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Navigating Healthcare AI: A Guide for Private Equity Investors

January 2024

Market Update

Increasing Healthcare Expenditure Amplifies Need for AI Innovation

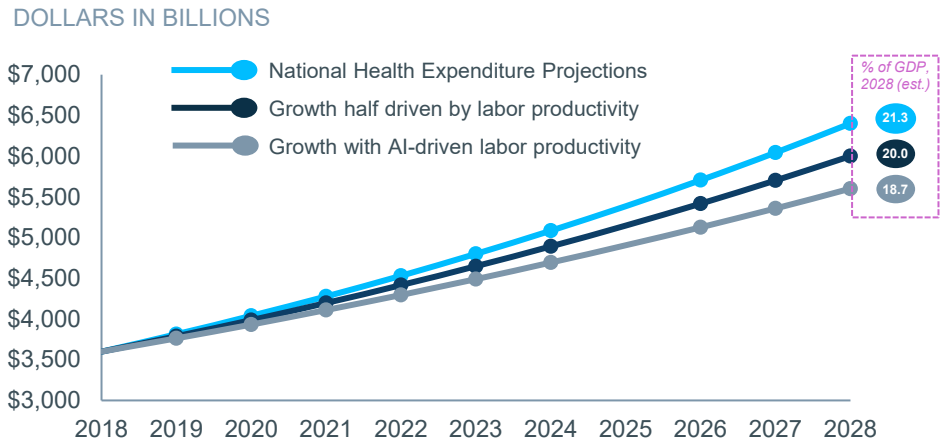
Healthcare Burdened with Increasing Costs and Demand

- An expanding geriatric population and increase in life expectancy are driving additional demand for care
- An increase in the sophistication of treatments and demand for personalized care is driving increase in costs
- Nearly 30% of the $4T+ annual US healthcare spend represents admin activities. ~$300B is estimated as repetitive, labor-intensive processes and wasteful administrative opex that can be addressed by AI
- Companies will need to rely on labor productivity gains rather than workforce expansion to meet demand growth
- Population demographics are outpacing rate of replenishment of skilled labor and new entrants of specialty care providers

Organizations are Seeking Efficiency and Innovation

- AI offers a “low-code, no-code” approach that makes it easier for organizations to adopt AI capabilities at scale
- 98% of leaders indicate that their organization has or plans to implement an AI strategy, and companies will need to keep pace with peers
- Generative AI’s democratizing power means competitors will have the same access to information, and non-participants will lag
- Implementing AI will not improve workflows in isolation
- Differentiation comes from implementing AI solutions to address specific pain points, and users’ ability to prompt the system;

Current System Spending Growth Projections[1]



AI has Staying Power, and Market is Rapidly Expanding

- ***As of 2023, the market for AI in healthcare is expected to close at $12.63bn, with an expected 40.1% CAGR from 2023-2031***
- Investment and M&A activity is high as seen in merging of public companies, mid-market acquisitions, venture capital investments, and consolidators investing in innovation

Favorable Timing and Market Conditions

Increasing applications across healthcare landscape and development new technologies

Increase in availability of data through proliferation of EHRs

Supportive government initiatives and end-market users

Source:
1. Bureau of Economic Analysis; McKinsey Analysis
2. NHE, research reports

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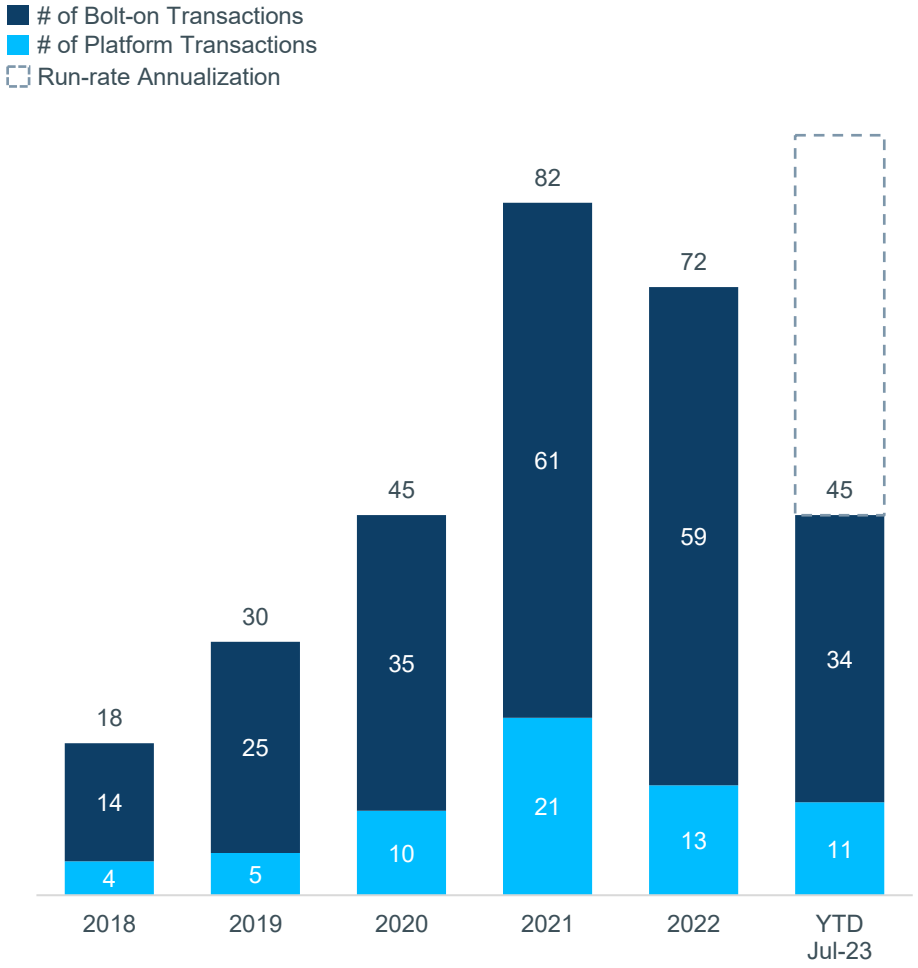
Deal Activity and Fundraising Environment

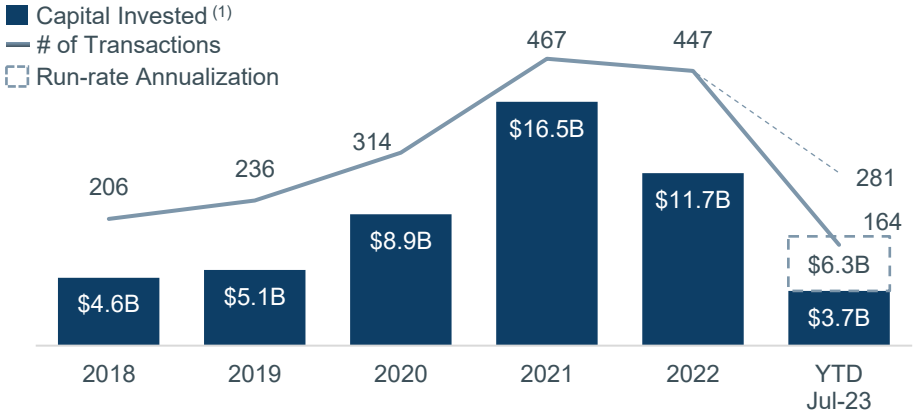
AI adoption is driving YTD M&A activity within healthcare

- 98% of leaders indicate that their organization will implement an AI strategy, suggesting transactions will remain strong across traditional M&A and fundraising
- AI solutions generally have a positive near-term impact by decreasing operating costs and improving performance, encouraging greater adoption
- AI M&A activity reached a significant level in 2022, even if not matching 2021's record-breaking standard. Fundraising similarly remained high

Healthcare AI M&A Update



Healthcare AI Fundraising Update



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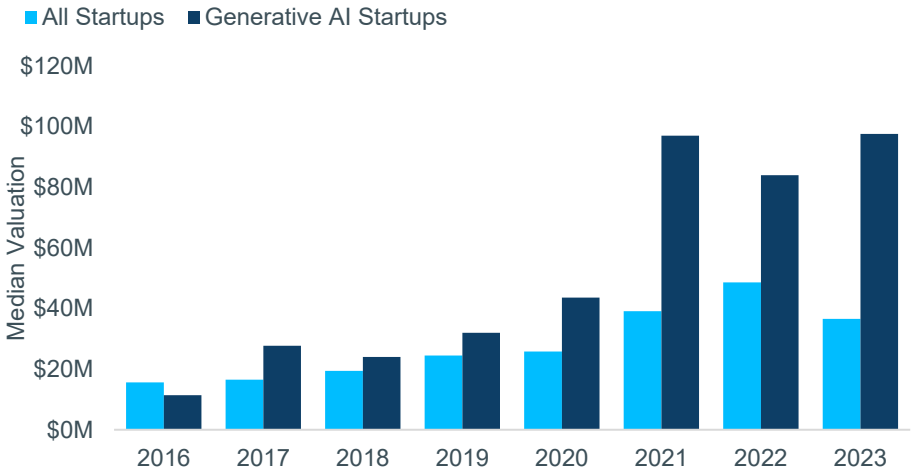

Source: PitchBook

1. Fundraising values based on disclosed financial details

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What is Generative AI and Its Significance in Healthcare

What is Predictive AI?

- Predictive AI involves **mathematical models that learns from historical data to identify patterns from the past to predict future**
- This type is most valuable to processes that benefit from RPA and clinical applications in healthcare today, as it is traceable, discrete, and consistent

What is Generative AI?

- Generative AI, (aka Large Language Models "LLMs" or Foundation Models) are technology that relies on deep-learning algorithms to **create new probabilistic content in the form of text, audio, code, images, and more**
- Takes unstructured data sets — information that has not been organized according to a preset model making it difficult to codify — interpret, analyze, and synthesize findings
- Represents a potential breakthrough in healthcare operations, which are rich in unstructured data such as clinical notes, diagnostic images, medical charts, and recordings
- Generative tools (e.g. ChatGPT), are trained on un-curated materials found on the internet
  - The inputs themselves often contain inaccurate information, thus the models can produce inappropriate and misleading text, "hallucinations"
  - Generative applications generally have a need for "human in the loop" (HITL) to review output and interact with the system in real time

When to Implement AI Solutions

- The main applications of this technology target cost saving and automation in back office operations and making workflows more efficient for frontline staff

Automating Tedious Operational Work

- Identification of patterns in large data sets
- Connecting data sets from multiple systems

Complex Cases Prone to Human Error

- Identification of tumors
- Understanding explanation of complex benefit codes

When Considering an AI Solution, Companies Should Ask

- Where efficiencies can be unlocked?
- Where was complexity the roadblock for innovation? Why couldn't we innovate here before?
- How will this technology change employees' roles and how they are deployed in the organization?
- How can we identify and contend with biased output from generative AI models?
- Where do you need a "human in the loop" to ensure suggestions are beneficial?

Source: Washington Post

Regulatory Backdrop is Supportive of Healthcare AI Innovation

Where are we with Respect to AI Legislation Right Now?

- As of July 2023, there are no **generative** AI algorithms that have been approved for use in healthcare by any regulatory agency; Current HIPAA guidelines do not cover generative AI
- FDA has cleared or approved over 500 **predictive** AI algorithms; approved algorithms mimic Robotic Process Automation (RPA) (e.g. executing 1 linear task, versus a multi-step, multi-modal decision analysis using a transformer model)
- ONC (Office of the National Coordinator for Health Information Technology, created in 2004) mandating a "nutrition label" for predictive tools in attempt to reduce algorithmic bias
  - Will govern AI and application programming interfaces (APIs) that interact with Fast Interoperability Resources (FHIR)
  - Will likely require electronic health record systems using predictive tools to provide users with information about how that technology works, including a description of the data it uses
- Initial ONC proposal, HTI-1: Health Data, Technology, and Interoperability: Certification Program Updates, Algorithm Transparency, and Information Sharing (HTI-1: Link Here)

What about Google and other general search systems?

Protected under Section 230 of the 1996 Communications Decency Act

No regulatory burden when it comes to processing medical queries; 3rd party sources carry the liability

Can be used by doctors because it is more of a self-contained systems; passive transmitter of information provided by others vs generated content

Challenges of Approval for Use of Generative AI

1 Data Availability to Reduce Algorithmic Bias

- Algorithms require large datasets to train on
- In healthcare, this data can be difficult to obtain, ingest and may be subject to privacy regulations

2 Trustworthiness, Interpretability and Traceability

- Healthcare providers need to understand how the algorithm is making decisions in order to trust the results
- With generative AI tools, data sources are not always disclosed and not trusted individually
- Algorithms can be difficult to interpret, which can make it difficult to understand how they work and why they produce specific results

Source: HealthIT.gov, hhs.gov, Fedscoop, Wall Street Research

Framework for AI Solutions

Leerink Framework for Generative AI Uses Cases Across Healthcare Services

Enterprise → Consumer

Clinical

EHRs
- ✓ Clinical decision support
- ✓ Referral management

Devices and Diagnosis
- ✓ Detection, diagnosis, triage
- – Multi-condition classification and prognosis
- ✓ Enhance / analyze images
- ✓ Surgery support / training

Providers / Care Delivery
- ✓ Patient intake and triage
- ✓ Care coordination
- ✓ Referral management
- ✓ Scribing, documentation

Consumer Driven Care
- ✓ Talk therapy / chatbots
- ✓ Patient engagement

Non Clinical

Payers
- ✓ Payments and collections
- ✓ Fraud, waste, abuse
- ✓ Risk management
- ✓ Contract management

Providers
- ✓ Billing
- ✓ Claims processing

Revenue Cycle Management

Workforce
- ✓ Staffing and recruitment
- ✓ Utilization management
- ✓ Scheduling
- ✓ Compliance, quality monitoring, reporting

Patient Access
- – Benefits management/ enrollment
- – Patient financial assistance
- – Social needs coordination
- – Public-health surveillance

BioPharma

Drug Discovery / Research
- – Accelerated drug discovery
- – Protein folding/ drug design
- ? Personalized drug delivery
- ✓ NGS / Genomics
- ✓ Dx

Development
- – Clinical-trial design
- – Improved patient enrollment
- – Data collection, safety monitoring, compliance
- – Regulatory submissions

Commercialization
- ✓ Customization of marketing materials and launch
- ✓ Treatment and patient matching
- ✓

Pharmacy / Distribution
- ✓ Supply chain risk identification and process augmentation
- ✓ Improved distribution and restocking

✓ Validated – In Development ? Conceptual

Source: Leerink Analysis

Adoption and Investment Trends

Stakeholder Incentives for Pursuing AI Solutions

Healthcare Sellers

Sellers with AI-enabled solutions consummate deals at higher valuations

- Seller activity increased, with the number of transactions involving AI-enabled offerings jumping from 7% in 2021 to 13% in 2022 to 21% in 2023 YTD
- Integrated AI solutions often garner aggressive valuation multiples, positioning companies as innovative and capable of high-growth
- Median pre-money valuations for early-stage rounds of AI companies jumped by 16%, while prices for all other startups raising a Series A or Series B have dropped by nearly 24%

Healthcare Companies

Operators demonstrate stronger financial results within a short implementation window in a conservative environment

- Macroeconomic outlook has created cash-conservation mentality; shareholders and investors are focused on operating efficiencies
- End market customers (e.g. health systems with thin margins) are more willing to spend on solutions that deliver immediate value in automation, managing unstructured data, and cost savings vs adding traditional vendors with promises of long-term cost efficiencies
- Productivity gains can greatly reduce costs and operational overhead; employees can be repurposed into higher value-added roles

Healthcare Buyers

Buyers see opportunities to build capital efficient companies, with innovative technologies that are desirable to strategics

- AI for workflow drivers, RPAs, bots, scribes, and other automation tools can immediately improve labor shortage constraints, reduce errors in current workflows, and improve accuracy and insights across the platform
- For future exits, AI solutions are high demand way to get in the door with strategics and to attack their broader software stack
- Acquiring a company with effective internal technology drives synergies and growth across the old and new businesses

Source: Wall Street Research, Leerink Analysis

Landscape and Forward Outlook

Incumbents Recognize AI's Potential, Drive Large Scale Acquisitions, and Maintain Valuations

Notable Healthcare AI Transactions by Incumbents

SIEMENS + varian	$16.4B / Apr-21	Microsoft + NUANCE	$18.8B / Mar-22
PHILIPS + Cardiologs AI Serving Cardiology	Und. / Nov-21	amazon + one medical	$3.9B / Jul-22
R1 + cloudmed	$4.1B / Jan-22	GE HealthCare + Caption Health	$150m / Feb-23
SIRONA + Nines	Und. / Feb-22	BIONTECH + InstaDeep™	$724m / Jul-23

Factors Softening Valuation

- × **Rate outlook remains bleak:** rates remain high (+5% expected through 2024)
- × **Broad tech-sector challenges:** companies raising down rounds from previous valuation boom
- × **New key metrics:** valuations based on actual revenues and growth traction, with expectation for clear path to profitability
- × **Lack of liquidity from PE:** less funds recycled and redeployed into new investments
- × **Risk-off environment:** corporates focused on cost cutting, and investors focused on unit economics vs innovation potential

Factors Driving Valuations / Activity

- ✓ **Need for operational efficiency:** macro backdrop forcing efficiency into labor, cost, VBC/ outcomes etc.
- ✓ **Immediacy potential:** potential for new solutions to deliver large and immediate value, while maintaining workflows, and operating environments
- ✓ **Insightful analyses:** Ability to generate consumable and novel insights, from unstructured datasets; potentially reduce complexity of challenging problems (e.g. VBC or new product development)
- ✓ **Interest from incumbents:** gives legitimacy and staying power to AI and galvanizes use cases

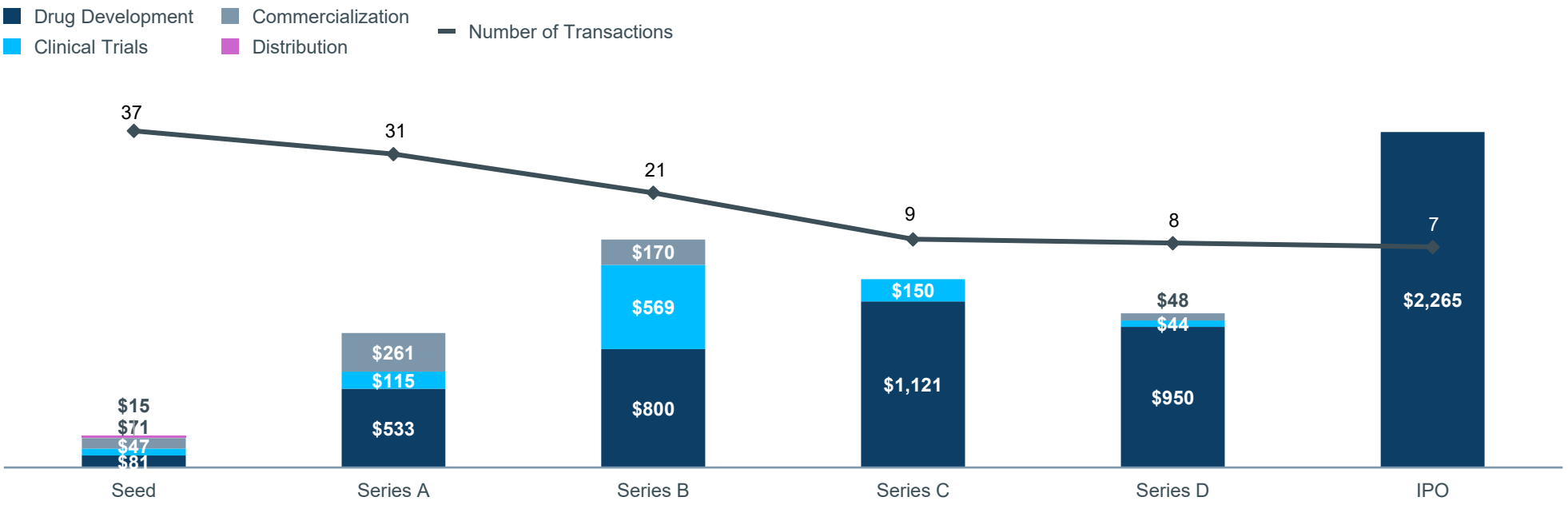
Source: Wall Street Research, Leerink Analysis

What Companies Are Getting Funded / Where Is the Activity?

Companies are receiving early-stage financings primarily in the Drug Development space, with few emerging as winners who are able to secure high-value late-stage funding

Total Deal Value and Volume Since 2021

($ in millions)



Early-Stage

- aily — Series A | $21M
- BigHat Biosciences — Series A | $19M
- Cartography Biosciences — Series A | $57M
- Dyno Therapeutics — Series A | $100M
- Hippocratic AI — Do No Harm — Seed | $50M
- Memora Health — Series A | $40M

Growth-Stage

- Deepcell — Series B | $73M
- Exscientia — Series C | $100M
- Genesis Therapeutics — Series B | $200M
- Insilico Medicine — Series C | $255M
- notable — Series B | $100M
- Valo — Series B | $300M

Late-Stage

- absci — IPO | $200M
- Benevolent AI — SPAC | ~$500M
- komodo Health — Series D | $44M
- Recursion — IPO | $502M
- somalogic — SPAC | $651M
- XtalPi — Series D | $400M

Source: Wall Street Research, Leerink Analysis

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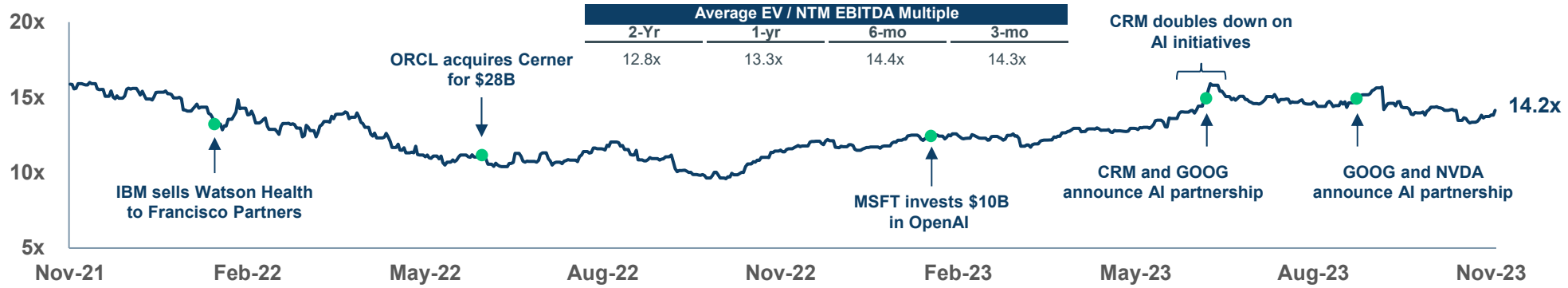
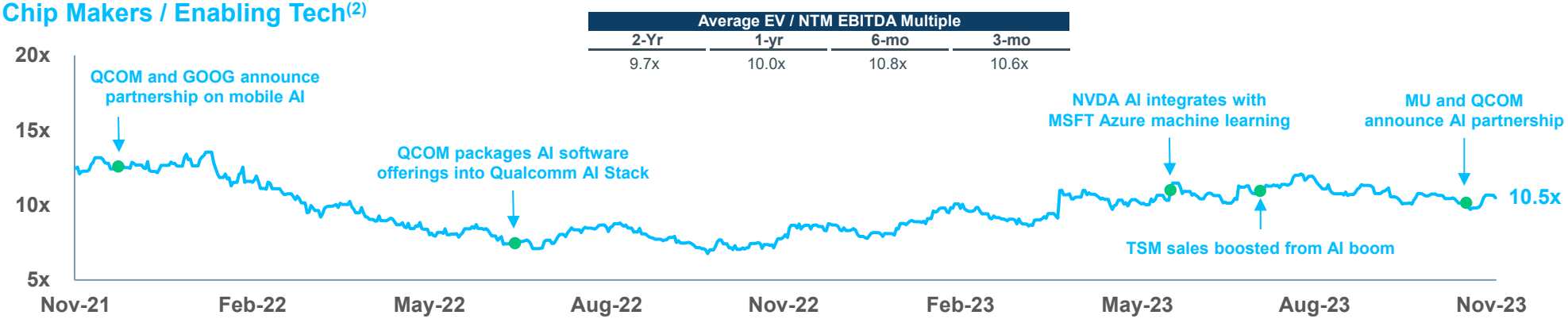
Trading Performance of Public Peers

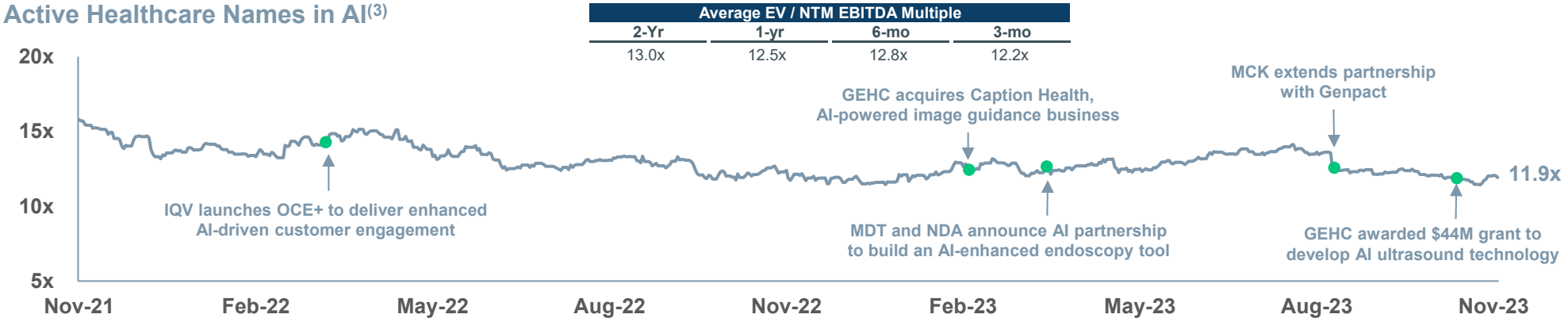
Incumbents / Strategics Funding Innovation[1]



Chip Makers / Enabling Tech[2]



Active Healthcare Names in AI[3]



Source: FactSet. Market data as if 11/08/2023.

1. Index includes: Microsoft, Google, Oracle, IBM and Salesforce.
2. Index Includes: Nvidia, Taiwan Semiconductor, Micron Technology and Qualcomm.
3. Index includes: GE HealthCare Technologies, Medtronic, McKesson and IQVIA.

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Appendix

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Glossary of Terms

Alignment

- Attempts by AI researchers and ethicists to ensure that artificial intelligences act in accordance with the values and goals of the people who create them

Anthropomorphism

- The tendency for people to attribute humanlike qualities or characteristics to an A.I. chatbot. For example, you may assume it is kind or cruel based on its answers, even though it is not capable of having emotions, or you may believe the A.I. is sentient because it is very good at mimicking human language

Artificial Intelligence

- An artificial intelligence that matches human intellect and can do anything the human brain can do

Bias

- A type of error that can occur in a large language model if its output is skewed by the model's training data. For example, a model may associate specific traits or professions with a certain race or gender, leading to inaccurate predictions and offensive responses

Chatbot

- A generative AI program that can carry out complex yet conversational interactions with users

Deep Learning

- A subset of machine learning that uses multiple layers of increasing complexity and subtraction in a hierarchal neural network. Each deep leaning layer is created with knowledge gained from the preceding layer of hierarchy

Emergent Behavior

- Unexpected or unintended abilities in a large language model, enabled by the model's learning patterns and rules from its training data. For example, models that are trained on programming and coding sites can write new code. Other examples include creative abilities like composing poetry, music and fictional stories

Foundational Model

- Refers to a neural trained on massive unlabeled datasets that can be adapted to a wide range of downstream task, including text and analyzing medical images
- Can be trained on multimodal data (text, images, audio, etc.)

Generative Adversarial Network

- Machine learning model in which two networks compete with each other by using deep learning methods to become more accurate in their predictions
- Used widely in image, video and voice generation

Generative AI

- Technology that creates content — including text, images, video and computer code — by identifying patterns in large quantities of training data, and then creating original material that has similar characteristics. Examples include ChatGPT for text and DALL-E and Midjourney for images

Graphics Processing Unit

- Specialized processor originally designed to accelerate graphics rendering
- Can process many pieces of data simultaneously, making them useful for machine learning. Video editing and gaming applications

Hallucination

- A well-known phenomenon in large language models, in which the system provides an answer that is factually incorrect, irrelevant or nonsensical, because of limitations in its training data and architecture

Source: NY Times, Leerink Analysis

Glossary of Terms

Interference Engine

- Processing component of an AI model that makes a decision from the data and rules on which the system was trained

Large Language Model

- A type of neural network that learns skills — including generating prose, conducting conversations and writing computer code — by analyzing vast amounts of text from across the internet. The basic function is to predict the next word in a sequence, but these models have surprised experts by learning new abilities

Machine Learning

- The use and development of computer systems that are able to learn and adapt without following explicit instructions by using algorithms and statistical models to analyze and draw inferences from patters in data
- Designed to imitate that way humans learn, recognizing a visual scene, understand written text in a natural language or perform an action in the physical world

Multimodal Systems

- AIs similar to ChatGPT that can also process images, video, audio and other non-text inputs and outputs

Natural Language Processing

- Techniques used by large language models to understand and generate human language, including text classification and sentiment analysis. These methods often use a combination of machine learning algorithms, statistical models and linguistic rules

Neural Network

- A mathematical system, modeled on the human brain, that learns skills by finding statistical patterns in data. It consists of layers of artificial neurons: The first layer receives the input data, and the last layer outputs the results. Even the experts who create neural networks don't always understand what happens in between

Parallelization

- Technique in computing that involves executing multiple tasks or processes simultaneously to improve performance
- In the context of machine learning (ML) algorithms are deploys across multiple processors to reduce the time it takes to train models

Parameters

- Numerical values that define a large language model's structure and behavior, like clues that help it guess what words come next. Systems like GPT-4 are thought to have hundreds of billions of parameters

Reinforcement Learning

- A technique that teaches an A.I. model to find the best result by trial and error, receiving rewards or punishments from an algorithm based on its results. This system can be enhanced by humans giving feedback on its performance, in the form of ratings, corrections and suggestions

Tensor Processing Unit

- Specialized hardware accelerator originally designed by Google in 2016 for use in deep neural networks and ML models
- Optimized for tensor operations and can significantly boost efficiency in the training and inference of large-scale ML models

Token

- Individual unit of meaning, usually a word or a symbol, derived from a text through the encoding process
- Helps algorithms understand and analyze language structure and meaning

Transformer Model

- A neural network architecture useful for understanding language that does not have to analyze words one at a time but can look at an entire sentence at once. This was an A.I. breakthrough, because it enabled models to understand context and long-term dependencies in language. Transformers use a technique called self-attention, which allows the model to focus on the particular words that are important in understanding the meaning of a sentence

Source: NY Times, Leerink Analysis

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