

AI Holds Promise to Drive Standards of Care, Cut Healthcare Waste



Morgan Holzaepfel
Partner, Primary
Investments

Thomas Bremner, CFA
Partner, Growth Equity

Alex Kessel
Partner, Co-Investments

Marcus Lindroos
Principal, Primary
Investments

Vikram Chari
Senior Associate,
Growth Equity

KEY TAKEAWAYS

- \$360 billion in administrative costs could be stripped from US healthcare sector alone through deployment of AI solutions
- Diagnosing rare diseases and analyzing digital imaging such as MRI scans are among the myriad AI applications that could help improve clinical decision making while reducing the administrative burden on healthcare professionals
- Because patient privacy is critical, health systems are developing guardrails and regulations to ensure record keeping and data transfer are secure and accurate when deploying AI technologies
- AI has the potential to speed up drug discovery while reducing the cost of pharmaceutical development while potentially reducing failure rates at the same time

Artificial intelligence (AI) has the potential to upend every sector in a way that we’ve not seen in our lifetime. Healthcare, a \$9 trillion global industry,¹ is no exception.

While there is much speculation about likely use cases and the potential impact of AI, we believe innovations will have a positive impact on costs and quality of care delivery. This is especially true when you consider the significant opportunity to reduce or eliminate upwards of \$1 trillion of fraud, waste, and abuse in the US healthcare system alone.²

We believe the impact of AI in healthcare will be far reaching, specifically as it relates to the following:

- Administration & Engagement
- Clinical Care
- Risk & Regulatory
- Pharmaceuticals

Administration & Engagement



Almost a quarter of all US healthcare spending is estimated to go towards administrative costs.³ Administration can comprise prior authorization, patient intake, billing and coding, among others, making administrative work flows ripe for improvement. As patients become more comfortable interacting digitally, everything from appointment scheduling to post-encounter engagement (e.g. post-discharge care and outcomes measurement, medication and instruction adherence, patient questions, etc.) could meaningfully benefit from AI applications.

According to the National Bureau of Economic Research, widespread AI adoption could save the US healthcare industry 5-10% a year, or as much as \$360 billion in 2019 dollars.⁴

Major Milestones

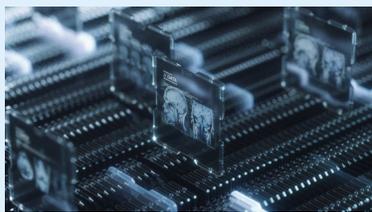


FEBRUARY 2023



Doximity rolls out DocsGPT.com

Doximity, a digital networking platform for medical professionals, launched a beta tool called DocsGPT.com, which integrates with OpenAI's ChatGPT. DocsGPT.com helps doctors to streamline administrative tasks such as drafting preauthorization and appeal letters to insurers. Developed in response to the considerable paperwork and still prevalent use of faxes in healthcare, DocsGPT.com allows physicians to utilize AI-generated letters, while also emphasizing the importance of manual review for accuracy.



APRIL 2023



Epic incorporates OpenAI within Electronic Records

Epic announced the integration of Microsoft's Azure OpenAI Service within its Electronic Health Records (EHR) platform, allowing for extended natural language queries and interactive data analysis. The goal is to leverage generative AI to auto-fill missing information, propose diagnoses, predict health outcomes based on past data, and reduce the time and potential errors associated with manual EHR updates.



Google Cloud unveils AI-enabled Claims Acceleration Suite

Google Cloud's new AI-powered solution is designed to expedite the prior authorization process as well as claims processing for health insurance companies. The solution leverages the new Claims Data Activator to convert unstructured data, such as from faxes or images, into structured data.



JUNE 2023

UNC Health pilots internal AI-powered chatbot using Azure OpenAI Service

Utilizing Azure OpenAI Service, University of North Carolina Health created an AI-powered conversational bot hosted in a secure, governed internal environment. The bot will respond to questions specific to UNC Health and provide real-time recommendations to streamline administration work for providers.



Carbon Health rolls out GPT-4-powered charting

Carbon Health, a provider of primary and urgent care, launched a hands-free charting capability leveraging OpenAI's GPT-4 LLM. With a patient's consent, providers can record patient interactions that are transcribed by Amazon Web Service's (AWS) Transcribe Medical to formulate a prompt for GPT-4. In just a few minutes, a visit summary can be auto-generated.





JULY 2023



AWS launches HealthScribe, an AI-powered transcription tool

To reduce the administration burden, Amazon unveiled an API¹⁷ called AWS HealthScribe¹⁸ to create transcripts, extract clinical details, and summarize patient interactions. HealthScribe is able to create notes for two medical specialties: general medicine and orthopedics.



AUGUST 2023



Microsoft and Epic expand AI collaboration

Microsoft and Epic expanded their partnership to integrate generative AI into the healthcare sector. The goal is to enhance patient care and tackle challenges such as workforce burnout and staffing shortages. The collaboration will integrate Microsoft's Azure OpenAI Service and Nuance ambient technologies within the Epic ecosystem to deploy copilot solutions in EHR.



75% of health system executives believe generative AI has reached a turning point for healthcare, but only 6% have an implementation strategy

Bain conducted a survey²⁰ of health system executives to gauge their opinion on the potential for generative AI within healthcare. The survey found that 75% of the executives believe generative AI has become advanced enough to positively impact healthcare through ways such as workflow productivity and cost efficiencies, given the issue of deteriorating hospital margins. However, only 6% of health systems have a strategy to implement the new technology. The main barriers include resource constraints, lack of technical experience, and regulatory considerations.



OCTOBER 2023



Indigo launches AI-powered medical professional liability insurance platform

Using proprietary AI-powered technology, Indigo will customize liability insurance pricing to ensure physicians only pay in line with their true risk profile. The platform also aims to vastly improve insurance brokers' win rate through real-time quoting and binding. Indigo was launched by Rubicon Founders and Oak HC/FT, with additional funding from Optum Ventures and other strategic investors.



NOVEMBER 2023



Suki expands availability of its ambient AI clinical documentation platform

Suki offers a voice assistant that generates notes in real time by listening to patient-clinician interactions. The application aims to improve clinical documentation, diagnosis coding, and information retrieval from electronic health records. The company recently expanded the solution to serve inpatient settings across hospital, ambulatory, telehealth, skilled nursing facilities, and home health.



Ambience announces end-to-end Epic integration with John Muir Health

John Muir Health and Ambience Healthcare announced a collaboration to launch a generative AI platform that is fully integrated with Epic's electronic health record. Clinicians at John Muir Health will be able to view Epic schedules in the Ambience app, record visits with Ambience AutoScribe, and edit AI-generated documentation directly inside Epic.

Clinical Care



Whether it be diagnosing rare diseases, speeding up clinical response times, or aiding clinicians in reading ECGs and other tests, there is clear value in the myriad applications of AI to support clinical decision making.

Moreover, more efficient use of clinicians' time could help alleviate an ongoing structural labor challenge – reducing the administrative burden is a priority given the shortage of physicians, pharmacists, nurses and workers in support roles.

However, it's early innings. Don't expect Dr. AI to visit patients anytime soon. Rather, today, real-time implementation of AI supports improved clinical documentation, for example, by using AI to transcribe a patient encounter into an electronic health record.

Major Milestones



MARCH 2023



Stanford experts examine the safety and accuracy of ChatGPT in serving doctor's curbside consultation needs

An ongoing study at Stanford Health Care seeks to assess ChatGPT's ability to answer clinical questions. Results show 91-93% of responses through March were deemed safe, while the remainder were considered "harmful" because of hallucinated citations.¹³ A hallucinated citation is when an LLM generates false information.¹⁴ There was also inconsistency in answers to repeated questions.¹⁵ The research emphasizes the need to refine and rigorously evaluate models before mainstream healthcare adoption.



MAY 2023



NVIDIA-accelerated AI model successfully detects delirium in the ICU

Up to 80% of critically ill patients develop delirium, but clinicians detect less than 40% of instances with validated screening tools. A study published in Nature¹⁶ evaluated the use of a rapid response electroencephalography (EEG) device and a supervised deep learning method analyzing the data. The results – 99.9%+ training and 97% testing accuracy – far exceeded the about 40% accuracy of clinician derived Confusion Assessment Method ICU assessments.



Hippocratic AI launches with \$50 million seed round to build safety-focused large language model for healthcare

With a \$50 million seed round led by General Catalyst and Andreessen Horowitz, Hippocratic AI emerged out of stealth to build the first LLM for healthcare with an initial focus on non-diagnostic, patient-facing applications. The company's mission is to develop the safest artificial Health General Intelligence platform.



JUNE 2023



NYU Langone and NVIDIA collaborate on LLM to predict patient readmission

Researchers at New York University Langone Health, the academic medical center of NYU, partnered with NVIDIA to develop an LLM called NYUTron, which helps to predict a patient's risk of 30-day readmission, a key indicator of quality of care. NYUTron was pretrained on 10 years of health records from NYU Langone Health, and helps doctors identify patients in need of a clinical intervention.



AUGUST 2023



NYU Langone launches private ChatGPT for its health data

NYU Langone launched a customized HIPAA-compliant version of ChatGPT. With the help of Microsoft representatives, the academic medical center had staff participants test out the interface. The prompts inputted were around themes of research, clinical applications, and patient education.



Study on ChatGPT finds greatest accuracy in tasks of final diagnosis compared to initial diagnosis

A study published in Journal of Medical Internet Research¹⁹ assessed ChatGPT’s capacity for ongoing clinical decision support by analyzing its performance on 36 reports of clinical cases. The authors found that ChatGPT demonstrates the highest accuracy in tasks of final diagnosis rather than initial diagnosis, but limitations include model hallucinations and the unclear makeup of its training data set.

Risk & Regulatory



Not so fast! Guardrails and regulation are critical when considering the transmission of Patient Health Information (PHI) and the requirements of the Health Insurance Portability and Accountability Act of 1996 (HIPAA).

Some health systems are trialing secure private data repositories when testing various AI use cases, though much work remains to be done. Further, as AI evolves to get closer to clinical decision making (even if just in a supporting capacity), there is a risk of inaccurate or misleading information, which encompasses everything from data integrity/accuracy to the algorithms themselves.

To illustrate, on June 20, 2023, a bipartisan, bicameral bill was introduced in the US House of Representatives called the National AI Commission Act to create a national commission that will “review the nation’s current approach to AI regulation, make recommendations on any new office or governmental structure that may be necessary, and develop a risk-based framework for AI.”⁵

Further, on Oct. 30, 2023, US President Joe Biden issued an Executive Order that “establishes new standards for AI safety and security, protects Americans’ privacy, advances equity and civil rights, stands up for consumers and workers, promotes innovation and competition, advances American leadership around the world, and more.”⁶



Major Milestones



FEBRUARY 2023

ChatGPT tested on the US Medical Licensing Exam

In a peer reviewed study,¹² ChatGPT was tested on the United States Medical Licensing Exam and achieved performance at or near the passing threshold for all three components of the test without specialized training. The study indicates that large language models (LLM) can potentially aid medical education and future clinical decisions due to their capacity for valid clinical insights and comprehensible reasoning.



APRIL 2023

Coalition for Health AI (CHAI) releases “Blueprint for Trustworthy AI Implementation Guidance and Assurance for Healthcare”

CHAI is a community of academic health systems, organizations, and AI/data science experts striving to provide guidelines for the responsible use of AI in healthcare. This 24-page blueprint outlines specific recommendations to increase trustworthiness within the healthcare community and ensure high-quality care when implementing AI.

Pharmaceuticals



On average, the drug approval process costs more than \$2 billion,⁷ takes over 10 years,⁸ and more than 90% of applications ultimately fail.⁹ And the process has only gotten more complex. While AI is now helping with administrative workflows such as clinical trial data collection and quality control, there is an exciting opportunity for researchers to utilize AI and machine learning (ML) to aid in drug discovery, clinical and non-clinical research, post-market surveillance and advanced pharmaceutical manufacturing.

According to Beth Seidenberg of Westlake Village Biopartners, “Without the utilization of AI/ML, many companies in the Westlake portfolio would not be able to discover the breakthroughs that will lead to more patients benefiting from the therapeutic products being developed, proprietary intellectual property, differentiated products and broad-based research platforms. This work has attracted interest from pharma companies as demonstrated by the business development dollars invested in Westlake-backed companies.”

While the public launch of OpenAI’s ChatGPT on November 30, 2022, significantly accelerated interest in AI among consumers, investors and business leaders, AI/ML has been a presence in the healthcare space since well before the launch of ChatGPT. For example, Adams Street portfolio company Freenome¹⁰ uses AI to detect cancer in its earliest, most treatable stages,¹¹ and 10X Genomics builds tools that help companies to understand the human genome. We believe the use cases will only grow.

Major Milestones



MARCH 2023

OpenAI CTO joins Board of Unlearn.AI

Unlearn.AI, which uses ML to create “digital twin” patient profiles for clinical trials, announced that OpenAI Chief Technology Officer Mira Murati will join its Board. UnlearnAI's technology aims to accelerate clinical drug trials and reduce their cost by diminishing the need for placebo group enrollments.



JULY 2023



NVIDIA invests \$50 million into Recursion

Through a private investment in public equity, or PIPE, NVIDIA invested \$50 million into publicly traded Recursion, a company that leverages ML and AI for drug discovery. With the funding and NVIDIA partnership, Recursion plans to develop AI-powered therapeutic discovery models on the NVIDIA DGX Cloud. Tools could be made available to other biotech companies via NVIDIA's BioNeMo, a cloud service to help speed up the use of generative AI within drug discovery.



SEPTEMBER 2023



Inceptive raises \$100 million to design new vaccines and therapies with AI

Founded by former Google AI researcher Jakob Uszkoreit and armed with a new \$100 million funding round led by NVIDIA's NVentures and Andreessen Horowitz, Inceptive aims to leverage AI to design novel biological molecules. Inceptive licenses these molecules to pharmaceutical companies to develop medicines and put them through clinical trials. The funding grants Inceptive access to NVIDIA's computing platforms, including its latest chips.



NOVEMBER 2023



Tempus announces research collaboration with Bristol Myers Squibb to apply multimodal AI approaches

Tempus, a provider of AI-enabled precision medicine solutions, announced a multiyear strategic research collaboration with Bristol Myers Squibb. The goal of the partnership is to identify new drug targets and validate them faster and with higher confidence using multimodal datasets, computational approaches, and patient-derived disease models in specific cancer disease areas.

Conclusion

While we are still in the early innings of AI's potential to impact the healthcare sector, we believe use cases will be far reaching. We are cautiously optimistic about the use of health data to inform AI models, given privacy and regulatory restrictions. We believe that AI will meaningfully impact the cost and quality of care delivered and will ultimately lead to more efficient and effective drug discoveries. While it will happen in phases over time, we are in a once-in-a-lifetime paradigm shift and are excited to monitor the impact on healthcare and the investible opportunities that advances in AI and ML will create. ■

1. Source: [World Health Organization](#)
2. Source: Jama Network [Waste in the US Health Care System: Estimated Costs and Potential for Savings](#), October 7, 2019
3. Source: Jama Network [Administrative Simplification and the Potential for Saving a Quarter-Trillion Dollars in Health Care](#), October 20, 2021
4. Source: National Bureau of Economic Research [The Potential Impact of Artificial Intelligence on Healthcare Spending](#), Page 4, January 2023, revised October 2023
5. Sources: [Forbes](#), [Congress.gov](#)
6. Source: [whitehouse.gov](#). [Executive Order](#).
7. Source: National Library of Medicine [Estimated Research and Development Investment Needed to Bring a New Medicine to Market, 2009-2018](#), March 3, 2020
8. Source: McKinsey & Company [Fast to first-in-human: Getting new medicines to patients more quickly](#), February 10, 2023
9. Source: National Library of Medicine [Why 90% of clinical drug development fails and how to improve it?](#), February 11, 2022
10. Source: For illustrative purposes only as a select example of a company in the Adams Street portfolio related to use of AI in healthcare. This company is not intended to be representative of the holdings of the broader Adams Street portfolio or any particular Adams Street-managed investment vehicle.
11. Source: [Freenome](#)
12. Source: PLOS Digital Health [Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models](#), February 9, 2023.
13. Source: Atropos Health [How Well Do Large Language Models Support Clinician Information Needs?](#), March 31, 2023
14. Source: [WhatIs.com](#) [What are AI hallucinations?](#), June 2023
15. Source: Atropos Health [How Well Do Large Language Models Support Clinician Information Needs?](#), March 31, 2023
16. Source: Nature [Supervised deep learning with vision transformer predicts delirium using limited lead EEG](#), May 16, 2023
17. Source: Amazon Web Services [What is an API \(Application Programming Interface\)?](#)
18. Source: Amazon Web Services [AWS HealthScribe](#)
19. Source: Journal of Medical Internet Research [Assessing the Utility of ChatGPT Throughout the Entire Clinical Workflow: Development and Usability Study](#) August 22, 2023
20. Source: Bain & Company [Beyond Hype: Getting the Most Out of Generative AI in Healthcare Today](#) August 7, 2023

LEADING WITH FORESIGHT™

Adams Street Partners is a global private markets investment manager with investments in more than 30 countries across five continents. The firm is 100% employee-owned and manages \$58 billion in assets under management. Adams Street strives to generate actionable investment insights across market cycles by drawing on over 50 years of private markets experience, proprietary intelligence, and trusted relationships. Adams Street has offices in Austin, Beijing, Boston, Chicago, London, Menlo Park, Munich, New York, Seoul, Singapore, Sydney, and Tokyo. adamsstreetpartners.com

Important Considerations: The above information is for informational purposes only and is not investment advice or an offer or sale of any security or investment product or investment advice. Offerings are made only pursuant to a private offering memorandum containing important information. Statements made are as of the date hereof unless stated otherwise, and there is no implication that the information contained herein is correct as of any time subsequent to such date. All information has been obtained from sources believed to be reliable and current, but accuracy cannot be guaranteed. References herein to specific sectors, strategies or companies are not to be considered a recommendation or solicitation for any such sector, strategy, or company. While Adams Street believes in the merit of private market investing, such investments are subject to a variety of risk factors and there can be no guarantee against loss. **Past performance is not a guarantee of future results.** Projections or forward-looking statements contained in the Paper are only estimates of future results or events that are based upon assumptions made at the time such projections or statements were developed or made. There can be no assurance that the results set forth in the projections or the events predicted will be attained, and actual results may be significantly different from the projections. Also, general economic factors, which are not predictable, can have a material impact on the reliability of projections or forward-looking statements. Adams Street Partners, LLC is a US investment adviser governed by applicable US laws, which differ from laws in other jurisdictions.