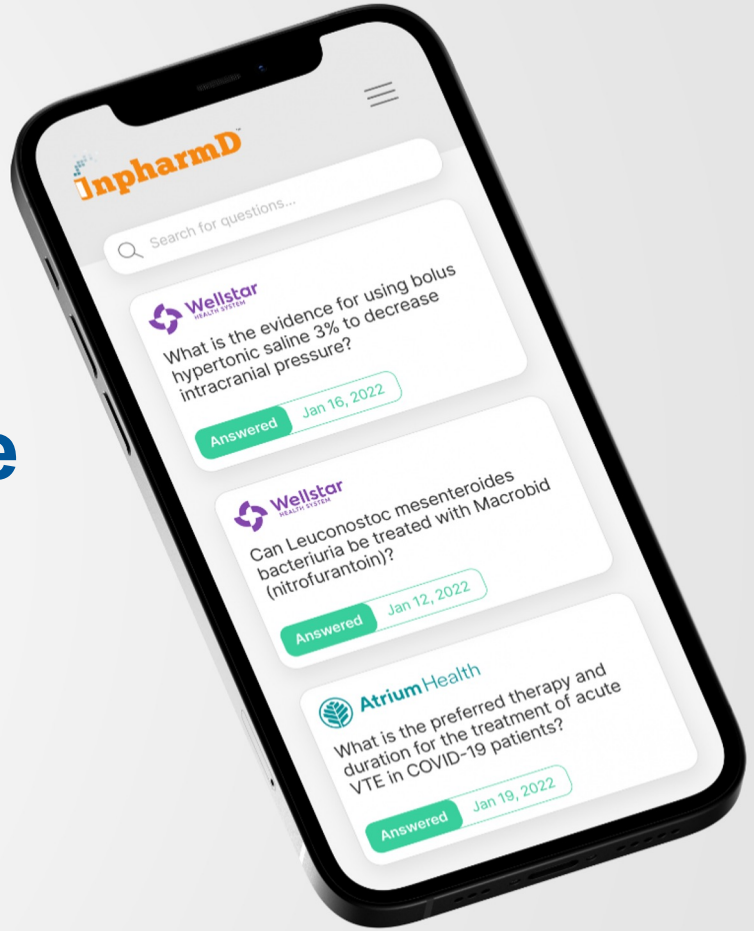
AI in Pharmacy Practice

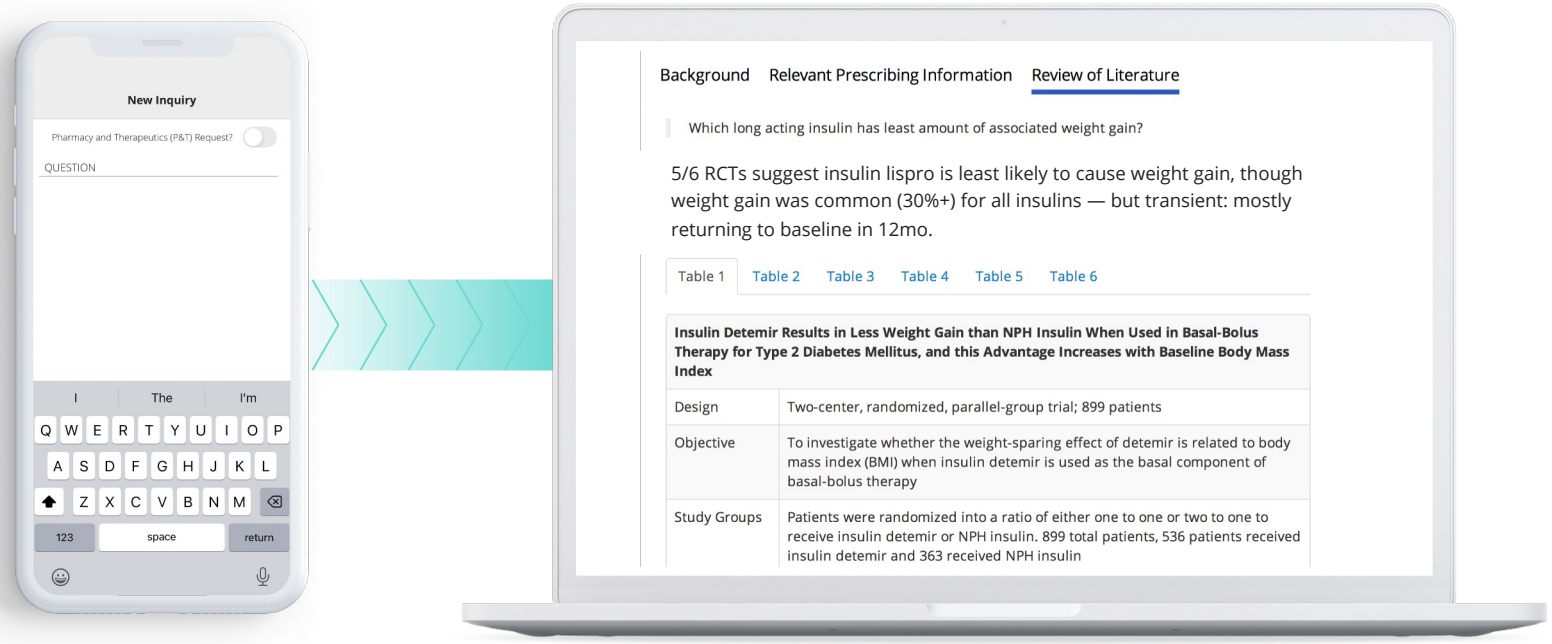
How Can This Technology Supplement the Advanced Role of the Pharmacist?

Ashish Advani, PharmD

InpharmD™



Ask any clinical question, get an evidence-based answer.



MOORE'S LAW TIMELINE

Moore's Law – the observation that computing dramatically decreases in cost at a regular pace – is short-hand for rapid technological change. Over the past 50 years, it has ushered in the dawn of the personalization of technology and enabled new experiences through the integration of technology into almost all aspects of our lives.

WHAT CAN BE DONE, CAN BE OUTDONE

Intel continues to deliver on the promise of Moore's Law with the introduction of powerful multi-core technologies, transistor architecture, advances in materials science and new innovations.

2012 First implementation of CMOS tri-gate transistors in high-volume manufacturing

2008 First implementation of high-k/metal gate in high-volume manufacturing

2004 First implementation of strained silicon in high-volume manufacturing

2002 300mm wafer production begins

1995 Moving from aluminium to copper

1991 200mm wafer production begins

1985 Moving from NMOS to CMOS

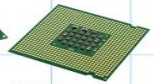
1970S Moving from Bipolar to MOS

2015: Intel introduces the 5th generation Intel® Core processor (**1.3 billion transistors**).

2012: Intel introduces the Intel® Core i5 processor (**1 billion transistors**).

2004: Intel introduces Intel® Pentium® 4 processor with HT technology (**125 million transistors**).

2001: Intel introduces Intel® Pentium® 4 processor (**42 million transistors**).



1995: Intel introduces Intel® Pentium® Pro processor (**5.5 million transistors**).

1993: Intel introduces Intel® Pentium® processor (**3.1 million transistors**).

1989: Intel introduces 486™ processor (**1.2 million transistors**).

1985: Intel introduces 386™ processor (**275,000 transistors**).

1982: Intel introduces 80286 processor (**134,000 transistors**).

1979: Intel introduces 8088 processor (**29,000 transistors**). In 1981, IBM introduces the PC using the 8088 and ignites the trend of personal computing.

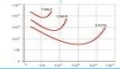
1977: Apple® II personal computer introduced.

1975: Gordon Moore updated his prediction of the rate of growth of IC components from doubling every year to doubling every two years.

1971: Intel's Ted Hoff invents the first microprocessor (called the 4004, **2300 transistors**).

1968: Gordon Moore and Robert Noyce leave Fairchild® to form Intel Corp.

1965: Gordon Moore authors paper predicting the rate of growth of IC components in Electronics magazine. His observation was later termed '**Moore's Law**'.



1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015

For more information, please visit intel.com.

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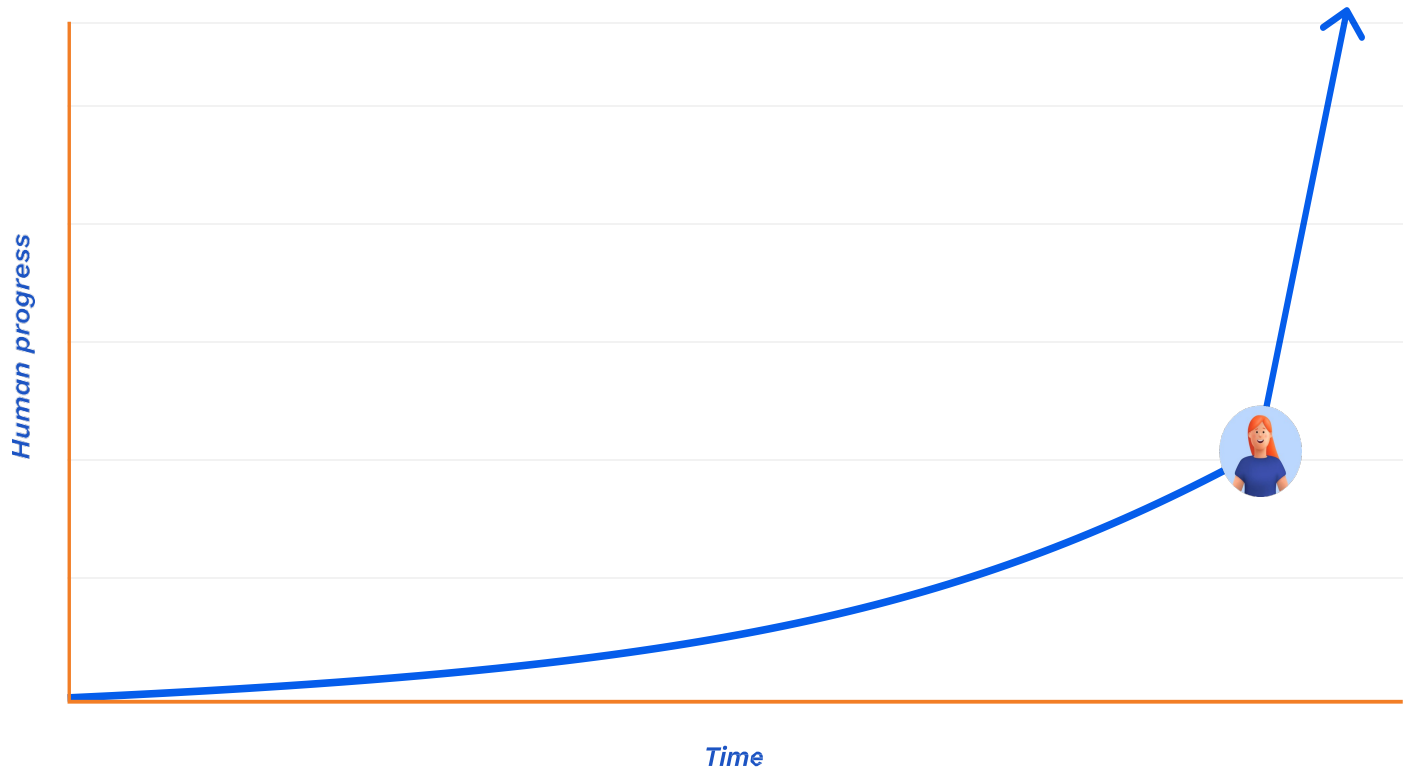
Human progress


Human progress
Time

Poll Question 1

Which of the following best describe you?

a. AI gives me a feeling of existential dread.

b. AI makes me excited for the future.

c. Both of the above.

d. None of the above (yet)

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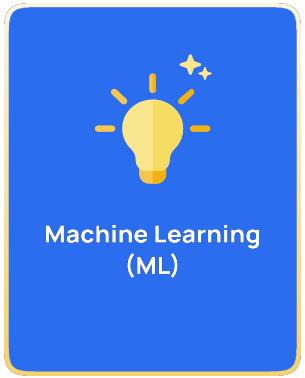
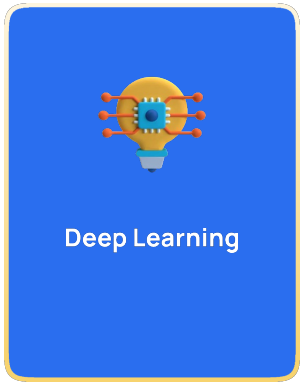
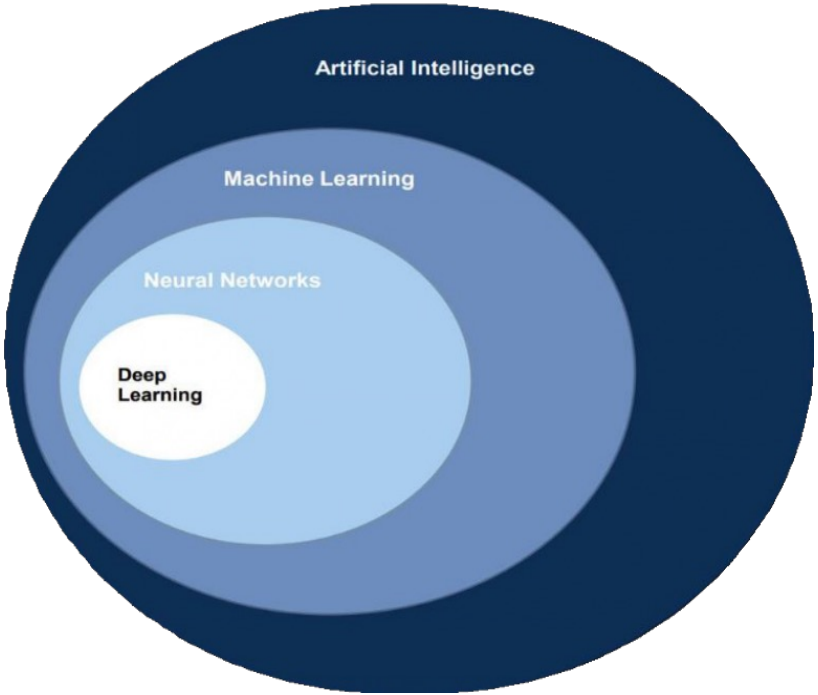
Where did Artificial Intelligence (AI) Come From?

Artificial intelligence is the development of computer systems capable of performing tasks that mimic human intelligence.

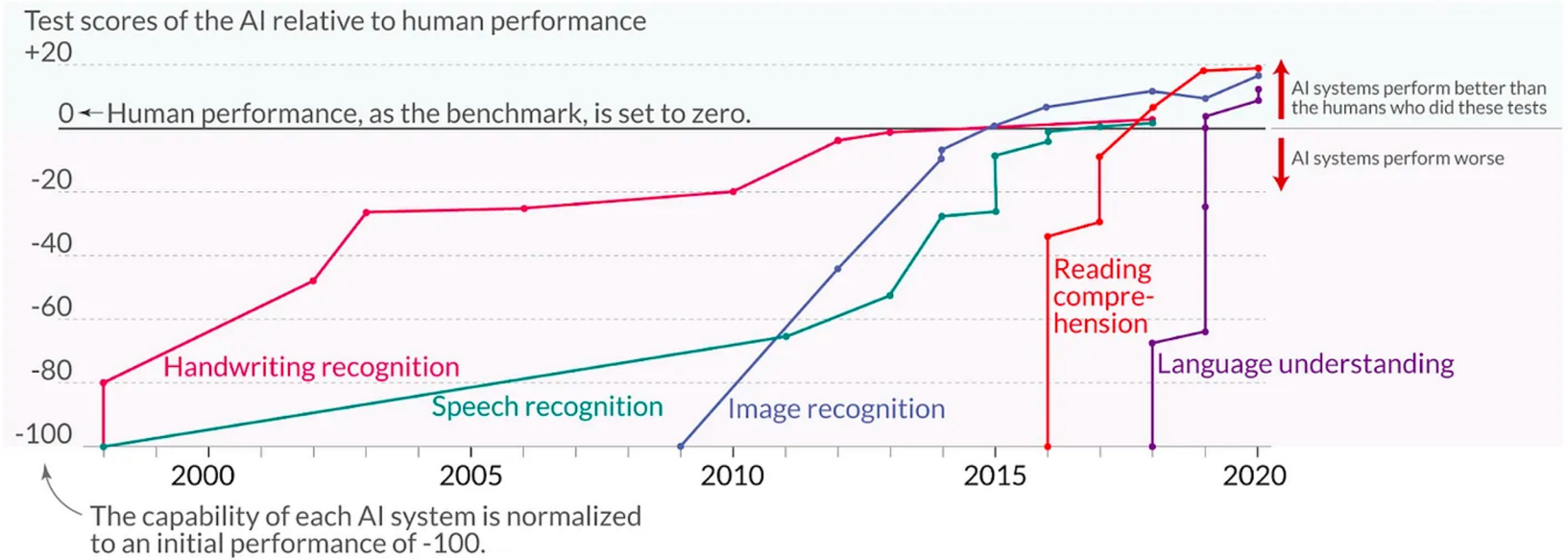






Language and image recognition capabilities of AI systems have improved rapidly

Our World in Data



Data source: Kiela et al. (2021) – Dynabench: Rethinking Benchmarking in NLP

OurWorldinData.org – Research and data to make progress against the world's largest problems.

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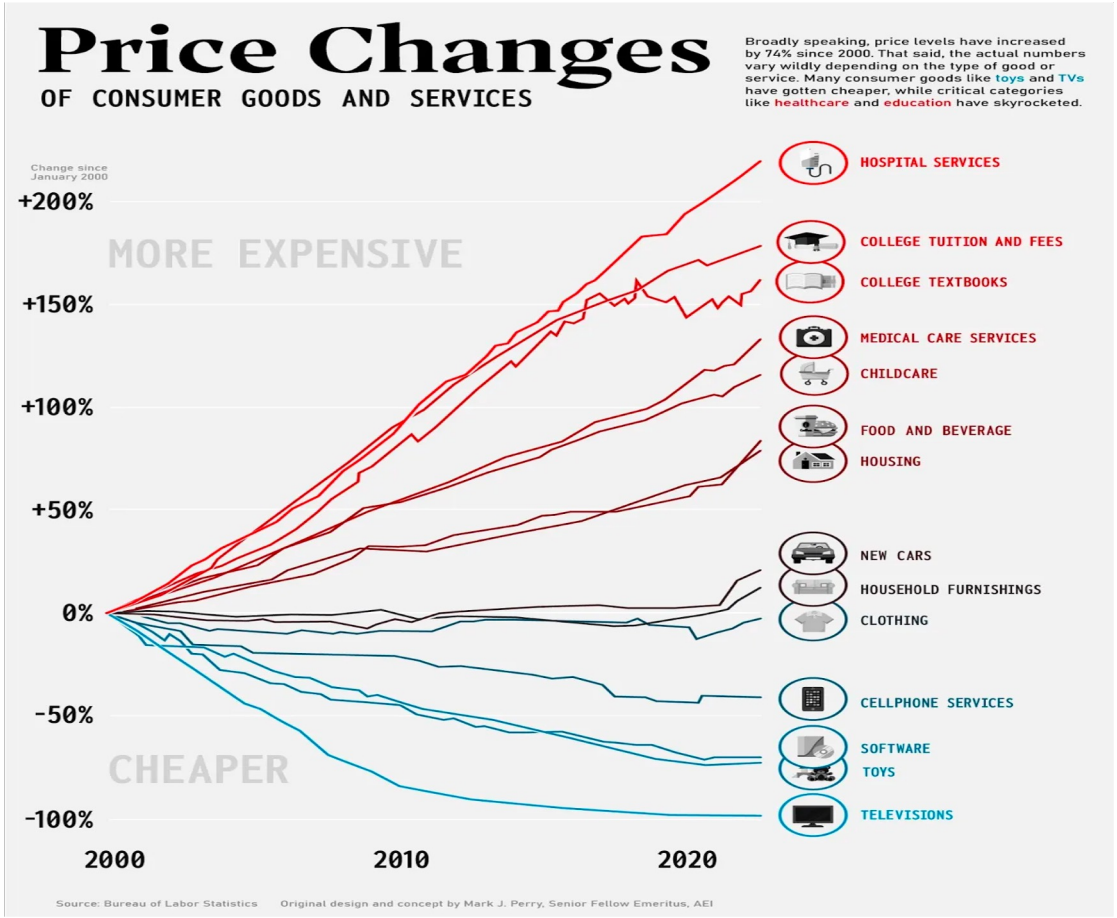
Source: AI Checkup



Source: AI Checkup

Poll Question 2

Which of the following have you used or seen used in pharmacy?

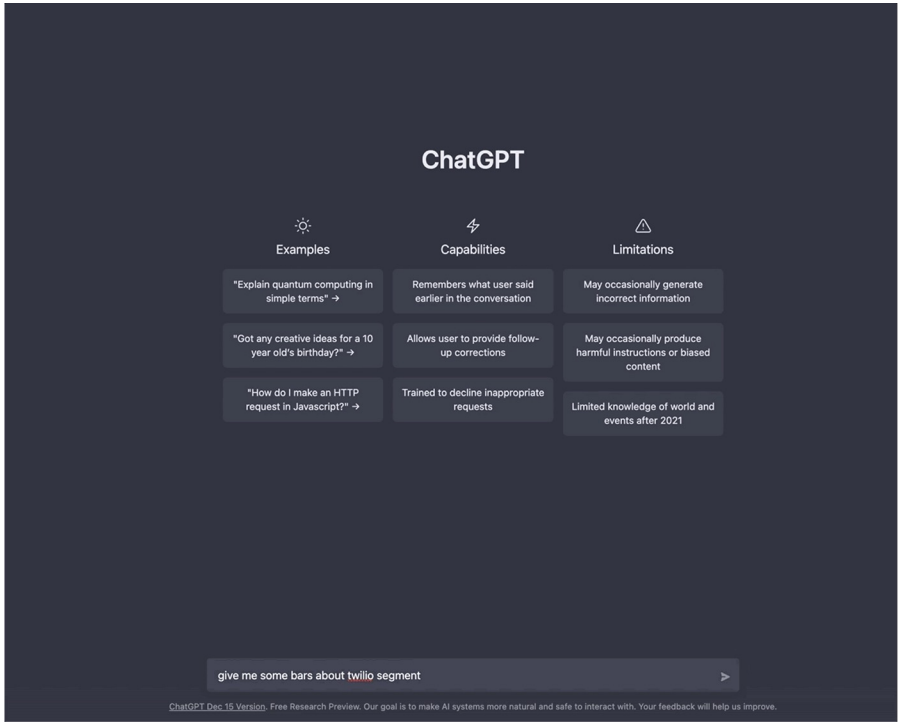
a. Chat GPT

b. BARD/ Gemini/ MedPaLM

c. Perplexity AI

d. None of the above (yet)

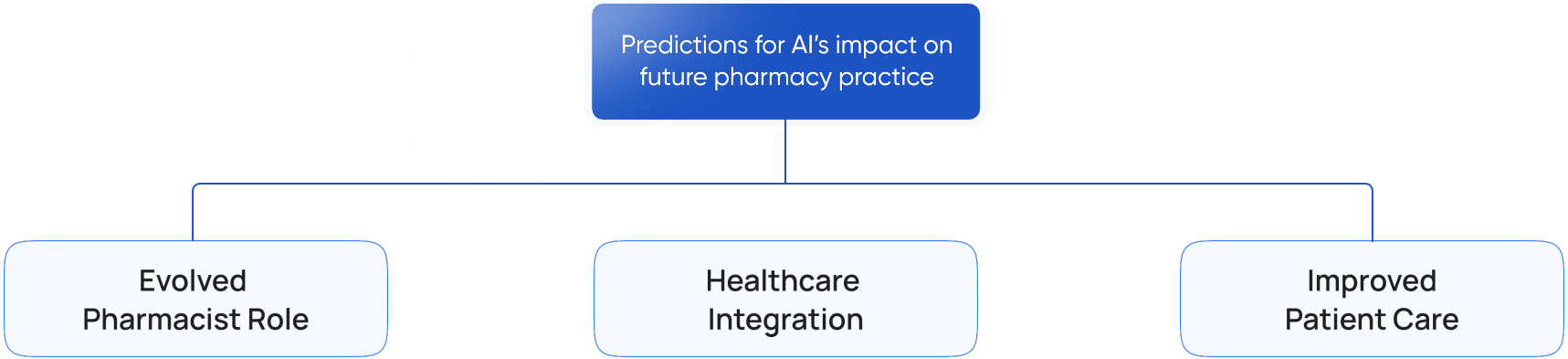
Chat GPT (by Open AI)



Source: chatgpt.com

Streamlining Pharmacy Operations to Augment Pharmacists

- Patient-specific data extraction for faster claims reimbursement
- Drug utilization reviews for duplications, interactions, contraindications, dosing, etc.
- Predictive analysis for risk and timelier interventions
- Predictive analysis for non adherence and timelier patient education
- Review of data and generation of insights for better decisions
- Automation of routine tasks



Poll Question 3

Which of the following are challenges to integrating AI in pharmacy practice?

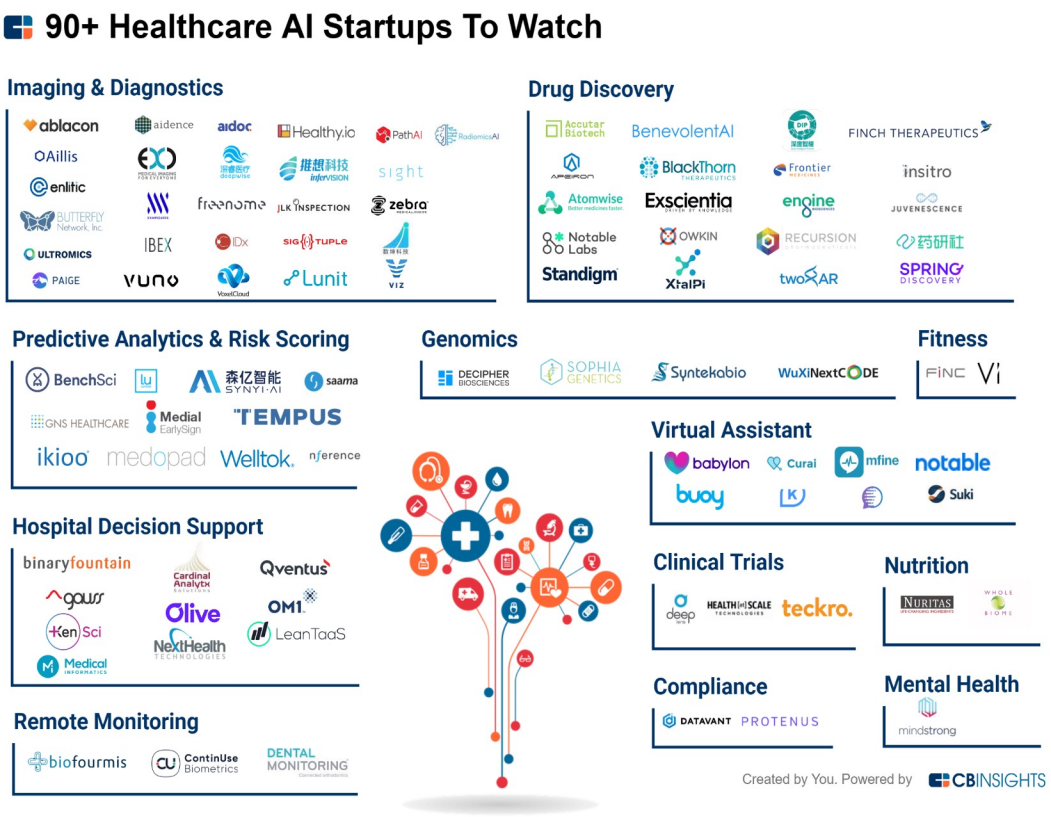
a. Overcoming resistance/ status quo

b. Training

c. Fitting AI into existing workflows

d. All of the above

2020 Predictions



DECISION SUPPORT

Next-generation diagnostics

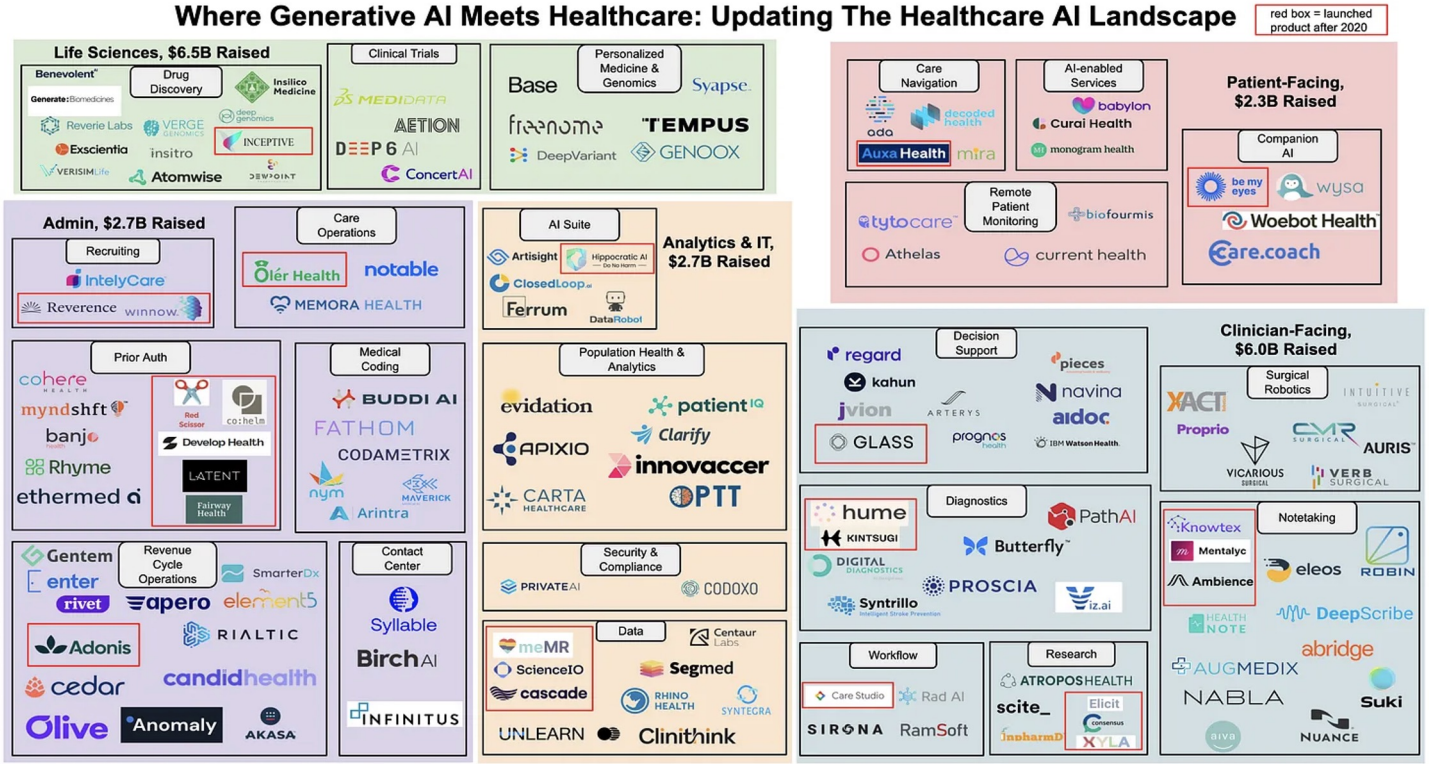
Butterfly
AliveCor
Eko
heru
TYMPAHEALTH

Reference tools

UpToDate (acquired)
GoodRx
ATROPOS
MDCALC
InpharmD
pathway
epocrates (acquired)
pyrls
figure1
Doc Matter
DRUGBANK

Source: CB Insights

2024 Reality



Source: CB Insights

Ethical Principles in Pharmacy

Protecting human autonomy	• This includes informed consent, privacy protections, and transparency/ explainability in decision making
Protecting well being and safety	• All technology used by clinicians must meet accuracy standards, with quality control in place to ensure AI benefits patient well being and public interest
Responsibility and accountability	• AI tasks must align with regulations and be used appropriately. If issues arise, mechanisms for questioning and redress must be available, emphasizing accountability.
Inclusiveness and equity	• AI for health should encourage widespread, equitable use across diverse demographics. Monitoring for disparities could prevent it from worsening existing forms of discrimination. • Strategies to identify and address biases that can manifest within AI systems are also required to ensure its improvement is in the right direction.

Questions

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