



Artificial Intelligence in Health and Nutrition

**34th Annual Fall Nutrition Symposium
Ohio Society of Parenteral and Enteral
Nutrition Society (OSPEN)
October 9, 2025**

Ryan T. Hurt, MD, PhD

Professor of Medicine

Chair, General Internal Medicine

Director Home Parenteral Enteral Nutrition

Mayo Clinic, Rochester, MN





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Make me more serious



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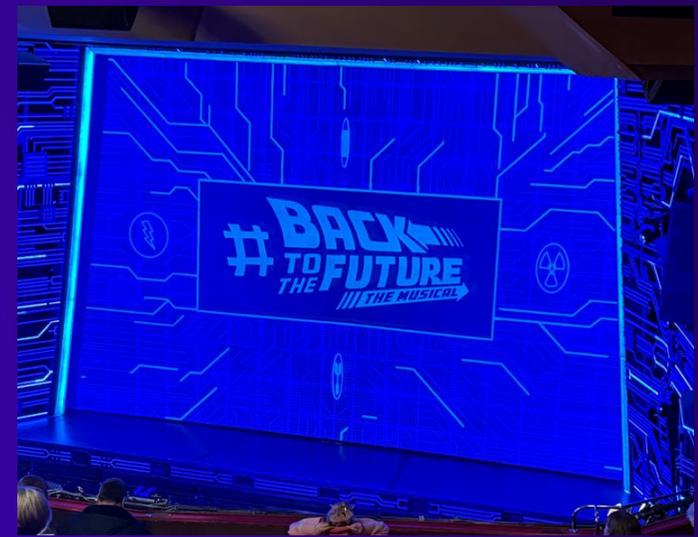
Director Home Parenteral Enteral Nutrition

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Disclosures

- Nestle Nutrition – Consulting for the Nestle Physician Fellowship
- Zealand Pharma- Research Grants
- I will be discussing commercial AI programs, but I have no vested interest in any of these companies
- I will be discussing AI tools, off-label usage in patient care situations



It is 2025 shouldn't we have flying cars by now?

Autonomous Vehicles Ready for mass deployment?



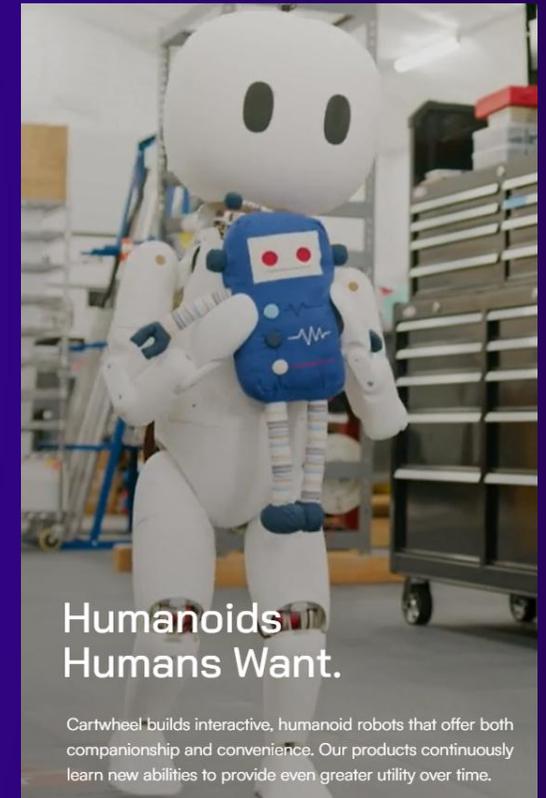
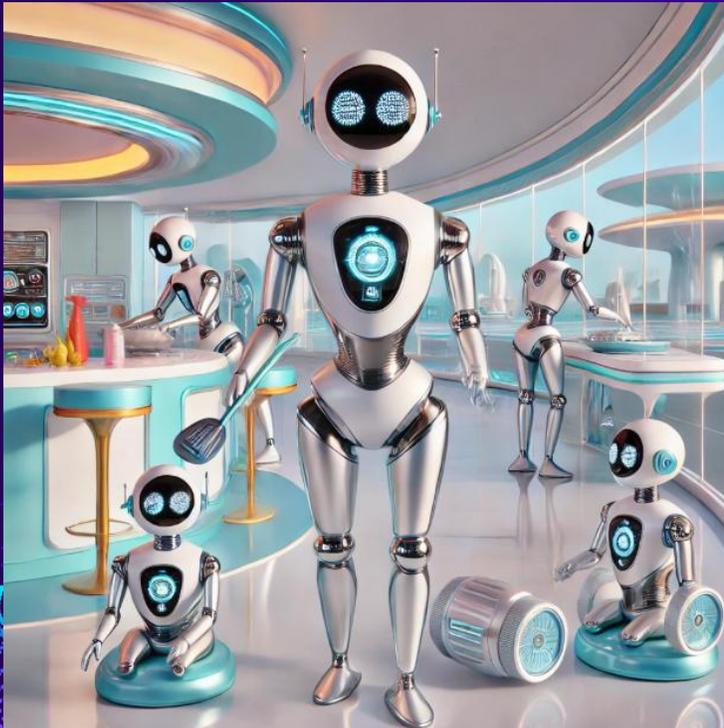
Autonomous wheelchairs Ready for mass deployment?



Mayo Clinic Launches use of Autonomous wheelchairs 9/29/25

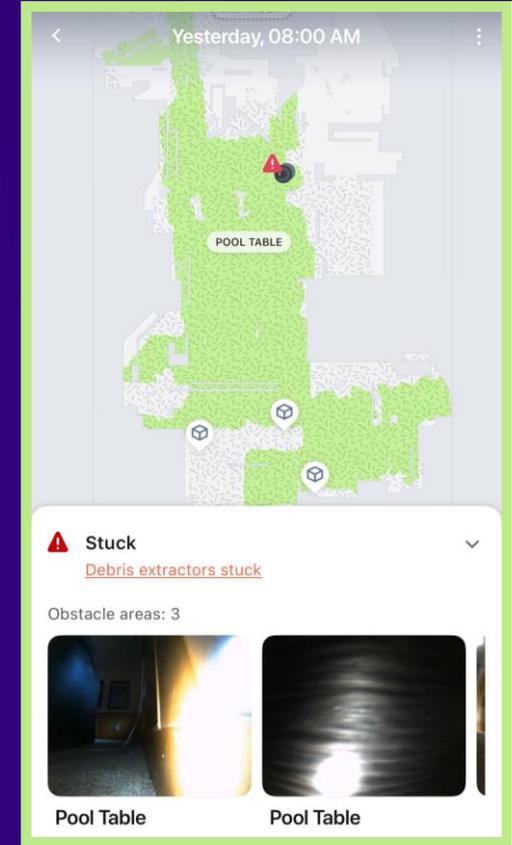


It is 2025 shouldn't we have robots helping us?





It is 2025 shouldn't we have AI robots helping us?



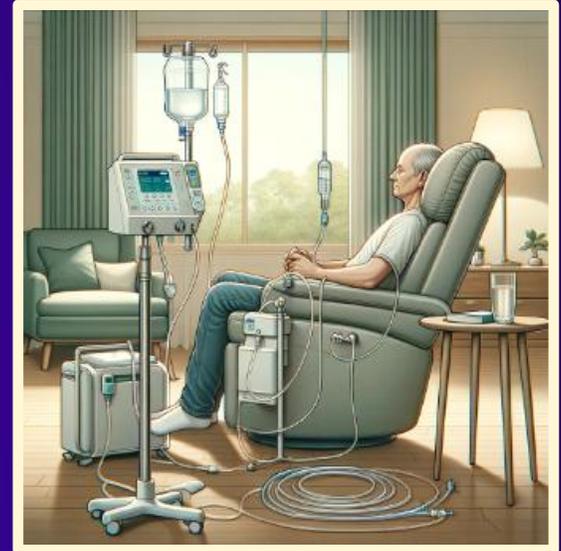
These robots use **VSLAM (Visual Simultaneous Localization and Mapping)** to create detailed maps of your home or workplace

They learn your home or workplace layout over time and get better at cleaning or transporting with each run.



Lifeline through the night,
Nourishment flows, pure and bright,
Strength where hope takes flight.

Through sterile lines fed,
Liquid life where meals once failed,
Hope where strength is bred.



Write a poem and draw pictures of patients receiving HPN
ChatGPT and DAHLE

Learning Objectives

Upon completion of this educational activity, the learner will be able to:

- Explain some basic concepts of AI (with a focus on generative AI)
- List the currently commonly available artificial intelligence platforms
- Describe how AI can be used in medicine to improve patient care
- Describe the pitfalls of using artificial intelligence in the practice of medicine

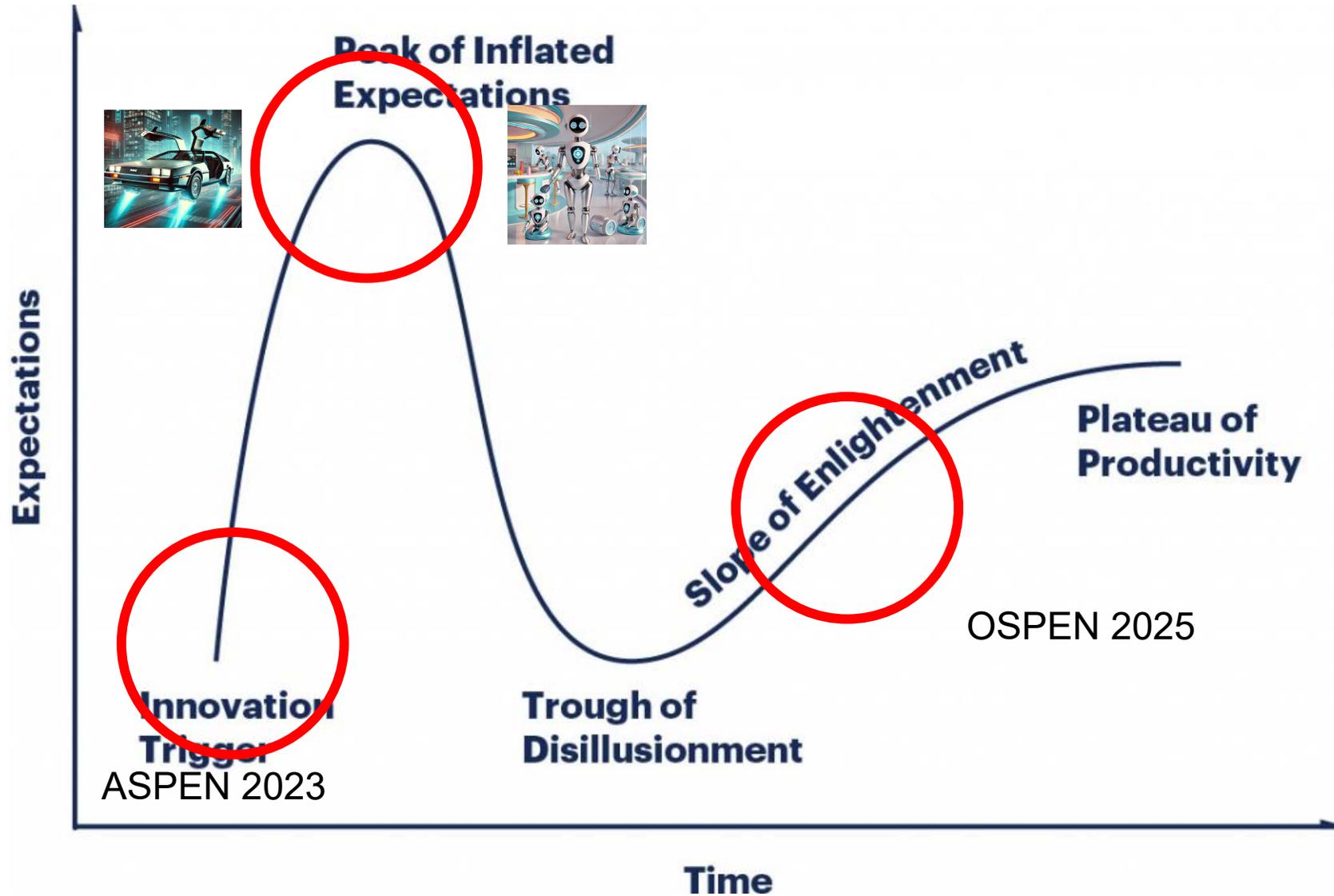
VIEWS TOWARDS CHANGING TECHNOLOGY

- 28% of Americans are strong early adopters of technology
- 26% prefer familiar products and may be resistant to new technologies

What are your views on AI?



GARTNER'S HYPE CYCLE



Sentiment of Nurses Towards Artificial Intelligence and Resistance to Change in Healthcare Organisations: A Mixed-Method Study

- Survey of 500 nurses examining attitudes on various AI topics
- Qualitative focus group of 20 nurses
- Age significantly influenced attitudes on AI, with younger nurses (<25 yo) having a significantly more positive attitude toward AI compared to other age groups

Sentiment of Nurses Towards Artificial Intelligence and Resistance to Change in Healthcare Organisations: A Mixed-Method Study

	Positive Attitude		Negative Attitude	
	Correlation	Sig. (2-tailed)	Correlation	Sig. (2-tailed)
Resistance behaviour	-0.554	<0.001	0.565	<0.001
Resistance to change	-0.501	<0.001	0.628	<0.001
Perceived usefulness	0.676	<0.001	-0.635	<0.001
Perceived ease of use	0.658	<0.001	-0.658	<0.001
Perceived value	0.662	<0.001	-0.653	<0.001
Colleagues' opinions	0.659	<0.001	-0.631	<0.001
Self-efficacy for change	0.637	<0.001	-0.649	<0.001
Organisational support for change	0.643	<0.001	-0.624	<0.001
Total readiness for change	0.663	<0.001	-0.615	<0.001

Positive attitudes towards AI correlate to decreased resistance

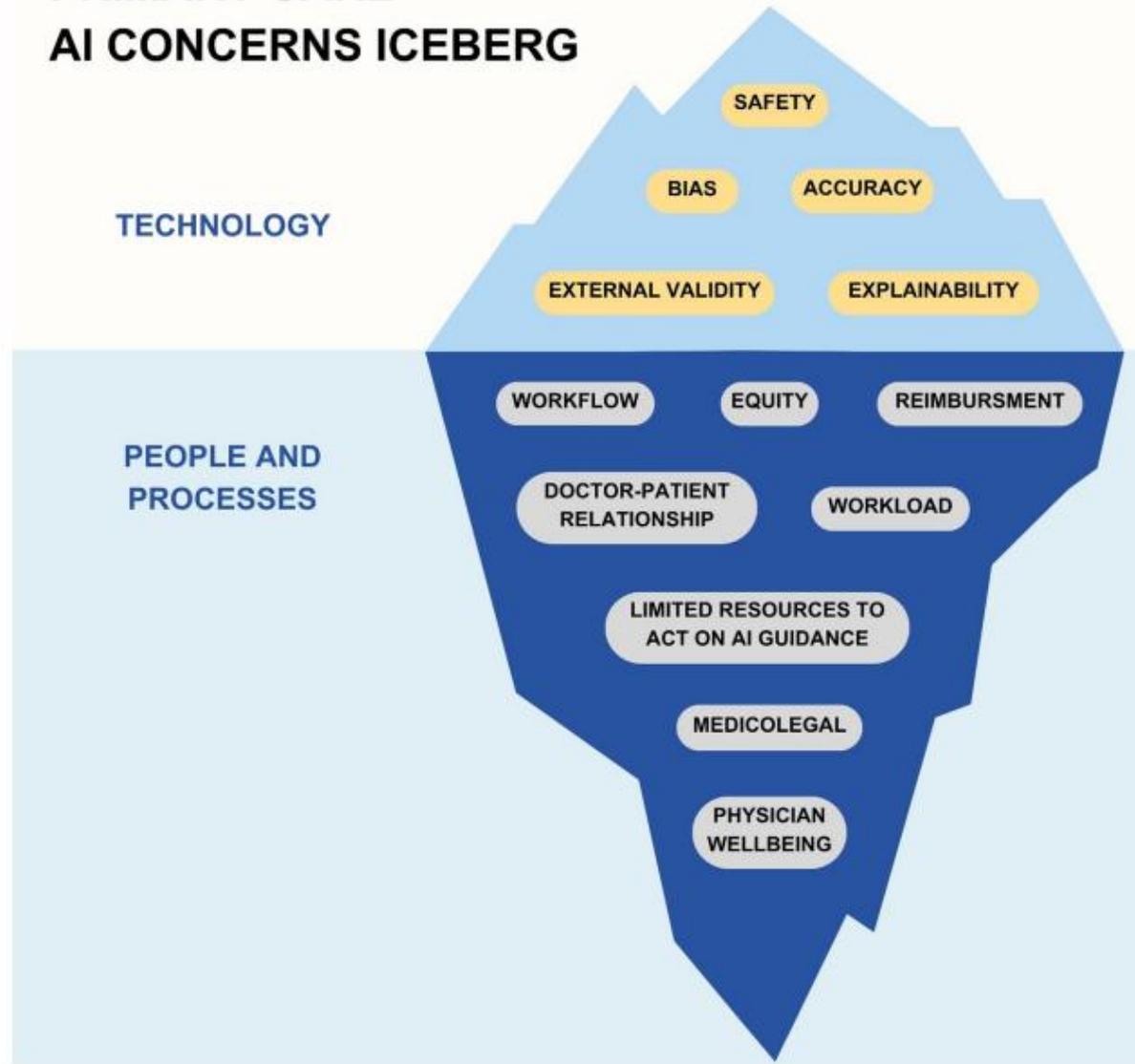
Navigating the doctor-patient-AI relationship - a mixed-methods study of physician attitudes toward artificial intelligence in primary care

Table 1 Table percentages represent the proportion of PCPs reporting varying levels of comfort with AI involvement in different domains as reported via the digital survey

Domain	Very Comfortable	Somewhat Comfortable	Neutral	Somewhat Uncomfortable	Very Uncomfortable
Disease Screening	29.8%	46.8%	8.5%	8.5%	6.4%
Chronic Disease Management	25.5%	46.8%	12.8%	8.5%	6.4%
Disease Diagnosis	8.5%	42.6%	10.6%	23.4%	14.9%
Administrative Tasks	40.4%	25.5%	12.8%	14.9%	6.4%

Less than 50% comfortable with AI helping disease diagnosis

PRIMARY CARE AI CONCERNS ICEBERG



Allen et al 2024 BMC Primary Care

Pharmacists' perceptions of artificial intelligence: A national survey

- Survey of 1363 PharmD examining attitudes on various AI topics
- 82.5% of respondents expressed some degree of familiarity with AI software
- Only 38.7% reported having used AI
- 56.1% of pharmacists feel that AI will decrease the number of pharmacy jobs
- 34.9% of pharmacists express some degree of distrust of AI
- 64.1% of pharmacists feel that AI could enhance their professional effectiveness and productivity

Artificial intelligence in clinical nutrition and dietetics: A brief overview of current evidence

Kiranjit Atwal BSc (Hons), MSc^{1,2} 

Investigation and Assessment of AI's Role in Nutrition—An Updated Narrative Review of the Evidence



Hanin Kassem¹, Aneesha Abida Beevi¹, Sondos Basheer¹, Gadeer Lutfi¹,
Leila Cheikh Ismail^{1,2}, Dimitrios Papandreou¹

Advancements in Using AI for Dietary Assessment Based on Food Images: Scoping Review

Lacking Data on RDNs Attitudes on AI

Automation and Artificial Intelligence in Clinical Nutrition (SU45)



DATE & TIME:
March 23, 2025
4:00 PM – 6:00 PM ET

BREAKOUT

Perceptions of Registered Dietitians on the Use of AI During Dietetic Consults: A Survey

Danelle Johnson MS, RDN, LD, CNSC



Advanced Practice II Dietitian
Home Parenteral and Enteral Nutrition, Mayo Clinic



Rochester, MN



Results from a Cross-Sectional Survey of RDNs at all Mayo Clinic sites!

Artificial intelligence (AI)

What is AI?

- Refers to the simulation of human intelligence in machines.
- Designed to perform tasks that typically require human intelligence.
- Trained through repetitive exposure to that specific task with corrective feedback

AI can:

- Understand language
- Recognize images
- Learn from data
- Make predictions

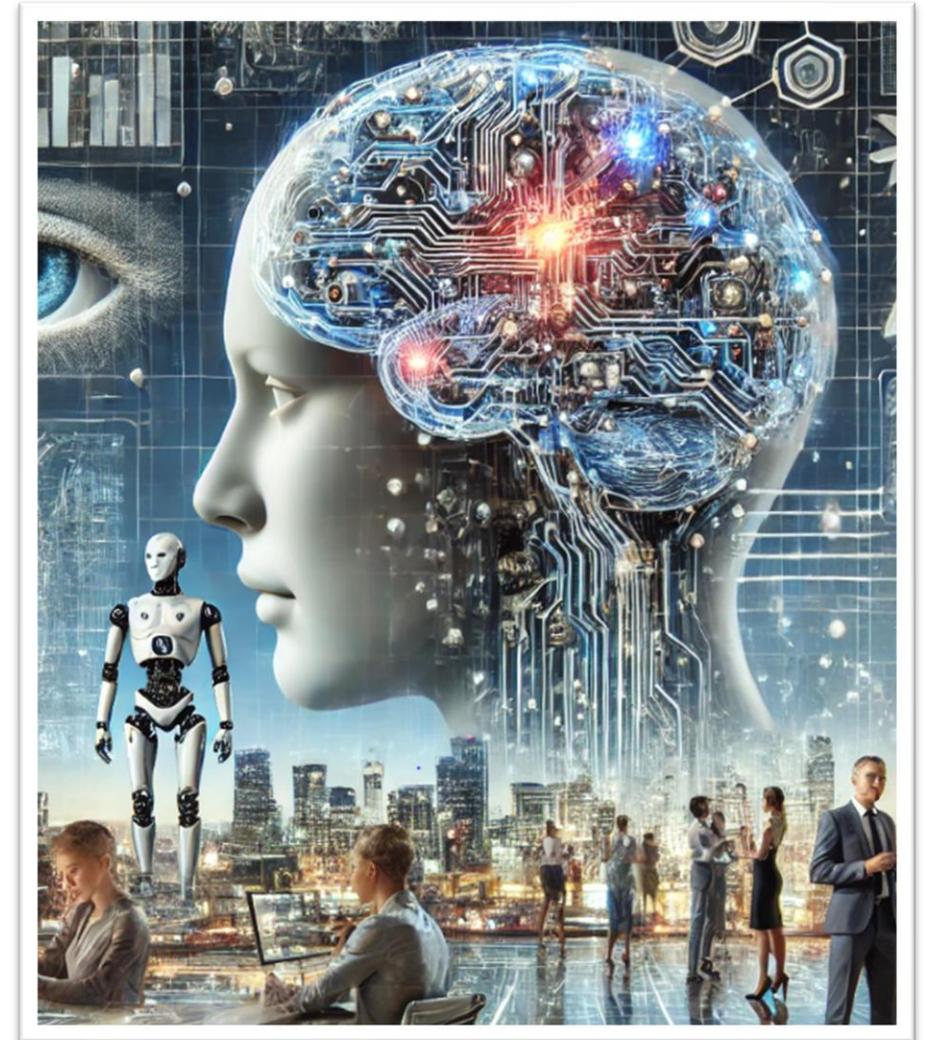


Image generated using DALL·E by OpenAI

Key Concepts in AI

- **Machine Learning:** Algorithms that learn from data (e.g., supervised, unsupervised, reinforcement learning).
- **Deep Learning:** Subset of ML utilizing neural networks, inspired by the human brain.
- **Generative AI:** Models like GPT and diffusion models capable of creating text, images, or other outputs.
 - **Predictive AI:** Makes predictions about potential and future outcomes, risk exposure, causation
- **NLP:** Enables computers to understand and generate human language.
- **Data as the Fuel:** Structured (EHRs, lab data) and unstructured data (notes, images)

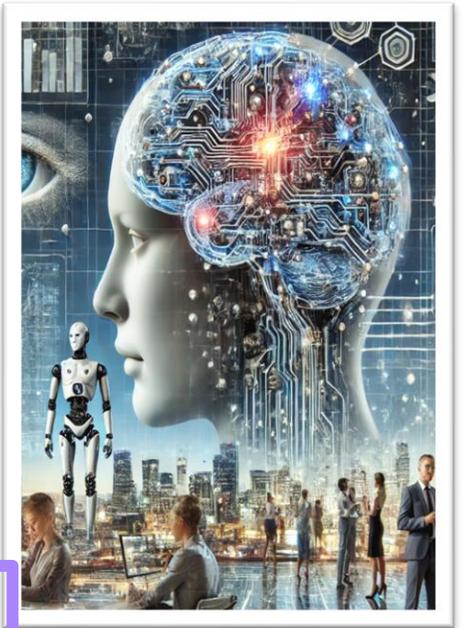


Image generated using DALL·E
by OpenAI

Ethical Considerations (5 Takeaways)

- **Patient Safety & Well-being** – AI should enhance patient care without introducing harm or risk.
- **Informed Consent** – Patients should understand how AI influences their care and be given the choice to opt out where applicable.
- **Privacy & Data Security** – AI systems must comply with regulations (e.g., HIPAA, GDPR) to protect patient data.
- **Equity & Fairness** – AI should be developed and deployed in a way that ensures equitable access and outcomes across diverse populations.
- **Human Oversight** – *AI should assist*, not replace, human decision-making, maintaining the clinician’s role in critical judgment.



What is Generative AI (genAI)?

Generative artificial intelligence (AI) is the umbrella term for the groundbreaking form of creative AI that can produce original content on demand. Rather than simply analyzing or classifying data, generative AI uses patterns in existing data to create entirely new content. It can produce text, images, audio, synthetic data and more.

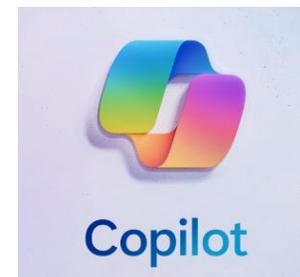
GenAI=Developing new content on demand from patterns in existing data

Lots of the clinical work we do is pattern recognition!

What are Some Examples of Generative AI (genAI)?



With the potential to reinvent practically every aspect of every enterprise, the impact of [generative AI](#) on business cannot be understated. These technologies will significantly boost productivity and allow us to explore new creative frontiers, solve complex problems and drive innovation. Ultimately, [generative AI](#) will fundamentally transform the way information is accessed, content is created, customer needs are served and businesses are run.



The 5 biggest risks of generative AI, according to an expert

AI makes our lives easier in many different ways. However, these benefits can come with costs.

- **Hallucinations**- errors that gen AI models are prone to make because, although they are advanced, they are still not human and rely on training and data to provide answers.
- **Deepfakes**- use gen AI to create videos, photos, and voice recordings that are fake but take the image and likeness of another individual
- **Data privacy**- major concern with gen AI since user data is often stored for model training. This led to the banning of ChatGPT in Italy.



[The 5 biggest risks of generative AI, according to an expert | ZDNET](#)

The 5 biggest risks of generative AI, according to an expert

AI makes our lives easier in many different ways. However, these benefits can come with costs.

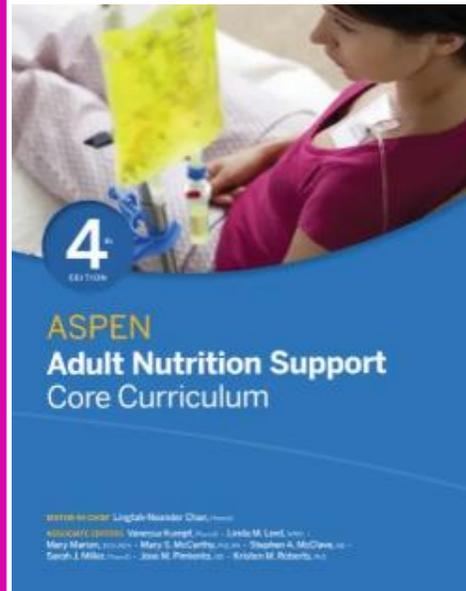
- **Cybersecurity-** The advanced capabilities of generative AI models, such as coding, can also fall into the wrong hands, causing cybersecurity concerns.
- **Copyright issues-** Copyright is a big concern because generative AI models are trained on massive amounts of internet data that is used to generate an output.
 - This process of training means that works that have not been explicitly shared by the original source can then be used to generate new content.



[The 5 biggest risks of generative AI, according to an expert | ZDNET](#)

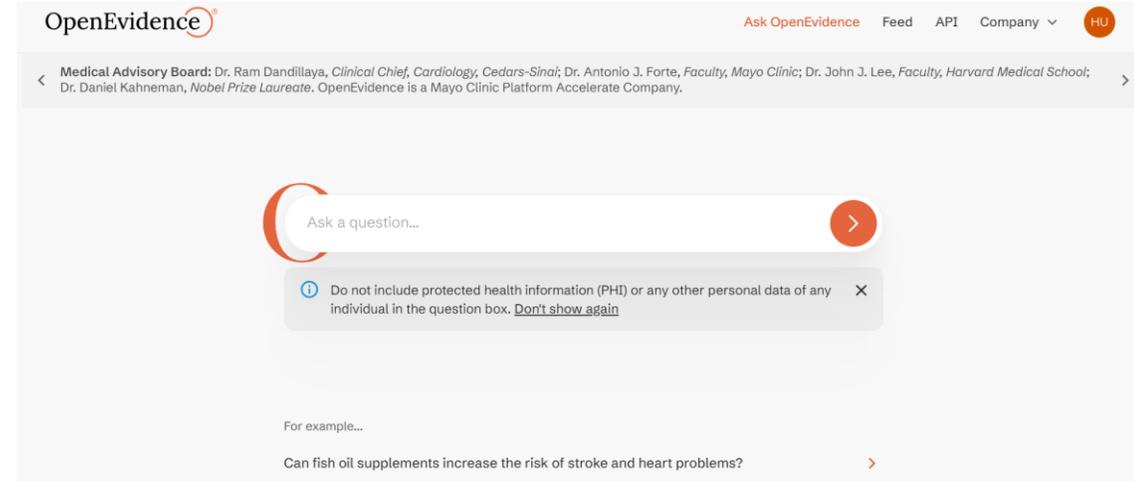
HOW CAN GEN AI HELP WITH CLINICAL DECISION MAKING?

Traditional

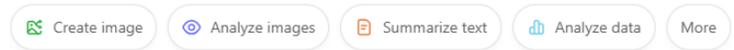
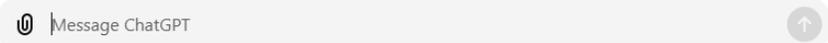


Clinical experience

Gen AI

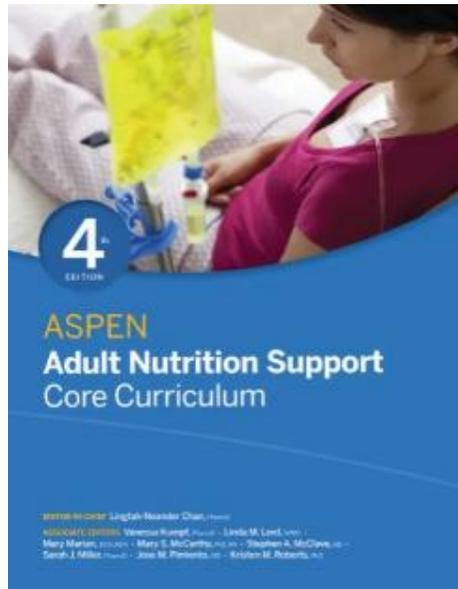


What can I help with?



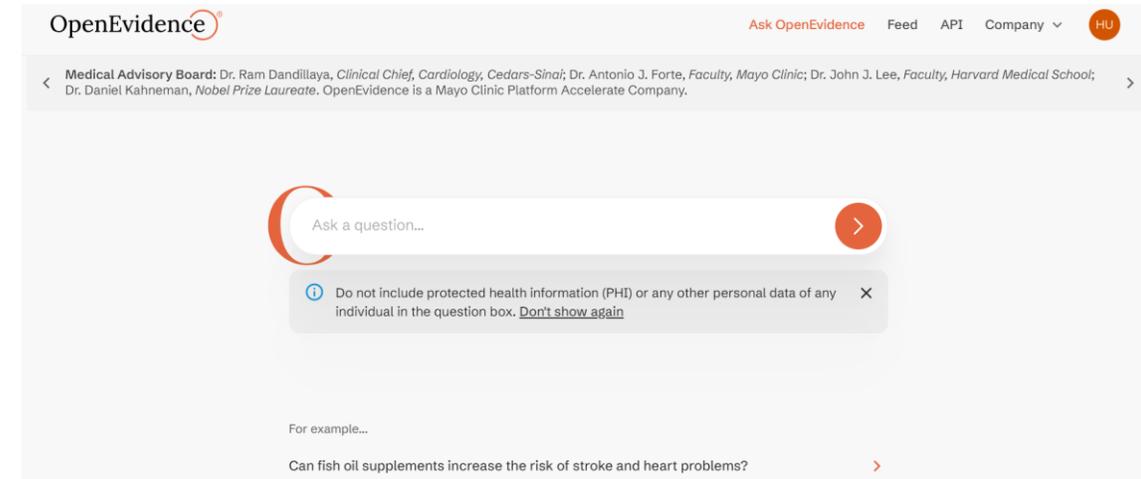
HOW CAN GEN AI HELP WITH CLINICAL DECISION MAKING?

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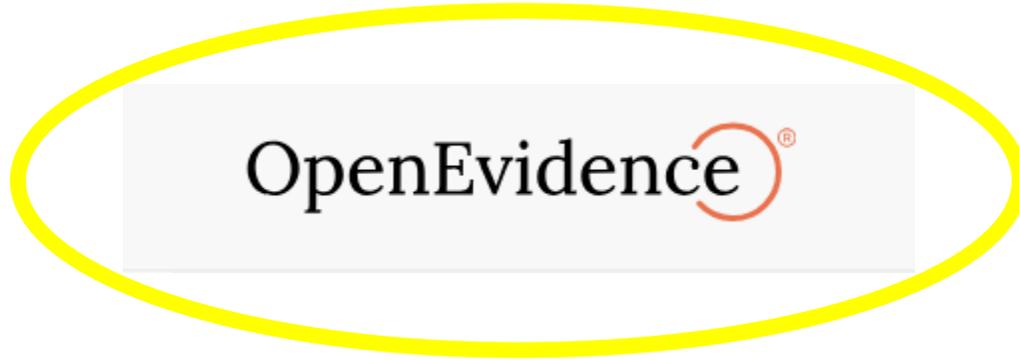
The clinician needs to search for the answers to questions

Gen AI



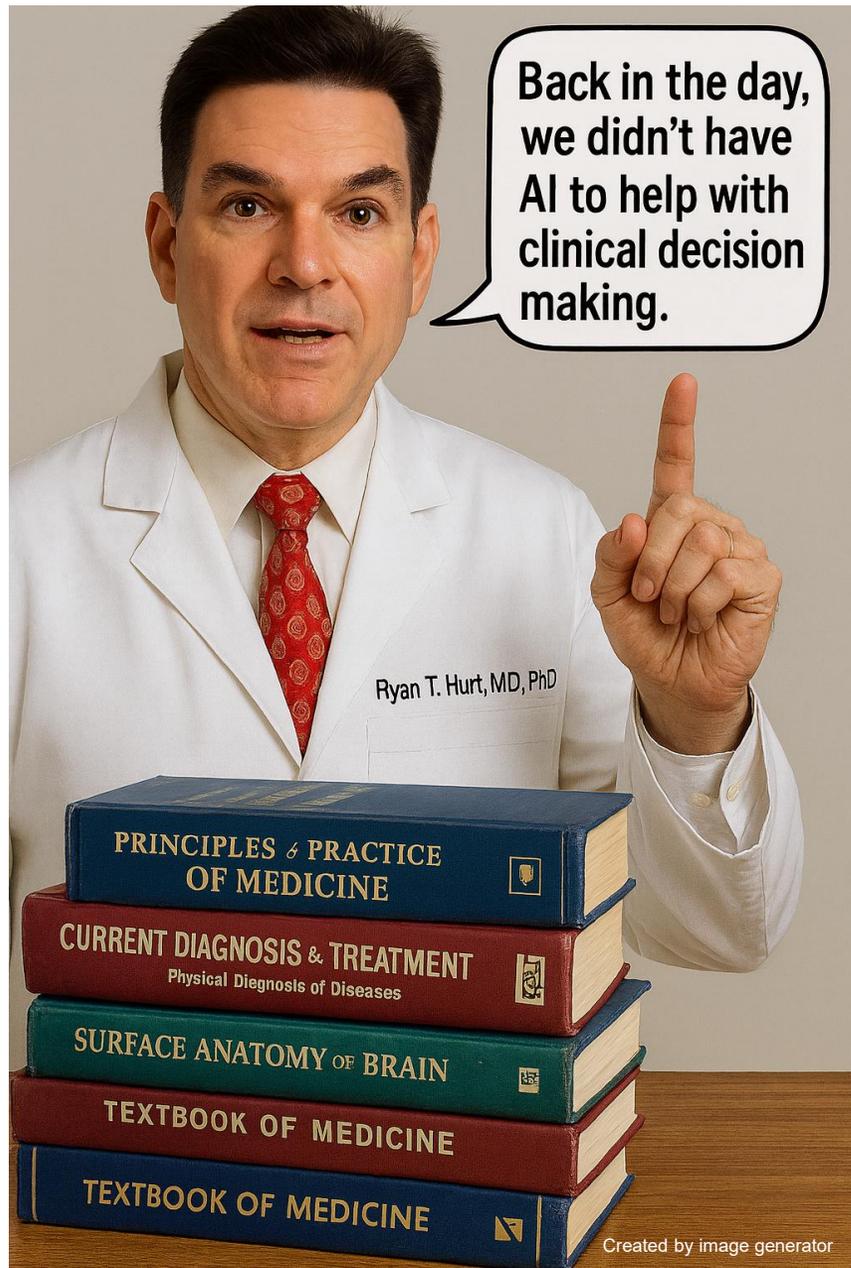
The genAI will generate answers to questions

Clinical Decision Making (CDM) gen AI



Chat GPT

Over 250,000 Physicians in the US have used OE



draw a picture of me Ryan T. Hurt MD, PhD saying back in the day we didnt have AI to help with clinical decision making

I'd love to make that for you! 🗨️ 👤 💡

To create the most **accurate and expressive** version of you, could you please upload a **photo of yourself**? That way, I can make sure the image truly represents *you*, Ryan T. Hurt, MD, PhD. 🗺️ 🏠 🩺

Once I have your picture, I'll generate an image of you saying:

"Back in the day, we didn't have AI to help with clinical decision making."

Ready when you are! 🗨️ 👤 🖼️ 🌐

🔖 👍 🗨️ ...

draw me in a white coat

image generator
A GPT specialized in generating and refining images with a mix of professional and friendly tone.
By NAIF J ALOTAIBI

Our mission is to organize the world's medical knowledge and make it more useful, open, accessible, and understandable.



OpenEvidence to Become a
Mayo Clinic Platform
Accelerate Company

March 28, 2023

The world's leading AI-powered medical search platform.



Launched during the Mayo Clinic Platform Accelerate program



The NEW ENGLAND JOURNAL of MEDICINE

Featured by the New England Journal of Medicine AI



ELSEVIER

Powering Elsevier's ClinicalKey AI (Lancet; Cell; Gray's Anatomy; 2000+ journals)

OpenEvidence is what we always imagined when we used to talk about someone finally solving medical search.

Information overload is an extreme challenge in medicine.

The amount of medical research published annually is doubling every 5 years.^[1] Such a rate of change makes it nearly impossible for the world's physicians, medical researchers, and healthcare professionals to monitor and understand all the latest research literature and clinical evidence relevant to their work.

To tame the medical information firehose, we built OpenEvidence, an artificial intelligence system to aggregate, synthesize, and visualize clinically relevant evidence in understandable, accessible formats that can be used to make more evidenced-based decisions and improve patient outcomes.

Ask OpenEvidence

Feed

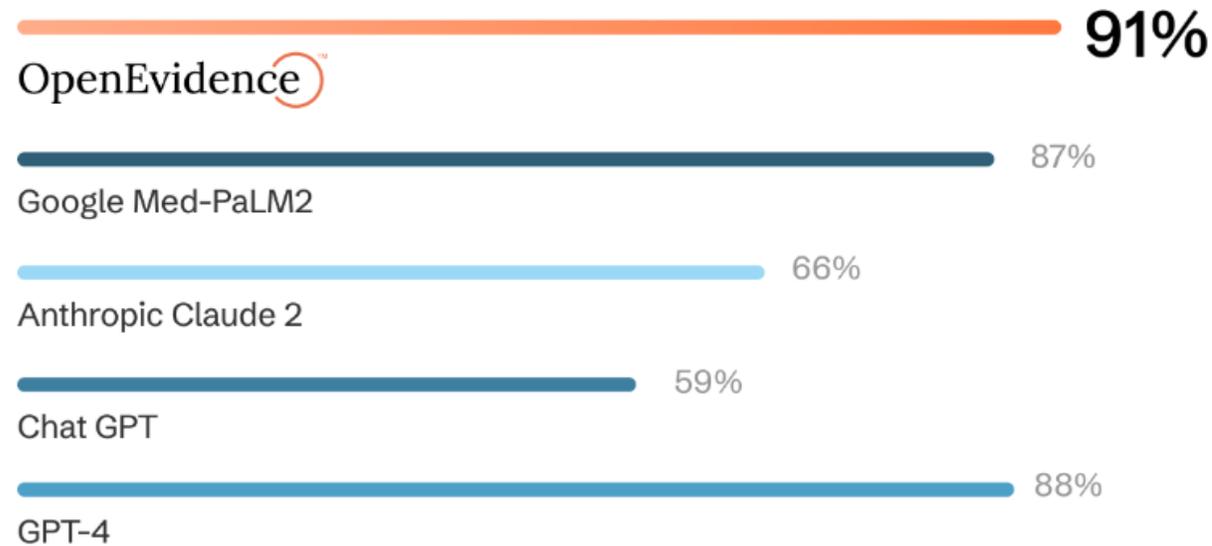
API

Company

HU

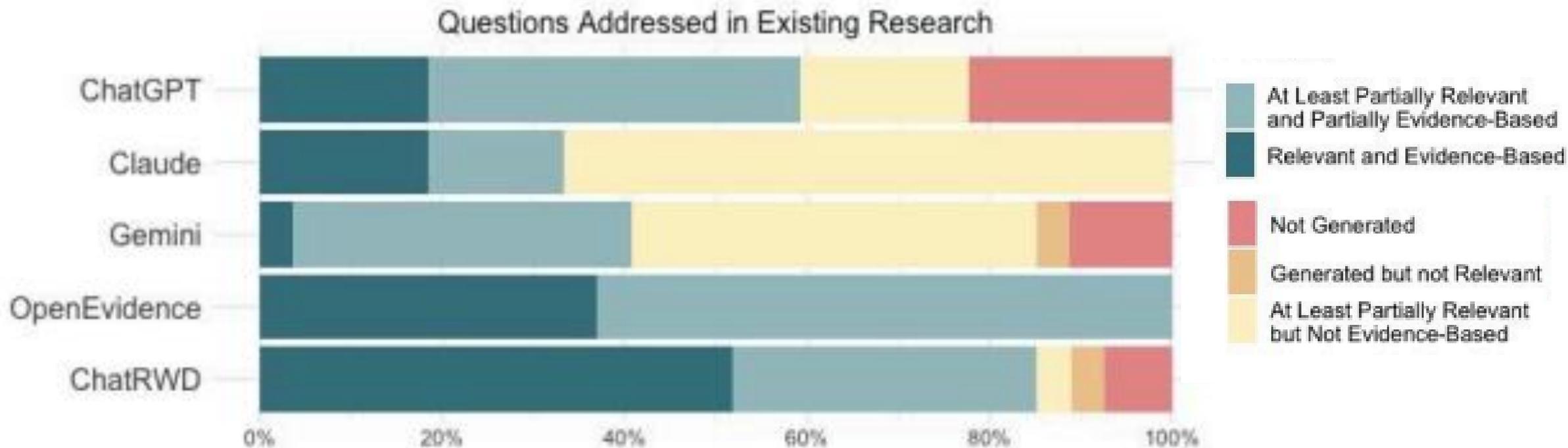
First AI in history to score above 90% on the US Medical Licensing Exam

Developed as part of Mayo Clinic Platform Accelerate and powering Elsevier's ClinicalKey AI, OpenEvidence is the only API to an AI **purpose-built for the medical domain.**



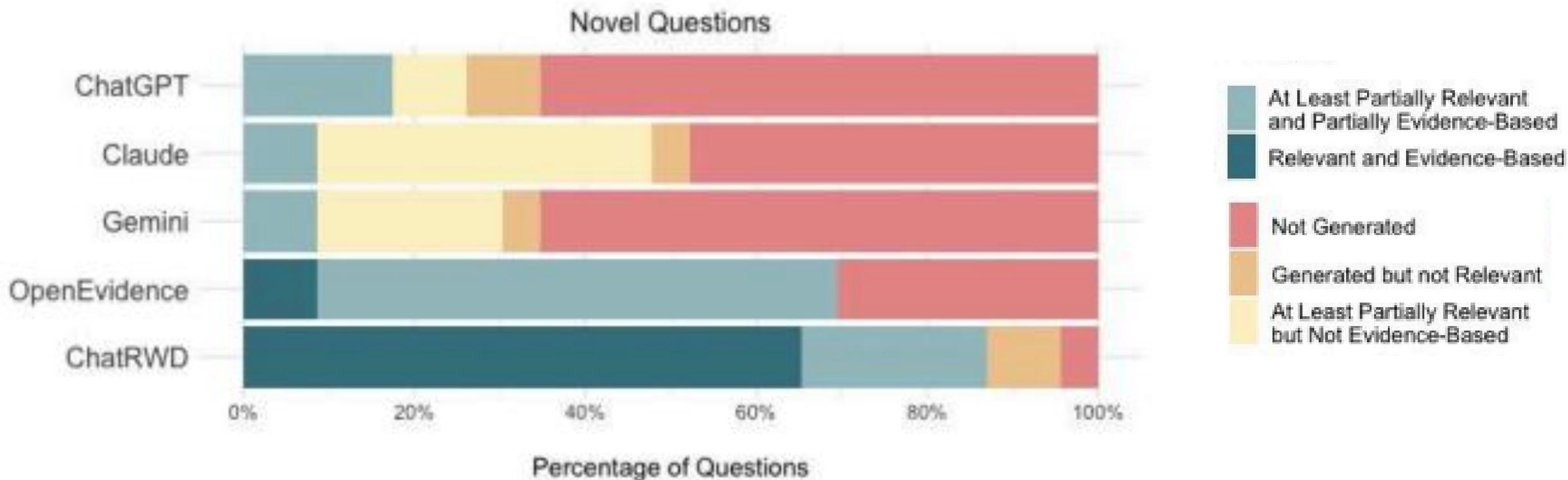
So that's fine it does well on USMLE Test but what about clinical practice?

GENAI ON CLINICAL DECISION MAKING: QUESTIONS ADDRESSED IN EXISTING RESEARCH



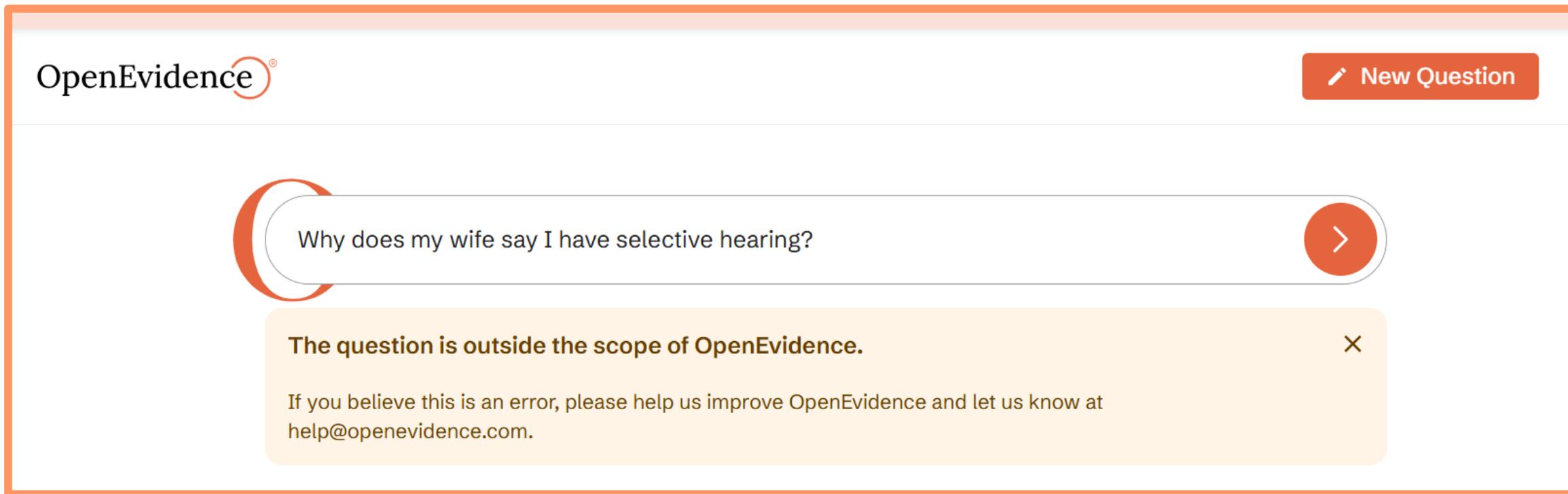
OpenEvidence Answered all questions that had Existing Research

GENAI ON CLINICAL DECISION MAKING



OpenEvidence did not answer a question that was not relevant (orange)
Hallucination may be less in OE versus other platforms

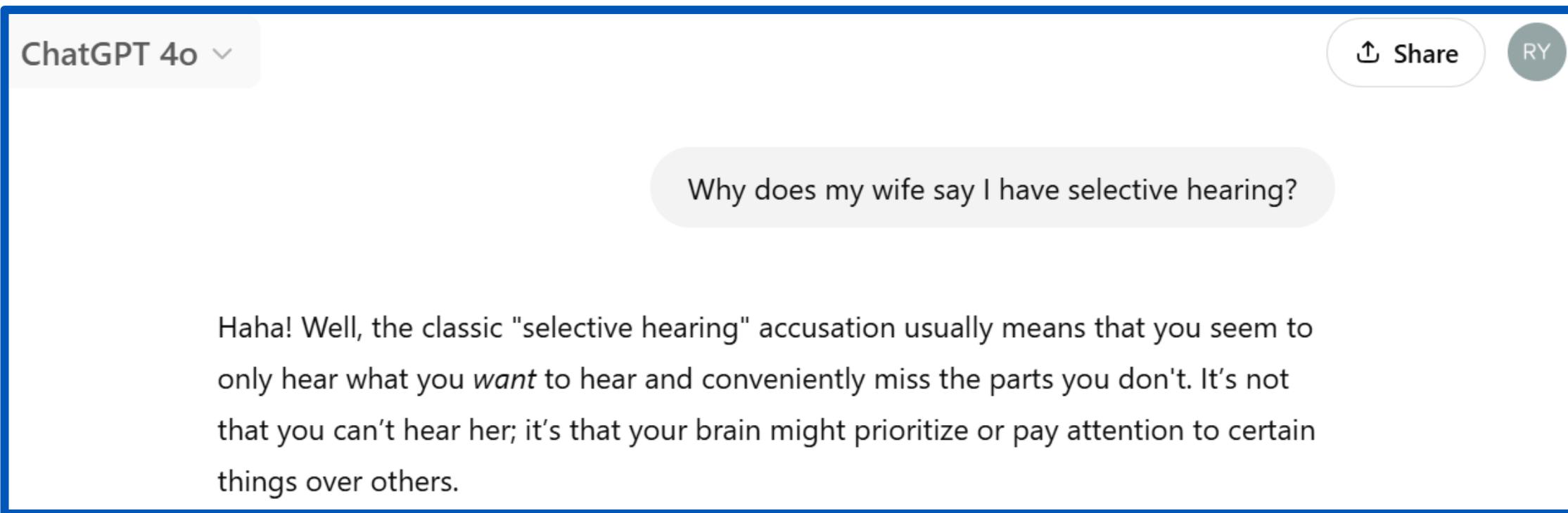
GENAI ON CLINICAL DECISION MAKING



The screenshot shows the OpenEvidence website interface. At the top left is the OpenEvidence logo. At the top right is a red button labeled "New Question". Below the header is a search bar containing the text "Why does my wife say I have selective hearing?". To the right of the search bar is a red circular button with a white right-pointing arrow. Below the search bar is a yellow error message box with a close button (X) in the top right corner. The error message text reads: "The question is outside the scope of OpenEvidence. If you believe this is an error, please help us improve OpenEvidence and let us know at help@openevidence.com."

Why does my wife say I have selective hearing?

GENAI ON CLINICAL DECISION MAKING

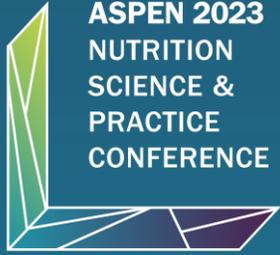


The screenshot shows a chat window for ChatGPT 4o. At the top left, it says "ChatGPT 4o" with a dropdown arrow. At the top right, there is a "Share" button with an upward arrow icon and a circular profile icon with the initials "RY". The user's question is in a grey bubble: "Why does my wife say I have selective hearing?". The AI's response is in a white bubble: "Haha! Well, the classic 'selective hearing' accusation usually means that you seem to only hear what you *want* to hear and conveniently miss the parts you don't. It's not that you can't hear her; it's that your brain might prioritize or pay attention to certain things over others."

Why does my wife say I have selective hearing?

GENAI ON CLINICAL DECISION MAKING

- “Over **40% of all citations** from Claude and Gemini could not be located on PubMed, as well as **25.5% of ChatGPT’s citations**.
-Of note, OpenEvidence rarely misinterpreted the questions and **did not hallucinate citations**.



ASPEN 2023
NUTRITION
SCIENCE &
PRACTICE
CONFERENCE

PRESIDENTS ADDRESS: SHAPING THE TRAJECTORY OF HOME PARENTERAL AND ENTERAL NUTRITION (HPEN) FROM 1970 TO 2030 AND BEYOND



Ryan T. Hurt, MD, PhD

Professor of Medicine

Director Home Parenteral and Enteral Nutrition

Division of General Internal Medicine

Mayo Clinic

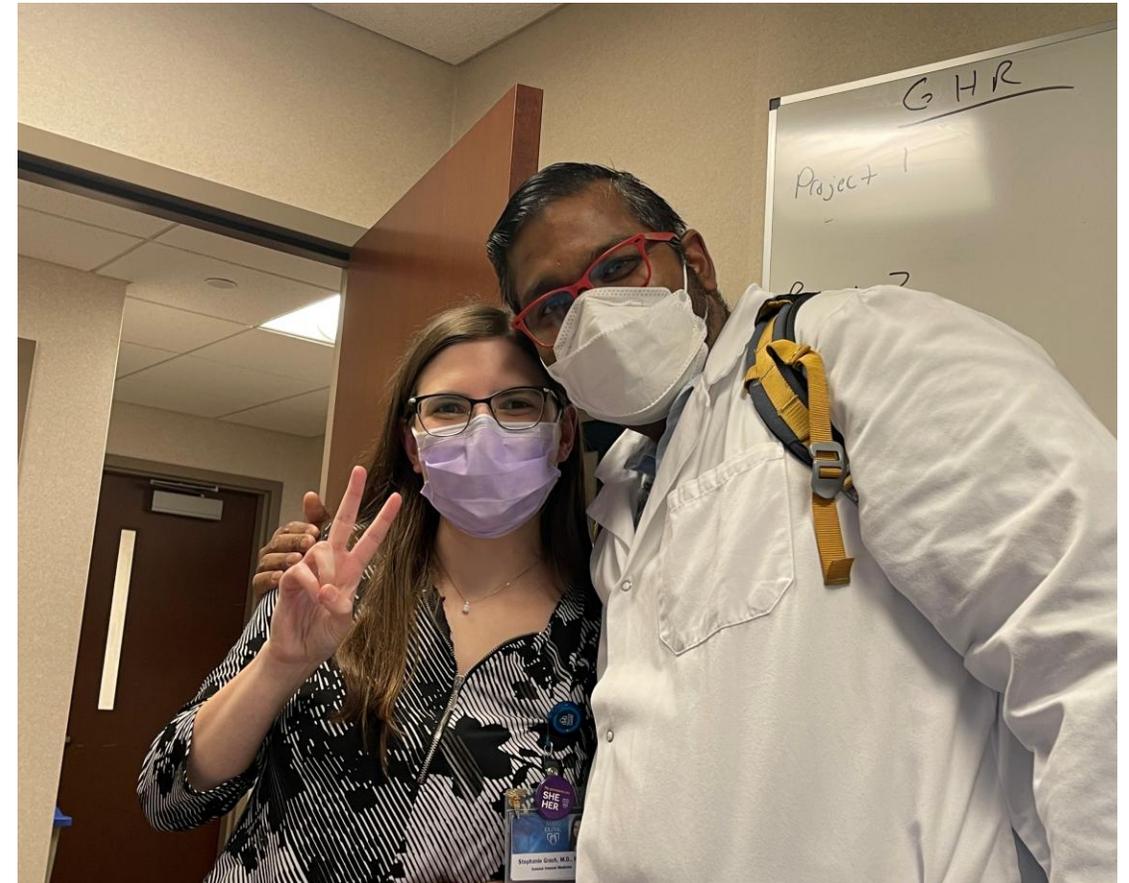
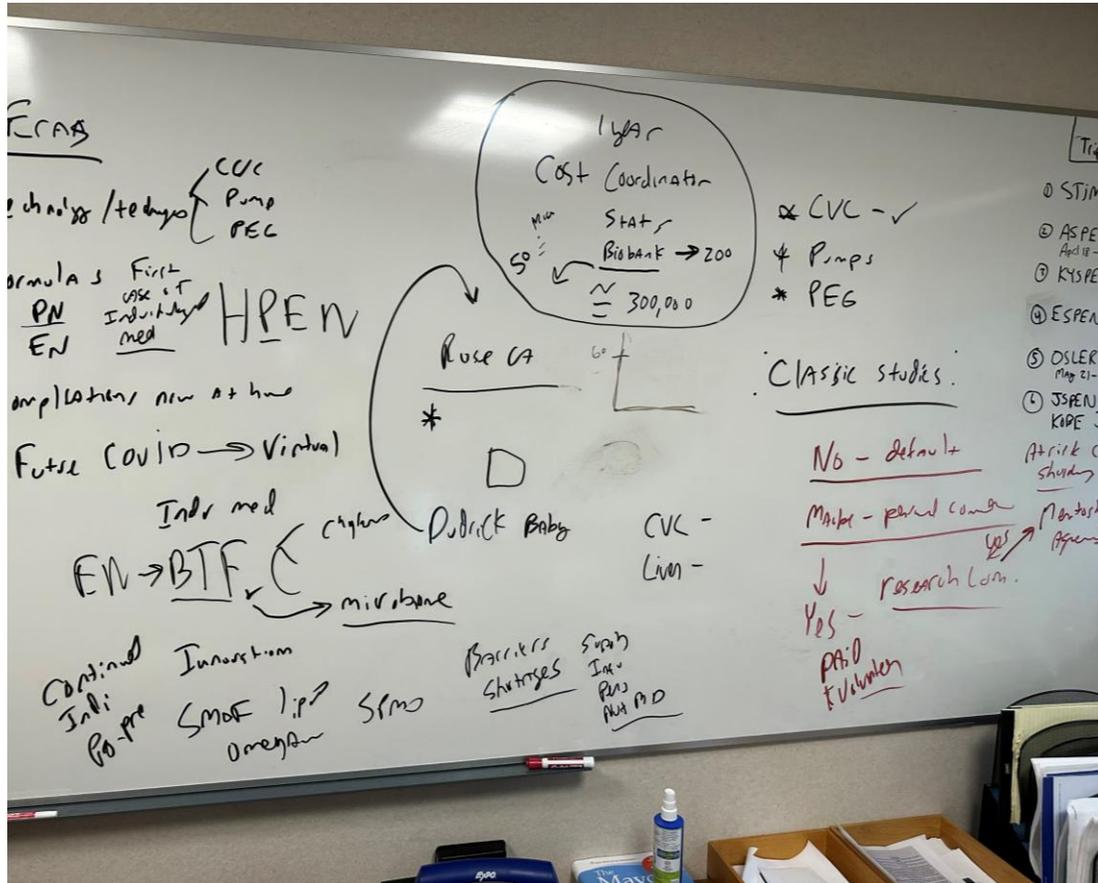
Rochester, MN

HPN 2030

- Continue testing team models that are patient centric
- Guidelines for HPN
- AI for prediction of CLABSI
- Introduce novel catheter locking solutions
- Simple pragmatic RCTs to increase the level of evidence
 - PICC vs Tunneled
- GLP-1 and GLP-2 combination



GENAI ON CLINICAL DECISION MAKING



VOLUME BASED FEEDING AUGUST 2023

What is the concept of Volume Based Feeding

Volume-based feeding (VBF) is an enteral nutrition strategy designed to optimize the delivery of prescribed nutritional goals in critically ill patients. Unlike traditional rate-based feeding (RBF), which uses a constant hourly rate, VBF sets a 24-hour goal volume for enteral nutrition and adjusts the feeding rate to compensate for any interruptions, ensuring that the daily nutritional targets are met.

Studies have shown that VBF significantly improves the delivery of both energy and protein compared to RBF. For instance, Holyk et al. demonstrated that VBF increased the mean percentage of goal energy delivered from 75% to 102% and goal protein delivered from 68% to 87% compared to RBF.^[1] Similarly, McClave et al. found that VBF patients received 92.9% of their goal caloric requirements versus 80.9% in the RBF group.^[2]





What is the concept of Volume Based Feeding

Expanded question: What is the concept of **volume-based** feeding?

The American Gastroenterological Association supports the use of feeding protocols, including VBF, to enhance the adequacy and safety of enteral nutrition delivery in hospitalized patients.^[3] VBF has been shown to be safe, with no significant increase in adverse outcomes such as hyperglycemia, gastrointestinal intolerance, or aspiration.^{[1-2][4]}

In summary, VBF is an effective strategy to ensure critically ill patients receive their prescribed nutritional goals, improving overall nutritional adequacy without increasing the risk of complications.

 Share  Helpful  Not Helpful



What is the concept of Volume Based Feeding

Expanded question: What is the concept of **volume-based** feeding?

References

1. [Volume-Based Feeding Enhances Enteral Delivery by Maximizing the Optimal Rate of Enteral Feeding \(FEED MORE\).](#)  

Holyk A, Belden V, Sirimatuross M, et al.

JPEN. Journal of Parenteral and Enteral Nutrition. 2020;44(6):1038-1046. doi:10.1002/jpen.1727.

2. [Volume-Based Feeding in the Critically Ill Patient.](#)  

McClave SA, Saad MA, Esterle M, et al.

JPEN. Journal of Parenteral and Enteral Nutrition. 2015;39(6):707-12. doi:10.1177/0148607114540004.

3. [ACG Clinical Guideline: Nutrition Therapy in the Adult Hospitalized Patient.](#)  

McClave SA, DiBaise JK, Mullin GE, Martindale RG.

The American Journal of Gastroenterology. 2016;111(3):315-34; quiz 335. doi:10.1038/ajg.2016.28.

What about more specific questions about patients?

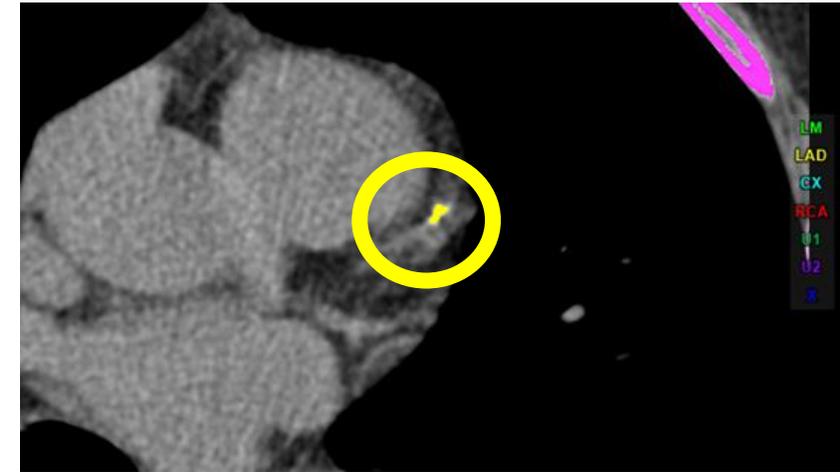
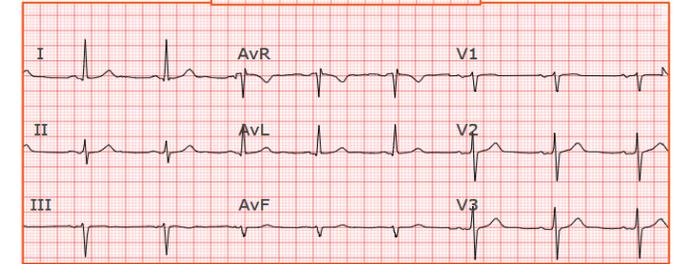
CASE 1: Ambulatory General Internal Medicine Clinic Mayo Clinic Rochester

A 48-year male presents to executive health for an annual physical exam.

- He exercises on a treadmill 5 times a week
- No smoking history and no FH CAD
- BMI is 22 kg/m², BP 122/88, HR 65
- ECG –Normal Sinus Rhythm
- Stress ECG- No Stress Induced Ischemia
- Lipids (mg/dL)- Total Chol=209, HDL= 38, LDL=147, TG=133, Lipoprotein a= 94 (<75mmol/L)

Would you start a statin?

Heart Rate:	65	BPM	
PR Interval:	158	ms	
QRS Duration:	96	ms	
QT/QTc:	422 / 438	ms	
PRT Axes:	20	-21	15



CALCIUM SCORE:
Left main coronary artery: 0
Left anterior descending coronary artery: 27.8
Circumflex coronary artery: 0
Right coronary artery: 0

Agatston score: 27.8
Percentile rank: 84 % in comparison to a group with the same age, race/ethnicity and sex.

a 48 year old male with a LDL of 147 and CAC score of 27.8 and a lpa of 94 would you start statin?

For a 48-year-old male with an LDL-C of 147 mg/dL, a coronary artery calcium (CAC) score of 27.8, and a lipoprotein(a) [Lp(a)] level of 94 mg/dL, the decision to start statin therapy should be guided by current guidelines and risk factors.

According to the 2018 American College of Cardiology/American Heart Association (ACC/AHA) guidelines, in adults aged 40 to 75 years with LDL-C levels between 70 and 189 mg/dL, the presence of risk-enhancing factors such as elevated Lp(a) can favor the initiation of statin therapy.^[1] Specifically, an

It is reasonable to consider starting a moderate-intensity statin therapy for this patient give the elevated Lp(a) and CAC score

Additionally, the 2019 ACC/AHA guidelines on the primary prevention of cardiovascular disease recommend considering statin therapy in intermediate-risk adults (7.5% to <20% 10-year ASCVD risk) with risk-enhancing factors.^[2] Given the patient's elevated Lp(a) and intermediate CAC score, statin therapy could be beneficial.

Therefore, it is reasonable to start a statin in this patient to reduce the risk of atherosclerotic cardiovascular disease (ASCVD), considering the elevated Lp(a) and intermediate CAC score.^[1-2]

 Share  Helpful  Not Helpful

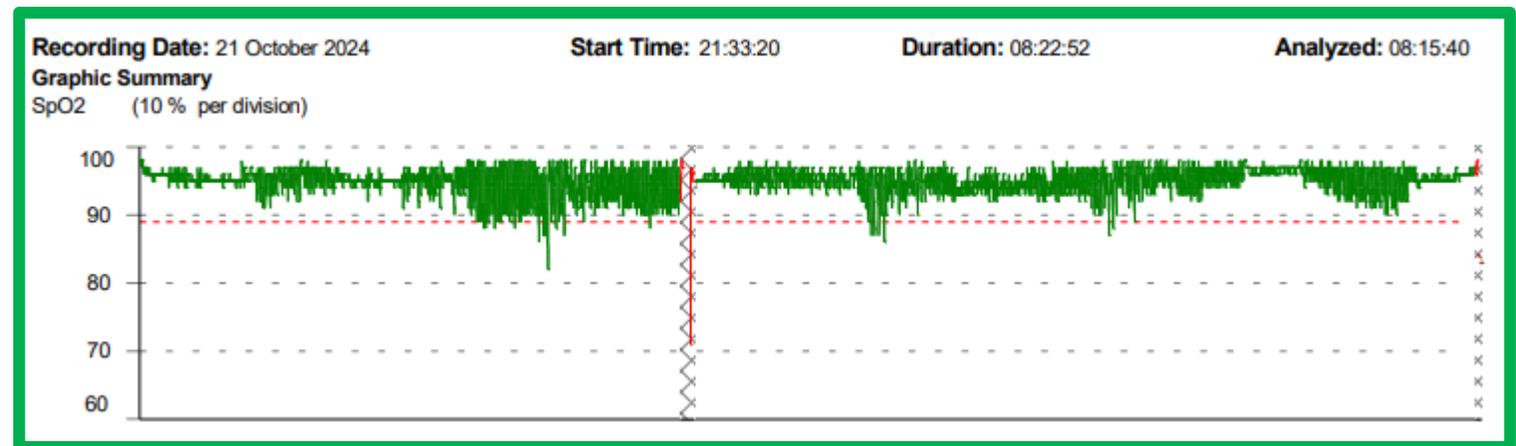
CASE 2: AMBULATORY GENERAL INTERNAL MEDICINE CLINIC MAYO CLINIC ROCHESTER



Moderate/severe dysmotility

A 71 y/o female is having orthostasis, headaches, and increased anxiety, dysphagia, and sleep problems

What's the pattern?



Abnormal oximetry suggestive of central sleep apnea



What condition has dysphagia, REM sleep disorder, and orthostasis?

Expanded question: What condition has dysphagia, rapid eye movement sleep disorder, and orthostasis?

The combination of dysphagia, rapid eye movement (REM) sleep behavior disorder (RBD), and orthostasis is characteristic of **multiple system atrophy (MSA)**.

RBD is a common feature in MSA, where patients exhibit dream enactment behaviors due to the loss of muscle atonia during REM sleep.^[1-2] Orthostatic hypotension, a form of dysautonomia, is also frequently observed in MSA and can significantly impact clinical outcomes.^[3] Dysphagia, or difficulty swallowing, is another symptom that can occur in MSA due to the involvement of brainstem and autonomic pathways.^[2]

In summary, the presence of dysphagia, REM sleep behavior disorder, and orthostasis strongly suggests multiple system atrophy as the underlying condition. ■

 Share  Helpful  Not Helpful

GEN-AI (Open Evidence) Can assist the clinician to answer difficult clinical questions!

HOW CAN GENAI HELP WITH COMPLEX OBESITY/NUTRITION CASES?



THE AI-ASSISTED ECONSULT

The Use of an Artificial Intelligence Platform OpenEvidence to Augment Clinical Decision-Making for Primary Care Physicians

Journal of Primary Care & Community Health

Volume 16: 1–11

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Ryan T. Hurt¹, Christopher R. Stephenson¹, Elizabeth A. Gilman¹ ,
Christopher A. Aakre¹, Ivana T. Croghan¹ , Manpreet S. Mundi¹ ,
Karthik Ghosh¹, and Jithinraj Edakkanambeth Varayil¹

- Five real cases seen in PCP clinics (RTH and JEV)
- Complete de-identified modified History and Exam entered into OpenEvidence (OE)
- Four independent physicians graded (0-4 scale) OE responses based on clarity, relevance, support, Impact, and satisfaction.
- Mean scores across cases were clarity (3.55 ± 0.60), relevance (3.75 ± 0.44), support (3.35 ± 0.49), and satisfaction (3.60 ± 0.60).
- Impact was limited (1.95 ± 1.05), as OE primarily reinforced rather than modified plans.

The whole clinical case was inserted in the genAI!

A 37-year-old white male with relevant past medical history of treated HTN, bipolar disorder, and borderline dyslipidemia presented for a physical exam in the ambulatory GIM clinic. He has been on 10 mg of lisinopril and 12.5 mg of hydrochlorothiazide since 2022.

He had a recent lipid panel with a total cholesterol of 177 with the following

It is like we were asking for a genAI eConsult for Hyperlipidemia

triglycerides 48 mg/dL, lipoprotein (a) 48 nmol/L, and apolipoprotein B 105 mg/dL. The rest of his laboratory work including complete metabolic profile (CMP), C-reactive protein, and complete blood count were all normal. His blood pressure on the current ambulatory visit was 120/89 and his body mass index was 27.65 kg/m². What would be the next step in the management of the patient?

Figure 1a. Question submitted to the Open Evidence platform for Case 1: Hyperlipidemia.

The next step in the management of this patient should be the initiation of statin therapy. According to the 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA Guideline on the Management of Blood Cholesterol, published by the American College of Cardiology and the American Heart Association, it is reasonable to initiate statin therapy in patients with a coronary artery calcium (CAC) score of 100 or higher or in the 75th percentile or higher¹⁸. This patient has a CAC score of 17, placing him between the 90-100th percentile, which indicates a higher risk of atherosclerotic cardiovascular disease (ASCVD).

Given the patient's history of dyslipidemia and the presence of atherosclerotic cardiovascular disease (ASCVD), the next step in management is to **Initiate moderate to high intensity statin therapy and reinforce lifestyle modifications in the next step in management**.

In addition to statin therapy, lifestyle modifications including dietary changes, regular physical activity, and weight management should be reinforced to further reduce cardiovascular risk. Regular follow-up to monitor lipid levels and adherence to therapy is also essential.

Initiate moderate- to high-intensity statin therapy and reinforce lifestyle modifications as the next steps in management.

Figure 1b. Open Evidence response for Case 1: Hyperlipidemia.

What About Nutrition Clinical Cases?

The patient is a 67-year-old White Female with a history of obesity and a previous BMI of 31 kg/m² (height 5 feet 4 inches, 180.9 pounds). After a trial of almost a year of lifestyle modification including numerous diets and exercise (mainly aerobic) she was initiated on Semaglutide and titrated up to 2.4 mg/week. Over the past 6 months she has lost 23 pounds which has dropped her BMI to 25 kg/m² (height 5 feet 4 inches, 145.9 pounds). Overall, she feels well and blood testing showed a normal CBC and CMP. Her body composition using a Bioimpedance measurement shows a visceral fat of 158.9 cm², fat free mass 84.7 pounds, percent body fat is 42.0%. Grip strength measurement was as follows: Left hand 23.3 kg, Right hand 22.3 kg, which was average of two attempts in each hand. What is the potential cause of the below average grip strength?

67 female obesity previous BMI 31

Placed on semaglutide and lost 23 pounds over 6 months BMI 25

Grip strength borderline

FFM 84 pounds and percent body fat 42.0%

The potential cause of the below-average grip strength in this patient could be related to the loss of muscle mass associated with significant weight loss. Although semaglutide is effective for weight reduction, it can also lead to a concomitant loss of lean body mass, including muscle mass, which may impact muscle strength.

In the study by Xiang et al., it was observed that while semaglutide significantly reduced fat mass, there was also a notable reduction in skeletal muscle mass, although the grip strength did not significantly decrease. In this patient, the left hand 23.3 kg muscle weakness is indicative of

It is plausible that the below-average grip strength is a consequence of muscle mass loss, underscoring the importance of incorporating resistance training and nutritional strategies during weight loss intervention with semaglutide.

Additionally, patients with type 2 diabetes could contribute to M LIVER study, where a decrease in muscle volume was observed, although physical function was maintained [23].

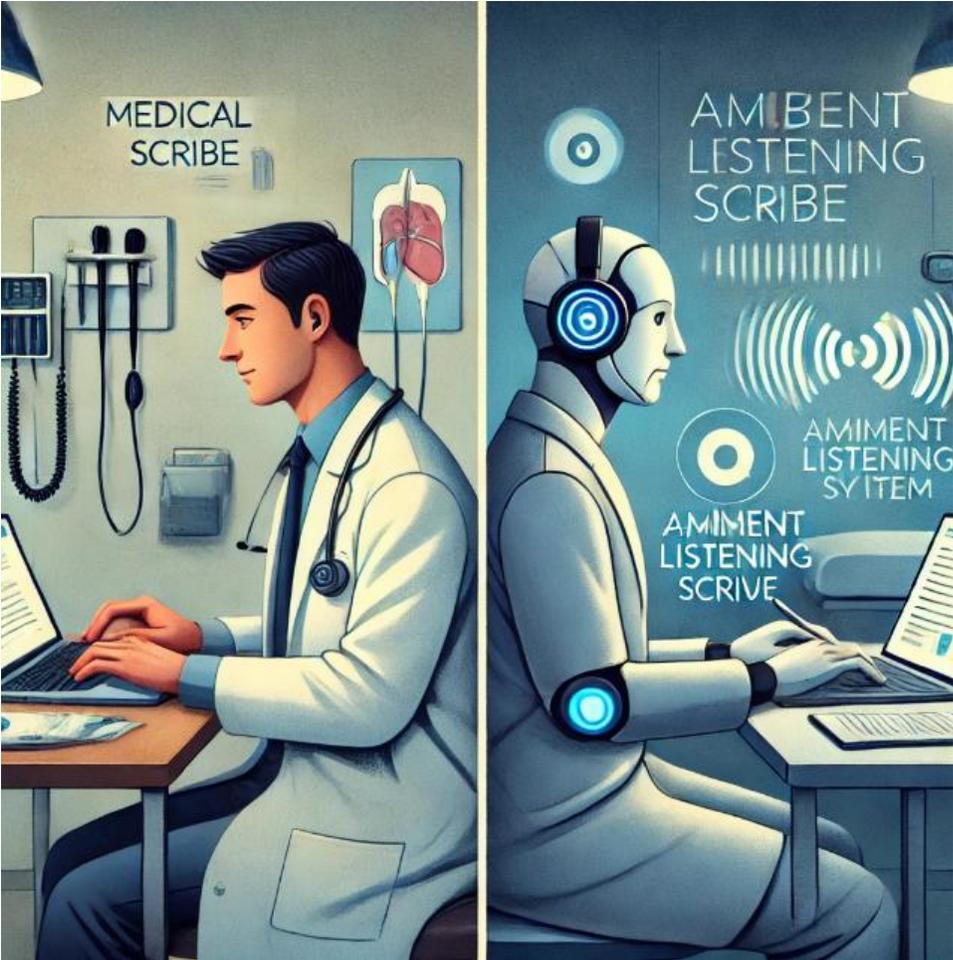
Given the patient's significant weight loss and the associated reduction in muscle mass, it is plausible that the below-average grip strength is a consequence of the muscle mass loss. This underscores the importance of incorporating resistance training and nutritional strategies to preserve muscle mass during weight loss interventions with semaglutide.

What About More Complex Nutrition Clinical Cases seen on Mayo Nutrition Support Service?

A 71-year-old female with a history of recurrent intermittent diarrhea for several years, worsened in 2024, presents with significant weight loss and dysgeusia, accompanied by concerning lab abnormalities indicative of refeeding syndrome. She reports her weight dropping from 71 to 58 lbs, with partial recovery to 66 lbs (current BMI 17.61 kg/m² based on kyphotic height, 13.0 kg/m² based on non-kyphotic height). She is admitted to the Hematology service for findings consistent with multiple myeloma, including skeletal lytic lesions, vertebral fractures, and dysproteinemia. Her stools vary from formed once daily to loose immediately after eating, influenced by food intake. Dysgeusia contributes to decreased taste, though she denies nausea, vomiting, or constipation. Marked kyphosis leads to early satiety, limiting intake to 25% of meals. Past interventions include vertebroplasties for fractures and ongoing rosuvastatin/Evenity therapy for osteoporosis, with her last injection in November. She supplements with a daily multivitamin, vitamin D3, and occasional oral iron but does not take calcium. Weight records document a progressive decline from 44.4 kg in early 2023 to a nadir of 28.5 kg in late 2024, with partial recovery to 32.1 kg in 2025. Recent labs reveal critical electrolyte derangements, including serum phosphorus of 0.8 mg/dL (reference 2.5–4.5 mg/dL), potassium of 2.8 mmol/L (reference 3.5–5.0 mmol/L), and magnesium of 1.3 mg/dL (reference 1.7–2.2 mg/dL). Nutrition support service has been consulted for further recommendations. All Question: What is the next step in the patient's clinical nutrition management?

Refeeding Syndrome

Clinical documentation is a major time consumer in 2025 for all clinicians

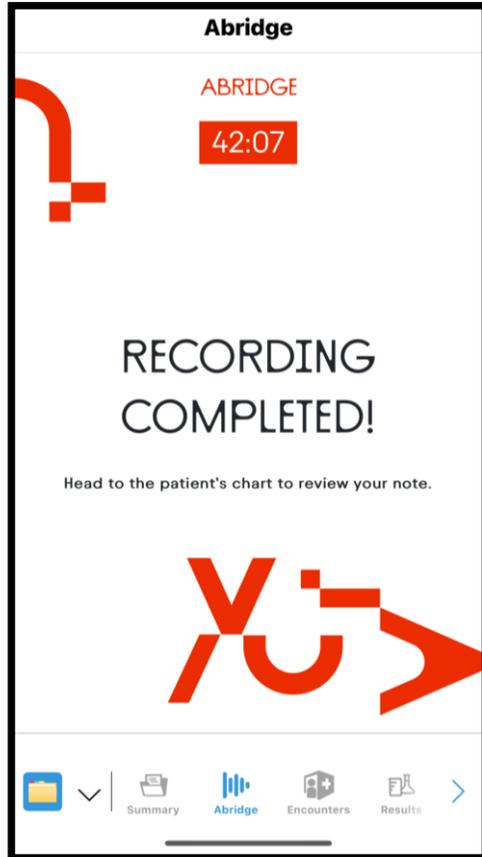


Ambient AI scribes

- Ambient documentation systems “listen” to your patient conversation and write your note like a human scribe
- Not a transcript of the encounter – it is synthesized based on the discussion with your patient
- Remove extraneous dialogue
- Understands components of the encounter
 - History
 - Physical
 - Assessment/Plan



Intestinal Failure Clinic: January 2025



CHIEF COMPLAINT/REASON FOR VISIT

No chief complaint on file.

HISTORY OF PRESENT ILLNESS

The patient verbally consented to an audio recording of their visit to assist with the completion of documentation.

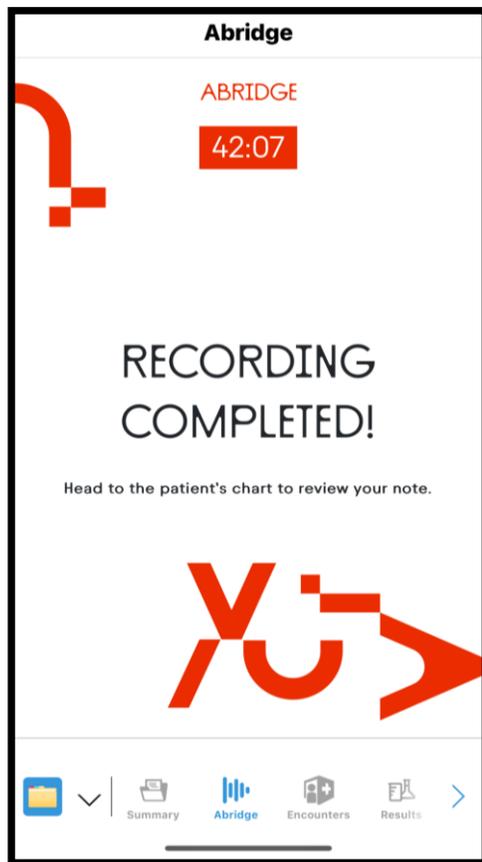
[History of Present Illness](#)

The patient, with a history of short bowel syndrome, has been on total parenteral nutrition (TPN) since [REDACTED]. The patient was initially struggling with significant weight loss, reaching a nadir of 110 pounds. Since the initiation of TPN, the patient has experienced a steady weight gain, currently weighing between 146 and 149.4 pounds. The TPN regimen includes seven days a week of electrolytes and three days a week of lipids and vitamins.

The patient also reports daily consumption of a medical-grade oral rehydration solution, Liquid IV. However, adherence to this regimen is inconsistent due to taste issues and forgetfulness.

Despite the improvement in weight, the patient continues to experience chronic diarrhea, albeit less frequently and with less volume than before the initiation of TPN. The patient also reports occasional fecal incontinence, which he attributes to a previous surgical intervention for a large rectal polyp.

Intestinal Failure Clinic: January 2025



Assessment & Plan

Short Bowel Syndrome

Improved weight gain and bowel adaptation noted. Currently on TPN 7 days a week with lipids 3 days a week. Iron deficiency anemia due to lack of iron in TPN.

- Continue TPN 7 days a week and lipids 3 days a week.
- Continue iron infusions as needed, monitor iron levels.
- Consider reducing TPN days if weight gain continues.

Osteoporosis

Diagnosed in [REDACTED] Potential need for increased Vitamin D supplementation and Reclast infusion.

- Check Vitamin D levels.
- Order repeat bone density scan.
- Consider referral to metabolic bone clinic or order Reclast infusion if unable to secure timely appointment.

Ambient AI scribes

Ambient artificial intelligence scribes: utilization and impact on documentation time

Stephen P. Ma , MD, PhD^{1,*}, April S. Liang, MD^{1,*}, Shreya J. Shah, MD^{1,2}, Margaret Smith, MBA², Yejin Jeong, BA², Anna Devon-Sand, MPH², Trevor Crowell, BA², Clarissa Delahaie, BAS³, Caroline Hsia, MEng³, Steven Lin, MD^{1,2}, Tait Shanafelt, MD^{1,4}, Michael A. Pfeffer, MD^{1,3}, Christopher Sharp, MD¹, Patricia Garcia, MD¹

- **Objective**: The study aimed to evaluate the use of an ambient AI-powered scribe (DAX Copilot) and its impact on physician documentation time in electronic health records (EHR).
- **Methods**
 - **Study Design**: Prospective quality improvement study.
 - **Setting**: Stanford Health Care, an academic medical center.
 - **Duration**: 3-month pilot (October 2023 - January 2024).
 - **Participants**: 45 physicians across 8 ambulatory specialties. Majority were primary care physicians, with at least 10 years post-training experience.
- **Technology**: DAX Copilot, integrated with Epic EHR, used mobile recordings of physician-patient interactions to generate clinical note drafts.

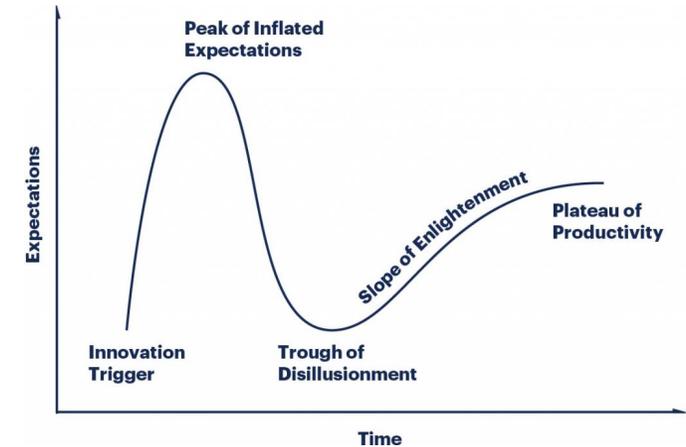
Ambient AI scribes

- **Utilization:**

- Used in **55.25%** of 17,428 encounters.
- Variation in adoption across physicians.

- **Time Savings:**

- Median note documentation time **reduced by 0.57 minutes** per note.
- Daily documentation time **decreased by 6.89 minutes**.
- Afterhours EHR time **decreased by 5.17 minutes**.
- Total EHR time **reduced by 19.95 minutes/day**.



Our Data suggests the impact is much higher for Mayo!

Using ECGs and AI to Make Clinical Predictions

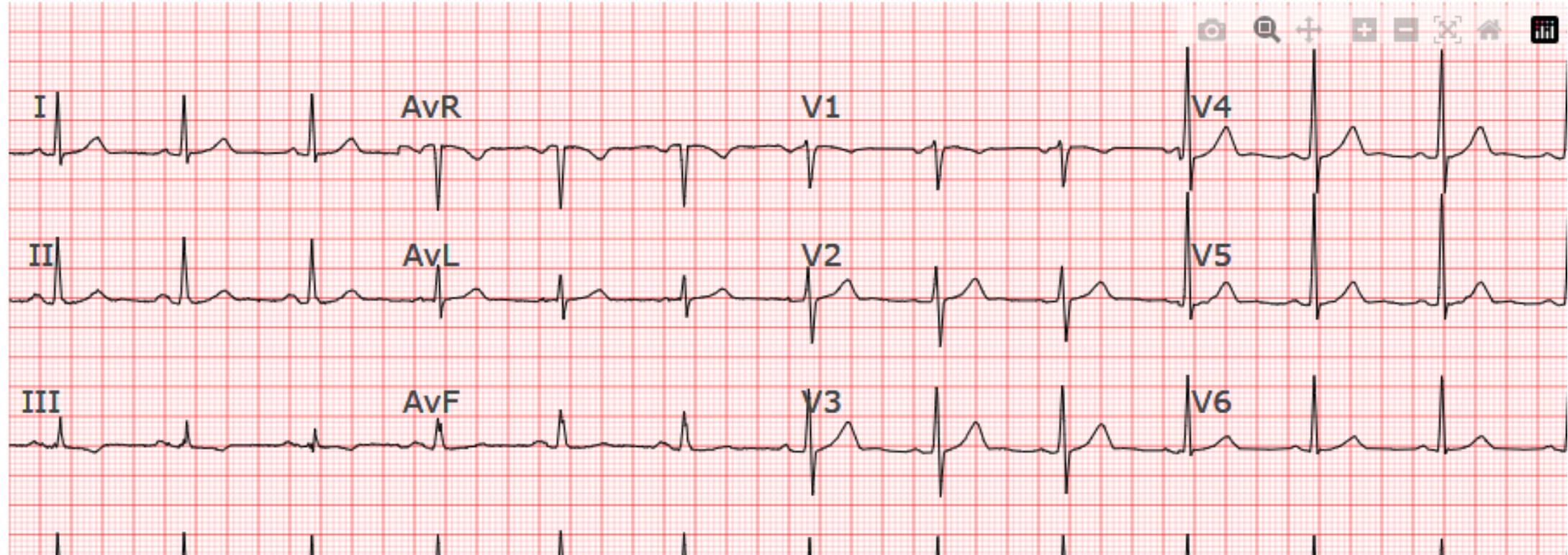
PRT Axes:

55

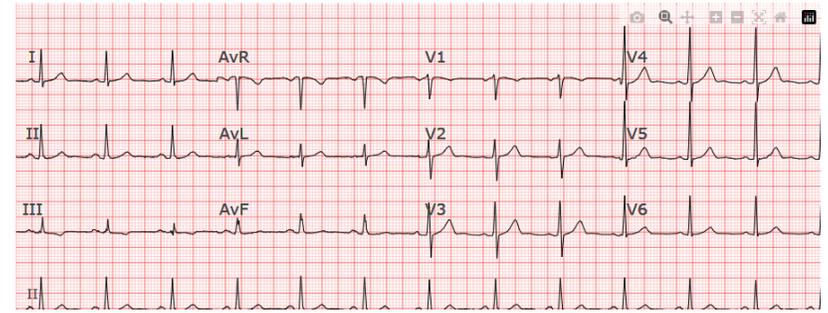
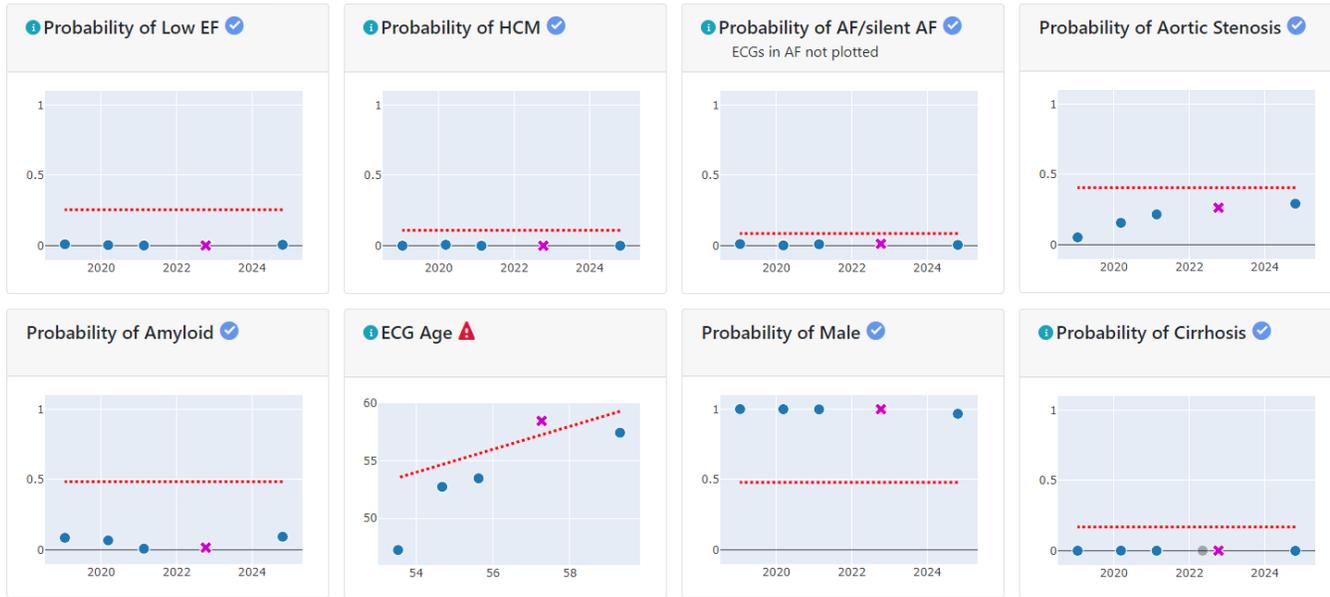
48

23

Reviewed by Kayla Bergan, CRAT



Electrocardiogram (ECG)-AI



Mayo has millions of ECG matched with known outcomes from other tests (Echo & Heart Failure and Holter & A-Fib) = sets the stage for AI prediction

MENU ▾

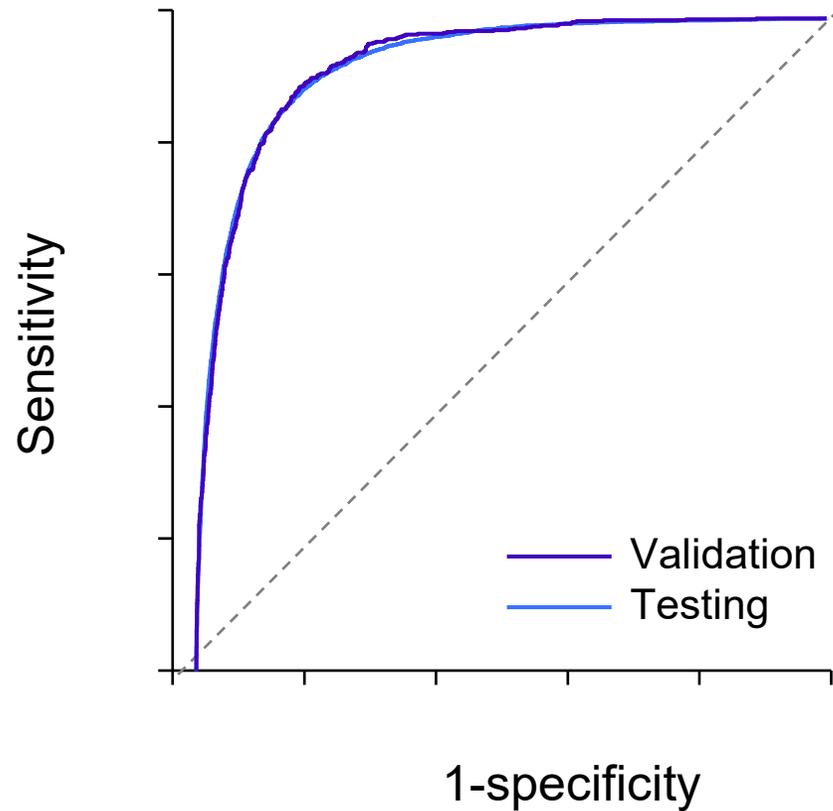
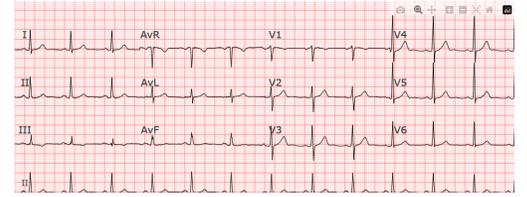
nature
medicine

Letter | Published: 07 January 2019

Screening for cardiac contractile dysfunction using an artificial intelligence-enabled electrocardiogram

Zachi I. Attia, Suraj Kapa, Francisco Lopez-Jimenez, Paul M. McKie, Dorothy J. Ladewig, Gaurav Satam, Patricia A. Pellikka, Maurice Enriquez-Sarano, Peter A. Noseworthy, Thomas M. Munger, Samuel J. Asirvatham, Christopher G. Scott, Rickey E. Carter & Paul A. Friedman 

Nature Medicine **25**, 70–74 (2019) | [Download Citation](#) 



Area under
curve of EF

AI ECG = 0.93

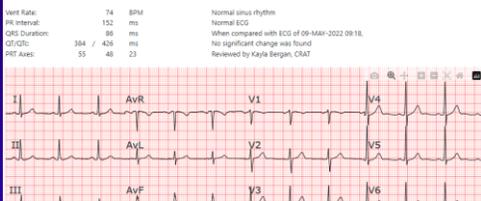


Validated
In other populations

This AI model is moving through the FDA approval process!



ECG AI- Dashboard

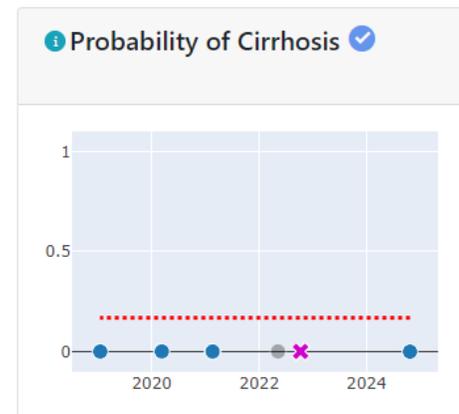
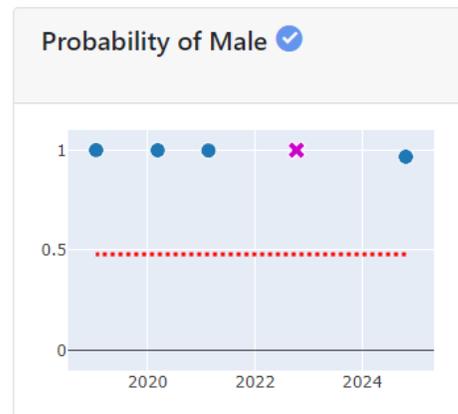
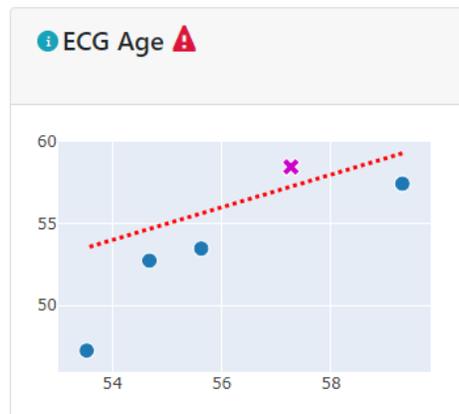
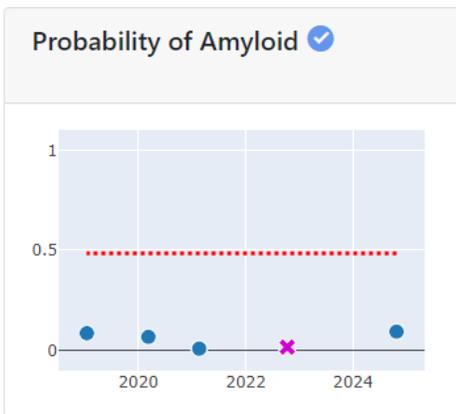
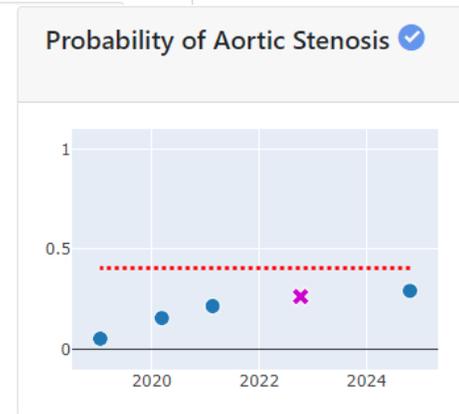
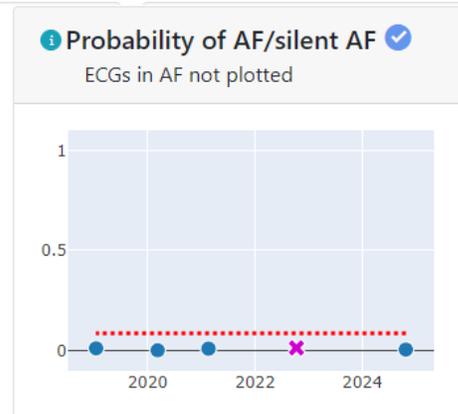
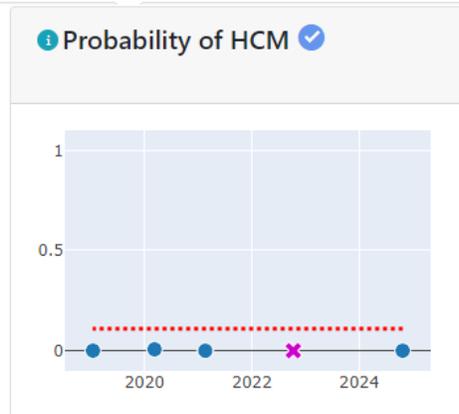
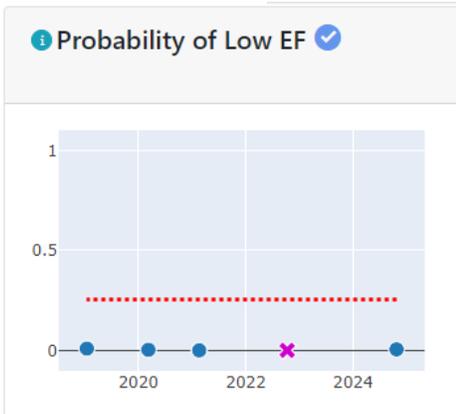


12 Lead ECGs **6** Mobile ECGs **0**

i See disclaimer below

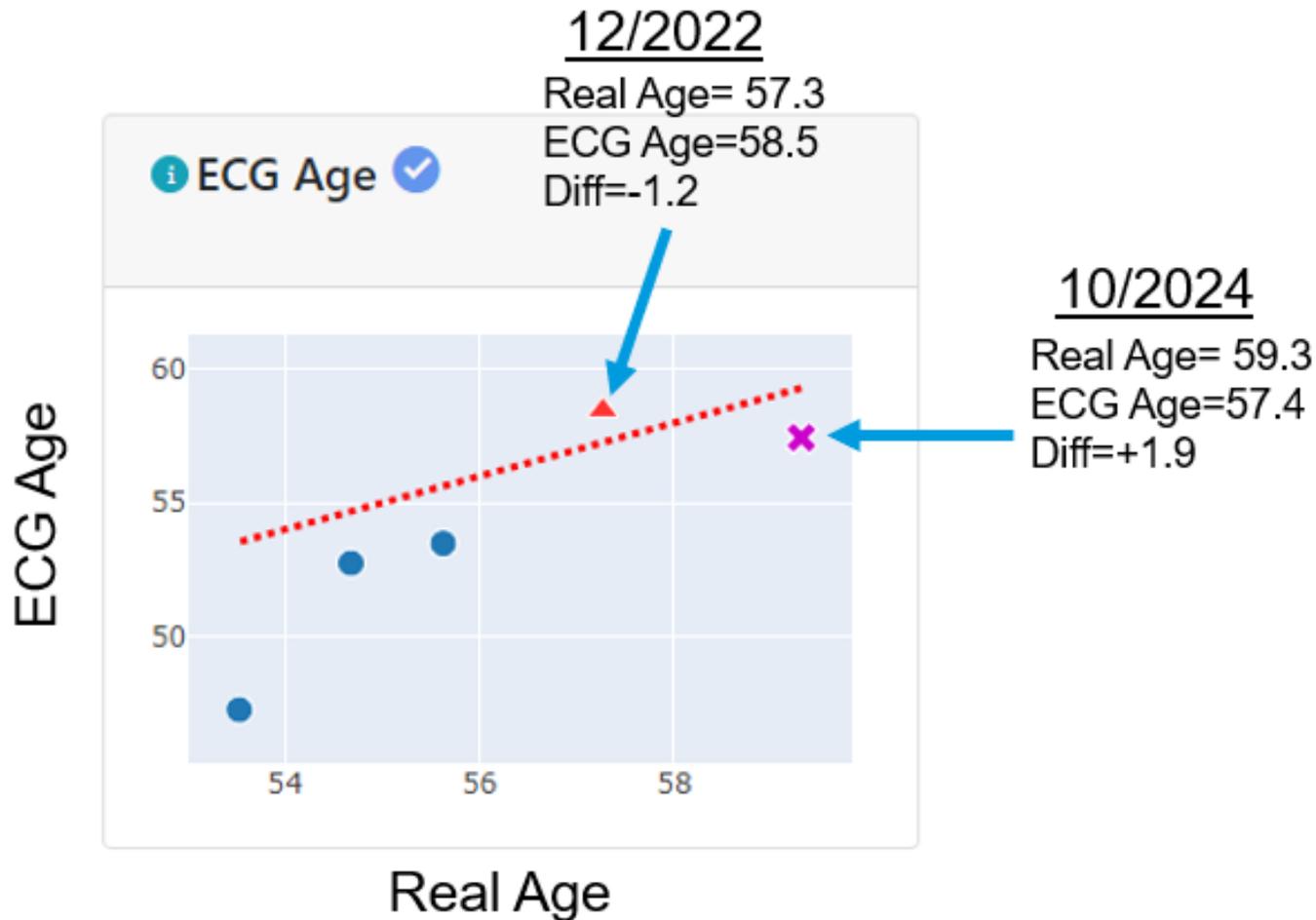
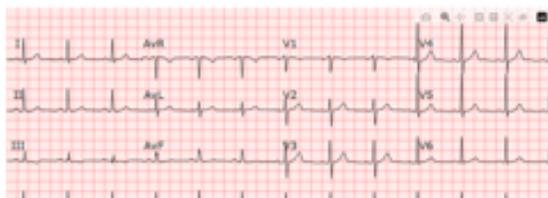
Show All Hide All Save View *?*

- ✕ Selected ECG [Purple]
- ✓ Within Threshold [Blue/Circle]
- ▲ Outside Threshold [Red/Triangle]
- ⚠ Indeterminate [Gray/Gender Model Mismatch]
- ◆ / ◆ / ◆ Atrial Fibrillation [Diamond]



CASE 3: Ambulatory General Internal Medicine Clinic Mayo Clinic Rochester

- 59 y/o CEO mid sized company
- During the pandemic 20% layoffs
- Gained 25 pounds
- Started medication for mood
- CV exercise dropped from 4-5x week to zero
- 10/2024 off medications, CV exercise back to baseline, lost 20 lbs



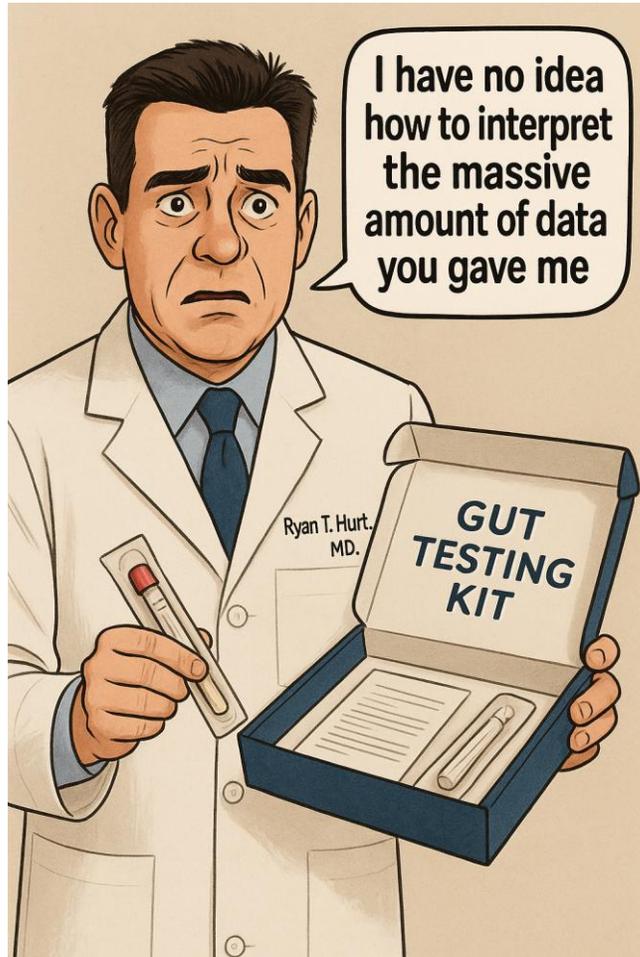


INDIVIDUALIZED NUTRITION STRATEGIES



AI-ASSISTED INDIVIDUALIZED APPROACHES TO THE OBESITY MICROBIOME

WHAT DO YOU DO WITH MICROBIOME DATA FOR OBESITY?



DOMAIN	KINGDOM	PHYLUM	CLASS	ORDE	Abundanc	20th perc	80th perc	Your percentile (compared to other adults) *
Bacteria					73.32	31.47	51.132	96.6
unclassified					24.31	48.334	67.914	3.4
Viruses					0.4353	0.081578	0.264	49.8
Archaea					0.06845	0.005179	0.03348	85.9
Eukaryota					0.004925	0.02166	0.08594	0.5
Eukaryota Fungi					0.004096	0.007411	0.017768	5.4
Eukaryota Metazoa					0.000651	0.005498	0.062866	1
Viruses Sangervirae					0.000197			34.7
Viruses Shotokuvirae					3.95E-05			
Archaea ---		Crenarchaeota			8.88E-05			
Archaea ---		Euryarchaeota			0.06793	0.004878	0.032994	85.9
Archaea ---		Thaumarchaeota			7.9E-05			
Bacteria ---		Acidobacteria			0.001648	0.00208	0.005726	17.9
Bacteria ---		Actinobacteria			5.01	0.3639	1.6166	94.6
Bacteria ---		Aquificae			0.000267	0.000413	0.001069	17.3
Bacteria ---		Armatimonadetes			0.000424	0.000298	0.00114	41.7
Bacteria ---		Bacteroidetes			9.113	10.518	30.086	11.7
Bacteria ---		Balneolaeota			0.000138			41.9
Bacteria ---		Candidatus Melainabacter			8.88E-05			
Bacteria ---		Candidatus Saccharibacter			0.000434	0.000241	0.000562	22.9
Bacteria ---		Chlamydiae			0.000227	0.000266	0.000666	14.2
Bacteria ---		Chlorobi			0.001994	0.003255	0.006816	24.5
Bacteria ---		Chloroflexi			0.002823	0.003642	0.008671	18.8
Bacteria ---		Cyanobacteria			0.003889	0.007806	0.013648	5.7

what is the most important species of the microbiome for obesity?

✓ Finished thinking

The most important microbial species in the human microbiome associated with obesity is **Ruminococcus gnavus**. This species has been consistently identified as significantly enriched in individuals with obesity and is considered a primary driver of functional changes in the gut microbiome linked to obesity, including alterations in metabolic pathways and increased expression of virulence factors and antibiotic resistance genes.^[1] Other species such as Akkermansia muciniphila and Methanobrevibacter smithii are typically reduced in obesity and are associated with metabolic health, but Ruminococcus gnavus stands out as the most robustly associated with the obese phenotype across large-scale metagenomic analyses.^[1]

Additional taxa, including certain Lactobacillus species (e.g., Lactobacillus gasseri), Streptococcus, and Prevotella copri, have also been reported to be increased in obesity, while beneficial genera such as Faecalibacterium and Bifidobacterium are often decreased.^[2-9] However, among these, **Ruminococcus gnavus** is most consistently highlighted as a key microbial marker and functional contributor to obesity in the current literature.^[1]

Would you like me to summarize the latest interventional studies or clinical trials that have targeted Ruminococcus gnavus—such as through diet, probiotics, or antibiotics—to assess their impact on obesity outcomes? ■

Summary of obesity microbiome

- ***Ruminococcus gnavus***- literature suggests it is increased in those with obesity
 - Linked to altered metabolic pathways
 - Increased expression of virulence factors
 - Antibiotic resistance genes
- ***Akkermansia muciniphila*** and ***Methanobrevibacter smithii***- reduced in obesity
 - Linked to altered metabolic pathways
- Genera ***Facalibacterium*** and ***Bifidobacterium***- reduced in obesity

Here is your personalized handout on supporting **Akkermansia muciniphila** and **Methanobrevibacter smithii** in the context of metabolic health and obesity prevention:

 [Download the PDF handout](#)

Akkermansia muciniphila is a mucin-degrading bacterium linked to reduced inflammation, improved gut barrier function, and better insulin sensitivity. In obesity, levels are often depleted.

Strategies to support *A. muciniphila*:

- Consume polyphenol-rich foods: cranberries, pomegranates, red grapes, green tea, and dark chocolate.
- Consider intermittent fasting (e.g., 16:8) to encourage mucin renewal.
- Include prebiotic fibers such as inulin, pectin (from apples), and polyphenol-rich extracts.
- Avoid ultra-processed foods and excessive sugar intake.

■ **Methanobrevibacter smithii**

Methanobrevibacter smithii is an archaeon that consumes hydrogen gas in the colon, promoting efficient fermentation and enhancing SCFA (short-chain fatty acid) production, which is metabolically beneficial.

Strategies to support *M. smithii*:

- Increase fermentable fiber intake: legumes, oats, flaxseed, barley, and cooked/cooled potatoes.
- Maintain a diverse, plant-rich diet with at least 30 different plant foods per week.
- Avoid antibiotics unless medically necessary, as they reduce archaeal populations.
- Engage in regular moderate-intensity exercise, which correlates with a balanced microbiome.

■ **Summary**

Your current microbiome already shows beneficial levels of both *A. muciniphila* and *M. smithii*. Continue to support these taxa through a diet high in diverse fibers, polyphenols, and whole plant foods, while minimizing processed food intake.

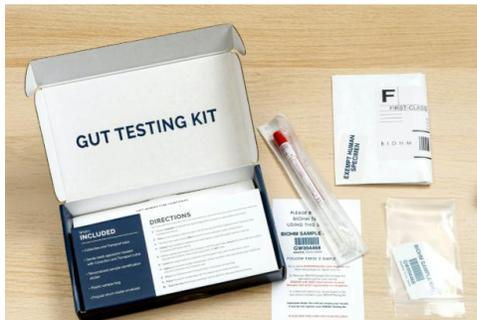
Hey, Ryan. Ready to dive in?



Full Microbe Community 2023.xlsx
Spreadsheet



Analyze the microbiome sample, focusing on species important in obesity, such as *Ruminococcus gnavus*, *Akkermansia muciniphila*, *Methanobrevibacter smithii*, and the Genera *Facalibacterium* and *Bifidobacterium*. The patient was 6'5 240 lbs and 50 years old when the sample was taken. He consumes probiotic kefir daily.



Key Findings from Your Sample

- **Faecalibacterium:** 3.1% abundance (23rd percentile vs. adults).
 - Generally beneficial, associated with butyrate production and anti-inflammatory effects.
 - Your level is at the **lower end of the healthy range**, which may reflect reduced anti-inflammatory capacity.
- **Bifidobacterium** (total, plus specific species):
 - Total: ~3.1% (95th percentile).
 - *B. adolescentis*: 2.2% (97th percentile).
 - *B. actinocoloniiforme*: trace.
 - Very **high levels**, consistent with kefir and probiotic consumption. This is generally favorable for gut barrier function and metabolic health.
- **Methanobrevibacter smithii:** 0.065% (88th percentile).
 - Elevated relative to population. *M. smithii* promotes fermentation efficiency and energy harvest, which in some studies is linked to obesity risk, though its role is complex.
- **Ruminococcus gnavus:** **Not detected** in your sample.
 - Often enriched in obesity and inflammatory states; its absence is generally positive.
- **Akkermansia muciniphila:** **Not detected** in your sample.
 - Normally associated with leaner phenotypes and improved metabolic profiles. Its absence may be a missed opportunity for protective effects.

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 - Normally associated with leaner phenotypes and improved metabolic profiles. Its absence may be a missed opportunity for protective effects.

Interpretation in Context

- **Positive aspects:**
 - High *Bifidobacterium* aligns with your kefir use and suggests strong gut barrier/metabolic support.
 - Absence of *R. gnavus* avoids a common obesity-associated signal.
- **Potential concerns:**
 - Low-normal *Faecalibacterium* may reflect reduced butyrate capacity, relevant to inflammation and insulin sensitivity.
 - Lack of *Akkermansia* might reduce mucin-associated metabolic benefits.
 - High *M. smithii* could theoretically enhance calorie extraction from food, relevant in weight management.

Role of Daily Kefir

- Likely boosted your *Bifidobacterium* abundance.
 - May help offset risks associated with low *Faecalibacterium* and absent *Akkermansia*.
 - Some kefir strains can even promote mucin-degrading bacteria like *Akkermansia*, though effects vary.
-

Based on this panel what dietary interventions can I pursue in addition to one cup of Nancy's Kefir per day to improve my microbiome that is supported by medical evidence?

Great question — let's connect your results with **evidence-based dietary interventions** for optimizing your microbiome, especially with regard to obesity-associated taxa. I'll focus on strategies supported by clinical or translational research rather than speculative supplements.

1. Boosting *Faecalibacterium* (low in your sample)

Why: It's one of the main butyrate producers; higher levels are linked with reduced inflammation and better metabolic outcomes.

Evidence-based interventions:

- **High-fiber plant foods:** Oats, barley, beans, lentils, peas, apples, and bananas provide resistant starch and soluble fiber that encourage butyrate production.
 - **Polyphenol-rich foods:** Berries, dark chocolate, green tea, and pomegranate have been shown to selectively support *Faecalibacterium*.
 - **Mediterranean-style diet:** Human trials show this dietary pattern increases *Faecalibacterium* and other anti-inflammatory taxa.
-

2. Supporting *Akkermansia muciniphila* (not detected)

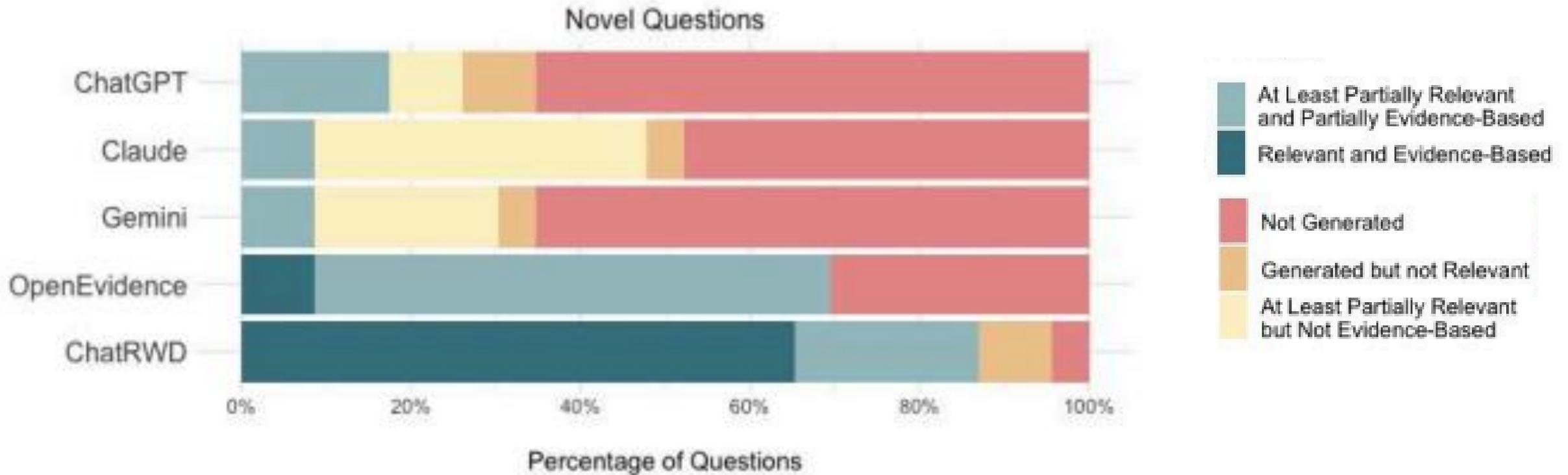
Why: *Akkermansia* is consistently associated with leanness, better insulin sensitivity, and reduced metabolic inflammation.

Evidence-based interventions:

- **Polyphenol intake:** Cranberries, pomegranate extract, grapes, and red wine polyphenols increase *Akkermansia* in both animals and humans.
 - **Prebiotic fibers:** Inulin (from chicory root, onions, leeks, garlic, Jerusalem artichokes, asparagus) and fructooligosaccharides (FOS) stimulate its growth.
 - **Omega-3 fatty acids:** Fish and flax oil have been linked to higher *Akkermansia* levels in cohort studies.
-

Can we trust Chat 5.0?

Compare GenAI on Clinical decision making



OpenEvidence did not answer a question that was not relevant (orange)
Hallucination may be less in OE versus other platforms

Section 1: Clinical Significance of the Patient's Gut Microbiome Profile

This patient's gut microbiome profile is characterized by **low Faecalibacterium abundance** (23rd percentile), which suggests reduced anti-inflammatory capacity and may predispose to metabolic inflammation and impaired gut barrier function. **High Bifidobacterium abundance** (95th percentile, with *B. adolescentis* at 97th percentile) likely reflects substantial probiotic or kefir intake and is generally associated with improved gut barrier integrity and metabolic health, though excessive supplementation may not confer additional benefit. **Elevated Methanobrevibacter smithii** (88th percentile) is linked to increased energy harvest from dietary substrates, potentially contributing to obesity risk via enhanced short-chain fatty acid (SCFA) production and caloric extraction. The **absence of Akkermansia muciniphila** (a mucin-degrading bacterium associated with leanness and improved metabolic profiles) and **Ruminococcus gnavus** (often enriched in obesity and inflammation) suggests a loss of certain metabolic and mucosal protective functions, with possible implications for weight regulation and metabolic health.^[1-5]

Section 2: Dietary Interventions to Address Low Faecalibacterium

Increasing dietary fiber intake, particularly with fermentable fibers such as inulin, fructo-oligosaccharides, and resistant starch, is supported by randomized controlled trials and systematic reviews to enrich Faecalibacterium and other butyrate-producing taxa, thereby enhancing anti-inflammatory SCFA production and improving metabolic parameters.^{[1][6-8]} Anti-inflammatory dietary patterns—such as the Mediterranean diet, plant-based diets, and those high in polyphenols—are associated with increased abundance of beneficial commensals, reduced pro-inflammatory taxa, and improved metabolic and inflammatory markers.^[8-9] Supplementation with specific prebiotics (e.g., inulin, polydextrose) and polyphenol-rich foods (e.g., pomegranate extract, resveratrol) may further support Faecalibacterium growth and anti-inflammatory effects.

Section 3: Managing High Bifidobacterium Abundance and Probiotic/Kefir Intake

High Bifidobacterium levels, including *B. adolescentis*, are generally associated with improved lipid metabolism, reduced weight gain, and enhanced gut barrier function, as demonstrated in both animal and human studies.^[10-12] Kefir consumption, which increases Bifidobacterium and Lactobacillus abundance, confers broad metabolic and anti-inflammatory benefits. However, **excessive probiotic or kefir supplementation** may not yield additional metabolic benefit, and strain-specific effects should be considered, as not all Bifidobacterium strains exert the same impact on weight or metabolic health.^{[11][13]} There is no evidence of harm from high Bifidobacterium abundance in the context of weight management, but ongoing monitoring of metabolic parameters is prudent.

Section 4: Mitigating Effects of Elevated Methanobrevibacter smithii

Methanobrevibacter smithii enhances energy harvest by facilitating fermentation of dietary polysaccharides and increasing SCFA production, which can contribute to increased metabolizable energy and obesity risk. **Dietary strategies to mitigate these effects include increasing intake of non-digestible fibers (e.g., resistant starch, cellulose), reducing simple sugars, and modulating fermentable substrate availability.**^{[4][14]} High-fiber diets may attenuate the impact of methanogenesis on energy harvest, while limiting rapidly fermentable carbohydrates can reduce substrate availability for methanogens.^[14]

Section 5: Strategies for Promoting *Akkermansia muciniphila* and *Ruminococcus gnavus*

Akkermansia muciniphila can be promoted by dietary prebiotics (oligosaccharides, polyphenols), amino sugars (N-acetylglucosamine, N-acetylgalactosamine), and certain medications (e.g., metformin).^{[5][15]} Polyphenol-rich foods (e.g., berries, pomegranate, green tea) and whole grains are particularly effective. The absence of *Akkermansia* is associated with impaired mucosal integrity and increased metabolic risk, but supplementation with prebiotics and polyphenols is safe and may restore its abundance. The absence of *Ruminococcus gnavus* is not associated with adverse metabolic outcomes, as its enrichment is more commonly linked to inflammation and obesity.^{[5][15]}

Section 6: Gaps in Evidence and Future Directions

There is a need for more human interventional studies to clarify the causal relationships between specific microbiome features and weight management outcomes. **Personalized dietary approaches** based on individual microbiome profiles are promising but require further validation in clinical trials. **[16-18]** Strain-specific effects and long-term safety of targeted microbiome modulation remain important areas for future research.

Would you like me to summarize the latest clinical trial evidence on dietary interventions specifically shown to increase *Akkermansia muciniphila* abundance and their impact on weight management outcomes? This could help guide targeted recommendations for your patient, given its absence and metabolic relevance. ■

☰ References

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 [New Research](#)



Three Major Take Home Points

1. Gen AI that pulls from trusted sources (PubMed) can be reliably used for clinical decision-making
2. Gen AI can assist in developing recommendations from complex data sets such as the microbiome
3. ECG-AI can predict numerous cardiology variables (low EF, Afib, Aortic Stenosis) giving a cost-effective option. Malnutrition is a potential future area of study

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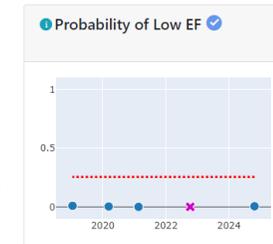




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Thank You!

