

Artificial Intelligence in Telehealth

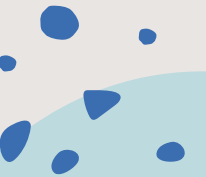
Early Trends and Caveats
Jessie Whitfield, MD MPH



Disclosures



Nothing to disclose



Learning Objectives

By the end of this activity, the audience will be able to:

- Describe an early two early uses and potential benefit of AI use in two different fields of medicine
- Identify at least one caveat to current use of AI
- Name at least one guiding principle for health equity, security or consumer protection in AI

Why AI Is Medicine's Biggest Moment Since Antibiotics

The dean of Stanford University's medical school thinks artificial intelligence will transform the medicines you take, the care you get and the training of doctors

Medical students get training from AI

Medical students' views and experiences on AI utilization and trust in the technology, are shared by Dr. Patrick Thomas, director of digital innovation in pediatric surgery at the University of Nebraska Medical Center College of Medicine.

An AI revolution is brewing in medicine. What will it look like?

Emerging generalist models could overcome some limitations of first-generation machine-learning tools for clinical use.

How Artificial Intelligence is Disrupting Medicine and What it Means for Physicians

Ted A James, MD, MHCM | April 13, 2023

WORLD / TECHNOLOGY

ChatGPT appears to pass medical school exams, educators rethinking assessments

5:09 pm on 12 January 2023

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<https://www.wsj.com/tech/ai/artificial-intelligence-medicine-innovation-6739b4f8>

<https://postgraduateeducation.hms.harvard.edu/trends-medicine/how-artificial-intelligence-disrupting-medicine-what-means-physicians>

<https://www.healthcareitnews.com/video/medical-students-get-training-ai>

<https://www.nature.com/articles/d41586-023-03302-0>

Dangers of artificial intelligence in medicine

BY ENID MONTAGUE, OPINION CONTRIBUTOR - 01/16/20 6:00 PM ET



National Eating Disorders Association takes its AI chatbot offline after complaints of 'harmful' advice



By Catherine Thorbecke, CNN
Updated 1:08 PM EDT, Thu June 1, 2023

ACLU

NEWS & COMMENTARY

Algorithms Are Making Decisions About Health Care, Which May Only Worsen Medical Racism

Unclear regulation and a lack of transparency increase the risk that AI and algorithmic tools that exacerbate racial biases will be used in medical settings.



SHORT WAVE

LISTEN & FOLLOW

Will artificial intelligence help — or hurt — medicine?

May 2, 2023 · 12:10 AM ET

By Geoff Brumfiel, Emily Kwong, Berly McCoy, Rebecca Ramirez



12-Minute Listen

+ PLAYLIST



REPORT | FEBRUARY 22, 2023



60% of Americans Would Be Uncomfortable With Provider Relying on AI in Their Own Health Care

Yet many see promise for artificial intelligence to help issues of bias in medical care

REPORT | FEBRUARY 22, 2023



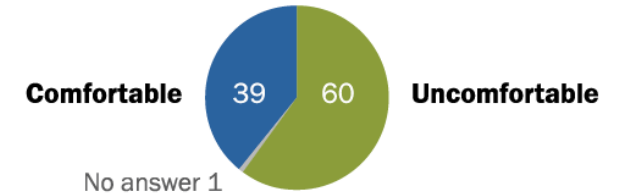
60% of Americans Would Be Uncomfortable With Provider Relying on AI in Their Own Health Care

Yet many see promise for artificial intelligence to help issues of bias in medical care

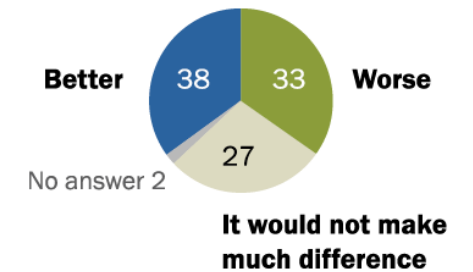
Fewer than half in U.S. expect artificial intelligence in health and medicine to improve patient outcomes

% of U.S. adults who say that thinking about the use of artificial intelligence in health and medicine to do things like diagnose disease and recommend treatments ...

They would feel ___ if their health care provider relied on it for their medical care



It would lead to ___ health outcomes for patients



Source: Survey conducted Dec. 12-18, 2022.

"60% of Americans Would Be Uncomfortable With Provider Relying on AI in Their Own Health Care"

PEW RESEARCH CENTER

What does AI in Medicine look like?

- Amplifying drug and biomarker discovery and development
- Clinician decision support tools
- Imaging/radiology detection and diagnostic support tools
- Precision Medicine
- Ex: reductions in mortality from sepsis by using an algorithm to predict sepsis and having that verified by clinicians

Two Main Categories:

- Autonomous
- Decision Support tools
- April 2019: First time the U.S. Food and Drug Administration (FDA) approved a device that was authorized to provide a screening/clinical decision independent of physician confirmation (IDx-Dr, a software program to assess the progression of diabetic retinopathy based on images)

Bhalla S, Laganà A. Artificial Intelligence for Precision Oncology. *Adv Exp Med Biol.* 2022;1361:249-268.

Mikdadi D, O'Connell KA, Meacham PJ, Dugan MA, Ojiera MO, Carlson TB, Klenk JA. Applications of artificial intelligence (AI) in ovarian cancer, pancreatic cancer, and image biomarker discovery. *Cancer Biomark.* 2022;33(2):173-184.

Ratner M. FDA backs clinician-free AI imaging diagnostic tools. *Nat Biotechnol.* 2018 Aug 6;36(8):673-674. doi: 10.1038/nbt0818-673a. PMID: 30080822.

Liu Z, Roberts RA, Lal-Nag M, Chen X, Huang R, Tong W. AI-based language models powering drug discovery and development. *Drug Discov Today.* 2021 Nov;26(11):2593-2607. doi: 10.1016/j.drudis.2021.06.009.

AI in Telemedicine

- Operationalized as:
 - o tele-assessment
 - o tele-diagnosis
 - o tele-interactions
 - o tele-monitoring

CBT for Chronic Pain using AI

- Study question: Can using AI that incorporates feedback on patient progress 1) improve a cognitive behavioral therapy intervention for chronic pain (CBT-CP) via phone (compared to standard telephone CBT-CP) and 2) reduce therapist time?
- 278 patients received 10 weeks of CBT-CP
 - AI-CBT-CP group: An AI engine processed patient feedback via daily interactive voice response calls to make weekly recommendations to adjust time of session (a 45-minute or 15-minute) or method (by phone with therapist vs an individualized IVR-delivered therapist message).
 - Comparison group received 10 therapist-delivered telephone CBT-CP sessions (45 minutes)

CBT for Chronic Pain using AI

- A greater proportion of patients receiving AI-CBT-CP had clinically meaningful improvements at 6 months (37% vs 19%; $P = .01$) and pain intensity scores (29% vs 17%; $P = .03$).
- Pain therapy using AI-CBT-CP required less than half of the therapist time as standard CBT-CP.

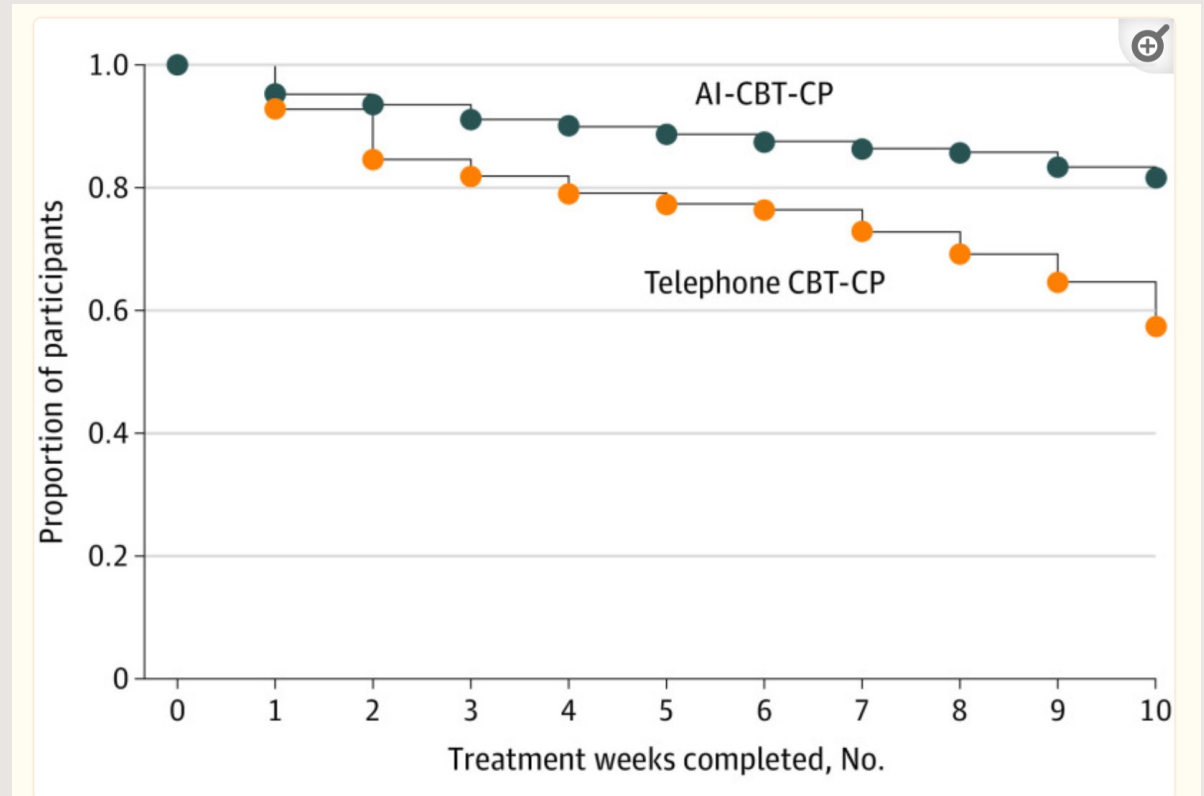


Figure 2.

Number of Completed Treatment Sessions, by Randomization Group

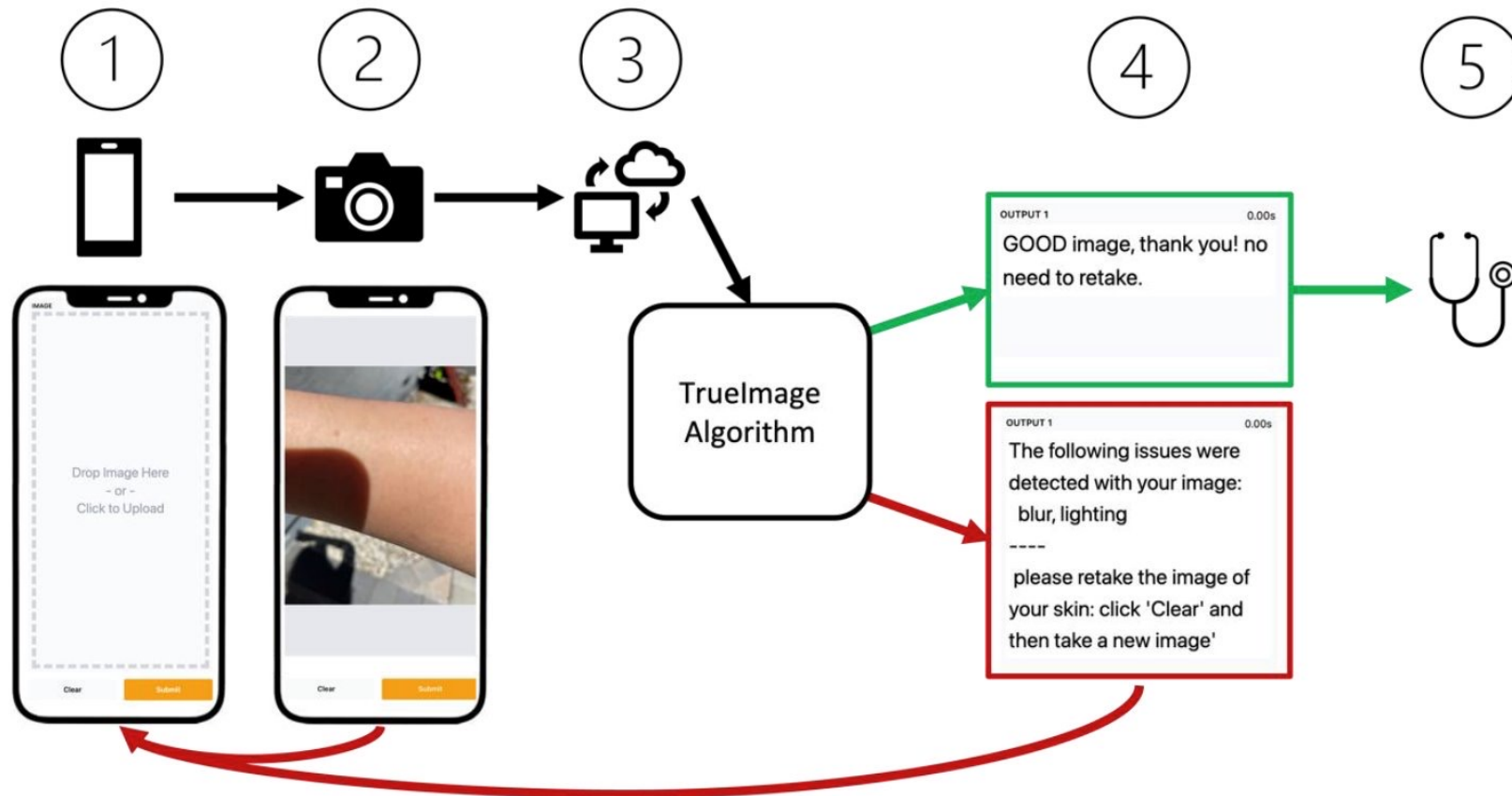
Dermatology: Improving Telemed Photo Quality with AI

eTable 1: Photo quality scale for annotating clinical dermatology images. Larger values indicate lower quality. “Poor quality” was defined by a quality rating > 1.

Quality rating (numerical value in analysis)	Description
0	Crisp, clear, perfect photo
1	Generally good quality with minor imperfections, but I can tell what is happening
2	I think I can tell what is going on, but the quality isn't great
3	Can barely discern what is happening in the photo
4	Cannot tell what is going on in the photo

- QI study to determine if an AI decision support tool could improve quality of photos submitted to tele-derm by providing real-time feedback and explanations to patients taking the photos.
- AI decision support tool
- using an deep learning models and classic computer vision algorithms
 - o trained on retrospective telemedicine images (taken from Stanford EHR)
 - o output directly to patients an overall classification of good or poor quality and if poor quality, an explanation for the poor quality.

eFigure 1: Overview of TrueImage usage: (1) Patient opens UI to access TrueImage. (2) Patient takes photo of lesion using the UI. Patient can review the photo prior to hitting submit and has the option to retake if they notice quality issues. (3) Once the photo is submitted by the patient, the photo is securely uploaded to a server running the TrueImage algorithm. (4) Server returns feedback to patient. If quality issues are detected, go back to step (1). (5) Doctor receives high-quality clinical photo.



Dermatology: Improving Telemed Photo Quality with AI

- 98 patients (mean age 49.8 years) and 357 images
- Patients using a machine learning algorithm had a 68% reduction in the number of poor-quality images compared with baseline.

Ophthalmology: Tele-screening for Retinopathy

- Retinopathy of prematurity (ROP) is a leading cause of preventable blindness that disproportionately affects children born in low- and middle-income countries
- Telemedicine screening programs are effective
- They require expensive and hard to access widefield digital fundus imaging (WDFI) cameras
- Cheaper, smartphone-based fundus imaging (SBFI) systems have have a narrower field of view (FOV) and relatively untested in telemedicine
- Goal: To assess the efficacy of SBFI systems compared with WDFI when used by technicians for ROP screening with both artificial intelligence (AI) and human graders in India.

Young BK et al. Efficacy of Smartphone-Based Telescreening for Retinopathy of Prematurity With and Without Artificial Intelligence in India. JAMA Ophthalmol. 2023 Jun 1;141(6):582-588.

Coyner AS et al. External Validation of a Retinopathy of Prematurity Screening Model Using Artificial Intelligence in 3 Low- and Middle-Income Populations. JAMA Ophthalmol. 2022 Aug 1;140(8):791-798.

Ophthalmology: Tele-screening for Retinopathy

- All participants had wide field images and from 1 of 2 smart phone devices
- N = 156 infants
- Human graders were effective with SBFI at detecting TR-ROP with a sensitivity of 100% and specificity of 83.49%.
- For the AI system, the sensitivity of detecting TR-ROP sensitivity was 100% with specificity of 58.6%
- key findings regarding AI: autonomous AI-based image interpretation was effective for detection of TR-ROP using the SBFI devices.

Young BK et al. Efficacy of Smartphone-Based Telescreening for Retinopathy of Prematurity With and Without Artificial Intelligence in India. JAMA Ophthalmol. 2023 Jun 1;141(6):582-588.

Coyner AS et al. External Validation of a Retinopathy of Prematurity Screening Model Using Artificial Intelligence in 3 Low- and Middle-Income Populations. JAMA Ophthalmol. 2022 Aug 1;140(8):791-798.

Concerns and Caveats

- Accuracy
- Health equity
- Data security
- HIPAA
- Lack of regulation keeping up with advancements

Accuracy of a Generative Artificial Intelligence Model in a Complex Diagnostic Challenge

Zahir Kanjee, MD, MPH¹; Byron Crowe, MD¹; Adam Rodman, MD, MPH¹

» Author Affiliations

JAMA. Published online June 15, 2023. doi:10.1001/jama.2023.8288

- Assessed the accuracy of an AI generative model capable of accurate and detailed text-based responses to written prompts (Generative Pre-trained Transformer 4 [GPT-4]) in a series of diagnostically difficult cases
 - Primary outcome: the model's top diagnosis matched the final case diagnosis.
 - Trained on NEJM clinical cases
- Results:
 - The AI model's top diagnosis agreed with the final diagnosis in 39% (27/70) of cases.
 - In 64% of cases (45/70), the model included the final diagnosis in its differential.
 - In line with a 2022 study evaluating the performance of 2 GPT models with similar NEJM cases found that AI identified the correct diagnosis in 58% to 68% of cases

Health Equity and AI

- How to develop AI that won't preserve biases built over decades in the US health care system?
- AI-enabled technologies might allow us to reach a people and places, more quickly, with more specialties, or diminish diagnostic error

Medical News & Perspectives | AI in Medicine

October 11, 2023

New AI Tools Must Have Health Equity in Their DNA



Hswen Y, Voelker R. New AI Tools Must Have Health Equity in Their DNA. *JAMA*. 2023;330(17):1604-1607.

Health Equity and AI

- "The training sets—the way that we build these models and how we train them—if they're built off of existing ways in which we work, existing ways in which our societies and our medical systems are structured, there's a great risk of it introducing or perpetuating the biases that we've been experiencing as a system for generations now and in some ways for hundreds of years. We have to deliberately design that out of AI."

Hswen Y, Voelker R. New AI Tools Must Have Health Equity in Their DNA. *JAMA*. 2023;330(17):1604-1607.

Medical News & Perspectives | AI in Medicine

October 11, 2023

New AI Tools Must Have Health Equity in Their DNA



Concerns about product development

- Study found that only 11 of all 118 FDA cleared AI algorithms (from 2008 to April 2021) had >1000 patients for validating the AI
 - Among those, only one reported validation from two different clinical sites.
 - lack of comprehensive and standardized information about the AI algorithm makes it difficult for product comparison.

FDA Policy Recommendations for AI in Med

Medical News in Brief

November 1, 2023

New FDA Advisory Team to Focus on AI, Other Digital Health Technologies

- FDA has approved several clinical support devices, from breast cancer screening to diagnostic support tools for diabetic retinopathy
- Concerns remain:
- 4 major opportunities in regulating AI-driven clinical support devices: algorithmic transparency, evidentiary standards, 510(k) premarket notification pathway eligibility, and bias evaluation

Habib AR, Gross CP. FDA Regulations of AI-Driven Clinical Decision Support Devices Fall Short. *JAMA Intern Med.* 2023;183(12):1401-1402.

Lee JT, Moffett AT, Maliha G, Faraji Z, Kanter GP, Weissman GE. Analysis of devices authorized by the FDA for clinical decision support in critical care. *JAMA Intern Med.* Published online October 9, 2023.

Potnis KC, Ross JS, Aneja S, Gross CP, Richman IB. Artificial Intelligence in Breast Cancer Screening: Evaluation of FDA Device Regulation and Future Recommendations. *JAMA Intern Med.* 2022 Dec 1;182(12):1306-1312. doi: 10.1001/jamainternmed.2022.4969. PMID: 36342705; PMCID: PMC10623674.

Format:

Future concerns regarding liability

- "Legal scholars have classified eight scenarios involving a physician's use of an autonomous AI system that are relevant to malpractice liability, and they hypothesized that there are only two scenarios in which the physician might face liability: (A) the system correctly recommends management that corresponds with the current standard of care, and the physician disregards this recommendation, resulting in patient harm; and (B) the system erroneously recommends management that is nonstandard care, and the physician follows this recommendation which results in patient harm"

Questions?



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