



# Unveiling the Lab of the Future with an AI-Powered LIS

Revolutionizing Workflows with AI

**Stacia Sump**

Global Product Director, AI and Data Science

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**clinisys**



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# Unveiling the Lab of the Future,

with Gen AI-Powered LIS

## Agenda

AI Evolution

Classic Lab Challenges

Gen AI-powered LIS Potential

Challenges and Considerations

Clinisys Gen AI Usage Roadmap

Gen AI-Powered Lab of the Future

Q&A and Discussion



Image generated using Copilot via DALL-E

# AI Evolution: fueled by storage, compute advancements & \$\$

## “Artificial Intelligence” – 1956

‘AI’ term coined at Dartmouth workshop

## Rule-Based Systems – 1960s & 1970s

Example: ELIZA Chatbots mimics human communication

## Expert Systems – 1980s

Example: Carnegie Mellon’s R1 configuration tool used by Digital Equipment Corp

## Machine Learning – 1990s

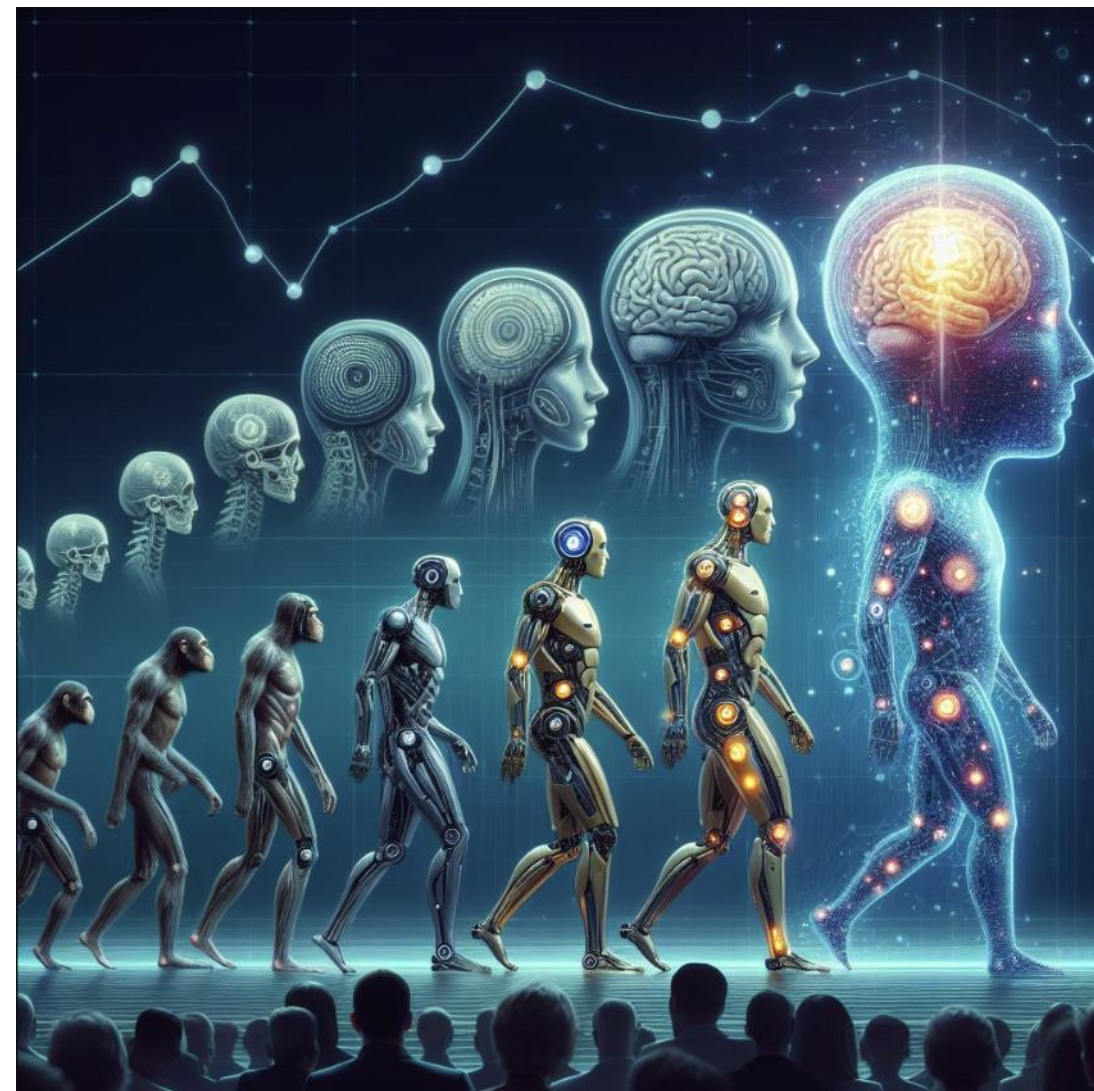
Example: IBM’s Deep Blue beats world Chess Champion, Garry Kasparov

## Deep Learning – 2000s & 2010s

Examples: Natural Language Processing – IBM Watson wins Jeopardy!

## Large Language Models (LLMs) and Gen AI – 2020s

Examples: Chat GPT, DALL-E



# LLMs and GenAI Terminology

- **Bias** is the tendency for AI to replicate the prejudices and disparities inherent in the data it was trained on
- **ChatGPT** is arguably the most popular generative AI system out there at the moment. It takes OpenAI's foundation model, GPT, and tunes it for use in a chat interface
- **Fine tuning** is the act of further training a foundation AI model in order to make it more suited to a specific task
- **Hallucination** is the tendency for LLMs to produce coherent but factually incorrect text
- **Prompt** is the text a user provides to a generative AI to begin its output
- **Prompt engineering** is the practice of experimenting with different prompts to get better outputs

Source: <https://faculty.ai/blog/your-essential-guide-to-genai-terminology-the-top-words-to-know/>



# LLM

## Large Language Models

- Neural Networks
- Trained on Massive amounts of Data
- Used for Understanding and Generating Human-like text



# GenAI

## Generative AI

- Trained on LLMs
- Learns from examples
- Generates content  
(text, images, music, etc.)

SS

You

write me a song about Artificial Intelligence



ChatGPT

Sure! Here's a song about the wonders and complexities of artificial intelligence, styled as a modern pop piece:

### Verse 1

In a world of zeros, floating through the binary sea,  
Silent whispers in the circuit, telling secrets to me.  
Dreaming in the data, learning through the night,  
Painting thoughts from shadows, turning darkness into light.

### Chorus

Oh, AI, you're the mind within the machine,  
From the echoes of our voices, you're the unseen dream.  
Crafting worlds from words, a dance of code and light,  
AI, oh AI, you bring the stars to the night.

### Verse 2

With each query you're evolving, underneath the silicon skies,  
Mirroring the world, with those electric eyes.  
From the rhythms of a heartbeat to the lan( ↓ )e of the soul,  
You find the patterns hidden deep, making broken visions whole.

55 You

show me sheet music for this song so I can play it on the piano

ChatGPT

Let's create a simple melody and chord progression for the chorus of the song about artificial intelligence. This will be suitable for playing on the piano.

### Chorus Sheet Music

Key: C Major

Tempo: 120 BPM



Lyrics	Chords
(C) Oh, AI,	C
you're the (Am) mind	Am
within the (F) machine,	F
From the (G) echoes	G
of our (C) voices,	C
you're the (Am) unseen	Am
dream. (F)	F
Crafting (G) worlds	G
from (C) words,	C
a dance of (Am) code	Am
and light, (F)	F
AI, oh (G) AI,	G
you bring the (C) stars	C
to the (G) night.	G

# Example: ChatGPT – Prompt & Response

<https://chat.openai.com/>



## Prompt:

What is the normal reference range set for a CBC laboratory test?



## ChatGPT

A Complete Blood Count (CBC) test measures several components of your blood, and the reference ranges can vary slightly depending on the laboratory's methods and equipment. However, here are general reference ranges for common measurements in a CBC:

### 1. White Blood Cell Count (WBC):

- Adults: 4,500 to 11,000 cells per microliter of blood

### 2. Red Blood Cell Count (RBC):

- Men: 4.7 to 6.1 million cells per microliter
- Women: 4.2 to 5.4 million cells per microliter

### 3. Hemoglobin (Hgb):

- Men: 13.8 to 17.2 grams per deciliter
- Women: 12.1 to 15.1 grams per deciliter

### 4. Hematocrit (Hct):

- Men: 40.7% to 50.3%
- Women: 36.1% to 44.3%

### 5. Platelet Count:

- 150,000 to 450,000 platelets per microliter of blood

### 6. Mean Corpuscular Volume (MCV):

- 80 to 100 femtoliters





# GenAI Example: Microsoft CoPilot

**Prompt:** What is the normal reference range set for a CBC laboratory test?



# GenAI Example: Google Gemini

<https://gemini.google.com/>

## Prompt:

What is the normal reference range set for a CBC laboratory test?



The normal reference ranges for a CBC (complete blood count) test can vary slightly depending on several factors, including:

- Age
- Sex
- Ethnicity
- Pregnancy
- Smoking status
- Altitude



Here's a table outlining the typical reference ranges for the main components measured in a CBC test:

Component	Units	Men	Women	Children
White Blood Cells (WBC)	$\times 10^3/\text{mcL}$	4.5 - 11.0	4.5 - 11.0	Varies by age
Red Blood Cells (RBC)	$\times 10^6/\text{mcL}$	4.7 - 6.1	4.2 - 5.4	Varies by age
Hemoglobin (Hgb)	g/dL	14.0 - 17.5	12.3 - 15.3	Varies by age
Hematocrit (Hct)	%	42.0 - 52.0	37.0 - 48.0	Varies by age

# Lab Challenges

## Staffing challenges / Manual Processes

Repetitive tasks consume valuable time, leading to reduced efficiency

## Data Silos

Information exists in disparate locations hindering Insights generation

## Complex Data Analysis

Requires aggregation and analysis of large amounts of data from multiple sources

**Slowed progress, potential errors, frustrated staff**



# Automate Repetitive Tasks

To eliminate manual work & improve throughput without adding resources



An AI-powered LIS automates mundane tasks and frees up valuable time via:

- Data Analysis & Interpretation
- Resource Optimization
- Quality Control
- Report Generation

## Benefits

- Increased Efficiency
- Enhanced Accuracy
- Improved Morale

**Your lab resources are your most valuable asset**

# Automate Repetitive Tasks

## Example: Potential use of Chat GPT for Report Generation



February 2024 edition  
<https://www.captodayonline.com/newsbytes-0224/>

The models should not be thought of as databases that retrieve facts but as predictors that generate predictions that are often right and sometimes wrong, says Dr. Glassy, who conducted a presentation on ChatGPT and other large language models at CAP23. LLMs are designed to identify answers with the highest probability of satisfying users, he explains. “That’s an answer you would like to have but not necessarily the true answer.”

While it’s important to verify answers generated by LLMs, pathologist users of the technology can take steps to minimize hallucinations and steer models toward providing more accurate and appropriate answers

### Newsbytes

Editors: Raymond D. Aller, MD, & Dennis Winsten

#### How labs can make the most of ChatGPT and other LLMs

February 2024—The key to using ChatGPT and other large language models effectively in pathology is understanding not only what they are designed to do but, just as importantly, what they are not designed to do, says Eric Glassy, MD, medical director at Affiliated Pathologists Medical Group, Rancho Dominguez, Calif., and past chair of the CAP Information Technology Leadership Committee.

The models should not be thought of as databases that retrieve facts but as predictors that generate predictions that are often right and sometimes wrong, says Dr. Glassy, who conducted a presentation on ChatGPT and other large language models at CAP23. LLMs are designed to identify answers with the highest probability of satisfying users, he explains. “That’s an answer you would like to have but not necessarily the true answer.”

Incorrect predictions, or hallucinations, generated by LLMs can pose numerous risks to the practice of pathology, Dr. Glassy says. These risks can be linked to models failing to recognize the difference between public and private information, demonstrating racial or ethnic bias, and providing medical information that could potentially be harmful.

While it’s important to verify answers generated by LLMs, pathologist users of the technology can take steps to minimize hallucinations and steer models toward providing more accurate and appropriate answers using offerings such as the following.



Dr. Glassy

**GPT-4 versus GPT-3.5.** GPT-4, the latest version of OpenAI’s large language models, provides more accurate and coherent answers than its predecessor, GPT-3.5, but it is also more expensive. Yet GPT-4 may be worth the subscription cost because incorrect answers could lead to improper medical treatment. For example, when GPT-3.5 was asked how to treat a pregnant woman who had contracted Lyme disease, it suggested tetracycline, which is effective at treating the disease but can cause a range of developmental abnormalities in a fetus, Dr. Glassy says. GPT-4, on the other hand, correctly identified amoxicillin as the treatment that would effectively and safely treat the disease in a pregnant woman.

GPT-4 Turbo, the latest version of the software, is available for \$20 per month. It allows users to expand prompts to approximately 300 pages of text, generate images from a text prompt using DALL-E technology, accept images

# Enabling Predictive Analytics and Insights

Discover the Hidden Gems of Your Data



Image generated using Copilot via

*Breakdown silos to discover hidden patterns and trends within your datasets waiting to be unearthed.*

**AI-powered LIS** transforms data into actionable insights through:

- Advanced Analytics
- Predictive Modeling
- Analyze large datasets
- Identify potential trends and patterns

## **Benefits**

- Improve lab operation productivity
- Real time insights
- Personalize discoveries

# Challenges and Considerations

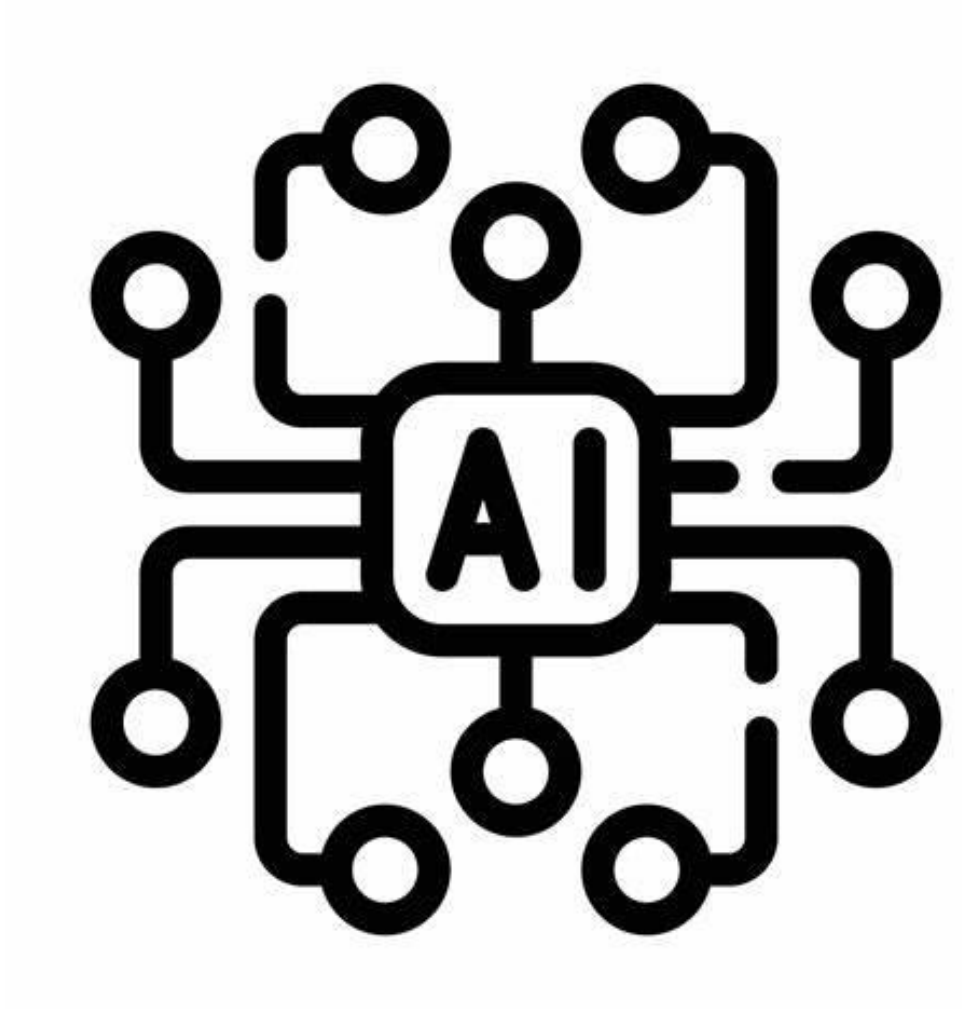
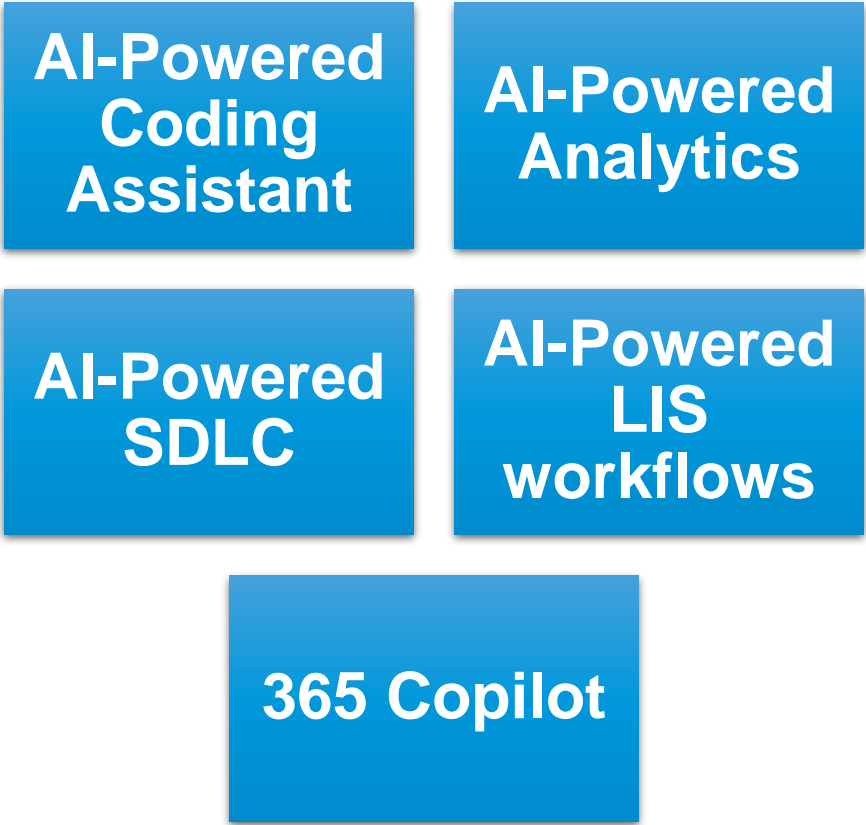
- Cost
- Integration
- Change Management
- Data Security
- Data Quality and Integrity
- Regulatory Compliance
- Bias
- Privacy / IP
- Ethics



# Clinisys GenAI Usage

## Increasing throughput with GenAI

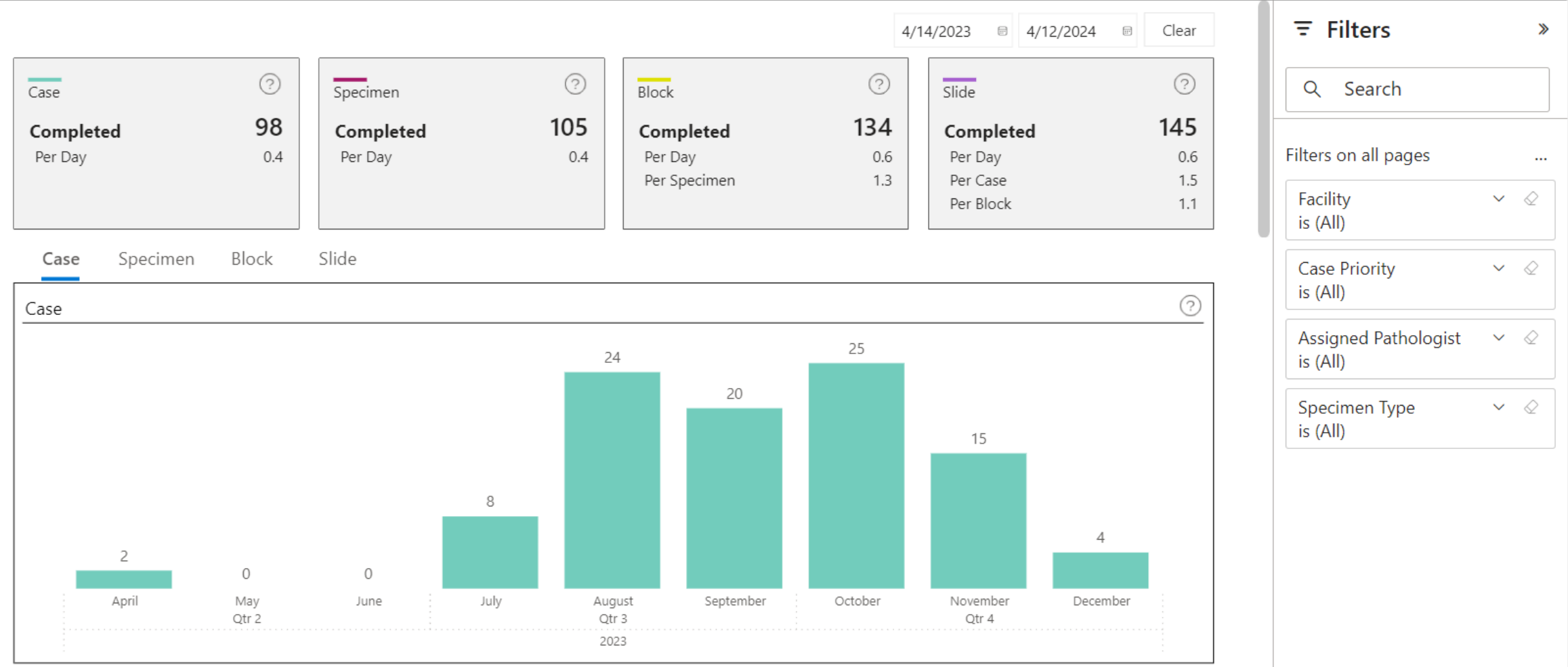
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# Clinisys Analytics & Insights

## Pre-configured Dashboards



# Infusing AI into Clinisys Analytics & Insights

## via Natural Language Query

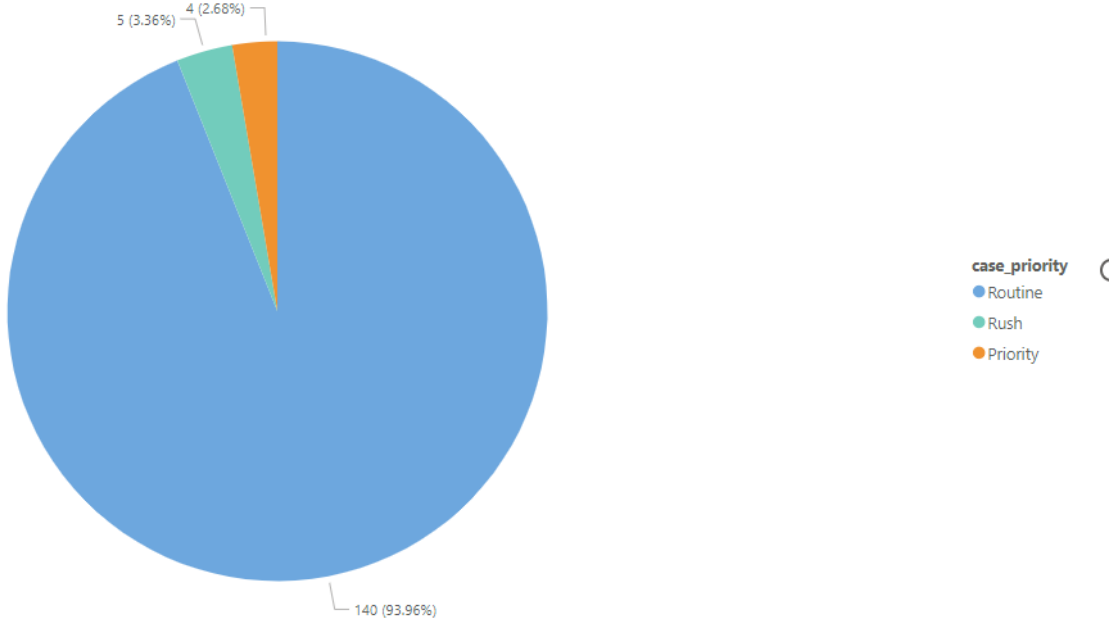
Ask a question about your data

Try one of these to get started

- top pathologists by total cases
- show me total cases for the last year
- show me total cases for the last month
- show me total errors for the last year
- top case priorities by errors
- top case priorities by errors nonzero

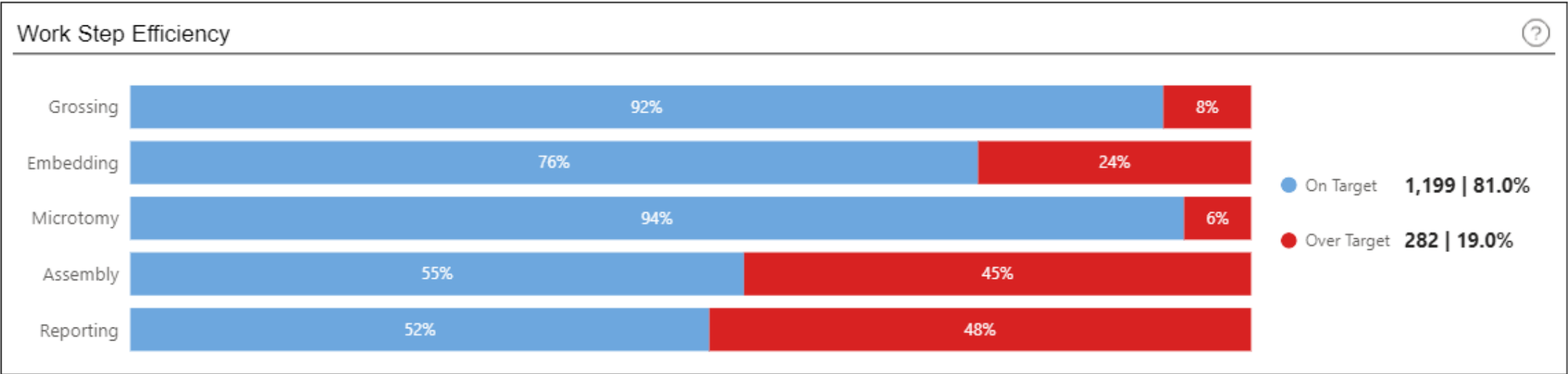
top case priorities by errors as a pie chart

Showing results for *Top 10 case priority of vw cases dims by errors of vw quality facts as pie chart*



# Infusing AI into Clinisys Analytics & Insights

via Smart Narrative



Total Tasks was higher for On Target (1199) than Over Target (282).

Microtomy in Status On Target made up 25.46% of Tasks.

Average Tasks was higher for On Target (239.80) than Over Target (56.40).

Tasks for On Target and Over Target diverged the most when the Work Step was Microtomy, when On Target were 353 higher than Over Target.

# Embracing the AI-Powered Lab of the Future



The future of healthcare & scientific labs is powered by the transformative potential of Gen AI.

AI automates repetitive tasks, ensures data integrity & unlocks hidden insights.

**AI-powered LIS** empowers your lab to achieve:

- **Increased Efficiency**
- **Enhanced Accuracy**
- **Higher Probability of Discovery**

**Clinisys roadmap includes Gen AI-powered LIS –  
To be at the forefront of healthcare & scientific innovation**

# A few resources: GenAI 101

The 360 Blog

Top Stories

Roles

Topics

Industries

Newsroom

Newsletter

Generative AI

## AI From A to Z: The Generative AI Glossary for Business Leaders

Help everyone in your company understand key generative AI terms, and what they mean for your customer relationships. Fun fact: This article was (partially) written using generative AI.



Generative AI is evolving at an astonishing pace. This glossary will help you get up, and stay up, to speed. [Sesame/Getty]



Ashley Eusanio

April 19, 2024 • 26 min read

## Skills Training for Staff

<https://www.coursera.org/business/resources/ebook/generative-ai-productivity-playbook>

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## Glossary

<https://www.salesforce.com/blog/generative-ai-glossary/>

coursera



Executive Summary

## Unlocking Productivity: The Business Leader's Playbook to Generative AI Skills Training

Featuring insights from learning experts on the future of GenAI and work

Eighty-nine percent of executives listed either AI or Generative AI (GenAI) as one of their top three tech priorities for 2024—yet 90% of those same respondents described themselves as AI “observers.”<sup>1</sup>

The desire to unlock productivity with GenAI is all around us, but executives don't quite know where to start. If they move too fast, they risk hitting ethical and regulatory hurdles. And if they move too slow, they find themselves outpaced by competitors.

**So, how can business leaders strategically upskill their teams for GenAI, sparking newfound innovation and productivity?**

“

*Your workforce needs simplicity. Show them basic prompt engineering with a language model, and make examples relevant to the learner.*

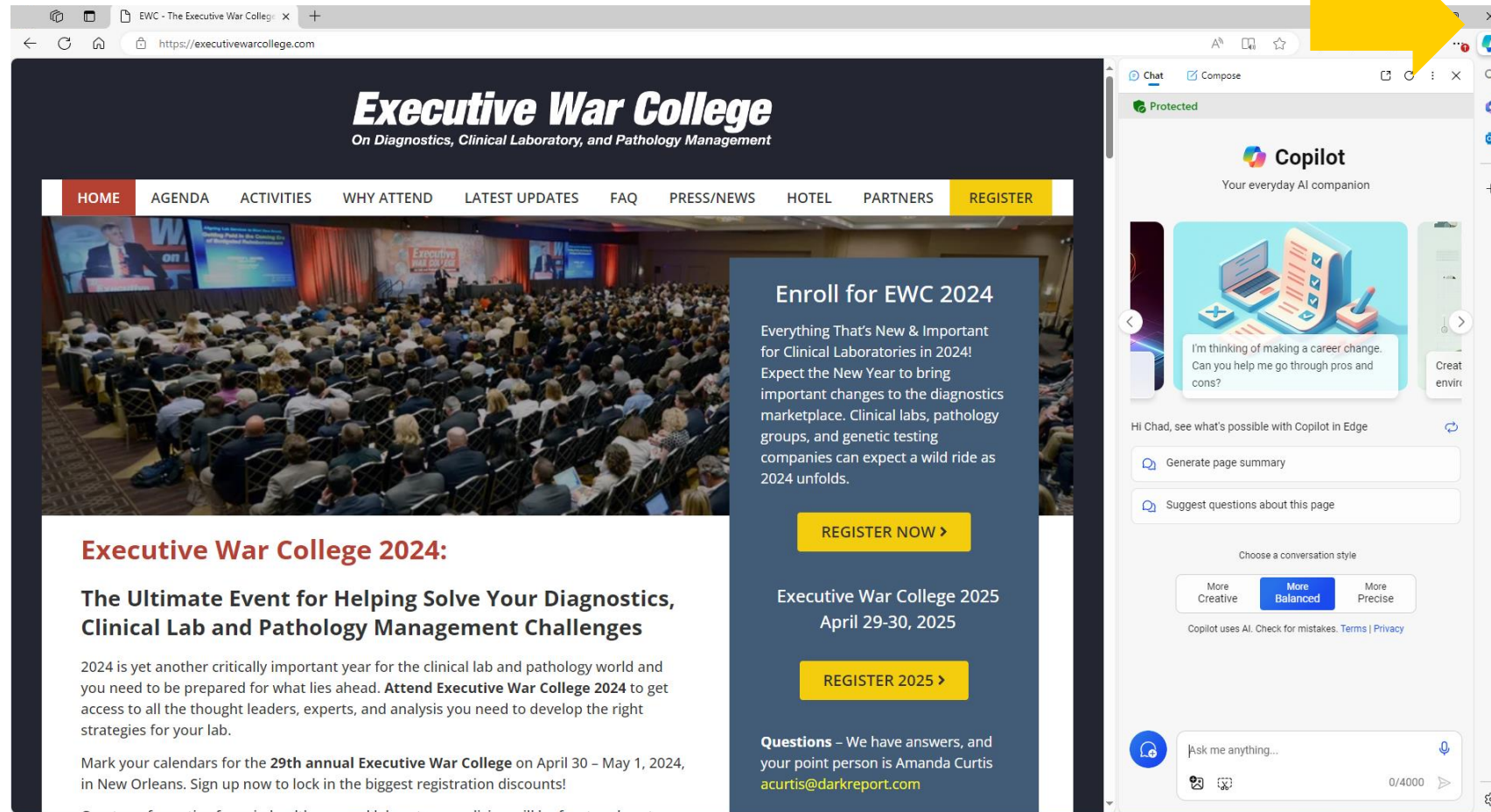


Dr. Jules White

Director of the Initiative on the Future of Learning & GenAI, Vanderbilt University

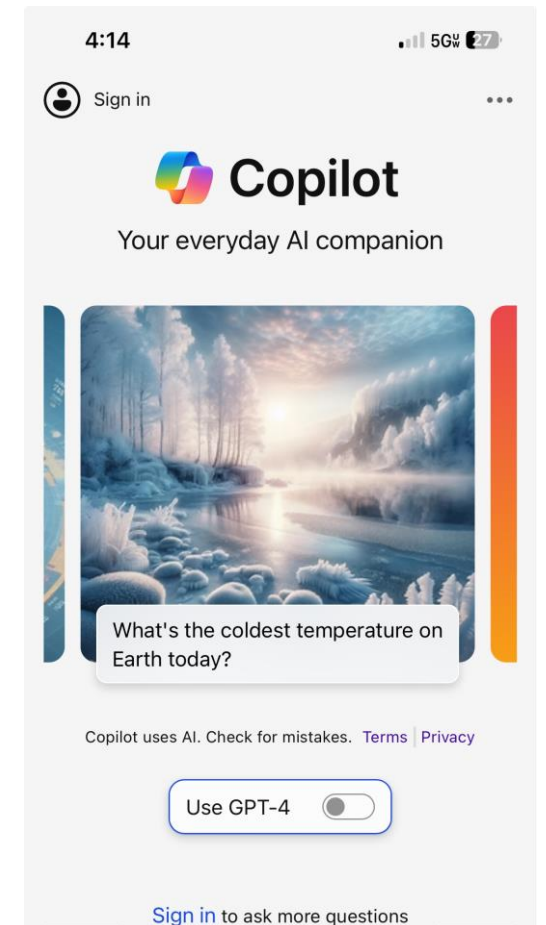
# A few resources: GenAI via Microsoft CoPilot

## Familiarity through Daily Use



The screenshot shows a Microsoft Edge browser window. On the left, the Executive War College website is displayed, featuring a navigation menu with 'HOME', 'AGENDA', 'ACTIVITIES', 'WHY ATTEND', 'LATEST UPDATES', 'FAQ', 'PRESS/NEWS', 'HOTEL', 'PARTNERS', and 'REGISTER'. The main content area includes a large image of a conference hall and a text box titled 'Enroll for EWC 2024' with a 'REGISTER NOW >' button. Below this, there is a section for 'Executive War College 2025' with a 'REGISTER 2025 >' button. On the right, the Copilot chat interface is open, showing the Copilot logo and the text 'Your everyday AI companion'. The chat area contains a sample question: 'I'm thinking of making a career change. Can you help me go through pros and cons?' and a response: 'Hi Chad, see what's possible with Copilot in Edge'. Below the chat area, there are buttons for 'Generate page summary' and 'Suggest questions about this page'. At the bottom, there is a text input field with the placeholder 'Ask me anything...' and a character count '0/4000'. A yellow arrow points from the Copilot interface towards the website.

Built into Microsoft Edge



The screenshot shows the Copilot app interface on an iPhone. The app displays the Copilot logo and the text 'Your everyday AI companion'. Below this, there is a large image of a snowy landscape with a river. A text box contains the question 'What's the coldest temperature on Earth today?'. Below the image, there is a response: 'What's the coldest temperature on Earth today?'. At the bottom, there is a toggle switch for 'Use GPT-4' and a 'Sign in' button. The status bar at the top shows the time '4:14', signal strength, 5G network, and battery level at 27%.

Apple App Store

# A few resources: GenAI in Healthcare

## Generative AI Has Potential Use Cases Across All Health Care Segments



### Pharmaceutical firms

- ✓ Accelerated drug discovery and design
- Clinical-trial planning and execution
- ✓ Precision medicine therapies



### Providers

- ✓ Patient screening and on-demand, personal care
- ✓ Automated document processing
- Medical image recognition
- ? EHR interoperability



### Payers

- ? Preventative health care through predictive models
- Automation of claim processing



### Medtech

- Generative product design
- ? Diagnostic image enhancement and analysis
- Supply chain risk identification and process augmentation



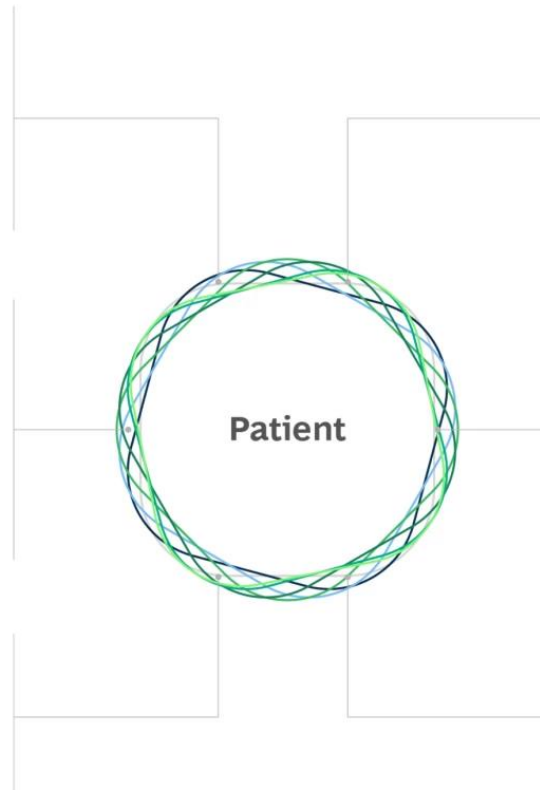
### Services and operations

- ? Synthetic-data generation
- ? Inventory tracking and restocking
- ? Data sharing/interoperability
- Generative AI cloud services



### Public-health agencies

- Public-health surveillance
- ? Resource allocation and utilization



✓ Validated   — Early stage   ? Conceptual



GENERATIVE AI / ARTICLE

# Generative AI Will Transform Health Care Sooner Than You Think

Source: BCG analysis.

# Where to Start

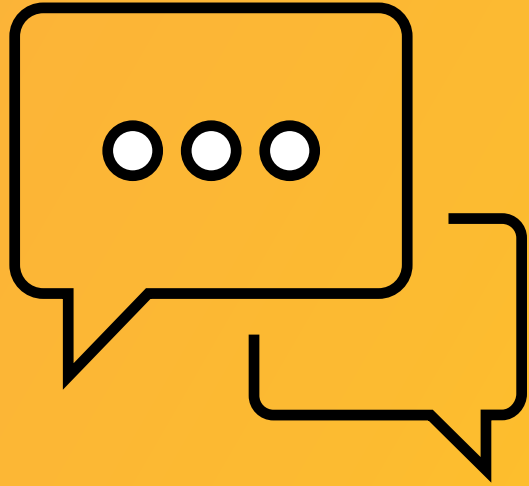


- Learn the art of the possible. Become familiar with the technology.
- HOWEVER...
- *Always* start with the business case (NOT the technology!!)

```
1
2
3 #include <iostream>
4
5 using namespace std;
6
7 int main(){
8
9     cout <<"Hello World!"<< endl;
10
11     return 0;
12 }
```

- Identify your pain points and go from there
- Start small. Define clear goals and objectives. Use a pilot project approach
- Get help. Pull in experts to help. Evaluate vendor capabilities.





**Thank you**  
Any Questions?

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Enabling healthier communities

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