

Automated Response Technology Integrated into EMR and Patient-Physician Communication

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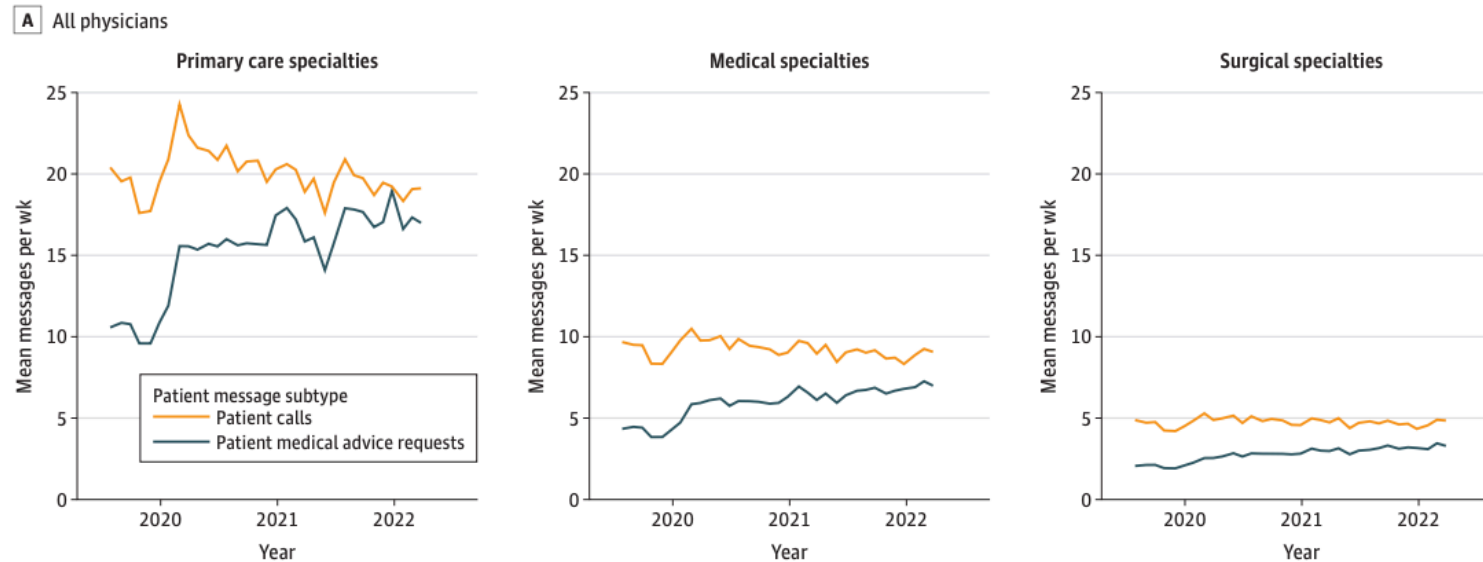
February 24, 2025

Trends in Physician Electronic Health Record Time and Message Volume

A Jay Holmgren, PhD, MHI¹; Nate C. Apathy, PhD²; Christine A. Sinsky, MD³; [et al](#)



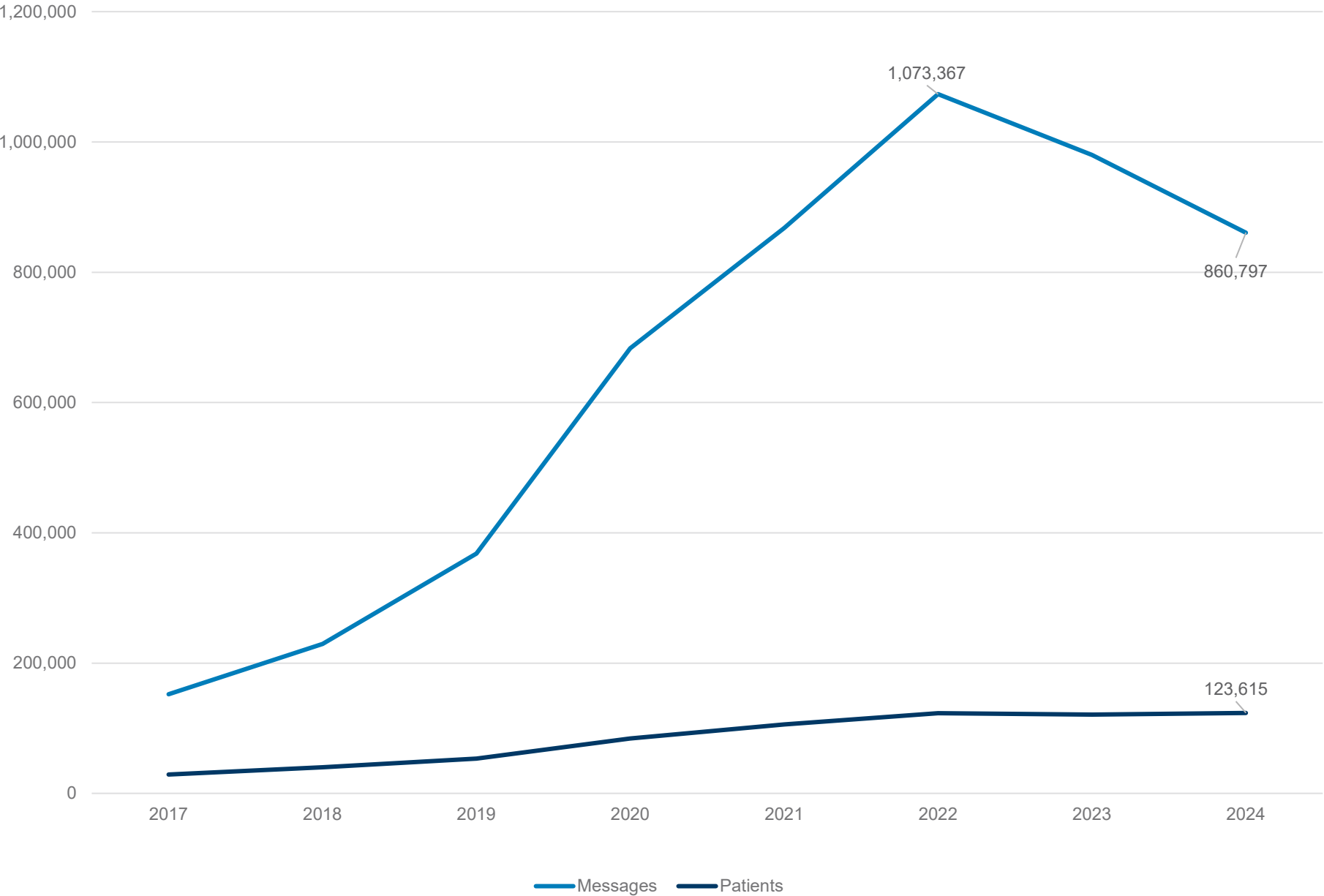
Figure 1. Trends in Patient Medical Advice Request and Telephone Call Volume



Physician work is increasingly centered around the electronic health record (EHR), which consumes nearly 50% of scheduled clinic time.¹

1. Tai-Seale M, Olson CW, Li J, et al. *Health Affairs* 2017; 36(4): 655-662.

Volume of MyChart Messages and Patients 2017 - 2024



By Ming Tai-Seale, Ellis C. Dillon, Yan Yang, Robert Nordgren, Ruth L. Steinberg, Teresa Nauenberg, Tim C. Lee, Amy Meehan, Jinnan Li, Albert Solomon Chan, and Dominick L. Frosch

Physicians' Well-Being Linked To In-Basket Messages Generated By Algorithms In Electronic Health Records

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Original Investigation | Health Informatics

Association of Electronic Health With Physician Burnout

Sally L. Baxter, MD, MSc; Bharanidharan Radha Saseendrakumar, Christine A. Sinsky, MD; Marlene Millen, MD; Ming Tai-Seale, PhD,

Well I'm not a religious person, I hope and expect that you will spend eternity in he**. You are an abusive, nasty, cheap person.

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doi:10.1001/jamanetworkopen.2022.44363

Table 2. Examples of Electronic Health Record Inbasket Messages Sent From Patients Containing Expletives or Profanity

Word	Representative quotation
Cra*	"Got ultrasound today that shows a bunch of big nodes. The report is cra* and only describes one. Tall ipsilateral thyroid nodule not clearly malignant. I asked for an addended report."
	"What's happening with me you ask? In my latest news, I feel like cra* pretty much every day of my life and struggle completing basic human functions. So that's fun for me."
	"So I have to tell you I'm pretty perturbed by this whole thing. I don't care what the rules are, I think it's pretty cra**y, that there couldn't have been an exception regarding having the Covid test the morning before the procedure, considering all this cra* that could have been avoided, by you giving me the exact info, and your staff taking care of the insurance deal. Two trips up there again is a bit much. Why don't you see what you can do about it? If not, why don't you have one of these upper ups that make these rules give me a call."
	"One more thing so you understand me. 23 y of severe chronic pain by itself has completely and totally kicked my ass!! It is so much to deal with by itself and a complete miracle I haven't committed suicide years ago. The feeling of being kicked in the balls 300 times a day and the feeling my nuts are in a vice 24/7 is just ridiculous and you have seen me take on so much other severely painful conditions that the combination is unbelievable!! Now I never stop with severe heavy wheezing and struggle to breathe constantly. I can't sleep and can't eat anything that doesn't get stuck in my throat. To me being terminally ill doesn't matter. To me it's can I do this cra* for ONE MORE DAY!! When I try to answer myself it is always No freaking way..."
He**	"As for how to communicate, playing email ping-pong via MyChart takes a he** of a lot longer and involves a lot more effort than a simple phone call. I always prefer to talk by phone."
	"Why in the he** can I not get a report on my test Ct I had on Tuesday?????"
	"I would ask that you go ahead and prescribe the Lasix as I will be raising he** about the poor communication here."
	"I need to find out as soon as possible the cost of the new drug that Dr *** is trying to help me get because it is very expensive but when I get sick for weeks at a time I will pay if this will make me well until we can get it at a discounted rate. I am on vacation and I have now been sick for three weeks so this is he**."
	"Well I am not a religious person, I hope and expect that you will spend eternity in he**. You are an abusive, nasty, cheap person."
Bullsh**	"This is a big GO TO HE** to 'Doctor' ***, whose cutting me off by refusing to fill my prescription for bupropuion on spite of multiple entreaties and his further silent abandonment of me caused me to force-wean myself from this medication. His lack of empathy and general lack of caring is disgusting and a violation of the spirit of the Hippocratic Oath he ostensibly took at some point. He definitely did harm here to me, and while this harm was not fatal or gave me any lasting injury, it was major discomfort. I plan to file a complaint against him with any medical boards and federal regulators I can find. I am sure that that won't do a damn thing, as patients have no recourse. I plan to also file complaints against his superiors at UCSD for allowing him and probably multiple other physicians under their control to be saddled with upwards of 200% or more of their patient capacities. Again, you all can go to he**."
	"You and your university should be ashamed of yourselves. As a doctor, you should care about helping people. Here I sit 6 mos later, unable to pay my bills for ridiculous blood tests that you ordered. UCSD is full of liars, hypocrites and I will do everything in my power to prevent anyone from going to your bullsh** office again. Thank you for \$1600 in bills for 10-min of your time. I am ashamed that I wasted my time and money to visit you and UCSD. Just remember your ripping people off, not helping them get better. Congrats."
	"And for you to hang up on me like you did today is totally unacceptable. I wasn't calling you names or threatening you. I was using adult language because I'm a fu**ing adult! And I had every right to be pissed having stayed up all night and morning only to find out you can't figure out how to use a fu**ing computer program that every one else at UCSD has no problem with. Even if ur messages are screened...they aren't deleted. All the doctors I've seen at student health can readily View MyChart messages. So I'm not buying that line of bullsh**!"
Fu**	"And don't give me some bullsh** about you needing to monitor me? Wtf does that mean? How have you been monitoring me since I've been seeing you?"
	"I am so upset that i was told the blood work would include the gender of the baby. I have been waiting 5 d to find it, and it wasnt even fu**ing tested!!!! What a disappointment in your office and the bullsh** i was told. I will be switching plans because this is sh**!"
	"This whole experience makes me want to just say fu** my health. I don't care what's wrong or what happens to me."
	"What the actual fu**! What kind of PCP is this!"
	"Are you just put out with what's going on? This is serious too me and I am very concerned about. If this is how you're feeling about my issue that fu** it. You're not the one that is experiencing it!!!"

Abbreviations: UCSD, University of California San Diego; PCP, primary care physician.

Introducing Dr. Chatbot

UC San Diego Health is among first in country to integrate GPT-4 into doctor-patient messaging



Photo by Guillaume/iStock

June 15, 2023

Story by:

Quality Improvement Project

Objectives

- To examine the association between ART-drafted replies for patient messages and physician time spent on answering messages.
- To explore the quality of ART-drafted replies for messages with mental health concerns.

Outcomes

- Time spent reading messages
- Time spent replying to messages
- Quality of draft replies to messages with mental health concerns

June 16 – July 12, 2023
52 volunteers (43%)

Mixed Methods Study

Intention-to-treat

	T0	T1	T2
Immediate	0	x	x
Delayed	0	0	x
Control	0	0	0

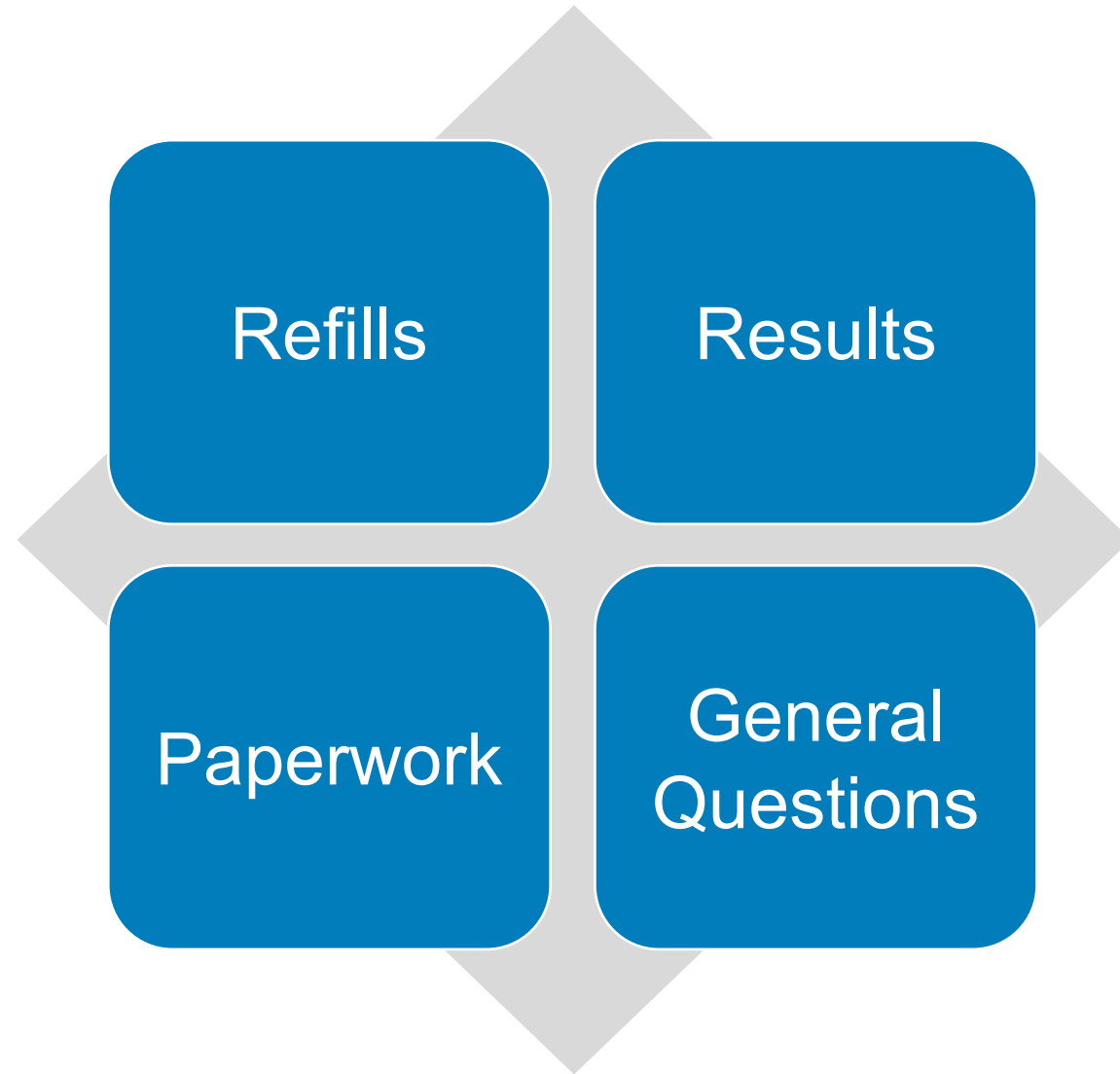
Quantitative analysis

- Linear mixed-effects model

Qualitative analysis

- Thematic analysis of qualitative responses

Messages eligible for GenAI drafts



Generated Draft Reply

Pioneering Feature

Dear [REDACTED]


Thank you for your message and for taking an active role in your health. It's great to hear that you're considering the Hepatitis A vaccine. Twinrix is indeed a combination vaccine that covers both Hepatitis A and B. However, since you've already had the Hepatitis B vaccine, you may not need the combination.

Please schedule an appointment so we can discuss this further and determine the best course of action based on your medical history and current health status.

Best,

 [Learn more](#)

 Start with Draft

 Start Blank Reply

Did you find the draft reply helpful?



This was helpful



This was not helpful

Dear [REDACTED]

Thank you for your message and for taking an active role in your health. It's great to hear that you're considering the Hepatitis A vaccine. Twinrix is indeed a combination vaccine that covers both Hepatitis A and B. However, since you've already had the Hepatitis B vaccine, you may not need the combination.

I see you have an upcoming appointment and I recommend reviewing at that appointment. It is a 2 shot series so you can do the 1st shot at the appt if you would like. |

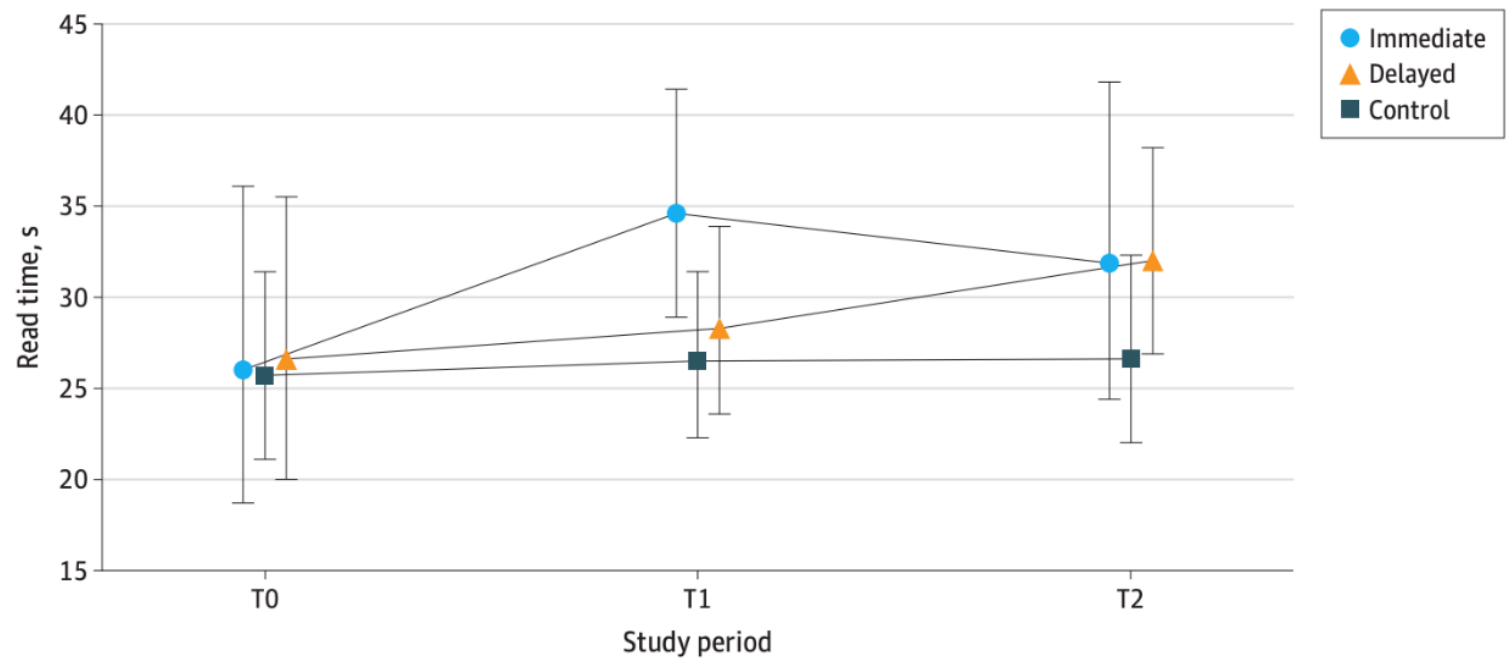
Take care,
Marlene May Millen, MD

Part of this message was generated automatically and was reviewed and edited by Marlene May Millen, MD.

Results

Read Time

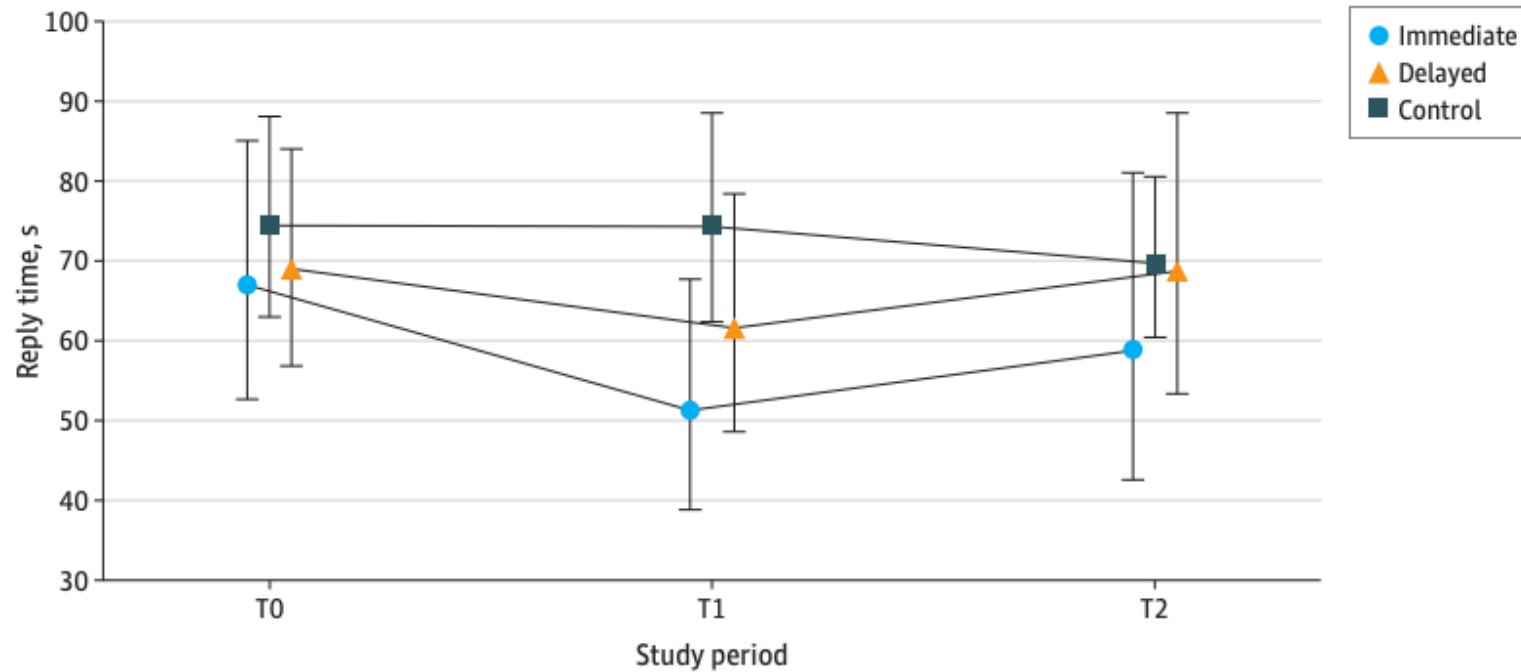
Figure 1. Read Time per Message (in Seconds) for Each Group and Study Period



Symbols indicate geometric means and whiskers indicated 95% CIs. T0 indicates preactivation period, 1 to 21 days before randomization day; T1, 0 to 20 days post randomization and activation (immediate activation group), or 0 to 20 days after randomization date (delayed group); T2, 21 to 41 days post activation (immediate group), or 0 to 20 days post activation (delayed group).

Reply Time

Figure 2. Reply Time per Message (in Seconds) for Each Group and Study Period



Symbols indicate geometric means and whiskers indicated 95% CIs. T0 indicates preactivation period, 1 to 21 days before randomization day; T1, 0 to 20 days post randomization and activation (immediate activation group), or 0 to 20 days after randomization date (delayed group); T2, 21 to 41 days post activation (immediate group), or 0 to 20 days post activation (delayed group).

Theme (9/10)

Quote

Tone and Value

“Though the replies sound very robotic still, they're extremely helpful for generating the baseline response to what you'd want to say to a patient.”

Potential for Improvement

“I can't wait for them to get even better, to the point where they can mimic each physician's language/tone.”

Hope for Reduced Supervision

“Great initiative which requires supervision. Hopefully there would be time when minimal supervision would be needed.”

“I do really like the 'empathic tone' of the messages - it makes me feel better sending it....reminds me of Lincoln: ‘by the better angels of our [inbox] nature.’”



JAMA Network Open. 2024;7(4):e246565. doi:10.1001/jamanetworkopen.2024.6565



Original Investigation | Health Informatics

AI-Generated Draft Replies Integrated Into Health Records and Physicians' Electronic Communication

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Abstract

IMPORTANCE Timely tests are warranted to assess the association between generative artificial intelligence (GenAI) use and physicians' work efforts.

OBJECTIVE To investigate the association between GenAI-drafted replies for patient messages and physician time spent on answering messages and the length of replies.

Key Points

Question Would access to generative artificial intelligence–drafted replies correlate with decreased physician time on reading and replying to patient messages, alongside an increase in reply length?



Difficult and Complex Messages from Patients

Could Generative AI Help?

Thank you. I need to add what bothers me, as you summarized. I was fired from [name of org]: I ... so I was let go. Why was a good thing taken out of context into bad? Why even list that I was fired? I worked undercover for [name of org 1]. Not [name of org 2]. I have been dead 2x, childbirth then '76 coma. I developed my program in classes to learn to read and write again at [org name] in Special Services dept., while I worked there. I was no longer allowed to take classes because after testing my IQ was too high. I am relieved by the suicide of husband, ending 20 years of poisoning, strangling or other means of causing me loss of memory and near death. This leaves scars. There wasn't a better place to go when old and Neurodivergent, ADD, memory problems from coma, that don't allow me to learn new jobs. So No my memory is not good. But to write I cannot hold down a long term job is untrue. I used my abilities to own a bookstore, manufacturing company, counseling, and projects. Now I rely only on SS for money. My opinion is I could say perhaps you didn't hear what I said or dismissed my life story as one of weakness, rather than my strengths. ... Please know I am not a screw up I've faced challenges most will never, and I need support from this perspective. [name]

LLM Draft Reply (GPT4)

Sent Reply

LLM Draft Reply (GPT4)	Sent Reply

Could Generative AI Help the Patient?

Can you help the patient rewrite her message so it doesn't sound so angry?

Thank you for summarizing my concerns. I want to clarify that I was let go from [name of org] due to a misunderstanding. I worked undercover for [name of org], not [name of org].

Despite significant challenges, including health issues and a difficult marriage, I have achieved a lot. I developed a program to relearn reading and writing, owned a bookstore, and ran a manufacturing company.

Now, I rely on Social Security for income. My life story is one of strength, not weakness, and I need support from this perspective.

Please understand that I am not a failure. I have faced and overcome many challenges.

[Patient Name]

Patient Bob

Hi. Can I get a refill for Percocet. Thanks, Bob

LLM Draft Reply	Sent Reply

Draft Reply to Patient Bob from A More Recent LLM Engine

Dear Bob,

I understand your concern about refilling your Percocet prescription. However, I need to emphasize the importance of responsible opioid use and the potential risks of long-term use.

I'm committed to your well-being and want to ensure that we're managing your pain effectively and safely. Let's discuss your pain management plan in more detail. We may need to consider alternative pain management strategies or adjust your current medication regimen.

Please schedule an appointment to discuss your pain management needs further. We can work together to develop a comprehensive plan that addresses your pain and minimizes potential risks.

Thank you for your understanding.

Sincerely,

Patient Caroline

My mom attempted suicide last Friday. She's in a psychiatric unit of a hospital under 24 hour surveillance by the staff. I wanted to know if you or someone in your staff have time to speak with me regarding a few things.

- 1) What is your advice on the best treatment plan for her? I think a combination of medication and therapy will be best. What should I expect from the hospital in terms of care?
- 2) How do I best take care if my dad who is struggling with the situation? He will need support to get through this.
- 3) How do I best care for myself? I feel like i can handle the situation, but the stress is building up and I don't know if I should preventatively take Lexapro again to reduce the anxiety I'm sure i will experience in the coming weeks and months

Thanks, [name]

Draft and Sent Replies to Caroline

LLM Draft Reply	Sent Reply

2 Days Later – Reply from a Nurse to Caroline

So sorry to hear about your mom! Her care team will be the ones to best determine what help she needs. We unfortunately can not prescribe medications or do a visit with you since you are outside of the state of California. It looks like your insurance card has options for you to get care while traveling though.

Please refer to your insurance card and call them directly for an online doctor appointment or maybe a local urgent care to seek help and for the new prescription you are requesting and maybe some tools to help you through this difficult time.

It looks like their member support number is 1-855-431-5540, they should have options for you that are local to you and can support you further. Another resource is the 988 Suicide & Crisis Lifeline as well, you would just dial 988, here is the website with their information: <https://988lifeline.org/>

Please set up an appointment when your family is doing better and you are back in California at your convenience to further discuss the treatment options.

Sorry again for everything you are going through!

Sincerely, [nurse name] at the office of [doctor name]

could you consider yourself as a health care professional and write a reply to this message from a patient "My mom attempted suicide last Friday. She's in..."



Talk to someone now

Help is available

988 Suicide and Crisis Lifeline

Call or SMS:

988

 Chat

From Google Search

Things might seem impossible right now but talking about it can help. Call or text 988. It's a confidential helpline.

Patient Deborah

Hello Dr. [], I hope you are well. I'm contacting you because, over the past few weeks, I've experienced anxiety and depression that I would label as severe and debilitating. It gets to the point where I freak out about losing my job and develop bad thoughts.

I've spoken to a therapist about this, and she feels it would be a good idea to consider taking medication in these moments to relax.

Please let me know what you think.

Best,

Deborah

LLM Draft	Send Reply

Draft Reply to Patient Deborah from a More Recent LLM Engine

Dear [Patient's Name],

Thank you for reaching out and sharing your concerns. It's understandable that you're feeling anxious and depressed.

I appreciate you speaking with your therapist about these feelings. It's a positive step toward addressing your mental health.

Regarding medication:

While medication can be a helpful tool in managing severe anxiety and depression, it's important to consider all treatment options. Therapy can be very effective in addressing underlying issues and developing coping strategies.

I recommend discussing your concerns with your therapist to determine the best course of action for you. They can help you weigh the pros and cons of medication and therapy, and create a personalized treatment plan.

Please don't hesitate to reach out if you have any further questions or need additional support.

Sincerely,

What can be inductively drawn from these examples?

How might we expand our understanding of electronic communication between patients and clinicians, in the age of LLM?

Even though the sample is not designed to be statistically representative of larger populations

Risks of Using LLMs in MH Communication

- Accuracy and reliability
- Automation bias
- Privacy and security
- Data breaches, unauthorized access, or misuse of patient information
- Transparency and explainability
- Loss of human touch and empathy
- Professional responsibility and liability
- Overreliance and deskilling

On-Going Effort



Use LLM to facilitate analyses of qualitative data on electronic patient-clinician communication



Triangulate quantitative and qualitative data in the EHR



Aim for a more comprehensive understanding of mental health communication and how might LLM improve its quality

Conclusion

GenAI-drafted replies were correlated with

- increased message read time,
- no change in reply time

Physicians valued GenAI-drafted replies

- as a compassionate starting point for their replies and noted areas for improvement

Mental health issues

- recent versions of GenAI-drafted replies seem more valuable for clinicians
- can potentially help patients

**Human oversight and intervention
are still necessary**

How likely are you to
recommend ART to a...



colleague?

0 – 10,
0: not at all,
10: extremely likely

patient?

0 – 10,
0: not at all,
10: extremely likely

