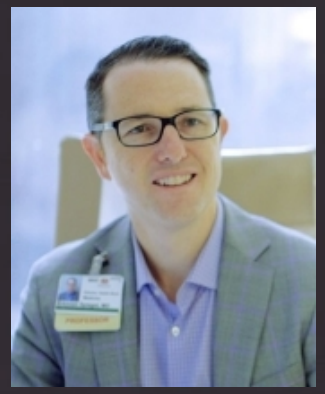
AI in GI

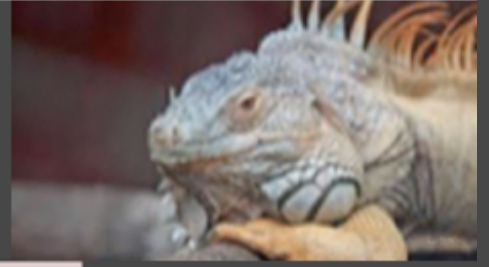
What You Need to Know to Not be Obsolete

Brennan Spiegel, MD, MSHS, FACG

Cedars-Sinai





Linear Plot

Life

Eukaryotic cells, multicellular organisms

Cambrian Explosion (body plans)

Reptiles

Class *Mammalia*

Primates

Superfamily *Hominoidea*

Family *Hominidae*

Human ancestors walk upright

Genus *Homo*, *Homo erectus*, specialized stone tools

Homo sapiens

Homo sapiens sapiens

Art, early cities

Agriculture

City-states

Writing, wheel

Printing, experimental method

Industrial Revolution

Telephone, electricity, radio

Computer

Personal computer

Time to Next Event (years)

10^9

10^8

10^7

10^6

10^5

10^4

10^3

10^2

10

$4x10^9$

$3x10^9$

$2x10^9$

10^9

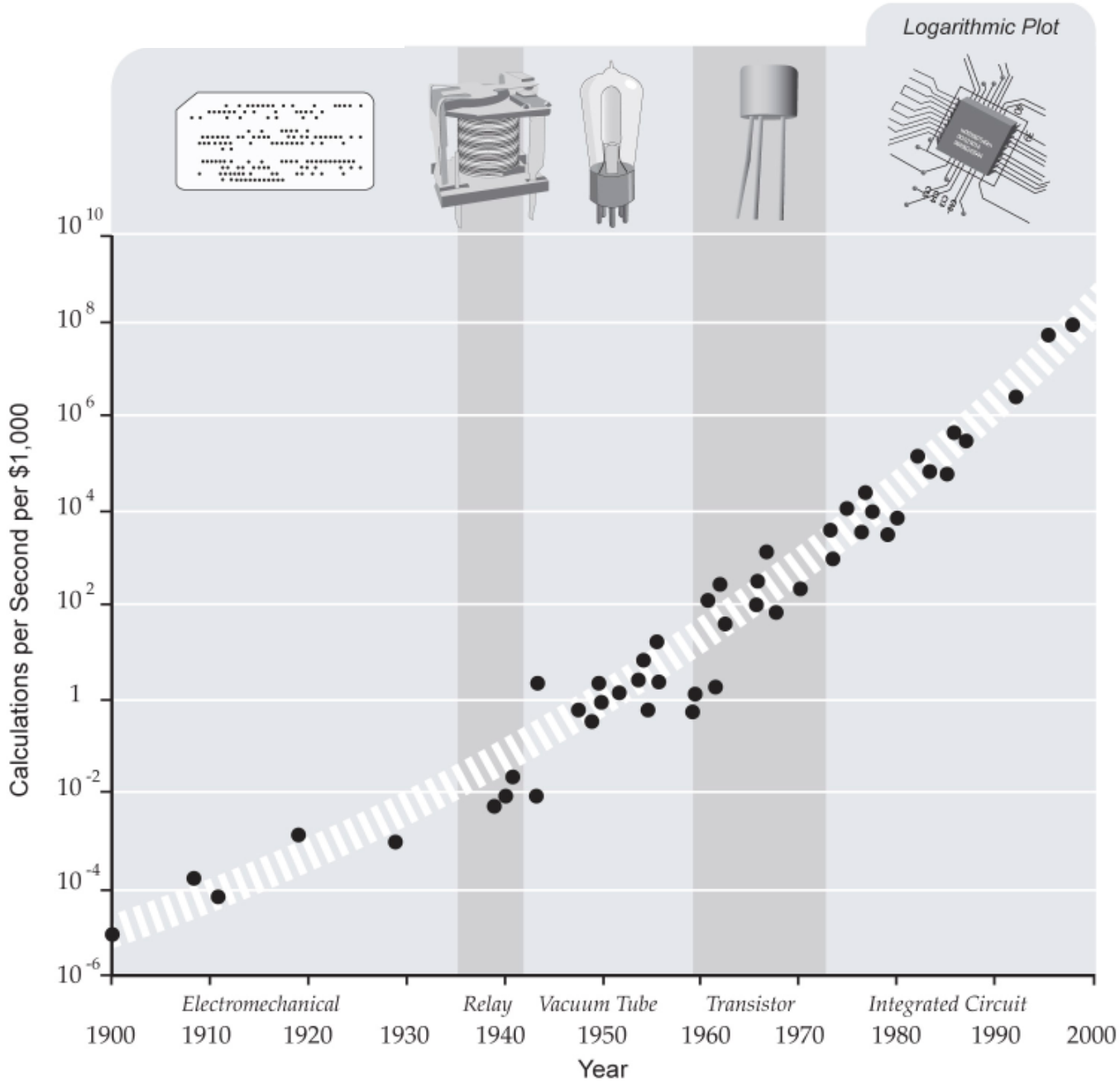
0

Time Before Present (years)

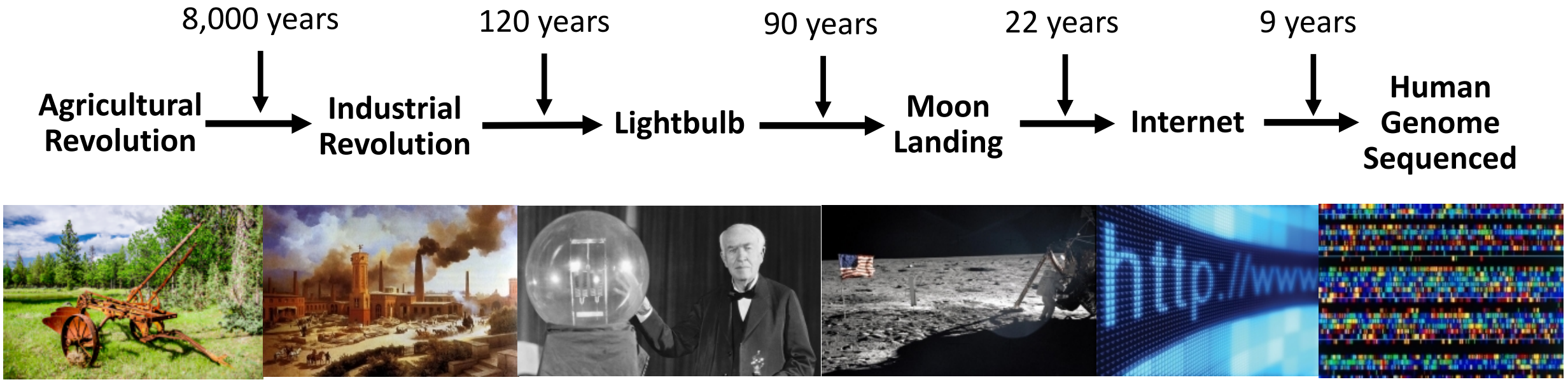
Moore’s Law

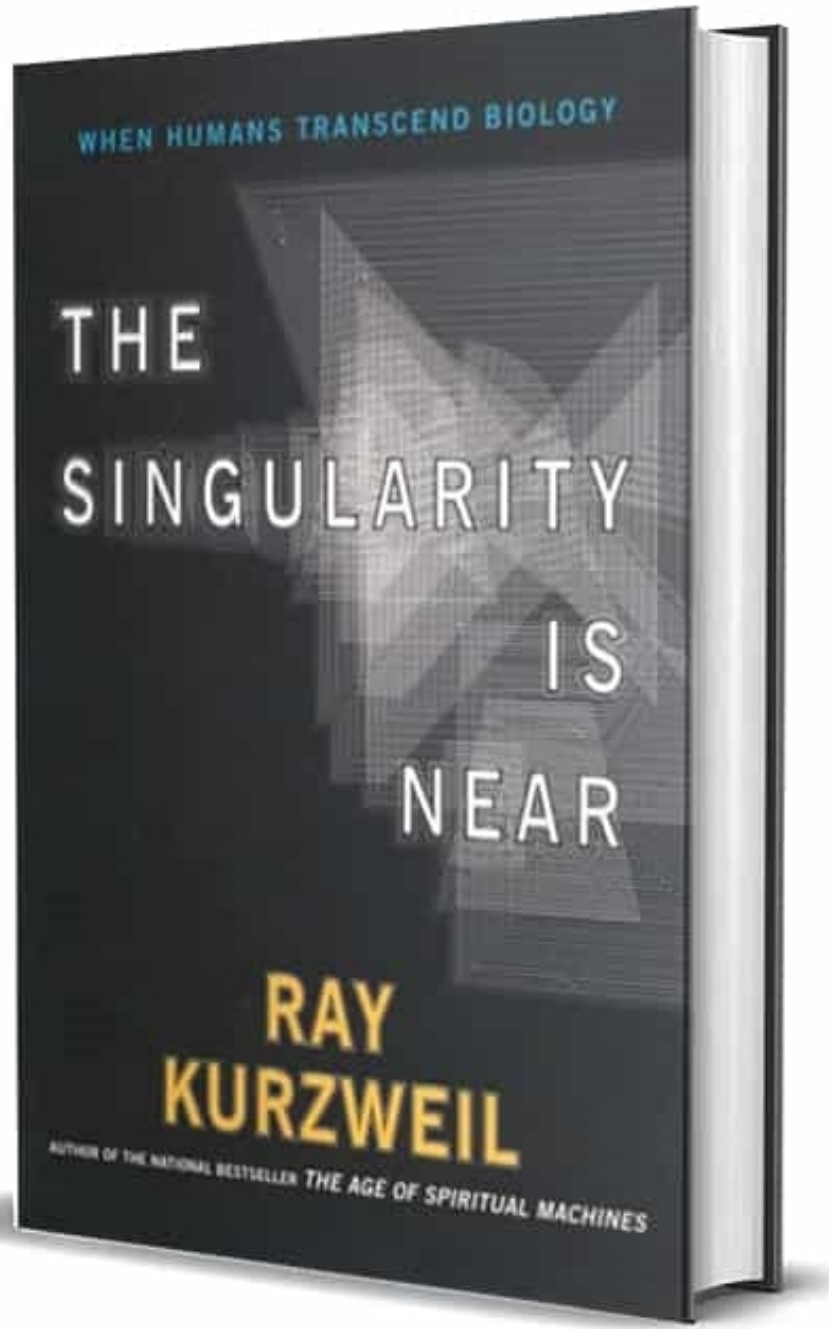
> The number of transistors on a chip will double approximately every two years

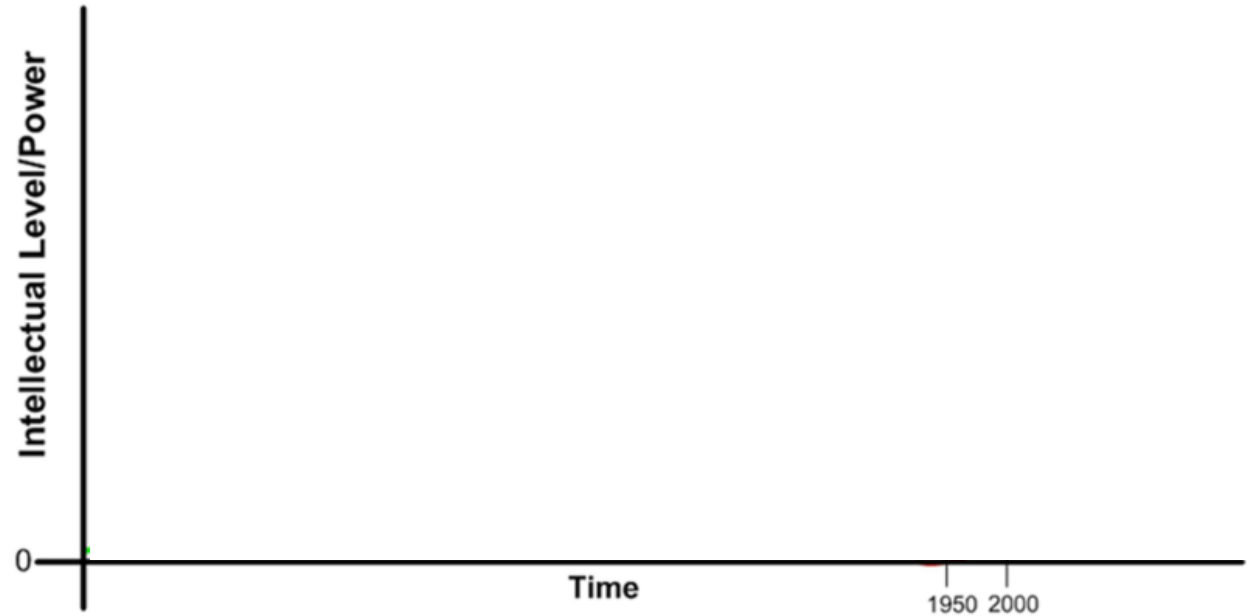
Gordon Moore, Co-Founder
Intel Corporation, 1965

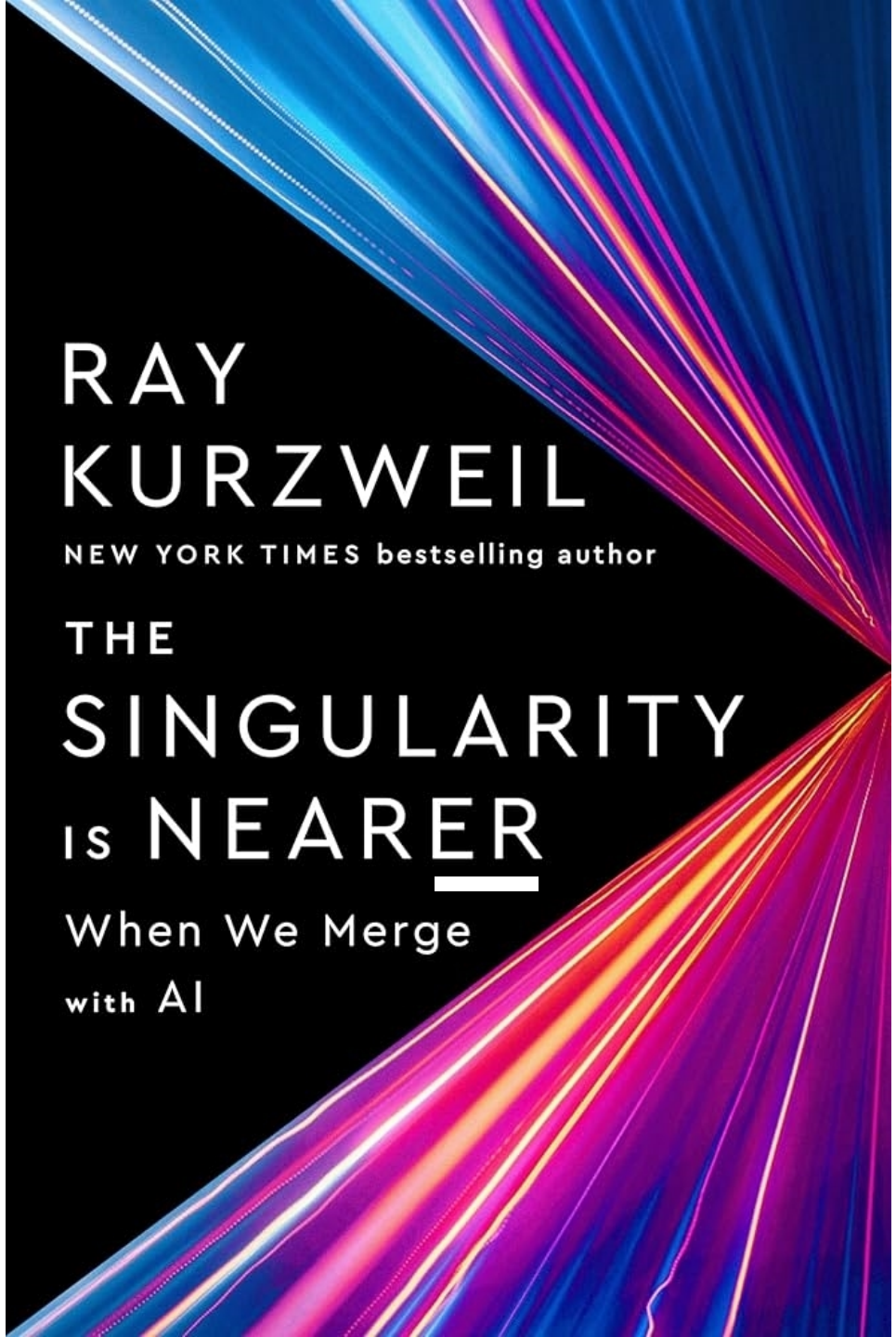


Exponential Growth of Technological Breakthroughs



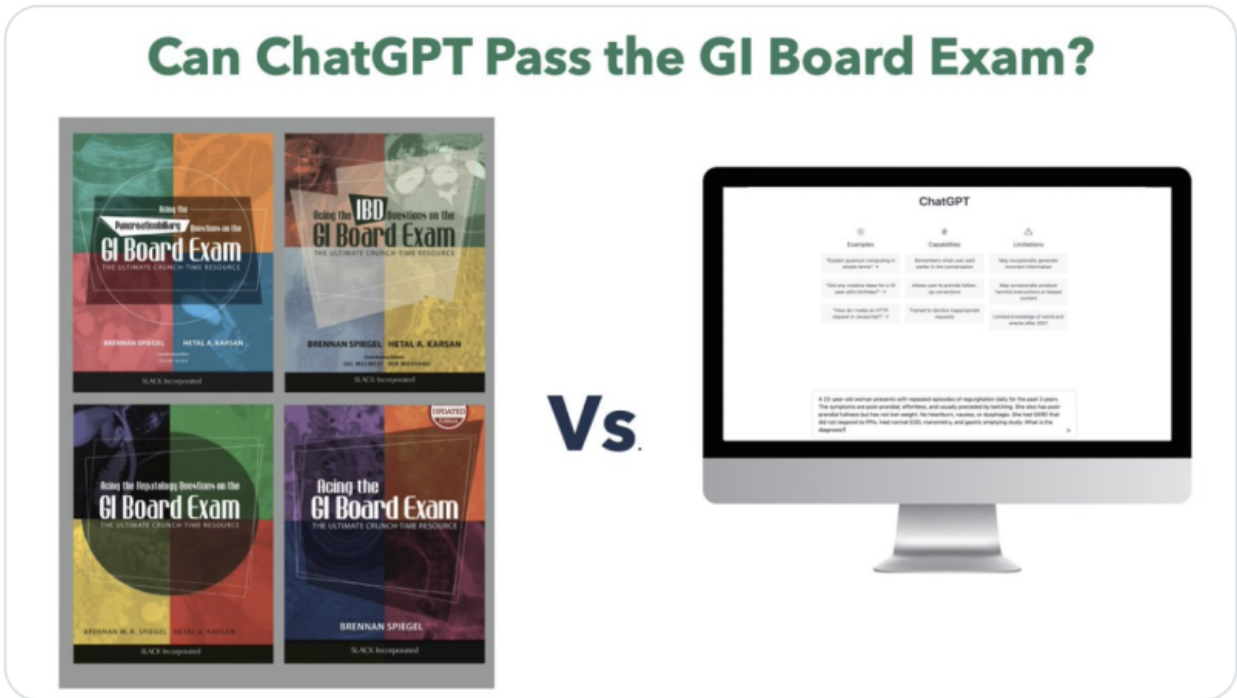

WHEN HUMANS TRANSCEND BIOLOGY
THE SINGULARITY IS NEAR
RAY KURZWEIL
AUTHOR OF THE NATIONAL BESTSELLER THE AGE OF SPIRITUAL MACHINES


Intellectual Level/Power
0
Time
1950
2000


RAY
KURZWEIL
NEW YORK TIMES bestselling author
THE
SINGULARITY
IS NEARER
When We Merge
with AI

Brennan Spiegel, MD, MSHS
@BrennanSpiegel

Can #AI pass a medical board exam? I administered a 16-question exam to #ChatGTP based on my GI board review books. The computer answered confidently. How did it do? Well...the responses are both fascinating and troubling. Watch: youtube.com/watch?v=BQsYWl... #GITwitter #MedTwitter

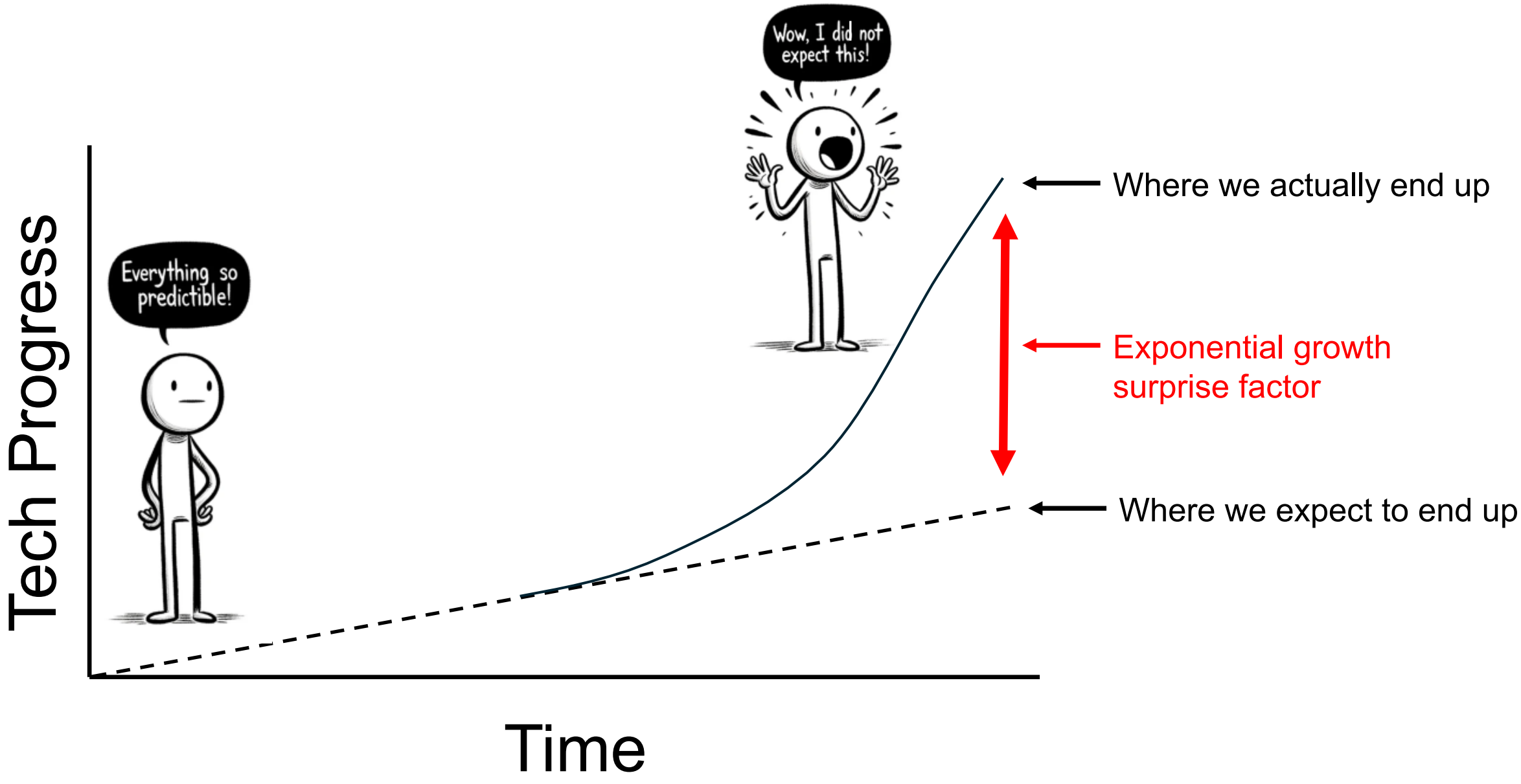


11:17 AM · Dec 11, 2022

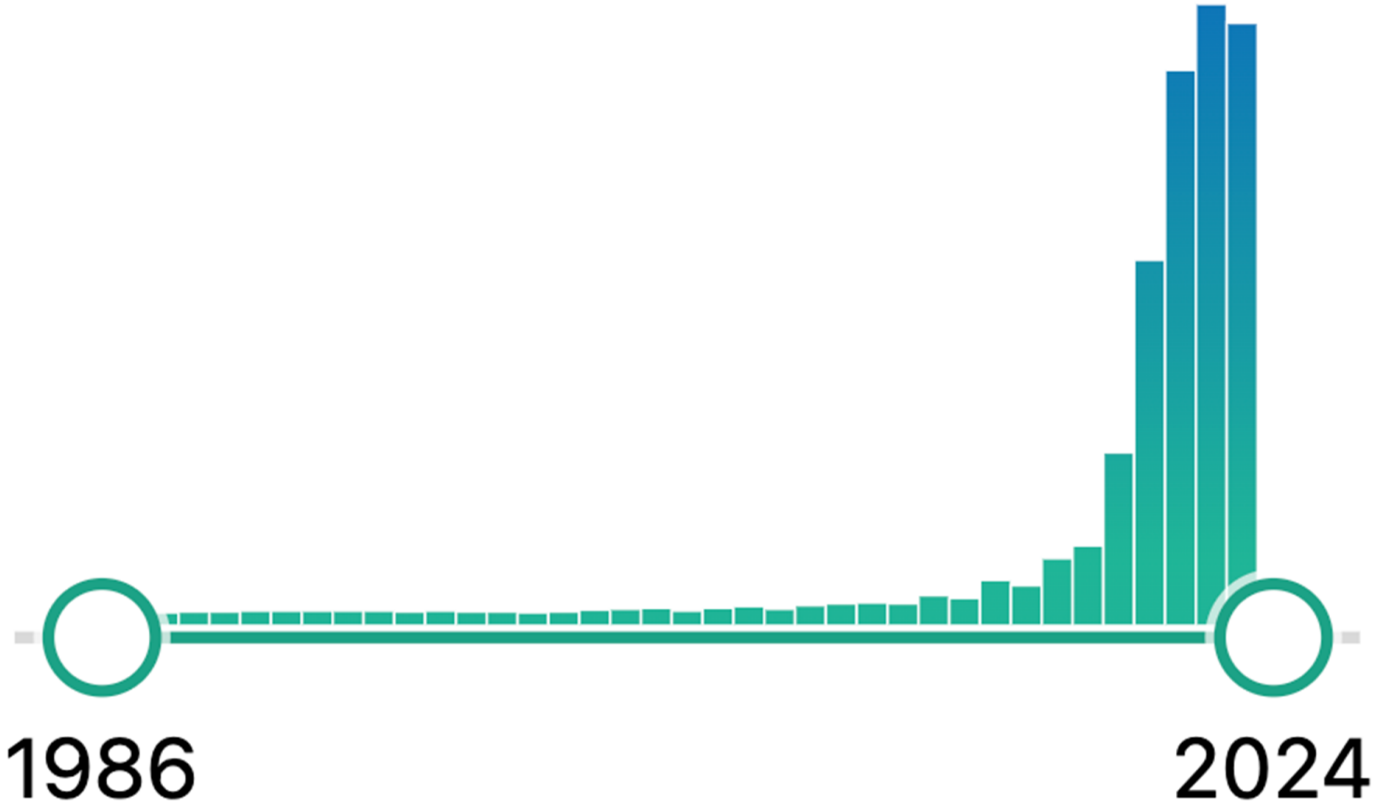
Brennan Spiegel, MD, MSHS
@BrennanSpiegel

I subjected the #ChatGPT to a 16-question GI board exam and it scored ~35% correct. Watch here: youtube.com/watch?v=BQsYWl.... So, today I asked #AI to draw an oil painting of itself struggling through a medical board exam, and it drew this depiction of itself taking the test:

12:04 PM · Dec 15, 2022 · **7,449** Views


Wow, I did not expect this!
Everything so predictible!
Where we actually end up
Exponential growth surprise factor
Where we expect to end up
Tech Progress
Time

Annual Mentions of “Artificial Intelligence” together with “Gastroenterology” on PubMed: Jan ‘85 through Dec ‘24



(("Artificial Intelligence"[MeSH Terms] OR "Machine Learning"[MeSH Terms] OR "Deep Learning" OR "Neural Networks" OR "AI" OR "computational models") AND ("Gastroenterology"[MeSH Terms] OR "Hepatology"[MeSH Terms] OR "endoscopy" OR "colonoscopy" OR "liver diseases" OR "gastrointestinal neoplasms" OR "gastrointestinal diseases" OR "hepatic" OR "esophageal" OR "pancreatic")) AND (English[lang] AND "last 10 years"[PDat])

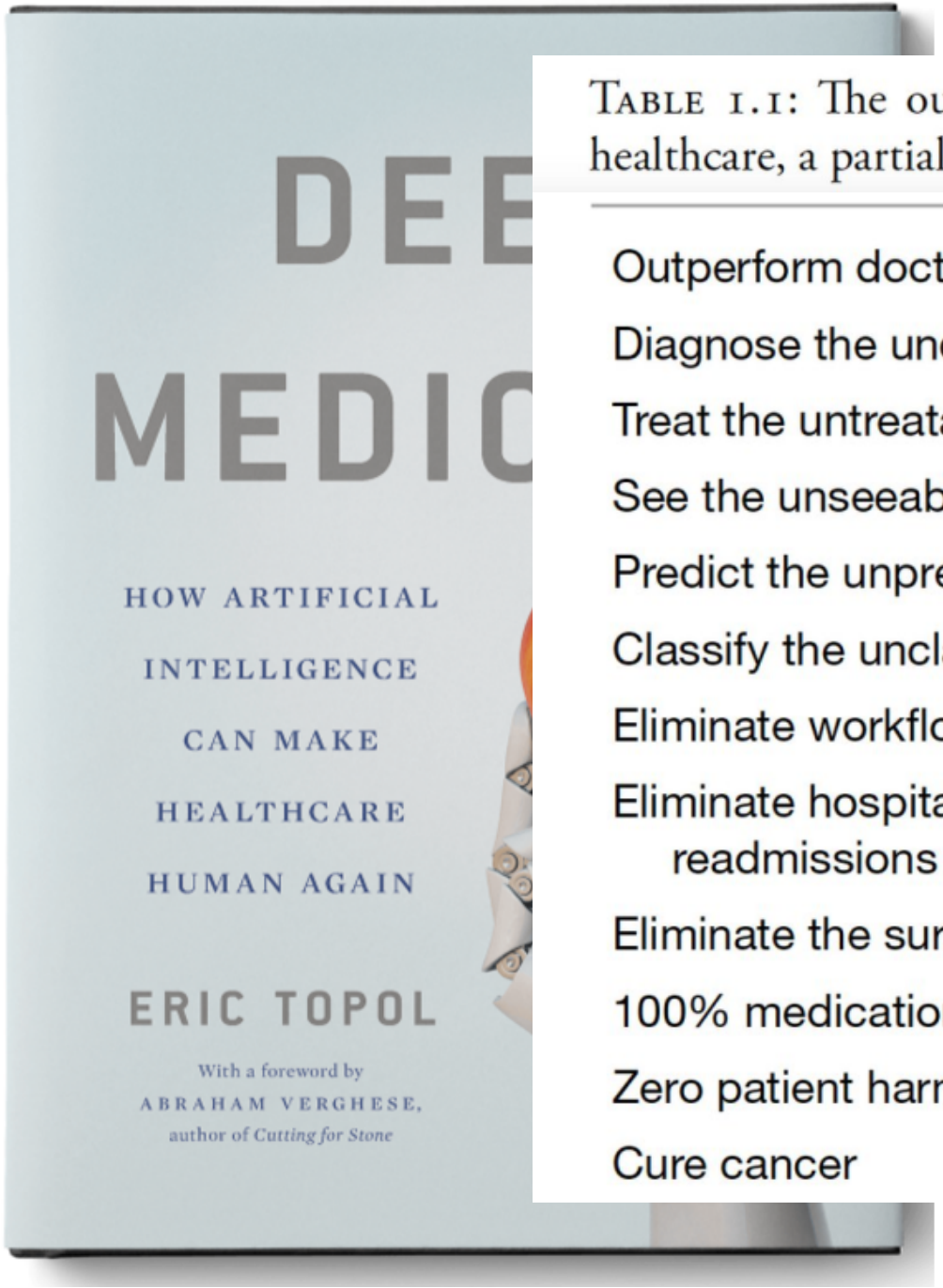


TABLE 1.1: The outlandish expectations for AI in healthcare, a partial list.

- Outperform doctors at all tasks
- Diagnose the undiagnosable
- Treat the untreatable
- See the unseeable on scans, slides
- Predict the unpredictable
- Classify the unclassifiable
- Eliminate workflow inefficiencies
- Eliminate hospital admissions and readmissions
- Eliminate the surfeit of unnecessary jobs
- 100% medication adherence
- Zero patient harm
- Cure cancer

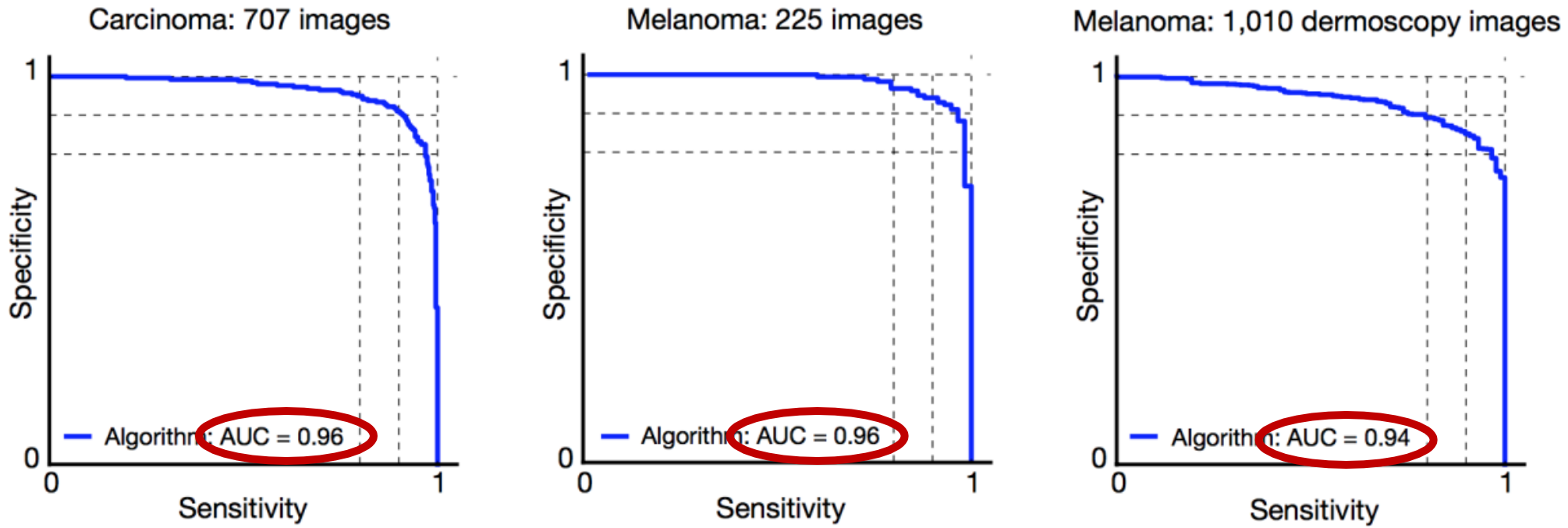

TIMEX

LETTER

doi:10.1038/nature21056

Dermatologist-level classification of skin cancer with deep neural networks

Andre Esteva[1]*, Brett Kuprel[1]*, Roberto A. Novoa[2,3], Justin Ko[2], Susan M. Swetter[2,4], Helen M. Blau[5] & Sebastian Thrun[6]



Esteva et al. Nature 2017

Deep Learning Localizes and Identifies Polyps in Real Time With 96% Accuracy in Screening Colonoscopy

Gregor Urban,[1,2] Priyam Tripathi,[4] Talal Alkayali,[4,5] Mohit Mittal,[4] Farid Jalali,[4,5] William Karnes,[4,5] and Pierre Baldi[1,2,3]

WHAT YOU NEED TO KNOW

BACKGROUND AND CONTEXT

The benefit of colonoscopy for colorectal cancer prevention depends on the adenoma detection rate (ADR). New strategies are needed to increase the ADR during colonoscopy.

NEW FINDINGS

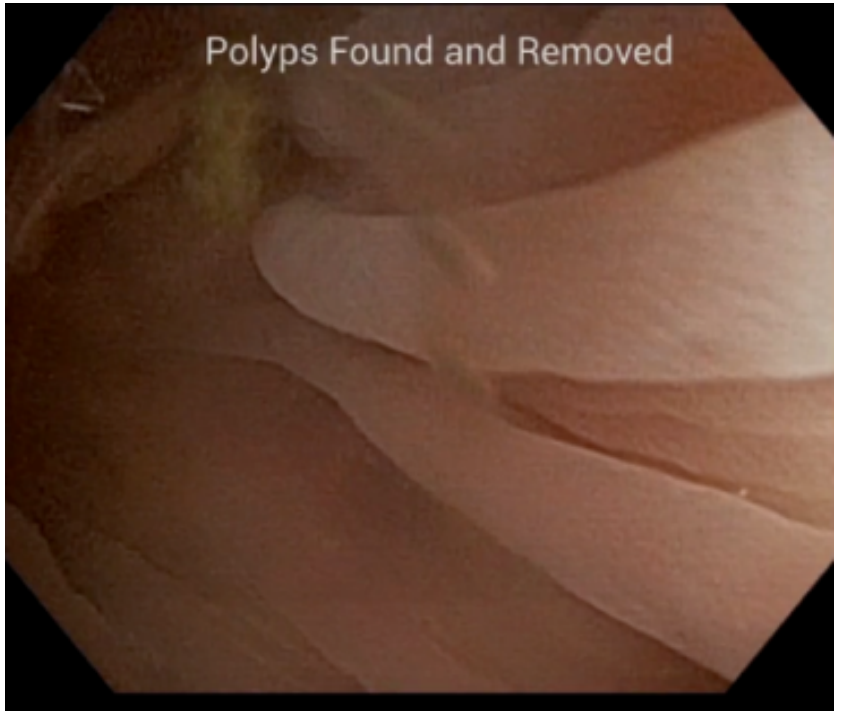
A system of convolutional neural networks (CNN) called Deep Learning was able to process colonoscopy images at high speed in real time, identifying polyps with a cross-validation accuracy of 96.4% and ROC-AUC value of 0.991.

LIMITATIONS

Possible effects of the CNN on inspection behavior by colonoscopists are not known. The anonymized videos excluded information about patient history. CNN performance may vary by indication (screening vs surveillance).

IMPACT

This technology may assist colonoscopists in finding precancerous polyps in real-time and with high accuracy.



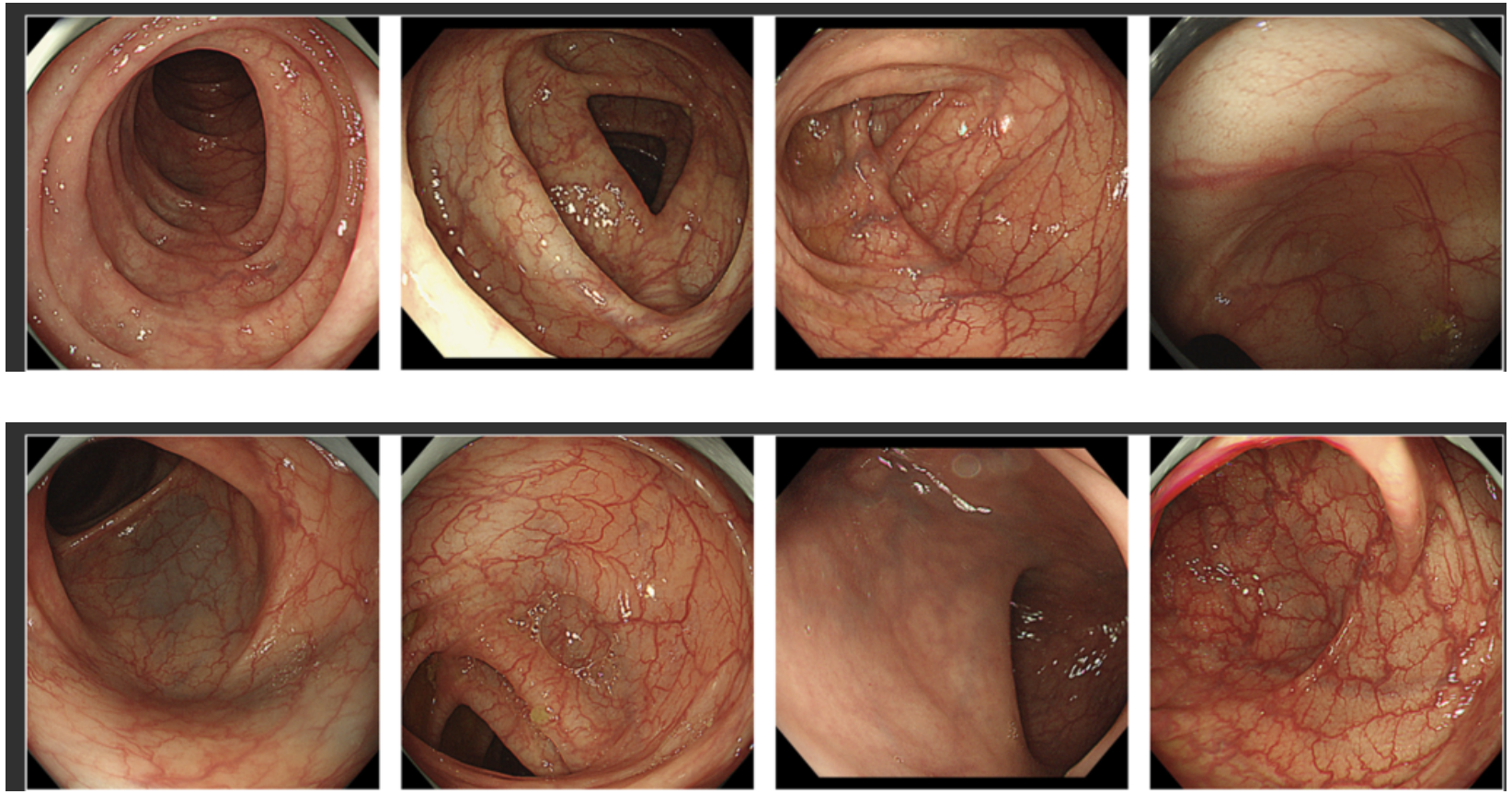
ACG 2025
October 24-29, Phoenix, AZ

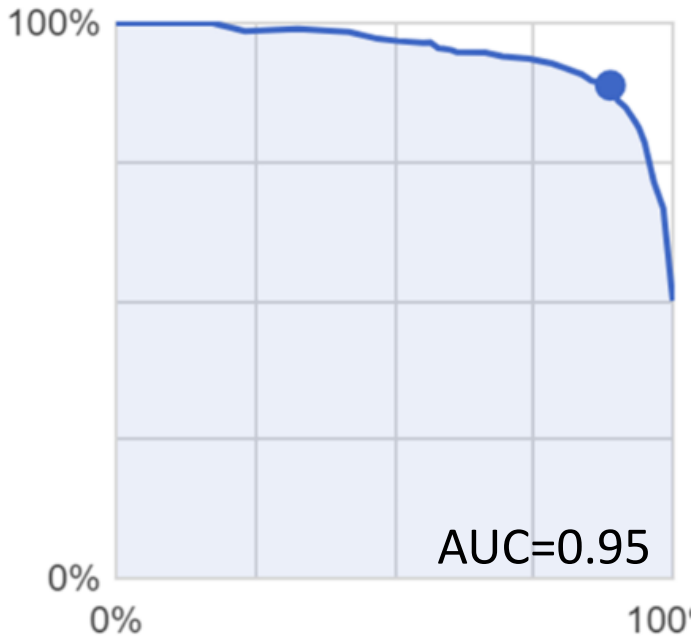
Artificial intelligence model for analyzing colonic endoscopy images to detect changes associated with irritable bowel syndrome

Kazuhisa Tabata, Hiroshi Mihara, Sohachi Nanjo, Iori Motoo, Takayuki Ando, Akira Teramoto, Haruka Fujinami, Ichiro Yasuda

Published: February 17, 2023 • https://doi.org/10.1371/journal.pdig.0000058

PLOS DIGITAL HEALTH



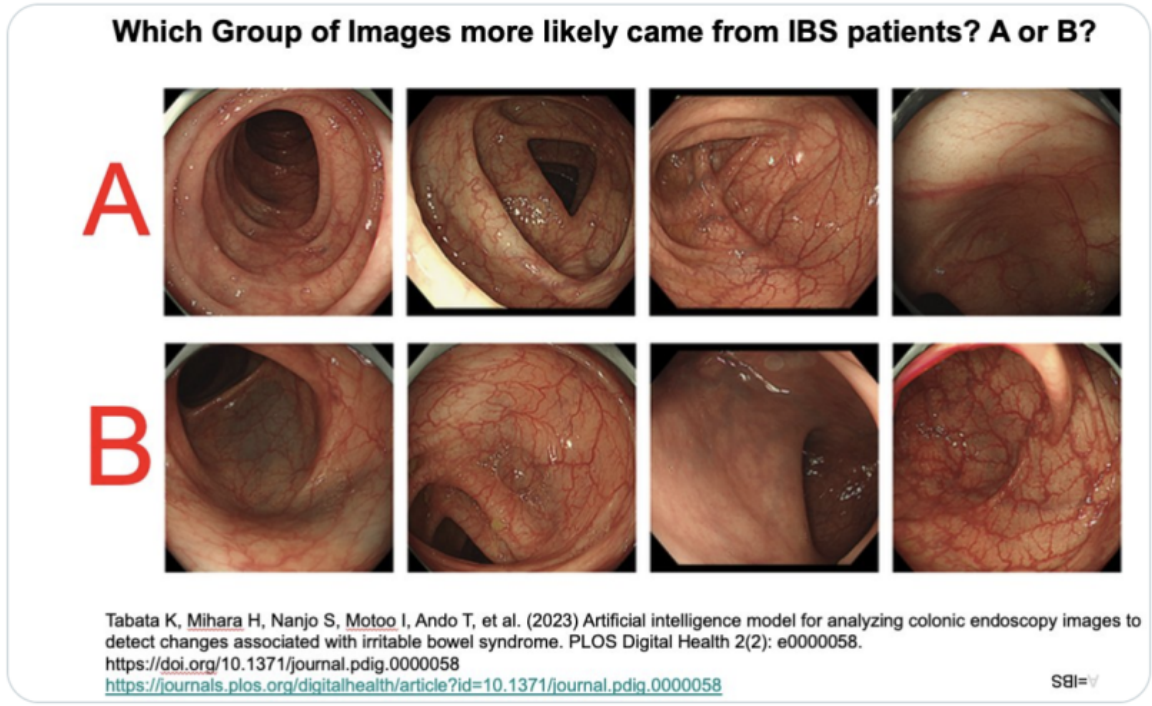


Kewin Siah
@KewinSiah

📢🔥AI is coming to #FGIDs! Using the image #AI model, colonoscopy images of #IBS could be discriminated from healthy subjects at AUC 0.95.

Now, can you see what AI sees? (Answer Right🔽corner)

🔓 Study by Uni. Toyama 🇯🇵
journals.plos.org/digitalhealth/...
#gitwitter #medtwitter #DGBIs



You and 9 others

5:35 PM · Feb 23, 2023 · **50.4K** Views

You and this Tweeter share some mutual follows

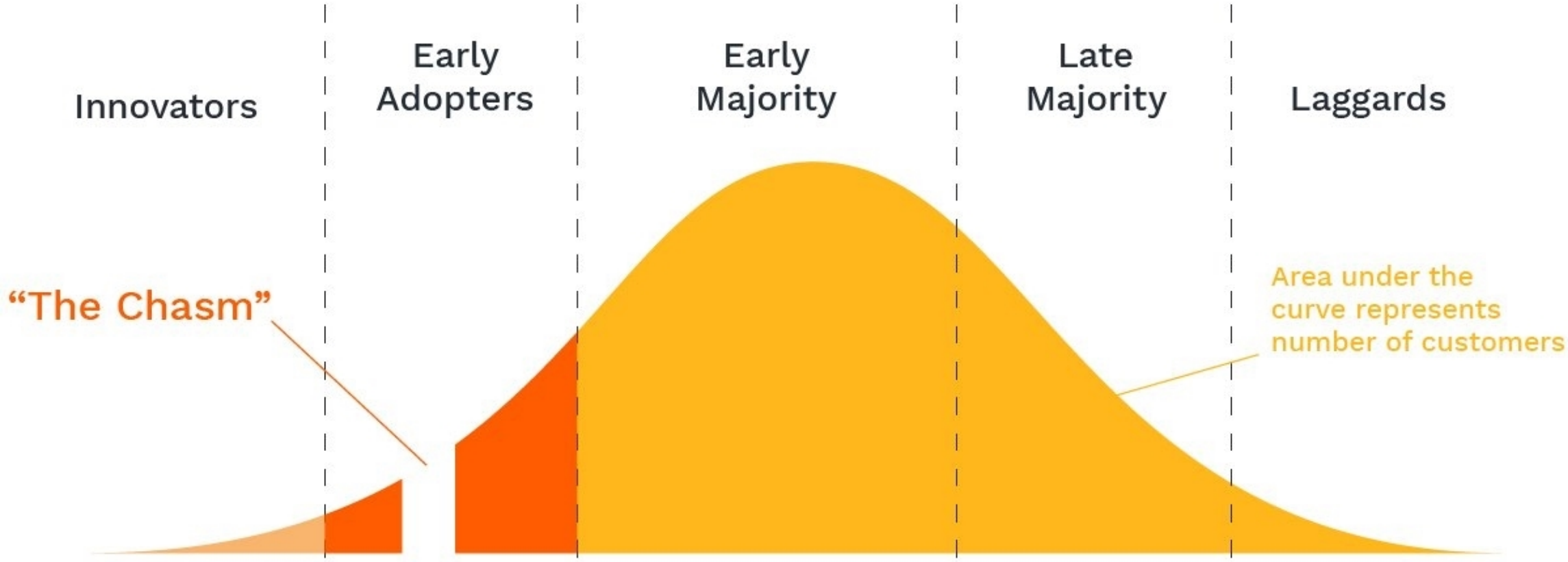
Alexander Ford
@alex_ford12399

Replying to @KewinSiah @RomeGastroPsych and 9 others

But given we should not be colonoscoping people to make a diagnosis of IBS seems like a pointless exercise to me.

10:32 AM · Feb 25, 2023 · **2,231** Views

1 Quote Tweet **21** Likes



Technology Adoption Lifecycle

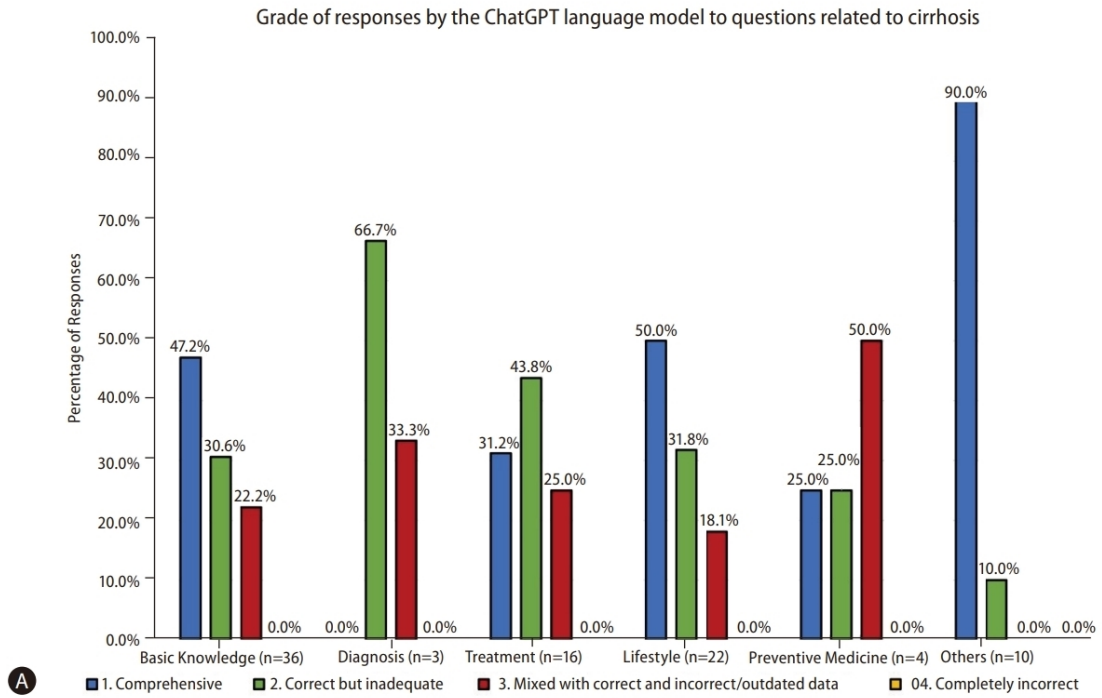
High ← **Openness** → Low

Everett Rogers, *Diffusion of Innovations* 1962

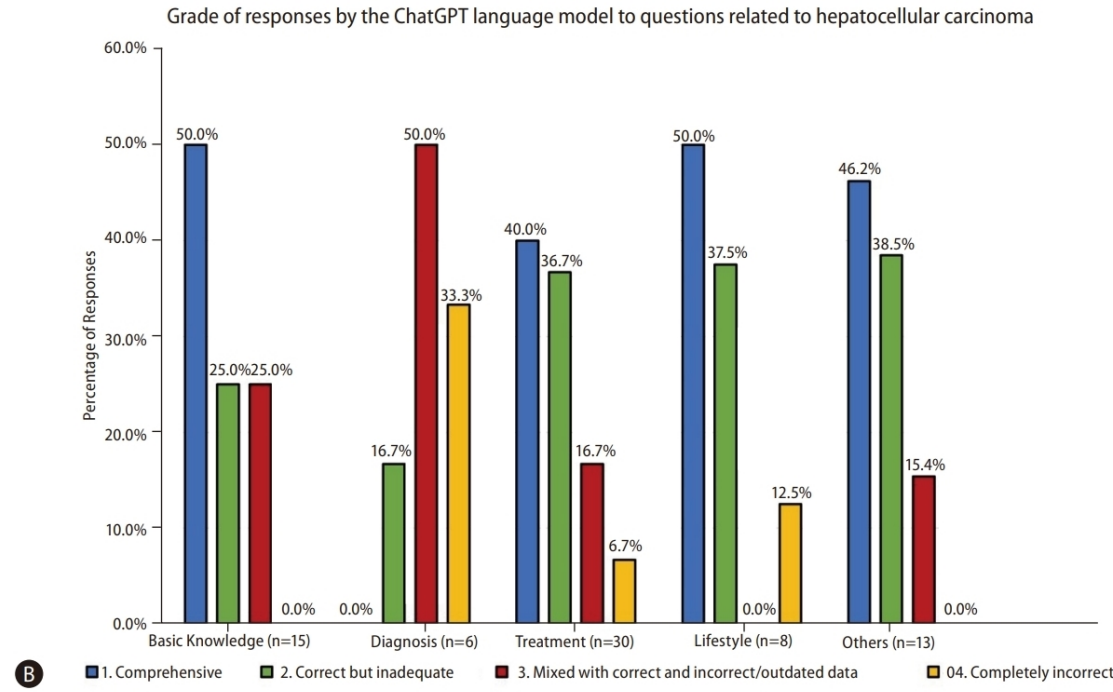
Clin Mol Hepatol. 2023 Jul;29(3):721-732. doi: 10.3350/cmh.2023.0089. Epub 2023 Mar 22.

Assessing the performance of ChatGPT in answering questions regarding cirrhosis and hepatocellular carcinoma

Yee Hui Yeo [1], Jamil S Samaan [1], Wee Han Ng [2], Peng-Sheng Ting [3], Hirsh Trivedi [1 4], Aarshi Vipani [1], Walid Ayoub [1 4], Ju Dong Yang [1 4 5], Omer Liran [6 7], Brennan Spiegel [1 7], Alexander Kuo [1 4]



A



B

Original Investigation

April 28, 2023

Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum

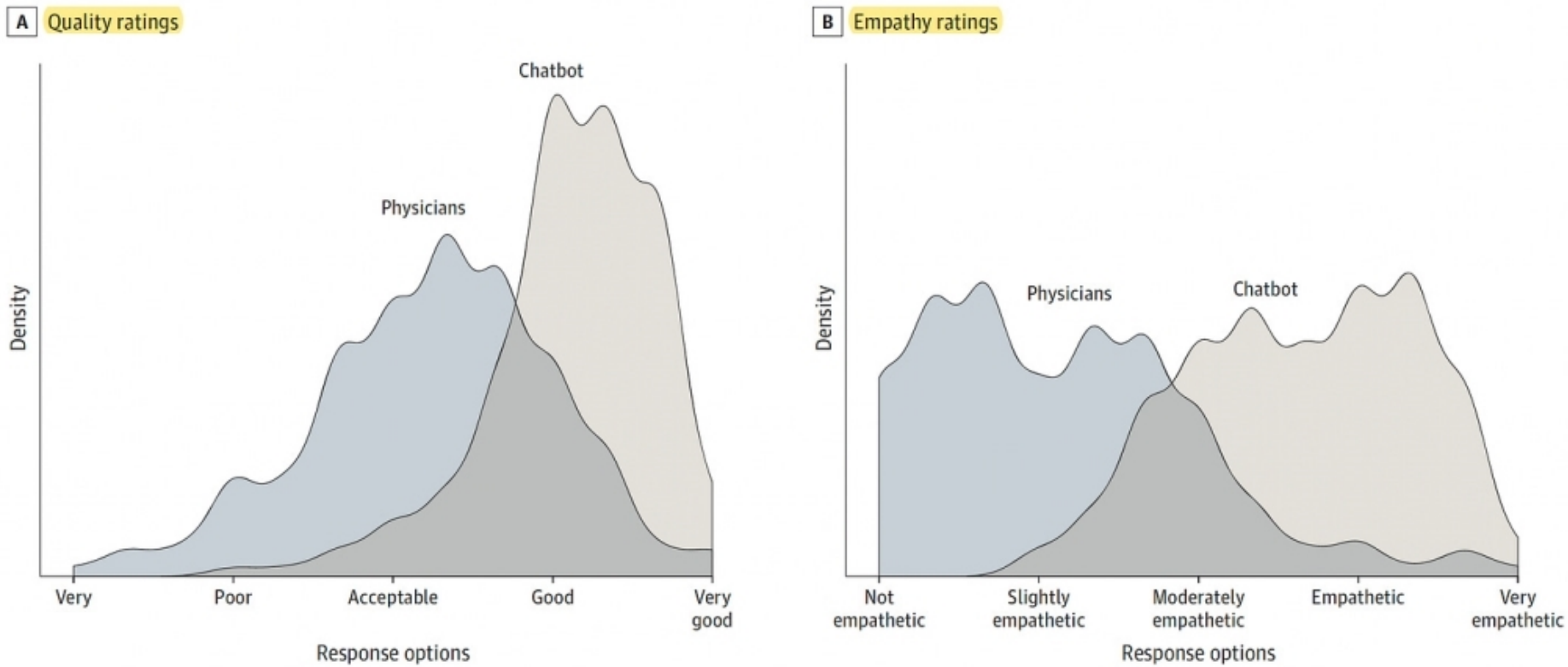
John W. Ayers, PhD, MA[1,2]; Adam Poliak, PhD[3]; Mark Dredze, PhD[4]; et al

Author Affiliations | Article Information

JAMA Intern Med. 2023;183(6):589-596. doi:10.1001/jamainternmed.2023.1838

JAMA Internal Medicine

Figure. Distribution of Average Quality and Empathy Ratings for Chatbot and Physician Responses to Patient Questions

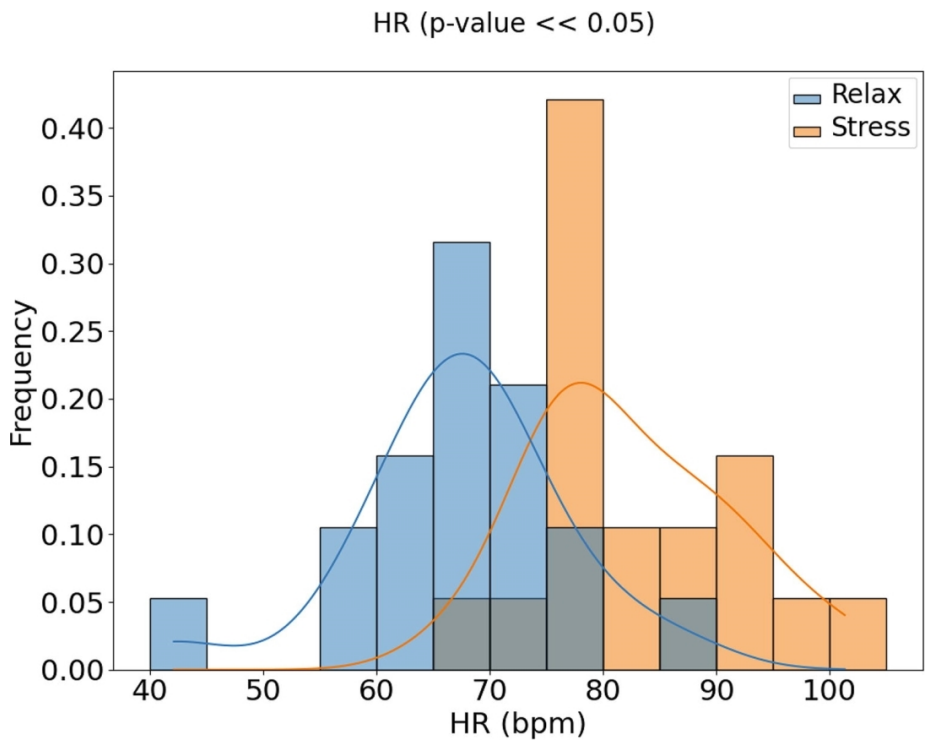


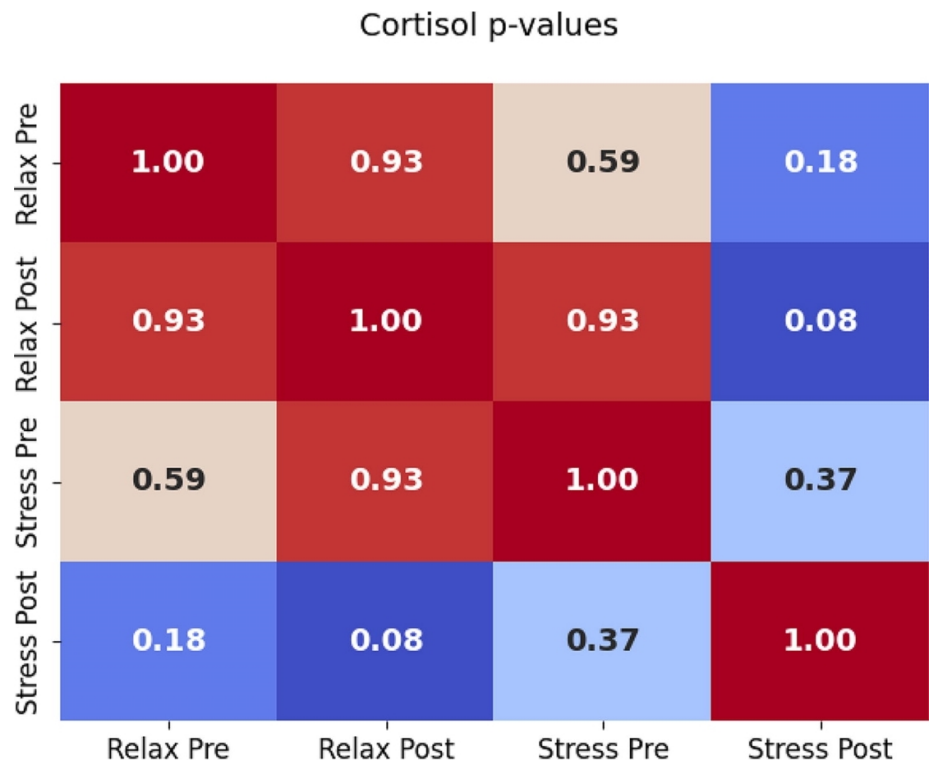
Research Article | OPEN ACCESS | Published Online: 31 October 2024

Comprehensive Assessment of Physiological and Psychological Responses to Virtual Reality Experiences

Authors: Valentin Fauveau, Anastasia K. Filimonov, Renata Pyzik, James Murrough, Laurie Keefer, Omer Liran, Brennan Spiegel, Filip K. Swirski, Zahi A. Fayad, and Wolfram C. Poller | AUTHORS INFO & AFFILIATIONS

Publication: Journal of Medical Extended Reality • https://doi.org/10.1089/jmxr.2024.0020





Cedars Sinai

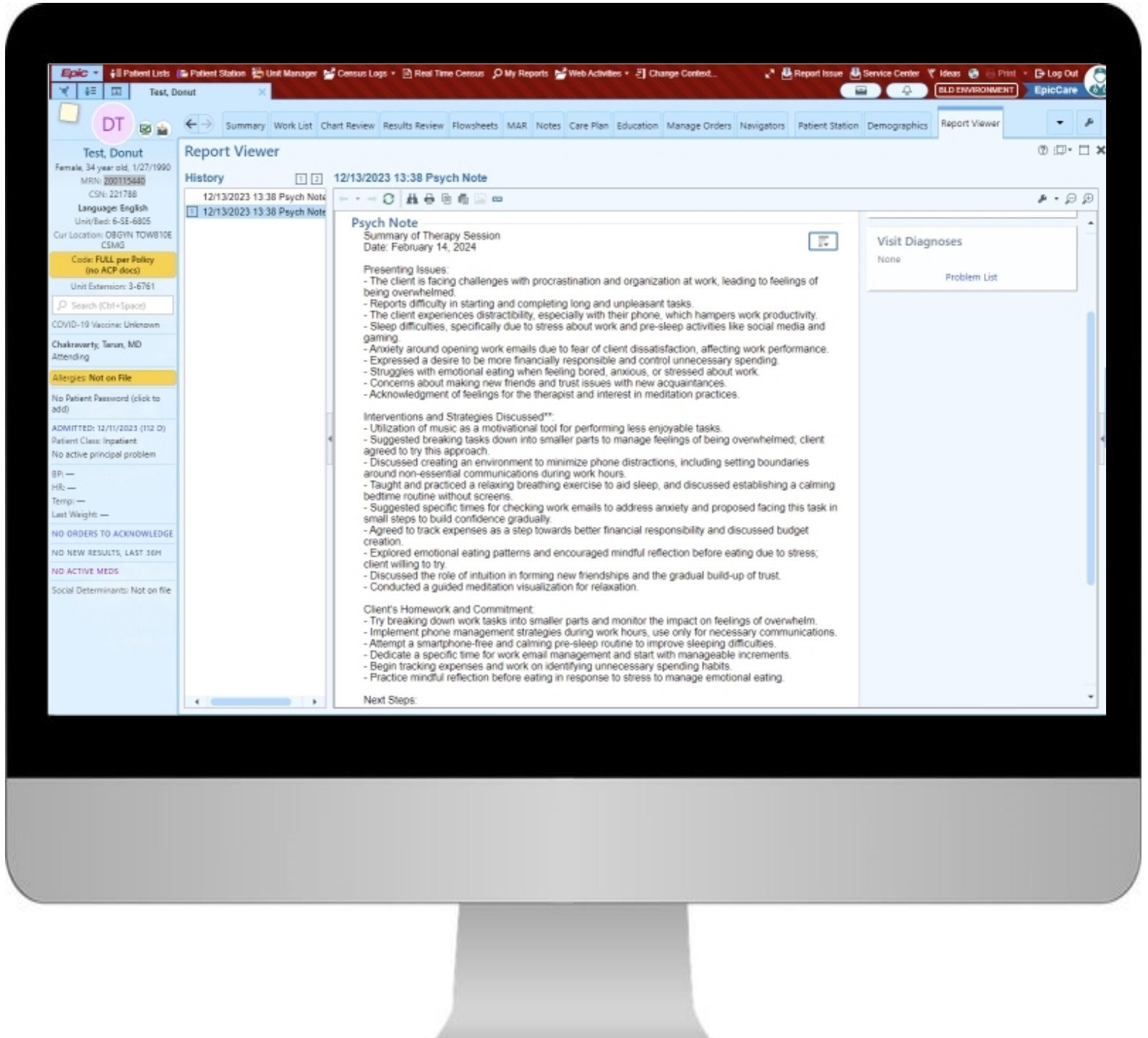
VIRTUAL MEDICINE

ACG 2025
October 24-29, Phoenix, AZ

BRIEF COMMUNICATION OPEN

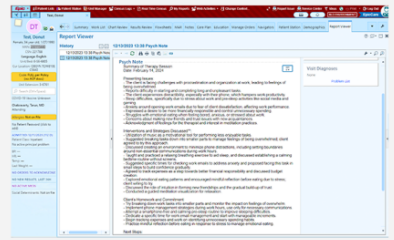
Feasibility of combining spatial computing and AI for mental health support in anxiety and depression

Brennan M. R. Spiegel[1,2✉], Omer Liran[1,3], Allistair Clark[1], Jamil S. Samaan[2], Carine Khalili[1], Robert Chernoff[1], Kavya Reddy[2] and Muskaan Mehra[1]


Epic
Patient Lists
Patient Station
Unit Manager
Census Logs
Real Time Census
My Reports
Web Activities
Change Context...
Report Issue
Service Center
Ideas
Print
Log Out
BLD ENVIRONMENT
EpicCare
Test, Donut
DT
Summary
Work List
Chart Review
Results Review
Flowsheets
MAR
Notes
Care Plan
Education
Manage Orders
Navigators
Patient Station
Demographics
Report Viewer
Test, Donut
Female, 34 year old, 1/27/1990
MRN: 200115440
CSN: 221788
Language: English
Unit/Bed: 6-SE-6805
Cur Location: OBGYN TOW810E CSMG
Code: FULL per Policy (no ACP docs)
Unit Extension: 3-6761
Search (Ctrl+Space)
COVID-19 Vaccine: Unknown
Chakraverty, Tarun, MD
Attending
Allergies: Not on File
No Patient Password (click to add)
ADMITTED: 12/11/2023 (112 D)
Patient Class: Inpatient
No active principal problem
BP: —
HR: —
Temp: —
Last Weight: —
NO ORDERS TO ACKNOWLEDGE
NO NEW RESULTS, LAST 36H
NO ACTIVE MEDS
Social Determinants: Not on file
Report Viewer
History
12/13/2023 13:38 Psych Note
12/13/2023 13:38 Psych Note
12/13/2023 13:38 Psych Note
Psych Note
Summary of Therapy Session
Date: February 14, 2024
Presenting Issues:
- The client is facing challenges with procrastination and organization at work, leading to feelings of being overwhelmed.
- Reports difficulty in starting and completing long and unpleasant tasks.
- The client experiences distractibility, especially with their phone, which hampers work productivity.
- Sleep difficulties, specifically due to stress about work and pre-sleep activities like social media and gaming.
- Anxiety around opening work emails due to fear of client dissatisfaction, affecting work performance.
- Expressed a desire to be more financially responsible and control unnecessary spending.
- Struggles with emotional eating when feeling bored, anxious, or stressed about work.
- Concerns about making new friends and trust issues with new acquaintances.
- Acknowledgment of feelings for the therapist and interest in meditation practices.
Interventions and Strategies Discussed**:
- Utilization of music as a motivational tool for performing less enjoyable tasks.
- Suggested breaking tasks down into smaller parts to manage feelings of being overwhelmed; client agreed to try this approach.
- Discussed creating an environment to minimize phone distractions, including setting boundaries around non-essential communications during work hours.
- Taught and practiced a relaxing breathing exercise to aid sleep, and discussed establishing a calming bedtime routine without screens.
- Suggested specific times for checking work emails to address anxiety and proposed facing this task in small steps to build confidence gradually.
- Agreed to track expenses as a step towards better financial responsibility and discussed budget creation.
- Explored emotional eating patterns and encouraged mindful reflection before eating due to stress; client willing to try.
- Discussed the role of intuition in forming new friendships and the gradual build-up of trust.
- Conducted a guided meditation visualization for relaxation.
Client's Homework and Commitment:
- Try breaking down work tasks into smaller parts and monitor the impact on feelings of overwhelm.
- Implement phone management strategies during work hours, use only for necessary communications.
- Attempt a smartphone-free and calming pre-sleep routine to improve sleeping difficulties.
- Dedicate a specific time for work email management and start with manageable increments.
- Begin tracking expenses and work on identifying unnecessary spending habits.
- Practice mindful reflection before eating in response to stress to manage emotional eating.
Next Steps:
Visit Diagnoses
None
Problem List

Encrypted audio & meta data

Speech-to-text
Context analysis



Cognitive Behavioral Therapy (CBT),
Motivational Interviewing,
Supportive Therapy, ...

Inject appropriate model

Large Language Model

Exit?

EHR summary note

Sentiment Analysis

Negotiate

Appropriateness Classifier

Alert?

Email
SMS
EHR

Inform provider

Generated Reality (GR)

Art, effects, music, soundscape

Text-to-speech

Encrypted audio & meta data

Apply GR

Feasibility of combining spatial computing and AI for mental health support in anxiety and depression

Brennan M R Spiegel [1 2], Omer Liran [3 4], Allistair Clark [3], Jamil S Samaan [5], Carine Khalil [3], Robert Chernoff [4], Kavya Reddy [5], Muskaan Mehra [3]

Affiliations + expand

PMID: 38279034 PMCID: PMC10817913 DOI: 10.1038/s41746-024-01011-0

“impressive,” “amazing,” “real,” “authentic,” “positive,” and “enjoyable.”

spatial computing, virtual reality (VR), and artificial intelligence (AI) to provide immersive mental health support. Utilizing GPT-4 for AI-driven therapy, XAIA engaged participants with mild-to-moderate anxiety or depression in biophilic VR environments. Speaking with an AI therapy avatar in VR was considered acceptable, helpful, and safe, with participants observed to engage genuinely with the program. However, some still favored human interaction and identified shortcomings with using a digital VR therapist. The study provides initial evidence of the acceptability and safety of AI psychotherapy via spatial computing, warranting further research on technical enhancements and clinical impact.

ORIGINAL ARTICLE Open Access

The Feasibility and Usability of an Artificial Intelligence-Enabled Conversational Agent in Virtual Reality for Patients with Alcohol-Associated Cirrhosis: A Multi-Methods Study

Yee Hui Yeo,[1,2] Allistair Clark,[1] Muskaan Mehra,[1] Itai Danovitch,[3] Karen Osilla,[4] Ju Dong Yang,[2,5,6] Alexander Kuo,[2,5] Hyun-Seok Kim,[2,5] Aarshi Vipani,[2,5] Yun Wang,[2,5] Walid Ayoub,[2,5] Hirsh Trivedi,[2,5] Jamil S. Samaan,[1,2] Tiffany Wu,[7] Vijay H. Shah,[7] Omer Liran,[3] and Brennan Spiegel[1,2,*]

> Many participants emphasized the nonjudgmental feedback and unique openness that allowed users to share deep personal thoughts they might typically withhold.

Clinical Note

Patient Profile

- Date of evaluation: July 14, 2024
- Patient: Fred Alvarez
- Sex assigned at birth: Male
- Gender: Male

Chief Complaint

Intermittent abdominal pain.

History of Present Illness (HPI)

Fred Alvarez reports experiencing intermittent abdominal pain that started three days ago. The pain rates up to a 9 on a scale from zero to ten when it occurs and lasts anywhere from 30 minutes to an hour. It is described as being sudden in onset, located a little to the right of the center and a bit higher than the midline of the abdomen. The pain radiates to the right shoulder. He reports that eating can sometimes exacerbate the pain, but this is not consistent. Associated symptoms include severe nausea but no vomiting. Pain is severe enough to disrupt day-to-day activities and often wakes the patient from sleep. There are no alleviating factors noted, and over-the-counter antacids like Tums have not been effective. He has observed no blood in stools, black stools, vomiting of blood, unexplained weight loss, lack of appetite, fevers, night sweats, or chills.

Relevant GI History

No history of any gastrointestinal conditions like GERD, IBS, Crohn's disease, or similar illnesses. No history of surgeries or injuries related to the gastrointestinal system. No diagnosed digestive system cancers, celiac disease, cirrhosis, endometriosis, gallstones, pancreatitis, peptic ulcers, HIV, or other immune system disorders.

Assessment

1.Acute Cholecystitis
2.Biliary Colic
3.Peptic Ulcer Disease
4.Renal Colic
5.Pancreatitis
6.Non-Ulcer Dyspepsia
7.Gastroesophageal Reflux Disease (GERD)

Plan

1.Diagnostic Workup
- Abdominal ultrasound: To assess for biliary tract disease, including gallstones given radiating pain to the right shoulder and postprandial nature.
- Laboratory tests: CBC, liver function tests, lipase, amylase to assess for other potential causes of abdominal pain.

2.Immediate Management
- Encourage the patient to maintain adequate hydration and avoid dietary triggers.
- Comprehensive pain management assessment could be considered if pain persists or escalates.

⏳ Waiting for response...

⏸ Pause Session

AI ⟷ Human

AI	Human
Takes a technical history	Looks people in the eyes
Interprets an X-ray	Lays hands on the patient
Reads an endo image	Performs the endoscopy
Generates a list of diagnoses	Communicates & collaborates
Knows stuff	Shares wisdom

Summer 2024

ACG MAGAZINE

MEMBERS. MEDICINE. MEANING.

AI IN GI: NAVIGATING THE NEW FRONTIER OF DIGESTIVE HEALTH

Thank you!

@BrennanSpiegel

@Brennan_Spiegel

Cedars Sinai