

UCSF

UC San Francisco Previously Published Works

Title

Medicine in the Era of Artificial Intelligence

Permalink

<https://escholarship.org/uc/item/3x02r32b>

Journal

JAMA Internal Medicine, 183(6)

ISSN

2168-6106

Author

Brender, Teva D

Publication Date

2023-06-01

DOI

10.1001/jamainternmed.2023.1832

Copyright Information

This work is made available under the terms of a Creative Commons Attribution-NonCommercial-ShareAlike License, available at <https://creativecommons.org/licenses/by-nc-sa/4.0/>

Peer reviewed

PERSPECTIVE

Medicine in the Era of Artificial Intelligence

Hey Chatbot, Write Me an H&P

Teva D. Brender, MD
Department of
Medicine, School of
Medicine, University of
California San
Francisco.



Invited Commentary



Related article

A third of the way through my internship I had already navigated my fair share of challenging experiences—manual disimpactions, pronouncing my first death, chasing down a delirious former college linebacker patient after he made a break for the exit. But there is nothing quite so demoralizing as spending all night stabilizing somebody who is critically ill only to sit down at 4 AM to face a blank note template. So I fired up a chatbot and typed into the search bar, "Write a history and systems-based assessment for a middle-aged man admitted to the MICU for acute hypoxemic respiratory failure..."

Of course, I only fantasized about using a chatbot to write a history and physical (H&P) that night; but given the rapid development of artificial intelligence (AI) language learning models and chatbots, health care, like the rest of society, is on the verge of a seismic transformation. Moreover, rather than worry about my job being taken over by robots, I am hopeful about the future of AI and the practice of medicine. To better understand why, it is worth reflecting on a typical afternoon in the life of a medical intern.

1:27-2:26 PM: The discharge. Fortunately, the discharge summary can count (for billing purposes) as the day's note. However, you still spend 20 additional minutes on the discharge instructions—a different summary written in patient-friendly language that reviews their hospitalization, medication changes, and upcoming appointments.

2:27-2:31 PM: Interruption No. 1. You receive an alert that a clinic patient's hemoglobin A_{1c} came back at 8.3%, necessitating that you draft a notification letter explaining that they have diabetes, which you will discuss at their next visit.

2:32-3:42 PM: Working. In other words, this involves answering pages, making phone calls, and catching up on notes.

3:43-3:49 PM: Interruption No. 2. A different patient needs a letter for his employer, so you stop what you were doing to compose a personalized, yet nondescript document that is compliant with the Health Insurance Portability and Accountability Act, explaining that he has been hospitalized and will require a week off from work to recover.

3:50-4:44 PM: Writing more notes.

4:45-5:12 PM: Interruption No. 3. A third patient's insurance company is requiring that you complete a pre-authorization form for her cardiac magnetic resonance imaging, and you wonder why you must manually devote the better part of half an hour to filling out information that could so easily be automatically pulled from her medical record.

5:13-5:58 PM: Sign out. And with the last 40 minutes of your day, you painstakingly update the sign-out

tab with everything that occurred in the 11 hours since you arrived that morning, to-dos for the cross-cover resident, and contingencies for the night team.

Extant AI-assistant programs and rapidly developing chatbots are incredibly sophisticated, and as physicians have already begun to demonstrate on social media,¹ they might soon be able to reliably perform test result notifications, work letters, prior authorizations, and the like—the mundane necessities that not only cumulatively consume valuable time, but are a substantial contributor to physician burnout.² Projecting a bit further into an AI-enhanced future, imagine that instead of writing discharge instructions, I could ask a chatbot to "create a synopsis of the patient's hospital course, written in Cantonese at a sixth-grade reading level." With the time saved, I could step away from the computer, go to the patient's room, and explain the most salient follow-up items face-to-face, prepped with materials that are compatible with best practices in health literacy.³ Likewise, these programs might help actualize the admirable intentions behind the provisions in the 21st Century Cures Act that have given patients access, but not accessibility, to their jargon-laden electronic medical records (EMR).⁴ In this world, when a clinic patient logs into their EMR's web portal, "cirrhosis c/b HE" could be accompanied by a helpful hyperlink to the following (which is an excerpt of a chatbot's response to my query "What does 'cirrhosis c/b HE' mean?"):

- "Cirrhosis" - a condition in which the liver becomes scarred and cannot function properly.
- "c/b" - this stands for "complicated by," meaning that the patient's cirrhosis is complicated by the following condition:
- "HE" - hepatic encephalopathy, a condition in which the brain becomes damaged due to liver failure. It can cause confusion, changes in personality, and difficulty walking and speaking.
- Therefore, the phrase "cirrhosis c/b HE" means that the patient has cirrhosis of the liver, which is complicated by hepatic encephalopathy, indicating that the patient has a serious, long-standing liver condition and brain damage due to liver failure.

On a slightly longer time horizon, I can envision some combination of speech recognition and language learning technology augmenting a substantial amount of routine medical charting: transcribing and narrativizing a patient's history; scanning the EMR to supplement an out-of-date problem list; synthesizing old notes, prescriptions, and pharmacy refill information to do a medication reconciliation; pulling in previous assessments and plans for long-standing chronic conditions; autopopulating the sign-out tab with important labs and imaging results. Clinicians will have a responsibility to su-

Corresponding Author: Teva D. Brender, MD, Department of Medicine, School of Medicine, University of California San Francisco, 505 Parnassus Ave, Room M1480, San Francisco, CA 94143-0119 (teva.brender@ucsf.edu).

pervise the AI (as attending physicians supervise their trainees) but will be left to manually complete only those tasks and documentation that require nuance and advanced medical knowledge.

However, my excitement is tempered by a healthy dose of skepticism. For instance, consider the example of more analog technology. Despite their initial promise, the effect of medical scribes on health care quality, patient satisfaction, and physician productivity and burnout has been decidedly mixed.⁵ One might counter that, leveraging the power of big data, AI's potential is limitless. Nevertheless, we should remain open to the eventuality that, like medical scribes, AI will similarly underdeliver, or that its implementation in health care might be slower and the initial use cases more circumscribed than the proponents hope.

Additionally, the current EMRs—with their templates, smart phrases, and clinicians' tendency to liberally copy and paste—already stagger under the weight of “note bloat.” How can we ensure that AI-generated text makes the medical record more, not less, legible?

Furthermore, I share the concern that machine learning will entrench and perpetuate health disparities,⁶ as the EMR is plagued by “chart lore,” stigmatizing language, and implicit and explicit bias. Furthermore, with the US Food and Drug Administration announcing

that it will regulate clinical algorithms in the interest of antidiscrimination,⁷ the specter of medicolegal risk looms over the wider adoption of AI in health care.

Finally, these programs are not sentient, they simply use massive amounts of text to predict one word after another, and their outputs may mix truth with patently false statements called *hallucinations*.⁸ As such, physicians will need to learn how to integrate these tools into clinical practice, defining clear boundaries between full, supervised, and proscribed autonomy. Just as I do not routinely count the little boxes when determining a heart rate, instead trusting the computer-generated electrocardiogram report, I always meticulously scrutinize the waveform before activating the catheterization laboratory for an ST-elevation myocardial infarction.

We should be clear-eyed about the risks inherent to any new technology, especially one that carries existential implications. And yet, I am cautiously optimistic about a future of improved health care system efficiency, better patient outcomes, and reduced burnout; a future where AI enables us to get back to the reason why we decided to pursue medicine in the first place—to get up from the computer and back to the bedside.

Published Online: April 28, 2023.

doi:10.1001/jamainternmed.2023.1832

Conflict of Interest Disclosures: None reported.

Acknowledgment: ChatGPT-3 was used for the query about cirrhosis described in this article.

Additional Contributions: I thank Robert M. Wachter, MD, who was not compensated, for his editing assistance.

1. Stermer C. AI ChatGPT for Medicine [Video]. TikTok. December 12, 2022. Accessed April 7, 2023. <https://www.tiktok.com/@tiktokrheumdok/video/7176340747170467114>

2. Fred HL, Scheid MS. Physician burnout: causes, consequences, and (?) cures. *Tex Heart Inst J*. 2018; 45(4):198-202. doi:10.14503/THIJ-18-6842

3. Weiss BD. *Health Literacy and Patient Safety: Help Patients Understand. Manual for Clinicians*. 2nd ed. American Medical Association Foundation; 2007.

4. Dworkowitz A. Provider obligations for patient portals under the 21st Century Cures Act. *Health Affairs Forefront*. May 16, 2022. doi:10.1377/forefront.20220513.923426

5. Ullman K, McKenzie L, Bart B, Park G, MacDonald R, Linskens E, Wilt TJ. *The Effect of Medical Scribes in Cardiology, Orthopedic, and Emergency Departments: A Systematic Review*. Department of Veterans Affairs (US); September 2020.

6. Celi LA, Cellini J, Charpignon ML, et al; for MIT Critical Data. Sources of bias in artificial intelligence

that perpetuate healthcare disparities—a global review. *PLOS Digit Health*. 2022;1(3):e0000022. doi:10.1371/journal.pdig.0000022

7. Goodman KE, Morgan DJ, Hoffmann DE. Clinical algorithms, antidiscrimination laws, and medical device regulation. *JAMA*. 2023;329(4):285-286. doi:10.1001/jama.2022.23870

8. Kevin Roose. A conversation with Bing's chatbot left me deeply unsettled. *The New York Times*. February 16, 2023. <https://www.nytimes.com/2023/02/16/technology/bing-chatbot-microsoft-chatgpt.html>