation and info management (+)
- Clinical communication (+)
- Decision support (+/-)
- Spreading liability (+/-)
- Standards of care (+/-)
- Privacy and data security (-)
- Informed consent (-)
- **Algorithmic bias (-)**
 - Over-reliance, unrealistic expectations (-)
 - Configuring, monitoring, updating (-)
 - Changes in interdisciplinary collaboration (-)
 - Training, education, certification (-)

Biased training data or algorithms may produce substandard or discriminatory care; both malpractice and civil rights claims.

Malpractice considerations using/not using

- Clinical error reduction and diagnostic accuracy (+)
- Documentation and info management (+)
- Clinical communication (+)
- Decision support (+/-)
- Spreading liability (+/-)
- Standards of care (+/-)
- Privacy and data security (-)
- Informed consent (-)
- Algorithmic bias (-)
- **Over-reliance, unrealistic expectations (-)**
- Configuring, monitoring, updating (-)
- Changes in interdisciplinary collaboration (-)

Risk of becoming overly reliant on AI functions; chilling effect on questioning, skepticism, inquiry; atrophy of judgment; complacent culture, defensiveness.

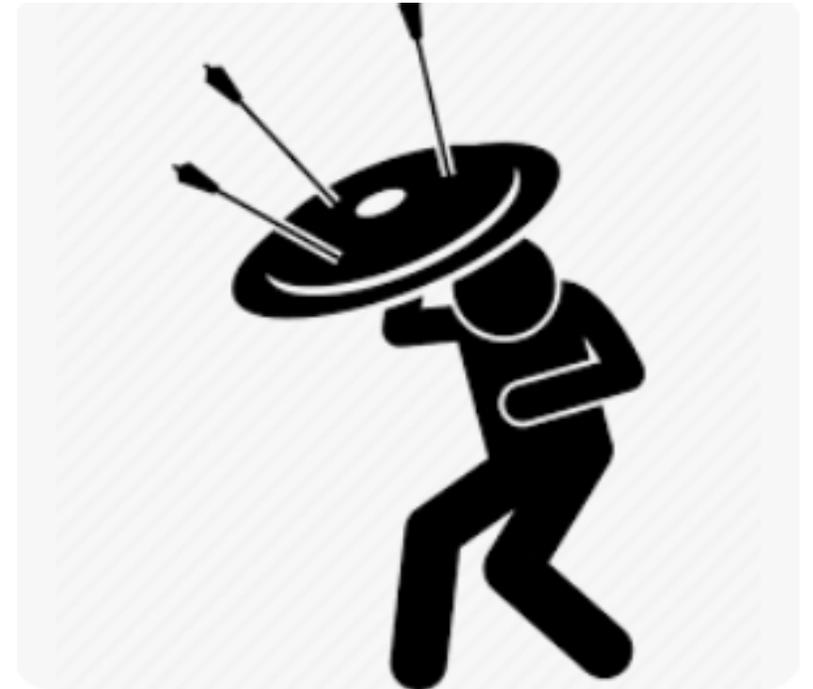
Malpractice considerations using/not using

- Clinical error reduction and diagnostic accuracy (+)
- Documentation and info management (+)
- Clinical communication (+)
- Decision support (+/-)
- Spreading liability (+/-)
- Standards of care (+/-)
- Privacy and data security (-)
- Informed consent (-)
- Algorithmic bias (-)
- Over-reliance, unrealistic expectations (-)
- **Configuring, monitoring, updating (-)**
- Changes in interdisciplinary collaboration (-)
- Training, education, certification (-)

Technology labor, costs and expertise. Duty to ensure diligent maintenance, oversight, auditing, quality management.

Some Potential theories of liability using/not using

- Negligence; failure to meet the standard of care
 - Failure to manage known risks
 - Failure to use necessary devices
- Failure to disclose; failure to inform; failure to obtain consent
- Vicarious liability (device/app is an “agent” of the provider)
- Product liability (device/app known to be defective)
 - Inadequate diligence
- Privacy breach
- Patient abandonment
- Failure in device selection, installation, configuration, maintenance
- Failure to monitor, follow-up; improper delegation
- Foreseeable injury or adverse effect
- Fraud, misrepresentation, quackery



What does AI know? Who should provide care?

NEWS / MEDICAL AI / MEDICAL AI NEWS

AI Bot ChatGPT Passes US Medical Licensing Exams Without Cramming – Unlike Students

Alicia Ault

January 26, 2023

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ChatGPT can pass parts of the US medical licensing exam, researchers have found, raising questions about whether the AI chatbot could one day help write the exam or help students prepare for it.



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Victor Tseng, MD, and his colleagues at Ansible Health, a company that manages mostly homebound patients with chronic lung disease, initially wanted to see whether ChatGPT could aggregate all the communications regarding these patients, which would allow Ansible to better coordinate care.



Precision Performance

TECH

There's a Pretty Glaring Issue With Tesla's Autopilot, Says New Study

DAVID NIELD 26 SEPTEMBER 2021

It's something that has long been suspected. Now, we have evidence from a new study – once the Autopilot self-driving tech is enabled on Tesla cars, human drivers tend to pay less attention to what's happening on the road.



- Oversight
 - “Human-in-the-loop”
 - “Competent human intervention”
- Currently no clear liability standards for “AI users”

Definition of Standard of Care Has Not Changed

- You will still be held to practicing at **“the standard of care.”**
- Humans will continue to be caregivers!





Thank You! Questions?

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