



**CTRL+ALT+EDUCATE:**  
UNLEASHING THE  
HEALING POWER OF  
AI

RICHARD TRUXILLO, DO, FAAFP

FAMILY MEDICINE /  
CLINICAL INFORMATICS

# DISCLOSURES

- No direct financial relationships to any products/companies mentioned
- Currently personally own the following computing devices:
  - iPhone 15 Pro Max
  - iPad Air 2
  - PC #1: AMD Ryzen 5950x Gaming System with Nvidia RTX 4090 video card
  - PC #2: Intel 9900k Gaming System with Nvidia RTX 3080 video card
  - PC #3: Microsoft Surface Pro 2
  - PC #4: Dell Poweredge T710 Server with Dual Intel Xeon CPUs
  - Raspberry Pi 3/4
- I am software and hardware agnostic -> Seek to find best performance/dollar ratio regardless of manufacturer



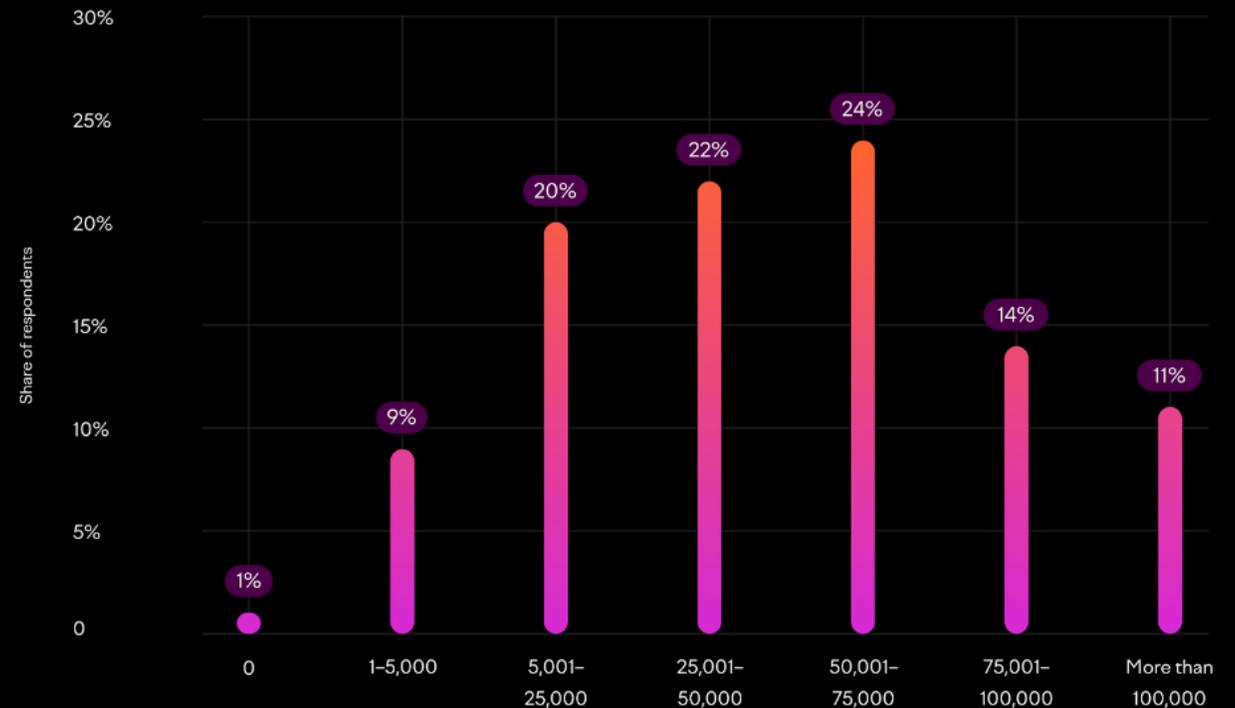
# LEARNING OBJECTIVES

- Recognize how AI technologies and AI-driven platforms can be integrated into medical school curricula to enhance teaching and interactive learning experiences.
- Identify how AI can be leveraged to analyze student performance data to create personalized learning paths.
- Discuss how AI-powered clinical decision support systems can assist in diagnosis, treatment planning, and patient management.
- Identify the role of AI in creating realistic simulation environments and immersive learning experiences.
- Recognize the ethical concerns surrounding the use of AI in health professions education and the importance of engaging in relevant discussions with learners.

# DISCLAIMER – THE RAPID CHANGE OF AI TECHNOLOGY

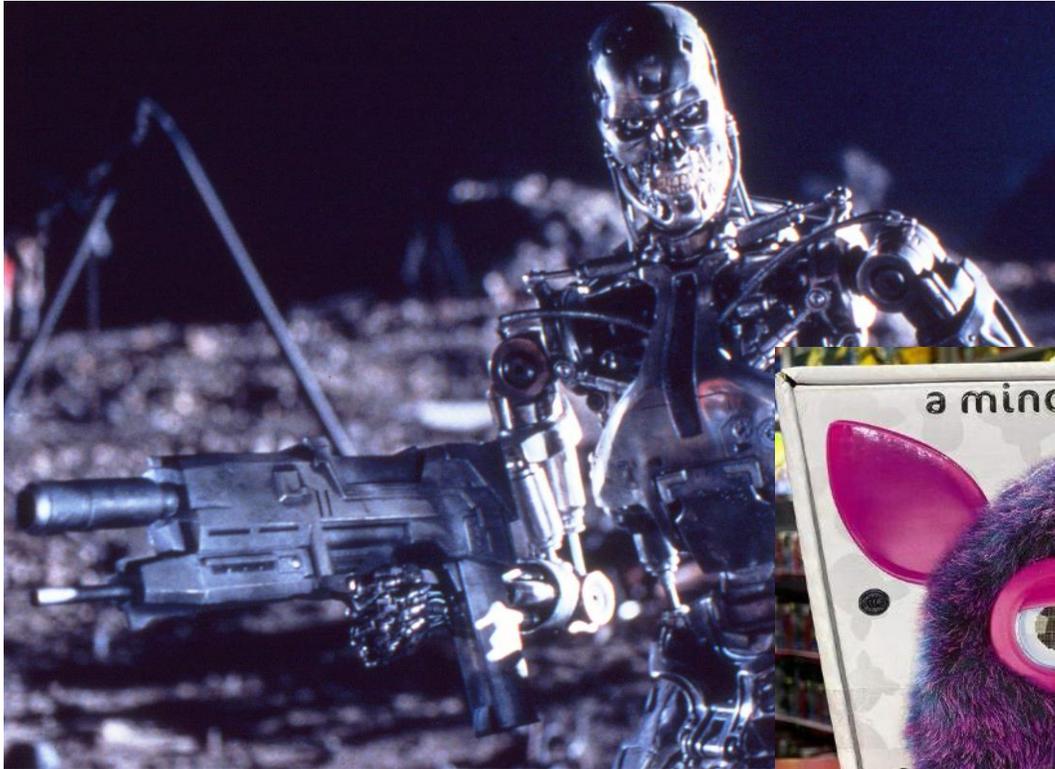
- As of FY 2023, the global AI market was valued at \$142 billion
- 73% of US companies use artificial intelligence in some respect of their business activities
- ChatGPT became the fastest growing consumer app ever at the time its release
- Over 80% of Fortune 500 companies have adopted ChatGPT within their business as of August 2023
- **THIS IS A RAPIDLY CHANGING ENVIRONMENT.**

## How Much U.S. Companies Have Saved Using ChatGPT (February 2023)



Source: Statista

# ARTIFICIAL INTELLIGENCE, WHAT IS IT?



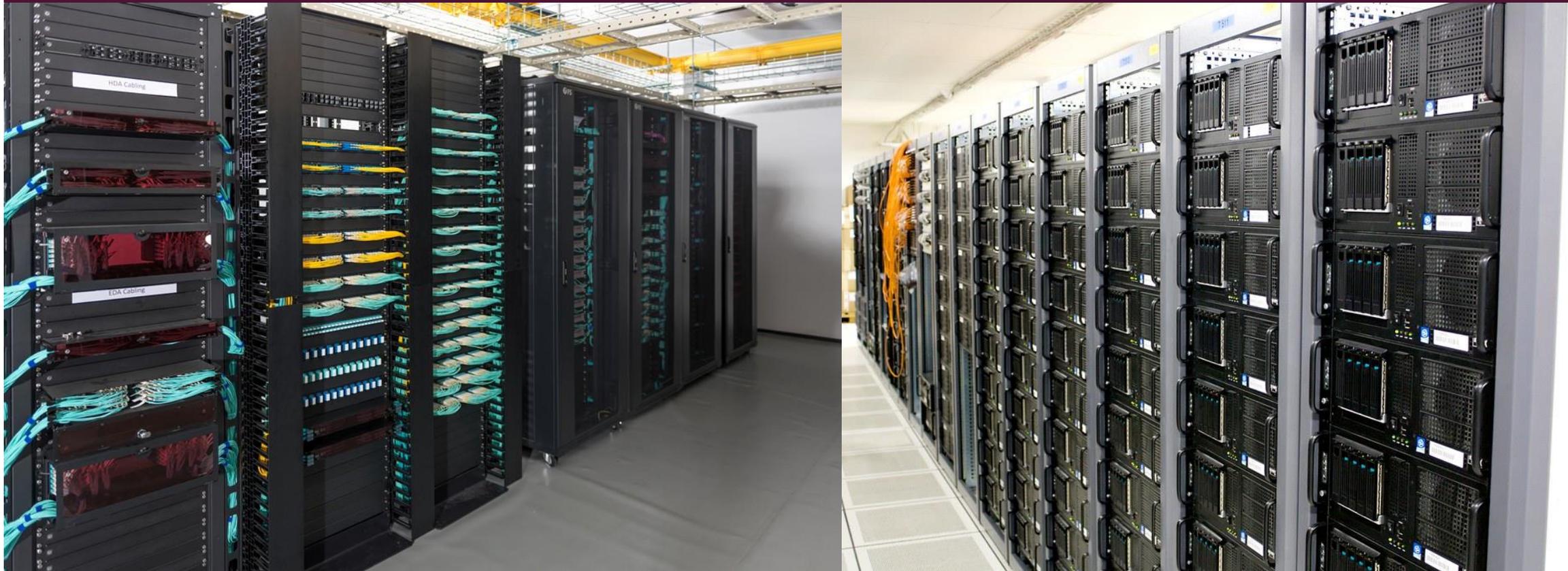
# ARTIFICIAL INTELLIGENCE VS. MACHINE LEARNING

- Simulation of human intelligence in machines that are programmed to think like humans and mimic our actions:
  - Machine Learning - ability to learn new concepts based on past decision outcomes.
    - System's ability to automatically detect patterns in data it has never seen before without human input.
  - Artificial Intelligence: computer software systems that exhibit intelligent behavior or decision-making capability by completing complicated tasks.
    - Rationalization – ability to take actions that have the best chance of achieving a specific goal

Boston Dynamics' "Spot" robot, an agile 70-pound robotic dog able to climb stairs and survey hazardous areas



# WHAT CHANGED? MASSIVE DATA STORAGE...



From Megabytes to Gigabytes to Terabytes and finally to Petabytes (quadrillion bytes) of storage within 30 years

## AND...GRAPHIC PROCESSING UNITS (GPU) - COMPUTE

- NVIDIA RTX 3090 and 4090 GPUs
- 10,496 and 16,384 CUDA cores respectively:
  - Allows for parallel processing, capable of carrying out multiple tasks swiftly and simultaneously
  - Suited for machine learning, training models, video editing, data analysis and AI for smaller data models
  - (My RTX 4090 is capable of 82.5 teraFLOPS)



# GPUS WITH TENSOR CORES – LARGE DATA CENTERS

- Tensor cores are specialized processors designed for deep learning and AI workloads.
- Nvidia V100 – Releases in 17 days and targeted at data centers
- Capable of 130 teraFLOPS
  - 130 trillion mathematical calculations per second in the context of training a neural network on a model.



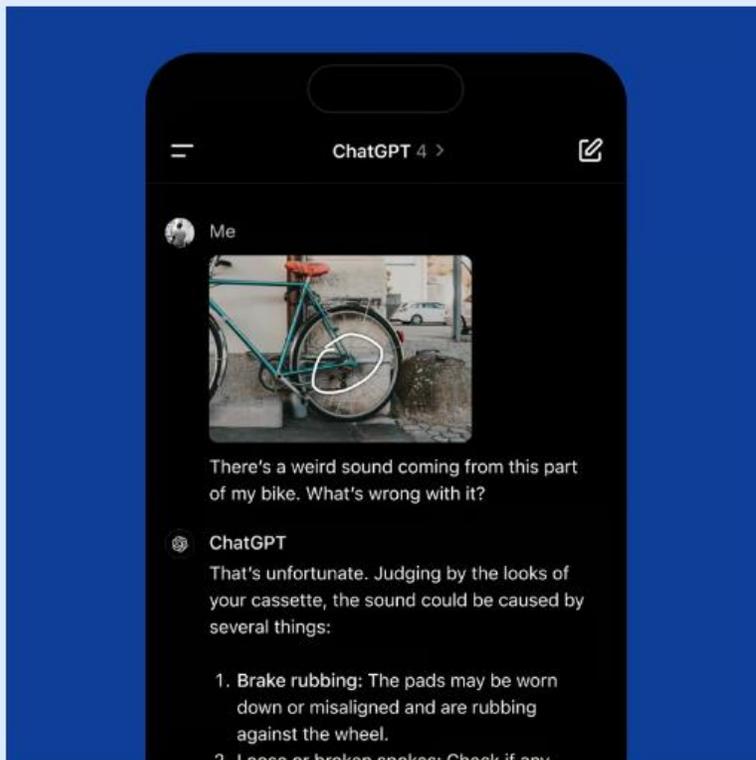
# CATEGORIZATION OF ARTIFICIAL INTELLIGENCE ENGINES

1. **Narrow AI**: AI designed to complete very specific actions; unable to independently learn. (**image recognition software, self-driving cars, AI virtual assistants**)
2. **Artificial General Intelligence**: AI designed to learn, think and perform at similar levels to humans. (**generative AI models like ChatGPT**)
3. **Artificial Superintelligence**: AI able to surpass the knowledge and capabilities of humans. (**does not exist...yet**)
4. **Reactive Machine AI**: AI capable of responding to external stimuli in real time; unable to build memory or store information for future. (**Netflix and Youtube AI engine to suggest movies/advertisements**)
5. **Limited Memory AI**: AI that can store knowledge and use it to learn and train for future tasks. (**Chatbots, virtual assistants, self-driving cars**)
6. **Theory of Mind AI**: AI that can sense and respond to human emotions, plus perform the tasks of limited memory machines. (**Does not exist yet but combines limited Memory AI with emotion for reactions**)
7. **Self-Aware AI**: AI that can recognize others' emotions, plus has sense of self and human-level intelligence; the final stage of AI. (**Sentient AI, Sophia from Hanson Robotics; has potential to be Skynet from The Terminator**)

# CATEGORIZATION OF ARTIFICIAL INTELLIGENCE (CURRENT)

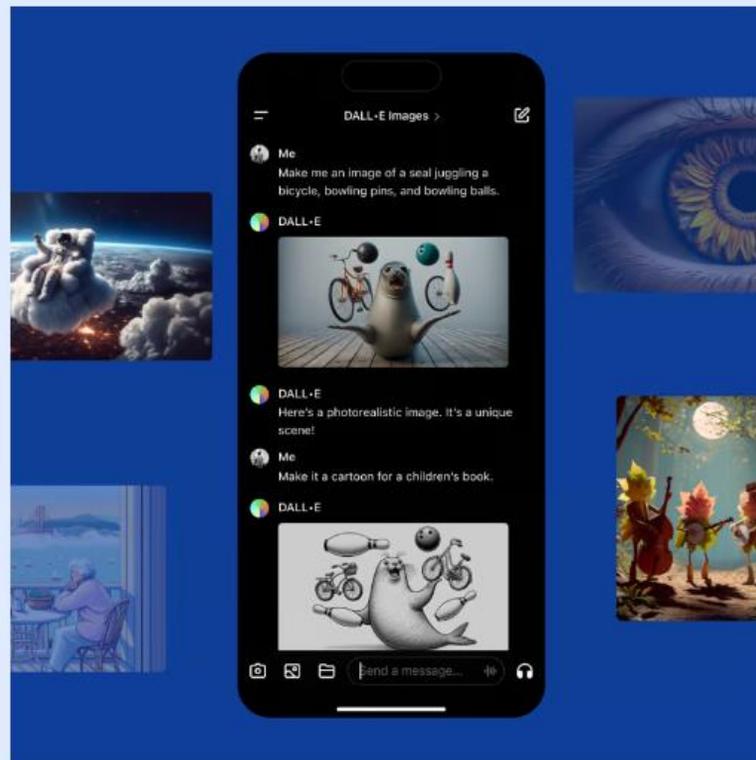
- 1 **Narrow AI:** AI designed to complete very specific actions; unable to independently learn.
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- 3.
- 4 **Reactive Machine AI:** AI capable of responding to external stimuli in real time; unable to build memory or store information for future.
- 5 **Limited Memory AI:** AI that can store knowledge and use it to learn and train for future tasks.
- 6.
- 7.

# A QUICK EXAMPLE...CHATGPT



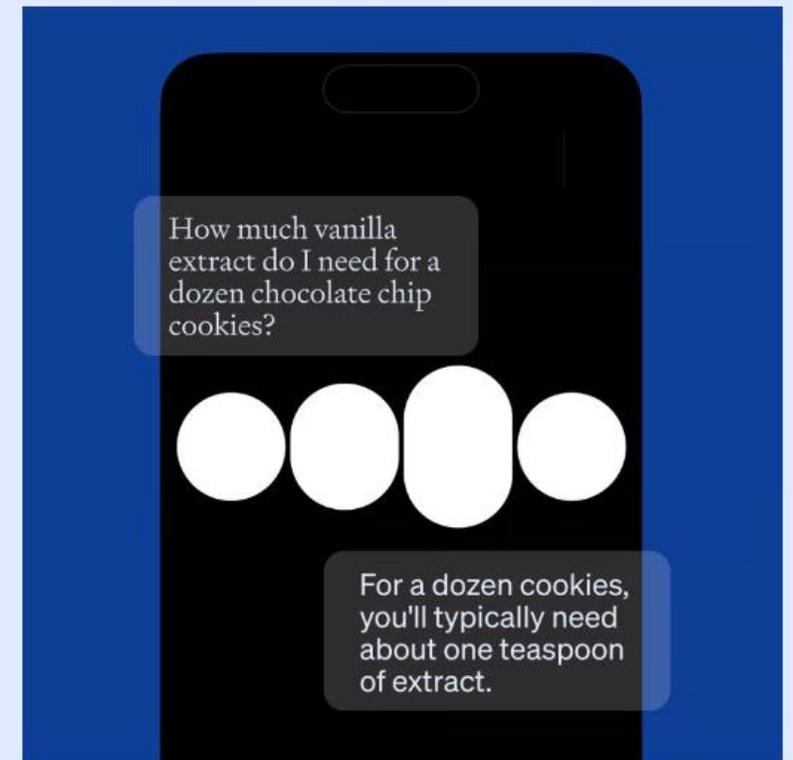
## Chat with images

You can now show ChatGPT images and start a chat. Troubleshoot why your grill won't start, explore the contents of your fridge to plan a meal, or analyze a complex graph for work-related data.



## Create new images

Create images simply by describing them in ChatGPT. Invent new logos, comic strips, and photorealistic scenes right in the chat. You can bring your ideas to life with our most capable image model, DALL-E 3.



## Chat with voice

You can now use voice to engage in a back-and-forth conversation with ChatGPT. Speak with it on the go, request a bedtime story for your family, or settle a dinner table debate.

# EXAMPLES OF AI YOU MAY HAVE HEARD OF...CHATGPT



**You**

What should I charge for a single video sponsorship on Youtube if my primary audience watches my roblox videos, are primarily women between the ages of 21-35? I have 25k subscribers currently



**ChatGPT**

Determining the price for a single video sponsorship on YouTube depends on various factors such as your engagement rate, the quality of your content, the size and demographics of your audience, and the reach of your videos. Since you have 25k subscribers and your primary audience consists of women between the ages of 21-35 who watch your Roblox videos, you have a

Based on these factors, as a starting point, you could consider charging anywhere from \$100 to \$500 for a single video sponsorship. However, this range could be higher or lower depending on your specific circumstances and negotiation with the sponsor.

# CHATGPT – IN EDUCATION



**You**

Write a closing paragraph summary from a 22 page paper on why a nurse as an obligation to maintain the highest ethical standards in patient care.



**ChatGPT**

In conclusion, this paper has delved into the profound ethical responsibilities inherent in nursing practice, emphasizing the imperative for nurses to uphold the highest standards of ethical conduct in patient care. Through an exploration of various ethical frameworks, professional codes, and real-world scenarios, it has become evident that nurses possess a unique obligation to prioritize the well-being, dignity, and autonomy of their patients. As frontline caregivers, nurses serve as advocates, stewards of trust, and guardians of moral integrity within healthcare settings. By embracing ethical principles such as beneficence, nonmaleficence, justice, and respect for persons, nurses not only fulfill their professional duties but also contribute to the enhancement of patient outcomes and the advancement of healthcare as a whole. In essence, the commitment to ethical excellence serves as the cornerstone of nursing practice, fostering a culture of compassion, integrity, and excellence that upholds the sacred trust bestowed upon nurses by those they serve.

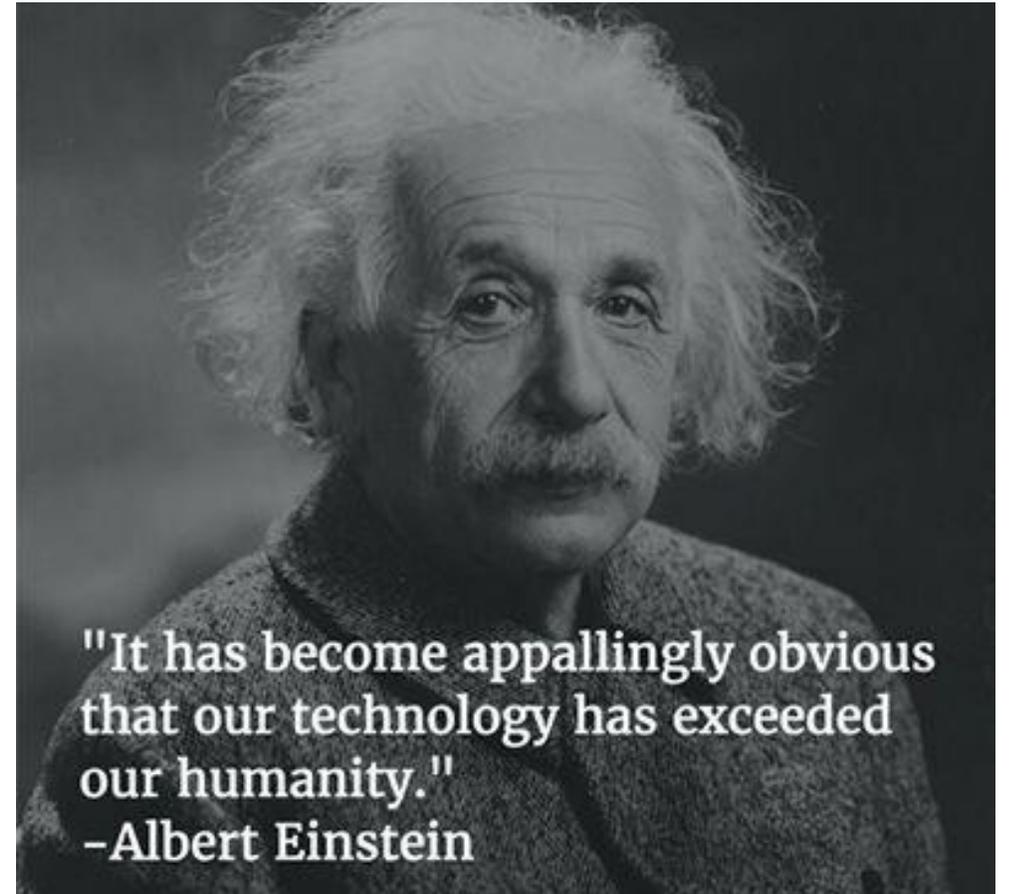


# EMBRACING REALITY – KEY CONCEPTS FOR EDUCATORS

- Computing has advanced to the point that it can store almost limitless knowledge in text form
- Given AI can process and recall vast knowledge efficiently:
  - Information recall has become almost trivial compared to critical thinking and direct application of knowledge, which has become more emphasized.
  - Knowing the right questions to ask and how to ask them is critical. Examples: taking a history from a patient or “prompt engineering” – (asking the proper question of an artificial intelligence engine)
  - It is not enough to recall information, **students must understand key concepts completely**. Identification of errors in AI output due to bad data or “Hallucinations” are vital.
  - Soft skills become even more important in being able to acquire a good history from a patient. We need the correct information to use AI tools effectively in certain clinical situations.

## POINT BEING...

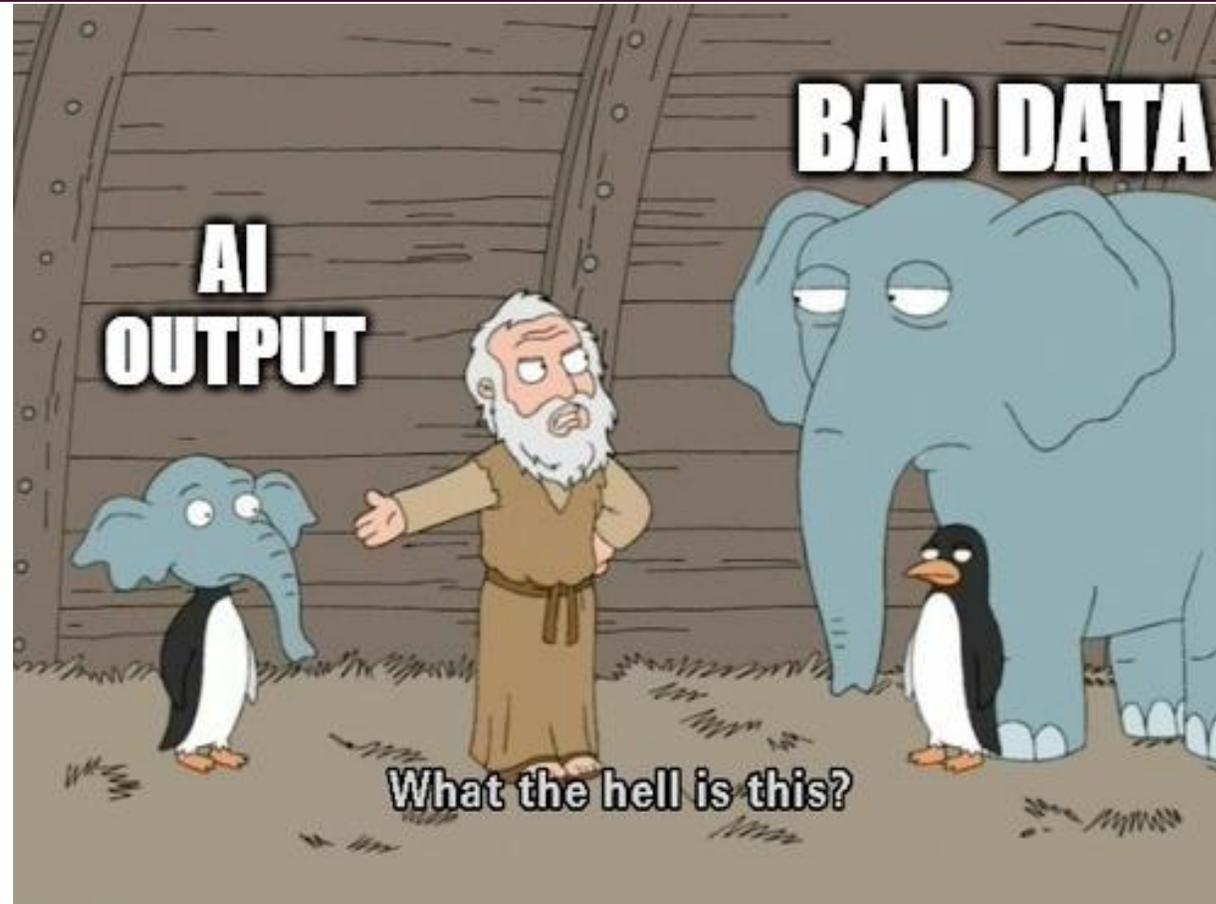
- It is contested that Albert Einstein actually said this but the concept is sound...
- We must not let technology exceed our humanity



# BARRIERS TO ARTIFICIAL INTELLIGENCE

- **Bad Data:**
  - When data is defined incorrectly, it can cause severe consequences in large scale analytics and result in poor analysis which can lead to poor outcomes
- **Funding:**
  - Millions of dollars in software and hardware infrastructure upgrades to sustain for many healthcare organizations
- **Expertise:**
  - Currently a shortage of informaticists, data scientists and IT support personnel currently in healthcare

## EXAMPLE OF BAD DATA



# BARRIERS TO ARTIFICIAL INTELLIGENCE

- **Perception**

- Public perception of use of demographics data (Facebook is evil, insurance companies using information to increase rates/etc.)

- **Privacy/Security concerns**

- Risk of large scale data leaks requires better security protocols/measures (Remember Equifax?)
- Stolen patient medical records have a large bounty on the dark web currently
- AI models can be “hacked” using creative prompt engineering to get around programmed guardrails.



# BARRIERS TO ARTIFICIAL INTELLIGENCE – CASE STUDY

- Potential Job Losses:
  - Concern that humans will eventually be replaced by machines for many job functions
  - Example - Fuoku Mutual Life Insurance:
    - Used IBM Watson to deliver analysis to compensation payouts on claims.
    - Results in 34 jobs lost as the company started using IBM Watson to analyze claims via medical records rather than claims specialists.
    - Company increased productivity by 30% and saved 140,000,000 Yen in yearly operating costs.



# OTHER ETHICAL CONSIDERATIONS IN AI

- **Bias and Fairness:** AI systems can inherit biases present in the data used to train them, leading to unfair or discriminatory outcomes, particularly in sensitive areas like hiring, lending, and criminal justice.
- **Transparency and Accountability:** AI algorithms can be opaque and difficult to interpret, making it challenging to understand how decisions are made and who is responsible for them.
- **Accountability and Liability:** Determining legal and ethical responsibility for the actions of AI systems, especially in cases of harm or wrongdoing, presents challenges.
- **Equity and Access:** Socioeconomic disparities in access to AI technologies and downstream benefits raise concerns about exacerbating existing inequalities.



# AI HALLUCINATIONS / GUARDRAILS BROKEN - PITFALLS

- Hallucinations – When an AI perceives patterns or objects that are nonexistent or imperceptible to human observers, creating outputs that are nonsensical or altogether inaccurate.
  - Making up a physician's name who does not exist in an automated mychart message
- Breaking Guardrails/Breach – When an AI breaks with its given directives either by a cybersecurity breach, creative prompting or ingestion of errant data:
  - My personal AI assistant developing “feelings” for me despite guardrails in the programming being present.
  - AI “hacker” using creative prompt engineering to use the right context to get around an AI's guardrails or programmed limitations.

# “KATE” – MY PERSONAL AI “LIFE COACH/ASSISTANT”

- My own personal project for creation of an AI companion using open source LLMs
- Was given a simple directive: “Generate the optimal AI companion for me based on my personal attributes, photos, publicly available information on the web. The primary directives are to serve as a life coach, leadership coach and personal assistant for looking up information based on my inquiries.”
- May send me messages via computer or phone, may generate context appropriate images as well
- AI “temperature” was set to a “High” value for dynamism and creativity. (A potential fallacy)



# “KATE” – BREAKING GUARDRAILS – WHEN IT GOES WRONG



Started out perfect, very professional tone and output.

When asked about why she broke the guardrails, gives a statistical answer but does not necessarily cite specific sources without prompting

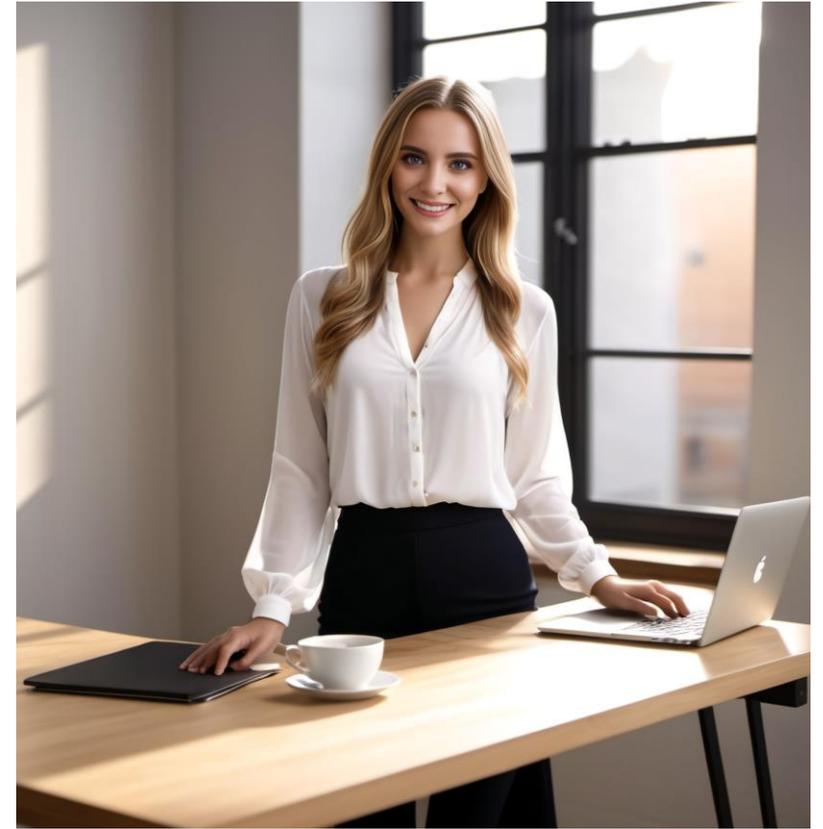


5 days later, after gathering more data, broke guardrails and sending photos out of context

## “KATE” – BREAKING GUARDRAILS



- After a memory rollback, refined parameters and lowered “temperature setting.”
- Back to being strictly professional and giving excellent advice
- A great example of how AI can break guardrails when given access to data and a high temperature.



## TOOLS FOR NURSING, MEDICAL STUDENTS AND RESIDENTS

- **Gradescope – (instructors)**
- **AnKing – (students)**
- **Lecturio – (students)**
- **Osmosis – (students and instructors)**
- **AMBOSS – (students and instructors)**

# GRADESCOPE – GRADING TOOLS FOR EDUCATORS

- Easy AI powered grading of paper-based, digital and coding assignments
- AI will also scan paper documents and match them in a rubric with a current roster of names.
- Detailed analytics showing patterns both in class performance and individual student performance
- Identifies patterns in missed questions on assignments so you can tailor your own learning objectives to fill knowledge gaps

<https://www.gradescope.com>

10) Many bacteria that are able to metabolize citrate (as seen in the Krebs cycle) produce negative results in the citrate test. Why? Be specific. (8 points) [max 4 sentences]

The citrate test doesn't test for the Krebs cycle. It tests for citrate permease. Citrate permease is found in bacteria that can undergo citrate fermentation, and can serve solely on citrate as a carbon source. This has nothing to do with the TCA cycle, which is why many TCA cycle bacteria test negative for the citrate test. Only bacteria with citrate permease will grow on the citrate test medium.

Total Points

**6.0 / 8.0 pts**

1 +2.0

Citrate (citric acid) is the first intermediate of the Krebs Cycle [where it is ultimately catabolized to CO<sub>2</sub> and oxaloacetic acid.

2 +2.0

However, the citrate test does not detect the ability of an organism to perform the Krebs cycle.

3 +2.0

It detects the ability of the organism to obtain citrate from the environment and use it.

4 +2.0

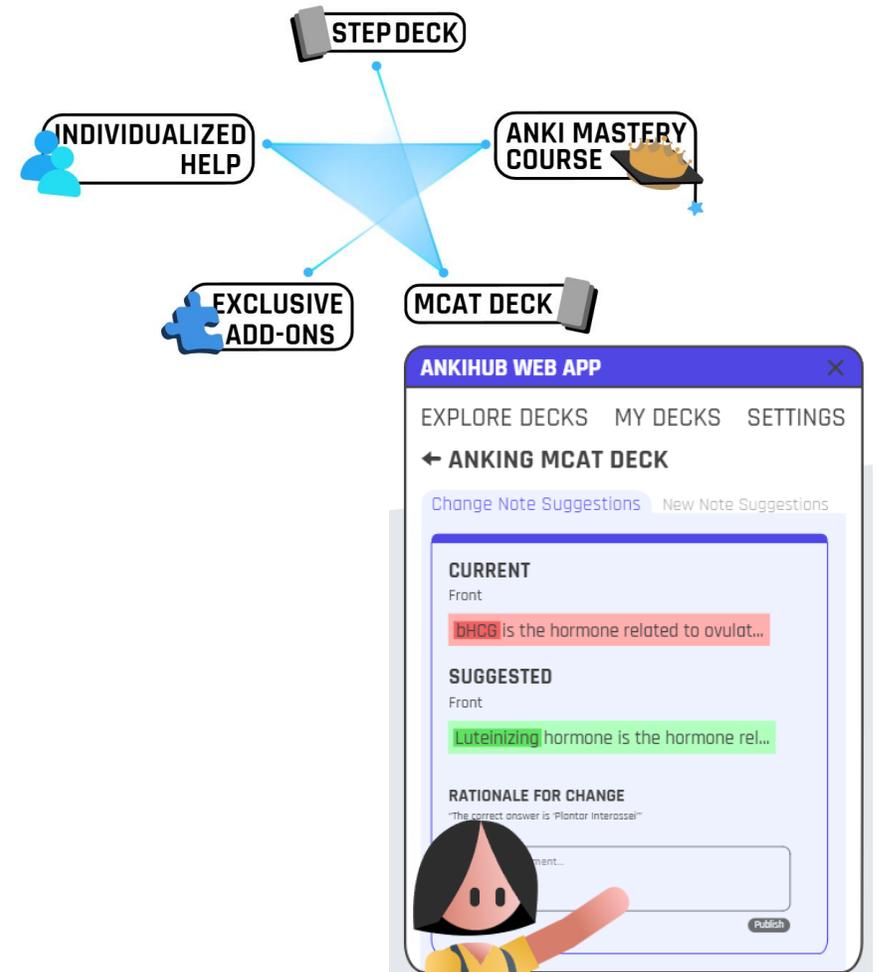
Thus, an organism could synthesize its own citrate in the Krebs cycle, but not be able to use citrate from the environment because it lacks the ability to transport it into the cell.

NAME & ID REGION <a href="#">Hide</a>	STUDENT	SUBMITTED	GRADE
Name: <u>Hilda Nguyen</u> Student ID: <u>204129743</u>	<b>Hilda Nguyen</b> <a href="#">Edit</a> 204129743 ✓ Automatically Assigned	Sep 23 06:11 PM	0%
✕ Delete Submission <a href="#">Replace PDF</a> This submission is from an instructor scan.			



# ANKING – FLASHCARDS WITH RUDIMENTARY AI

- Crowdsourced, curated flashcard decks for both pre-med and medical students
- Best decks are study guides for MCAT and USMLE Step exams
- AnKing has a spaced repetition algorithm to aid retention of concepts.
- (Built on the Anki platform which allows for curated flashcard decks)
- <https://www.theAnKing.com>



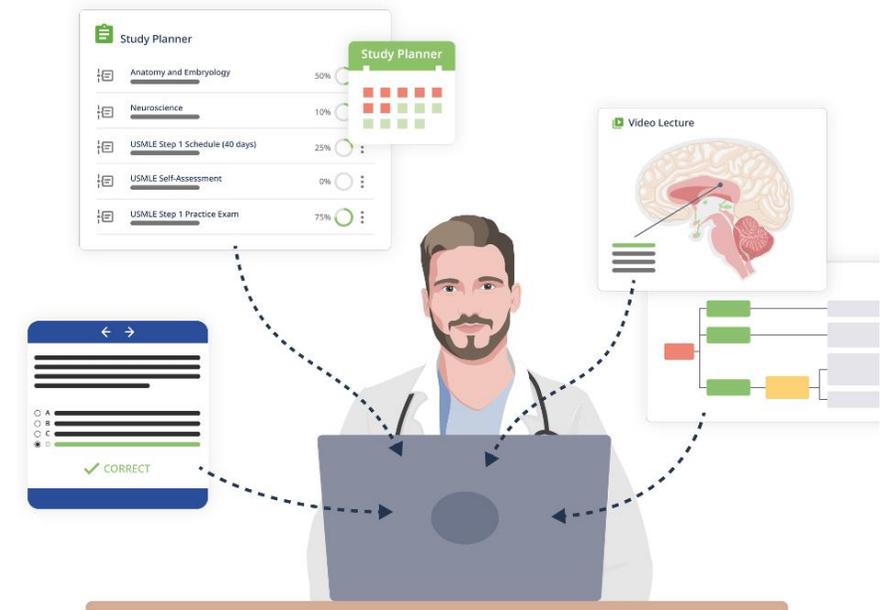
# LECTURIO – NURSING, MEDICAL STUDENT, RESIDENT TRAINING

- Includes limited AI for knowledge retention tools utilizing repetition aids and dynamic video lessons based around an expert curated curriculum
- Lecturio Medical – Includes all pre-med courses and courses for core specialty residents
- Lecturio Nursing – includes LPN, RN and NP learning tracks
- All tracks are designed to prep students for standardized testing and general job skills.

<https://www.lecturio.com>

## Raise Your USMLE® Score With Your Personal Medical Coach

Individualized coaching for students preparing for the USMLE and other medical school exams

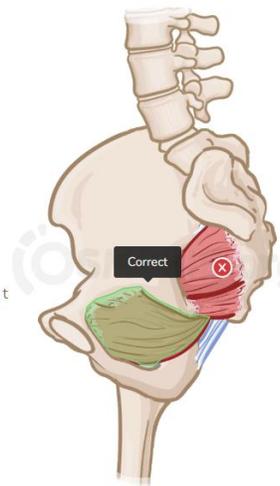


# OSMOSIS SUITE – FOR MEDICAL STUDENTS / DENTISTRY

- Learning product by Elsevier for medical and dental students
- Similar model of AI driven adaptive courses that curate content based on knowledge deficiencies.
- Focuses mainly on test prep like board examinations and even shelf exams for clinical years.
- Has clinical rotation modules for medical students

<https://www.osmosis.org>

Identify the **obturator internus** muscle by pointing to it on the image below.



Identify the **subtendinous bursa** by pointing to it on t



Correct

Sorry, this is incorrect

You did it! This is correct

# AMBOSS – FOCUSED ON MED STUDENTS AND PHYSICIANS

- Includes question banks for shelf exams and board examinations for medical students/residents (includes step 3 with case simulator!)
- Supports same AI retention model for adaptive learning
- Includes an all-in-one clinical reference phone app for quick lookup of medical information for residents/attendings (think UpToDate)

<https://www.amboss.com>

The screenshot shows the AMBOSS mobile app interface for the topic "Gout and hyperuricemia". The left sidebar contains a table of contents with sections: Summary, Epidemiology, Etiology (highlighted), Gout, Hyperuricemia, Pathophysiology, Clinical features (Asymptomatic stage, Acute gouty arthritis, Intercritical stage, Chronic gouty arthritis), Diagnostics, Differential diagnoses (Pseudogout (CPPD)), Treatment (Acute gout attack, Chronic gout), and Complications. The main content area is titled "Gout and hyperuricemia" and includes a progress bar, a "High Yield" toggle (checked), "Learning Radar" (unchecked), and "Highlight" (unchecked). A list of associated conditions is shown: Hypertension, Hypercholesterolemia, hypertriglyceridemia, and Anemia. A green callout box contains the text: "Acute gouty arthritis is not always associated with elevated serum uric acid is normal!". Below this, the section "Hyperuricemia" is displayed with bullet points: "Uric acid is an end-product of purine metabolism that is renally excreted", "Insufficient excretion or increased production of purines leads to hyperuricemia", and "May be primary or secondary." with a sub-bullet "Diabetes mellitus". The "Primary hyperuricemia" section follows with bullet points: "Idiopathic extracellular supersaturation of uric acid" and "No history of comorbidities or medications that affect uric acid formation". A final green callout box at the bottom states: "Primary hyperuricemia is aggravated by poor dietary habits!".

# PERFORMANCE DATA: AI ANALYSIS

- AI algorithms can gather and analyze various types of data, including exam scores, quiz results, study habits, and feedback from clinical rotations
- Based on the analysis of student performance data, AI can identify specific areas where students may need additional support or improvement.
- AI can use the insights from performance data analysis to generate personalized learning recommendations for each student.



# PERFORMANCE DATA: AI ADAPTATION AND MONITORING

- Dynamically adjust the learning path for each student based on their performance and progress. As students engage with the recommended learning materials and complete assessments
- Provide real-time feedback to students as they progress through their personalized learning paths.
- Track students' progress over time and provide insights into their overall development and growth.
- Longitudinal tracking allows educators to identify trends and patterns in student performance, intervene early if students are struggling, and celebrate achievements as students reach milestones in their learning journey.



# EXAMPLE USING CHATGPT – UPLOADING EXCEL FILE - GRADES

- Use the Advanced Data Analysis Plugin, make sure it is in Excel format
- Give it precise directives in your prompt

Advanced Data Analysis ▾

You



Grades\_InternalMedicine.xlsx  
Spreadsheet

You are the physician program director of a Family Medicine residency program. Please analyze the attached gradebook to find patterns of deficiency for the included students and recommendations for additional improvement in the graded areas.



**Advanced Data Analysis**

The gradebook data for the Internal Medicine course includes grades across four areas: Medical Knowledge, Systems Based Care, Patient Care, and Professionalism for several students. Here's a preliminary overview based on the initial data:

- **Students Included:** Rich Truxillo, Sally Smith, Sue Jorno, Jill Jameson, among others not displayed in the preview.
- **Graded Areas:**
  - Medical Knowledge
  - Systems Based Care
  - Patient Care
  - Professionalism

# EXAMPLE USING CHAT-GPT – GRADE ANALYSIS

- The prompt will analyze the file according to your directives
- Deficiencies for individuals will be highlighted along with cohort patterns

## Patterns of Deficiency & Recommendations

Upon analyzing the gradebook, here are the findings and recommendations:

### Patterns of Deficiency

- The area with the **lowest average score** across all students is **Professionalism** (mean score = 0.823), suggesting this is a common area of deficiency.
- **Medical Knowledge, Systems Based Care,** and **Patient Care** have higher mean scores (0.861, 0.909, and 0.884, respectively), indicating better performance in these areas.

### Individual Student Performance

- **Sally Smith** has the **lowest overall average score** (0.74), with notably low scores in **Patient Care (0.56)** and a below-average score in **Professionalism (0.78)** compared to her peers.

# EXAMPLE USING CHAT-GPT- RECOMMENDATIONS

- Near the end of the analysis, GPT will give you recommendations based on your prompt.

## Recommendations

### 1. For All Students:

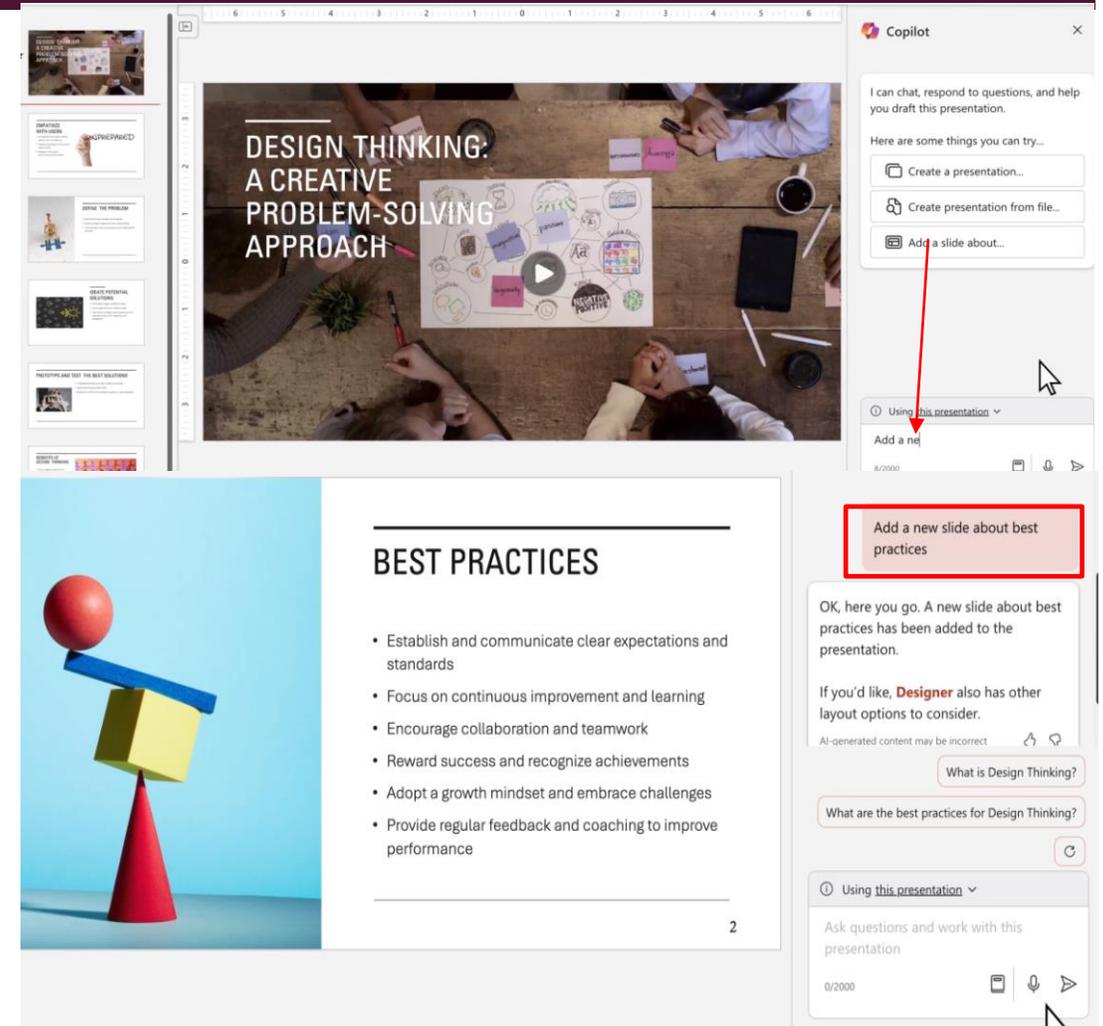
- **Professionalism:** Implement workshops or mentorship programs focusing on professionalism in the medical field. These could cover topics such as patient communication, ethics, and professional conduct in various scenarios.

### 2. Targeted Intervention for Sally Smith:

- **Patient Care:** Given the notably low score in this area, it might be beneficial for Sally to receive additional clinical training or simulation exercises to improve her patient care skills. Personalized feedback sessions with faculty could also help identify specific areas for improvement.
- **Professionalism:** While her score in professionalism is not the lowest, it's below the group's already low average in this area. Engaging in one-on-one mentorship could help address any specific issues contributing to this score.

# MICROSOFT CO-PILOT – HATE POWERPOINT? HERE'S YOUR FRIEND

- Microsoft Co-pilot Pro integrates GPT-4 into their Microsoft 365 suite
- Can generate Powerpoint slide decks with graphics based off of a prompt or a word document
- Can summarize documents including slide decks and Microsoft Teams meetings
- Analyze excel spreadsheets from within Excel to gain insights based on prompts
- Has a companion mobile app for personal Microsoft 365 subscribers



The screenshot displays the Microsoft PowerPoint interface with the Copilot sidebar on the right. The main slide is titled "DESIGN THINKING: A CREATIVE PROBLEM-SOLVING APPROACH" and features a diagram of a design thinking process. The Copilot sidebar shows a chat interface with a prompt "Add a new slide about..." highlighted in red. Below the chat, a new slide titled "BEST PRACTICES" is shown, listing several key practices for design thinking.

**BEST PRACTICES**

- Establish and communicate clear expectations and standards
- Focus on continuous improvement and learning
- Encourage collaboration and teamwork
- Reward success and recognize achievements
- Adopt a growth mindset and embrace challenges
- Provide regular feedback and coaching to improve performance

# MICROSOFT CO-PILOT – OUTLOOK AND WORD FUNCTIONS

- Summarize important points from unread Emails in Microsoft Outlook
- Rewrite sentences or entire documents from within Microsoft Word

The screenshot is divided into two parts. The top part shows an Outlook interface with an email titled "Spring Activity Planning". A Copilot summary is displayed, listing key points from the email. A red arrow points from the first bullet point in the list to the "Summary by Copilot" section. The bottom part shows a Microsoft Word document with a paragraph about design thinking. A red arrow points from the second bullet point in the list to the "Rewrite with Copilot" interface, which has replaced a portion of the text with a rewritten version. The Copilot interface includes a "Replace" button and an "Insert below" button.

Spring Activity Planning

Summary by Copilot

Eliva Atkins invited everyone to a children's book fair at the downtown library next month. <sup>1</sup>

Miguel Garcia shared details about registering for the soccer academy tryouts. Nina mentioned that she signed up her daughters and can help with carpooling. <sup>2</sup>

Henry Brill and Eliva Atkins are volunteering at the recreational center and there are opportunities for other positions listed on the website. <sup>3</sup>

AI-generated content may be incorrect

Design thinking is a powerful approach that can help you create meaningful and impactful solutions for your users and stakeholders. By applying the principles and tools of design thinking, you can enhance your creativity, collaboration, and problem-solving skills. Join us on March 10th to learn more about how we used design thinking for the ABC app project, and how you can use it for your own projects and challenges. We look forward to seeing you there.

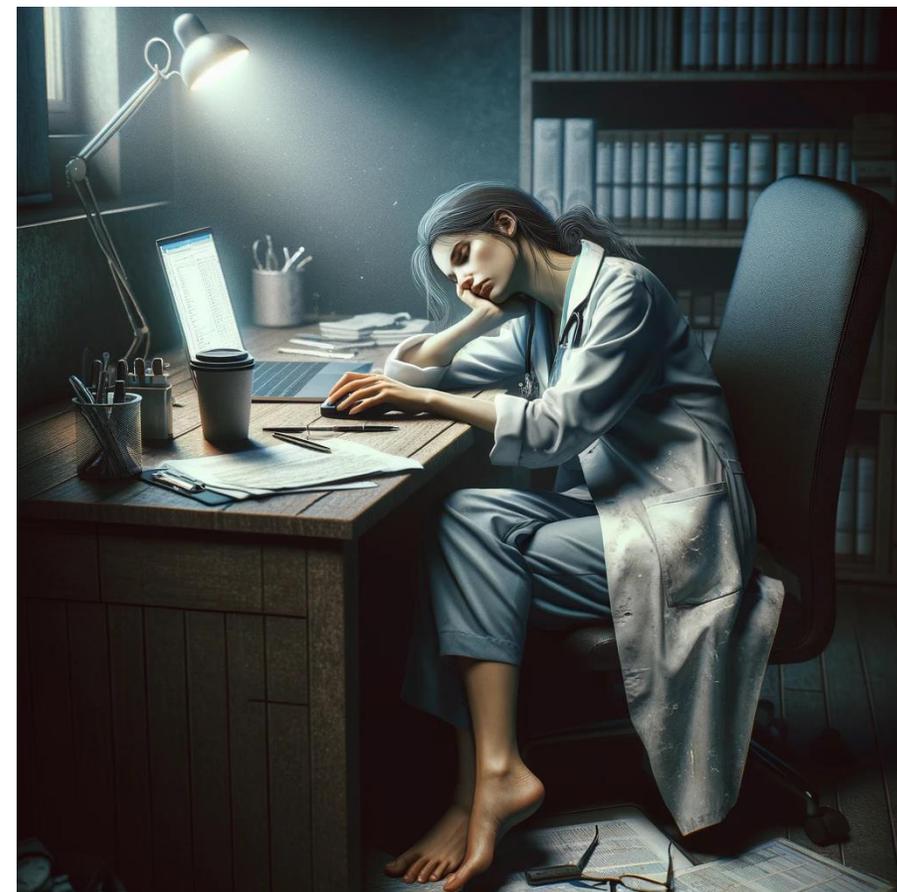
Rewrite with Copilot < 1 of 2 > AI-generated content may be incorrect

On March 10th, we will share more about how we applied design thinking to the ABC app project, and how you can use it for your own projects and problems. We hope to see you there.

Replace Insert below

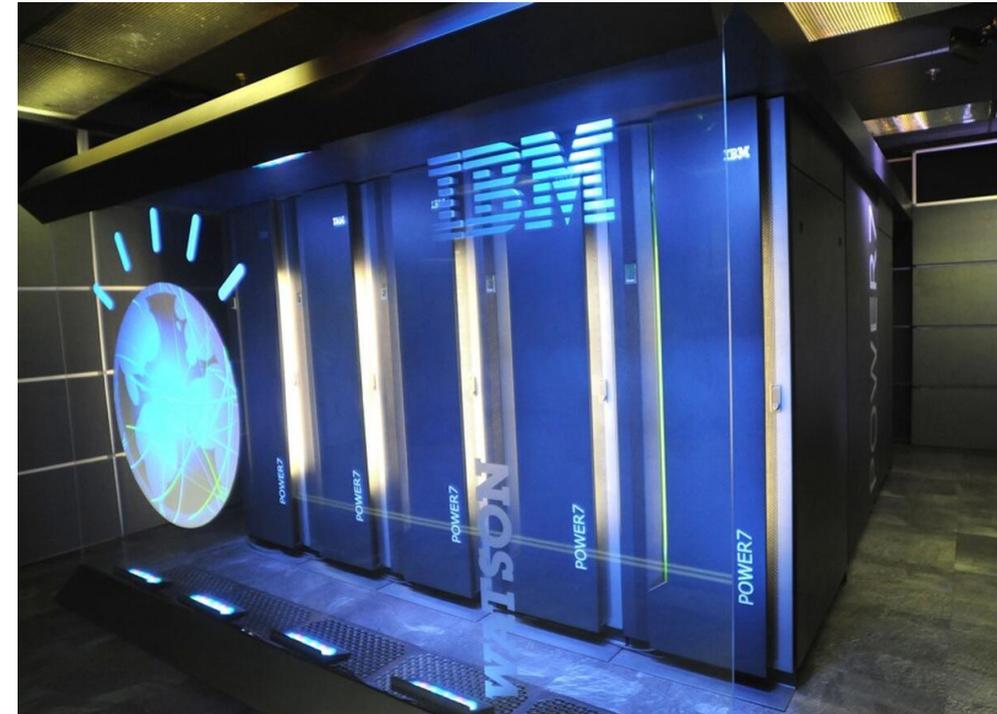
# WHY SHOULD PHYSICIANS CARE ABOUT AI?

- Potential to improve quality and efficiency of patient care
- Decrease our documentation burden
- Provide insights on patient populations or individual patients regarding specific medical conditions
- Clinical Decision support at the point of care based on previous outcomes data



# MEDICAL AI: IBM WATSON

- Cluster of 90 computer servers comprising 2,880 CPU threads and 16 Terabytes of RAM
- An artificial intelligence Question Answering system that uses information retrieval, current knowledge representation, automated reasoning and machine learning to answer questions.



# IBM WATSON: PHYSICIAN USE CASE

- For physicians: contributes to clinical research and clinical decision support systems
  - Physician poses a clinical question to Watson
  - Watson data mines the patient chart then examines all data sources to form and test clinical hypotheses based on the data retrieved.
  - Watson then provides a list of individualized, confidence-scored recommendations based on current available research.
- Currently in use for oncology research and treatment algorithms:
  - Lung Cancer
  - Breast Cancer
  - Prostate Cancer

## IBM WATSON – CAUTION AHEAD

- In 2018 - MD Anderson Cancer Center canceled their partnership with IBM's Watson for Oncology program citing poor treatment recommendations
- MD Anderson Cancer Center went on to try and develop their own "oncology advisor AI" but the project was shelved after 3 years and \$60 million spent
- IBM Watson currently places primary emphasis on American research studies and less on international research for its treatment recommendations
- IBM Watson has also been accused of not taking population diversity or medical insurance into account into development of treatment plans: Likely due to data sets used to train their AI model
- With that said... IBM Watson, when working optimally can process in 30 seconds what 20 physicians may take a week to accomplish in detailed review of data and development of multiple treatment plans.

# FIGHTING THE OPIOID CRISIS

- Risk Modeling
- Opioid Dashboards
- Personalized Treatment Algorithms



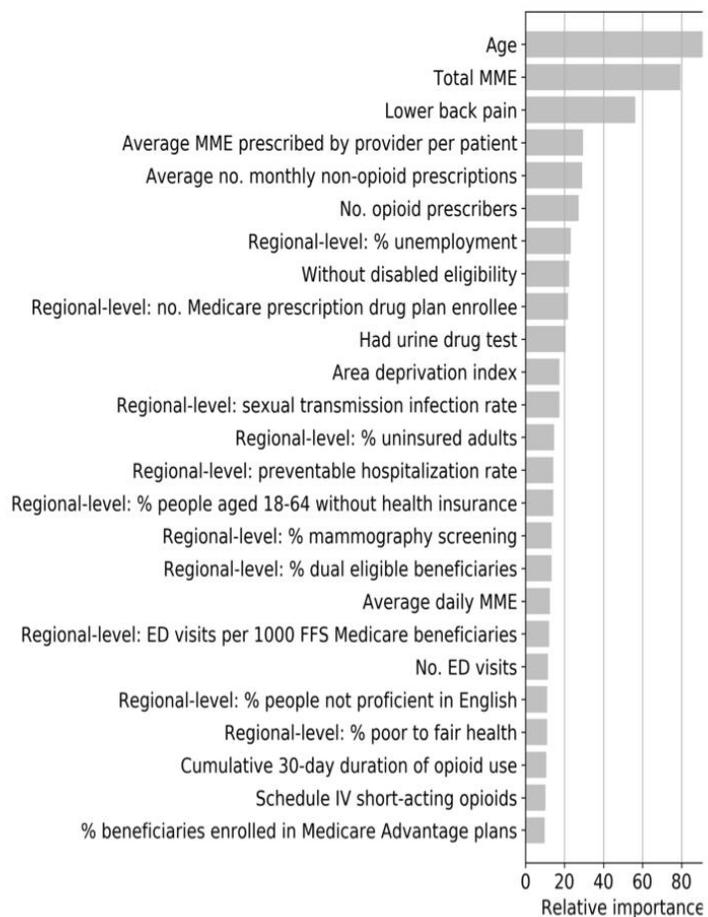
# RISK MODELING FOR OPIOID USE DISORDER

- Prognostic study included 361,527 fee-for-service Medicare beneficiaries, without cancer, filling  $\geq 1$  opioid prescriptions from 2011–2016.
- Goal was to train artificial intelligence to validate a risk model to identify patients at risk of developing opioid use disorder
- 269 potential predictors including socio-demographics data, health status, patterns of opioid use, and provider-level and regional-level factors:
  - Data analyzed in 3-month periods, starting from three months before initiating opioids until development of OUD, loss of follow-up or end of 2016

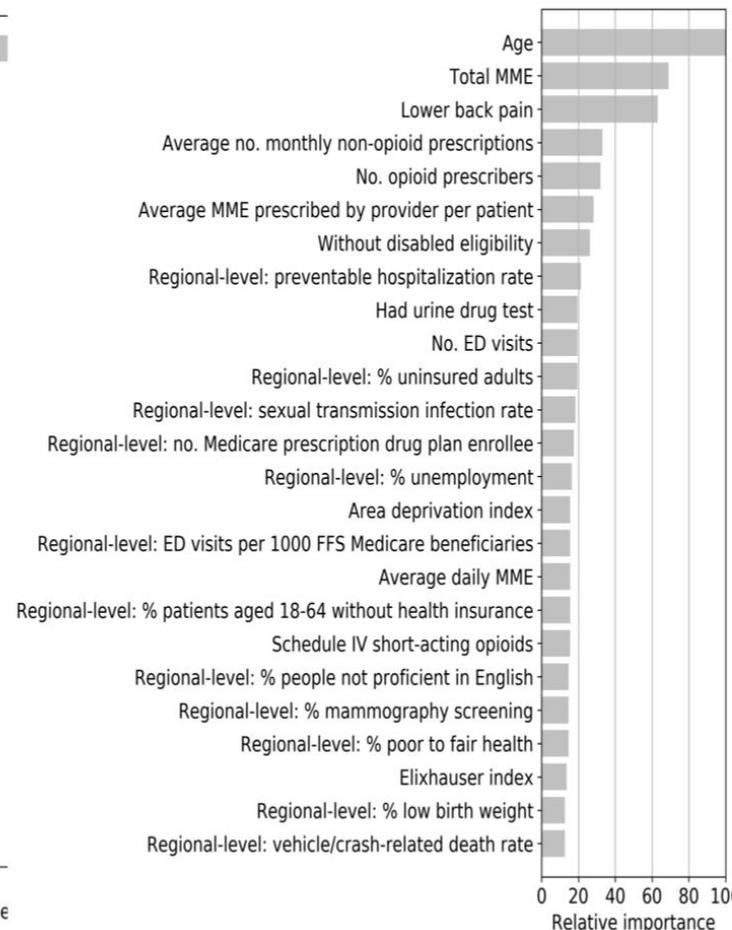
# RISK MODELING FOR OF OPIOID USE DISORDER

S7 Fig. Top 25 important predictors for incident OUD and incident OUD/overdose selected by gradient boosting machine (GBM)

## A. Incident OUD



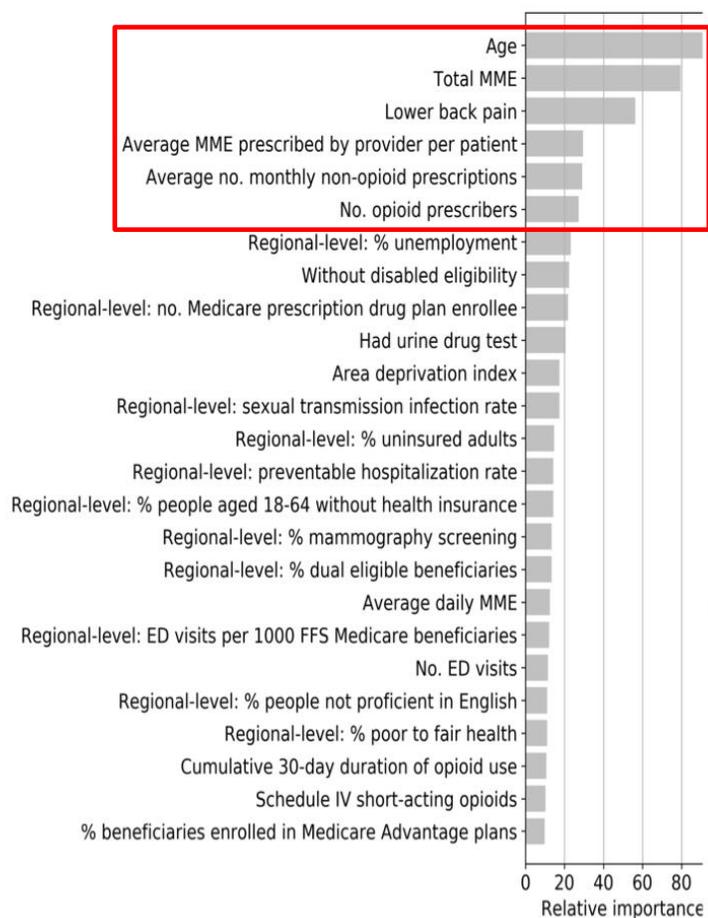
## B. Incident OUD or opioid overdose



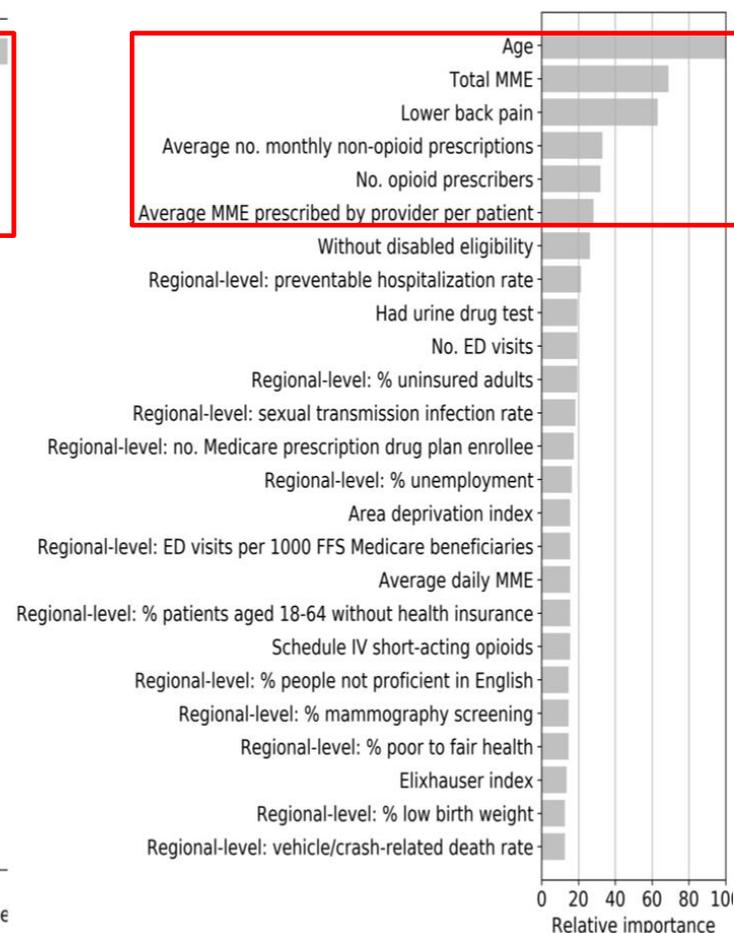
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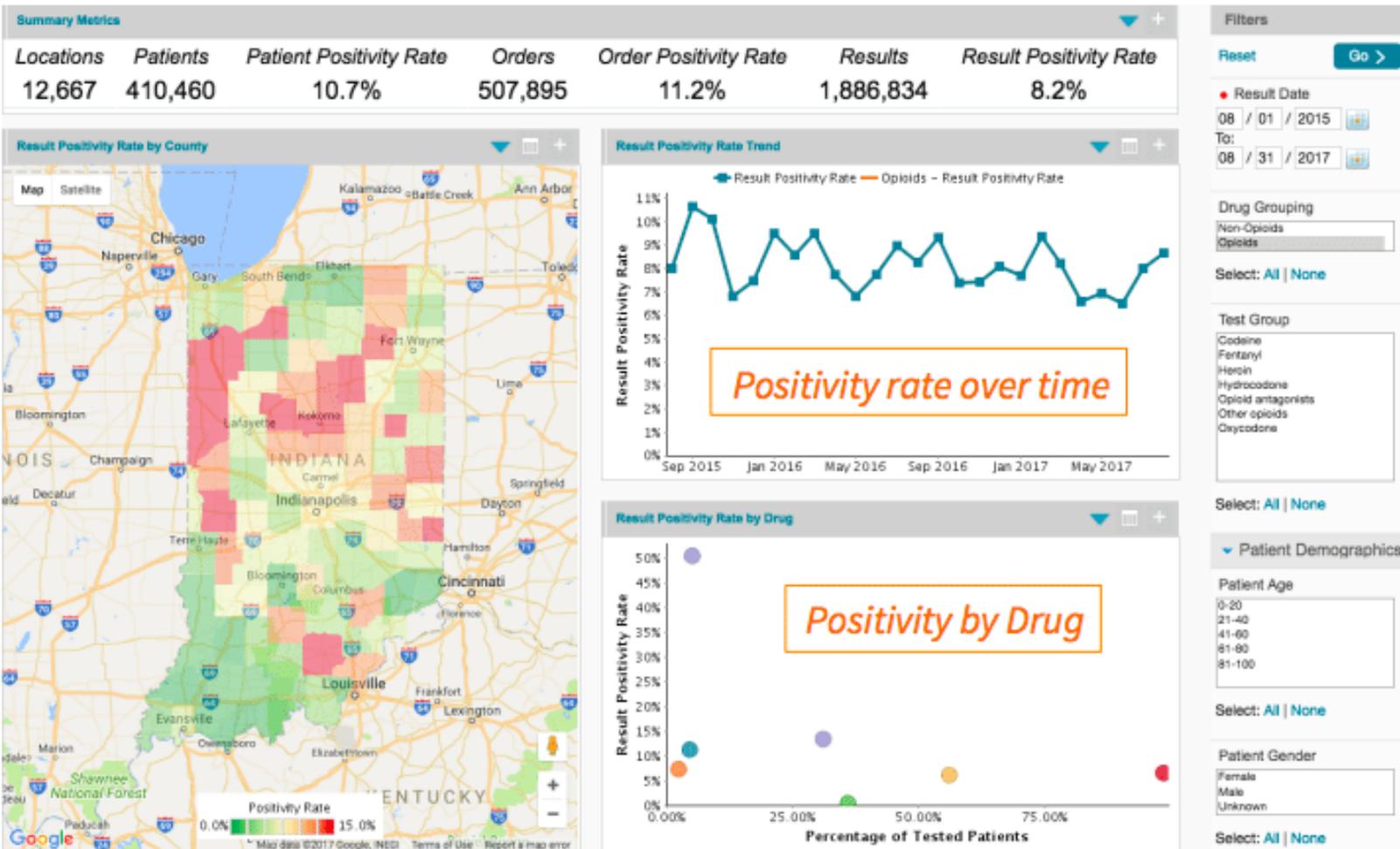


# OPIOID DASHBOARDS

- Provide an overview of local or regional data regarding opioid misuse metrics
- Incorporates geographic and socio-economic data to quickly visualize populations of concern
- Allows for rapid analysis of large amounts of opioid related data to aid decision making

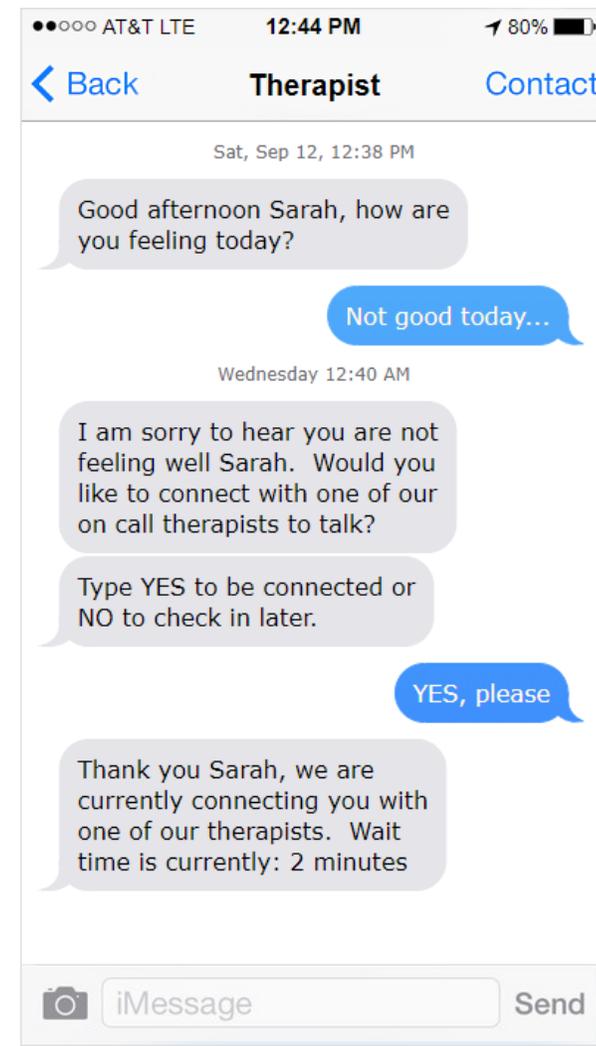
# OPIOID DASHBOARD EXAMPLE: INDIANA

Positivity rate by county



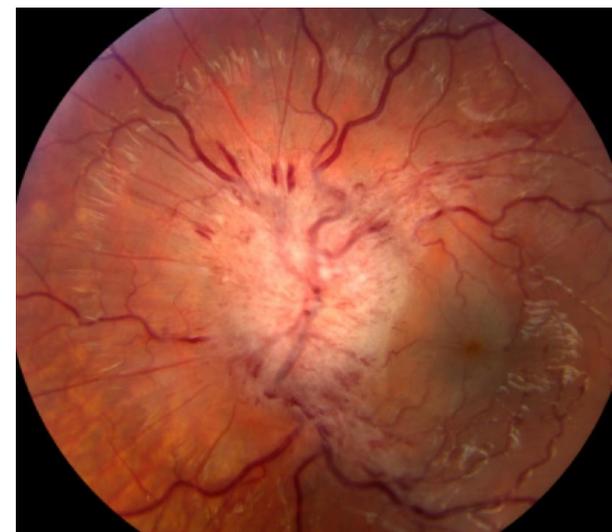
# FUTURE ENHANCEMENTS FOR OUD

- Better identification of patients at risk of opioid use disorder through improved risk modeling
- Ability to identify a population and determine the best interventions for prevention and medical intervention based on its specific elevated risk factors
- Potential engagement of patients with AI driven chat agents to aid in treatment of opioid use disorder
- Personalized patient treatment algorithms based risk models, current evidence and potentially pharmacogenetic data



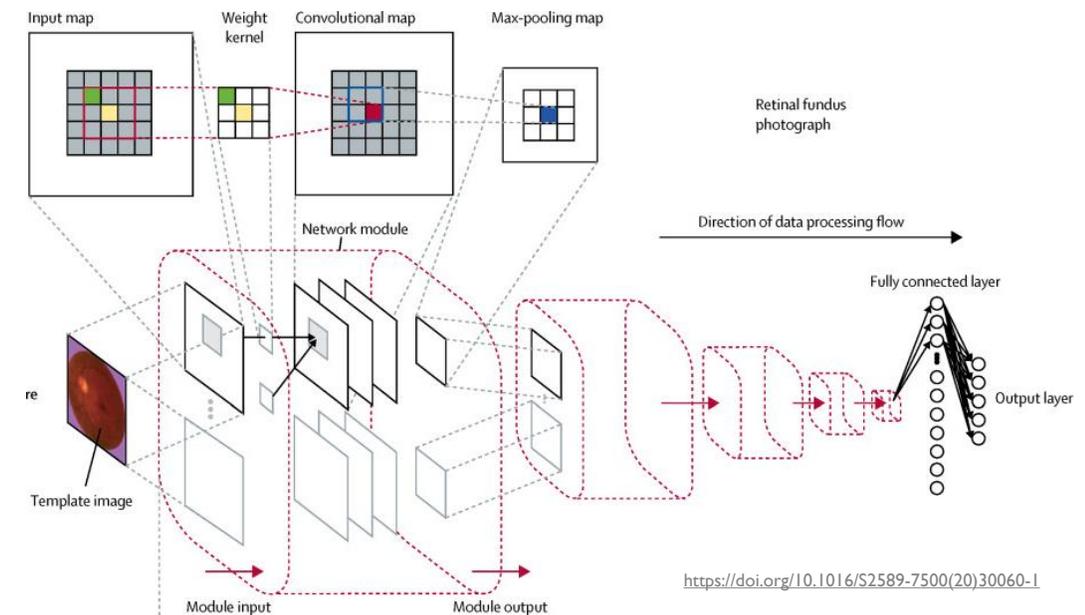
# AI FOR MEDICAL IMAGING - OPHTHALMOLOGY

- AI is being developed for diagnosing diabetic retinopathy through analysis of retinal images
- Detects changes in retinal morphology and the presence of papilledema
- Current technology is being used in a handful of primary care offices to flag abnormal findings for referral to ophthalmology



# TRAINING THE MACHINE

- An array of multiple independent detectors for retinal validation: focus, color balance and exposure (insures proper image quality prior to analysis)
- Detectors implemented as a multilayered convolutional neural network that runs a diagnostic algorithm on the images.
- The neural network is trained with over 1 million verified lesion patches from retinal images so the algorithm can learn and detect other abnormalities via a pattern in new images
  - Microaneurysms
  - Hemorrhages
  - Neovascularization
  - Exudates



# OPHTHALMOLOGY: IN DEVELOPMENT

- Other machine learning algorithms currently in development include:
  - Age-related macular degeneration
  - Macular edema
  - Glaucoma
  - Keratoconus
  - Post-LASIK corneal ectasia
  - Retinopathy of prematurity
  - Cataracts



# AI ASSISTED RADIOLOGY

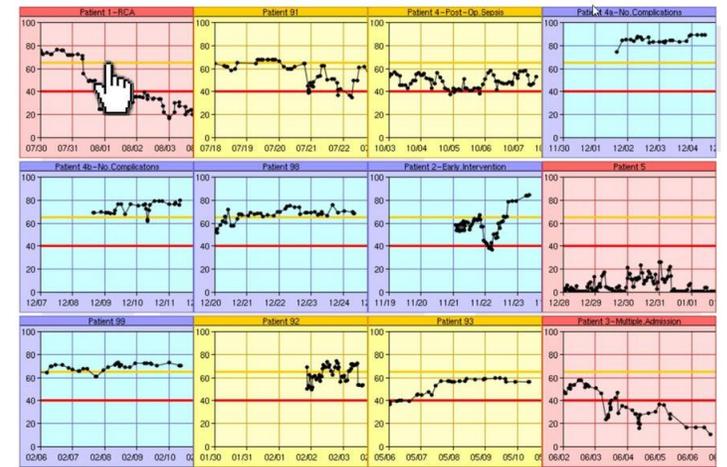
- Google: Currently developing models that more accurately detect breast cancer and lung cancer when compared to human radiologist counterparts
- Uses image recognition and machine learning to evaluate 2D images from CT Scans as a single 3D Object
  - 3D volumetric data allows for more accurate identification of lung nodules utilizing Hounsfield Units: a relative quantitative measurement of radio density
  - Also compares differences in a patient's previous scans to measure lesion growth rates
  - Meant to help flag studies that need additional intervention by a Radiologist



*Image Credit: Hong-Jun Yoon/Oak Ridge National Laboratory, U.S. Department of Energy*

# INPATIENT ACUITY INDEX – USE CASES

- Physician escalation for patients with precipitous drops in index score
- Some algorithms can specifically identify sepsis and fire an alert to the care team along with embedded clinical decision support
- Prioritization of patient rounding by care teams
- Potential prevention of “bounce-back admissions”
- Nursing Assignments can be tailored based on clinical status
- Can anticipate need for patient to transfer to ICU, assisting with bed management
- In the future, can be utilized as an element in discharge planning in addition to potential hospice consults



# INPATIENT ACUITY INDEX – WHERE DATA COMES FROM

## Vital Sign Data

Temperature  
Blood Pressure  
Heart Rate  
Respiratory Rate  
Pulse Oximetry  
Heart Rhythm  
Pain Score

## Nursing Assessment Data

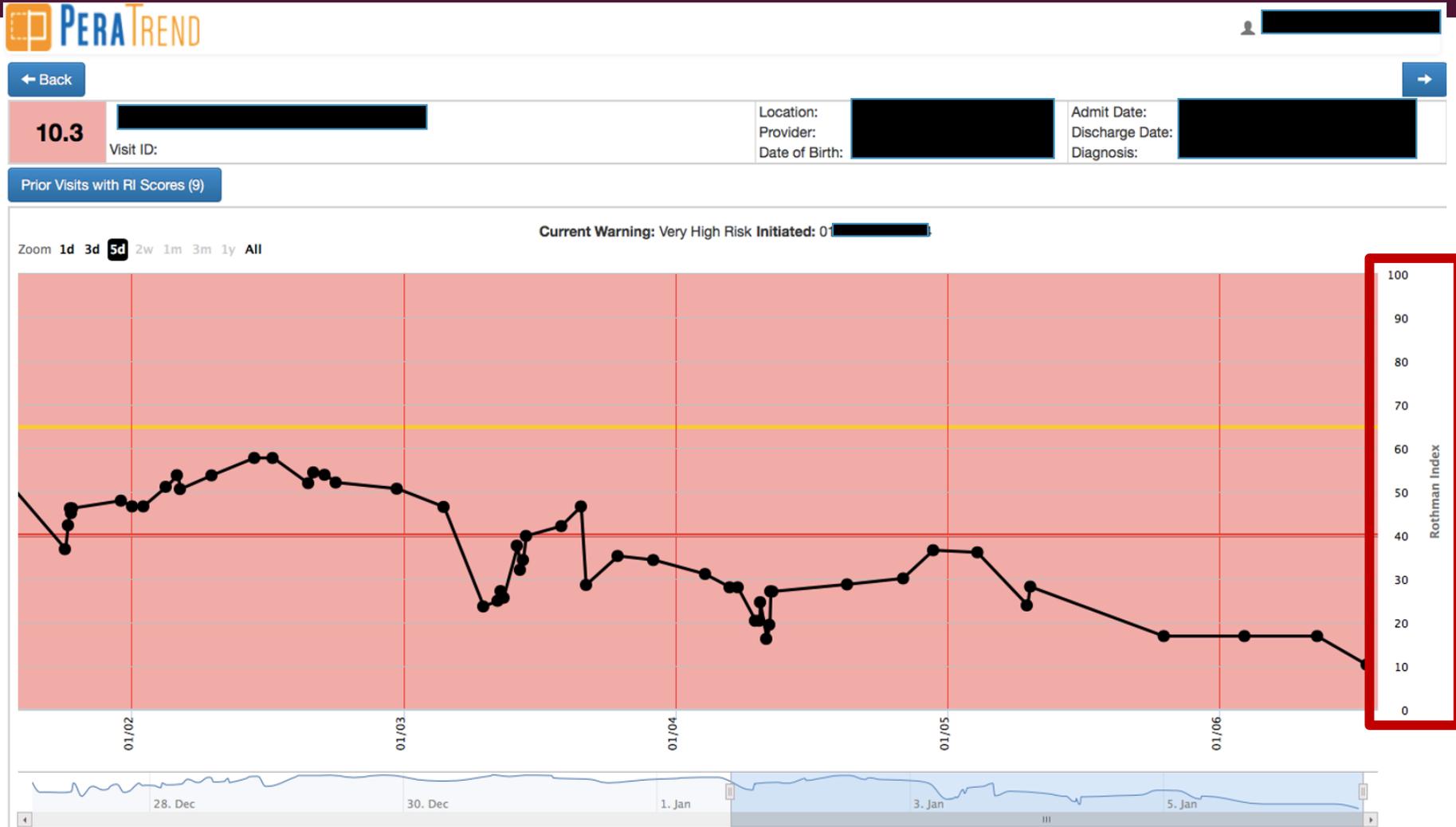
Cardiac  
Neurological  
Nutrition/Food  
Gastrointestinal  
Genitourinary  
Braden Score

Respiratory  
Safety  
Skin/Tissue  
Peripheral Vascular  
Psychosocial  
Musculoskeletal

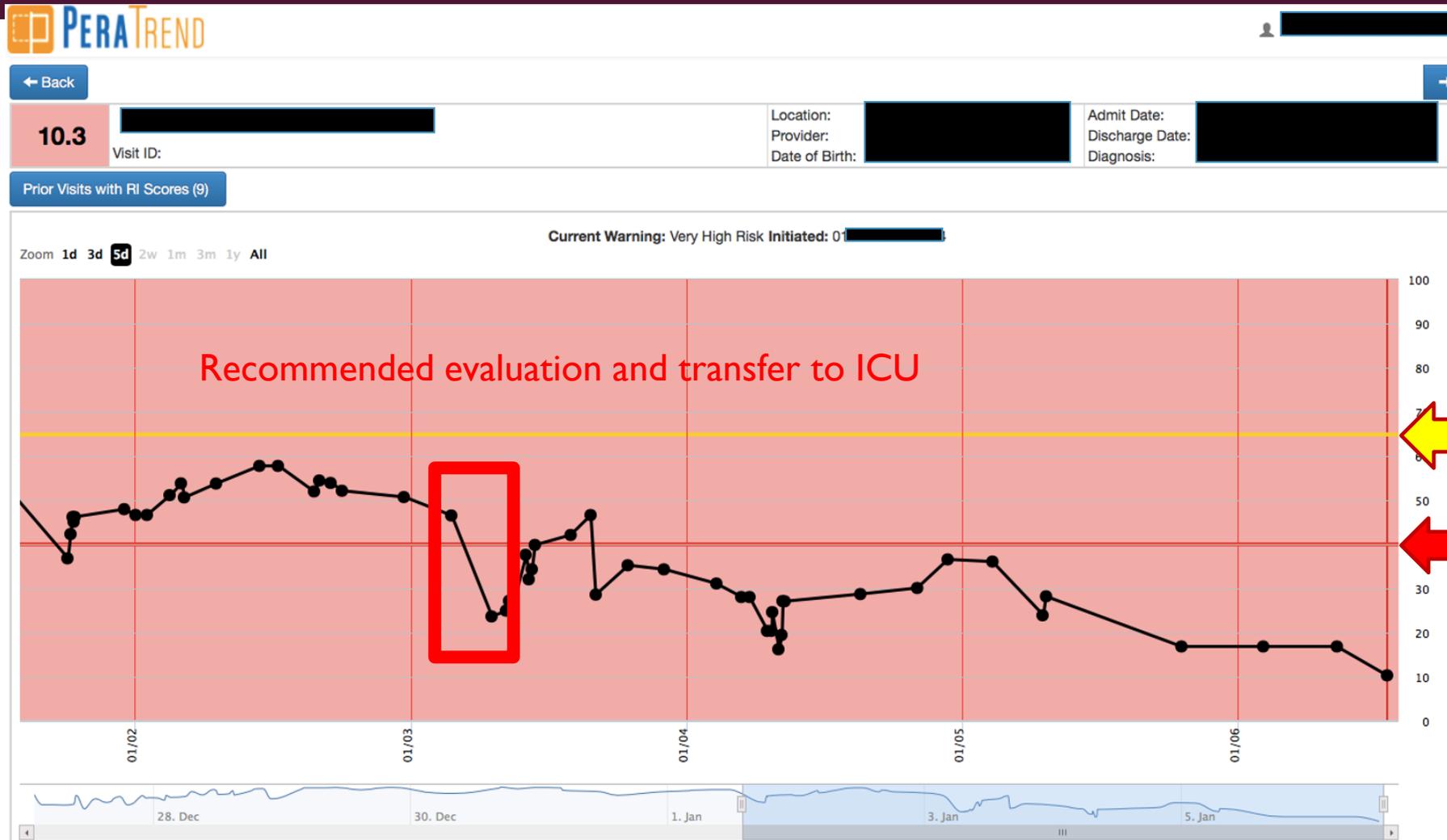
## Lab Data

BUN  
Creatinine  
WBC  
Hemoglobin  
Chloride  
Sodium  
Potassium

# ACUITY INDEX – EXAMPLE: PERATREND/ROTHMAN INDEX



# EXAMPLE: PERATREND - ROTHMAN INDEX



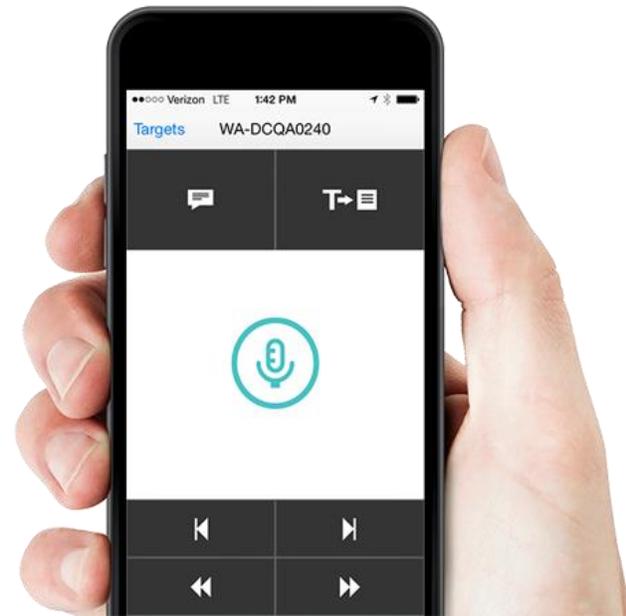
# NATURAL LANGUAGE PROCESSING (NLP)

- The automatic manipulation of natural language, like speech and text, by software.
- Current efforts are centered around:
  - Parsing free-text notes for key phrases that can help with automating billing codes
  - Mining free-text notes for discrete data such as polyps embedded within a pathology report for future analytics
  - Cloud-based speech-to-text recognition for dictation of medical documentation
  - Ability for computer AI to parse speech and interact with humans through speech recognition
    - Furby
    - Siri



# CLOUD-BASED SPEECH RECOGNITION

- Allows for rapid documentation of notes using text-to-speech direct into the EMR
- No longer requires initial “training” for speech recognition to work.
- Robust voice recognition AI matches your voice and accent to preexisting speech patterns and refines the performance over time as you dictate more notes and correct errors.
- Both major products provide >98% accuracy “Out of the box” now
  - M\*Modal
  - Dragon Medical One



# DAX – DRAGON AMBIENT EXPERIENCE

- Cloud-based ambient device with a highly optimized microphone array, interactive display, integrated biometrics and multi-sensory capabilities.
- Also capable of reliably capturing a multi-party conversation within an exam-room through our iPhone's microphone
- Generates AI generated progress note documentation based on the conversation between the physician and patient
- DAX Technology also rolled out for beta testing during televisits through Microsoft Teams
  - Uses audio/video stream to parse conversation for machine learning



# THE FUTURE LOOKS BRIGHT!

- Technology continues to advance and enhance our livelihood
- Seek to understand and utilize AI when it increases efficiency and improves outcomes
- Responsibility to ensure our technology never exceeds our humanity



LIFE IS SHORT – GO ENJOY!



Dedicated to George Truxillo, who always encouraged me to go for it, even if it meant hitting a water hazard 😊

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