Generative AI's Potential to Reshape Healthcare

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Executive Summary

The use of AI in healthcare has grown significantly, offering transformativ potential in areas ranging from diagnostics and imaging to drug discovery and personalized treatment. Advanced algorithms can now diagnose diseases quickly and accurately, often with a precision that rivals human experts, while streamlining drug development and tailoring treatments to individual patient profiles. Despite these innovations, the healthcare industry faces significant challenges, including a severe shortage of healthcare professionals and inefficient systems, leading to rising costs for payers. The introduction of Generative AI could usher in a new era of personalized medicine and operational efficiency in healthcare. By harnessing its ability to generate novel data, it can assist in the development of patient-specific medical solutions, from automated medical notes and diagnosis to the generation of tailored drug combinations. But it also requires rigorous validation to ensure safety and efficacy, presenting both exciting potential and challenges for the industry.

Challenges Faced by the Healthcare Industry

Administrative error puts lives at risk: There is a 1 in 300 chance that an individual will suffer harm during their healthcare journey. Previous studies have shown that up to 50% of medical errors in primary care are due to administrative oversight. Such errors can have far-reaching consequences, including failure to detect critical conditions or misdiagnosis. This can lead to inappropriate treatment and inappropriate scheduling of necessary interventions. The high prevalence of

these administrative errors highlights the urgent need for efficient processes and, potentially, the adoption of cutting-edge technologies to reduce such drawbacks. Implementing solutions such as generative AI can not only automate many of these processes, but also correct discrepancies, reducing errors and improving the quality of care.

Lack of health personnel:

These problems are exacerbated by a global shortage of health workers. The WHO estimates that by 2030 there will be a shortage of around 10 million health workers, with most of the shortfall in low- and lower-middle-income regions. This makes it even more challenging to provide equitable healthcare. By automating certain administrative and diagnostic processes with Generative AI, the impact of the worker shortage can be mitigated, ensuring that even with fewer hands on deck, healthcare delivery remains accurate, timely and efficient.

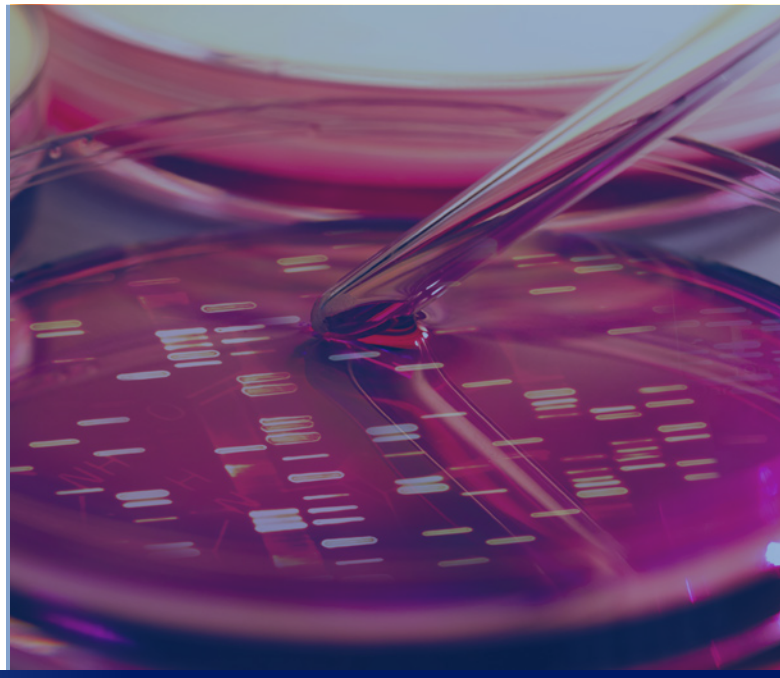
Rising healthcare costs:

Combined with a shortage of clinical staff, rising costs have put immense pressure on healthcare infrastructures, reducing access to services and potentially compromising the quality of care. This financial burden affects not only patients but also insurers and governments,creating barriers to coverage, increasing direct patient costs and complicating health policy decisions. Ensuring that healthcare remains affordable for all segments of the

What Is Generative AI?

Generative AI refers to a class of AI algorithms capable of generating new and unique content, such as text, images, video or music, by learning from existing data. Popular models such as ChatGPT, DALL-E and Midjourney have been trained on vast amounts of unlabelled and open data, deriving a collective knowledge of how humans have produced such information in the first place. The models are then able to generate unique content that is often indistinguishable from human-generated content.

As with many other industries, Generative AI is set to become a major disruptor in healthcare. With a projected market value of $6 trillion by Morgan Stanley, the significance of the impact of this technology is hard to ignore. While generative AI offers a promising solution to some of these challenges, it's important to recognise that the technology is still in its infancy and comes with its own set of challenges. Bias in training data is a significant risk. If the data used to train these AI models is unrepresentative or biased, the AI's predictions and recommendations could perpetuate or exacerbate existing healthcare inequalities, leading to unequal care. Inaccuracies in AI's treatment suggestions could pose a threat to a patient's health, so it is crucial that healthcare professionals and those they care for have full confidence in the system. Second, ethical concerns and trust are key. Ensuring the privacy of patient data, managing the potential misuse of generated data, and building trust between healthcare professionals and patients are critical to the successful integration of generative AI in healthcare.



Is this an Inflection Point for Generative AI's Impact on Healthcare?

We are currently on the cusp of a disruptive shift in healthcare, driven largely by advances in artificial intelligence (AI). The promise of AI in medicine has been heralded for some time, but it's only now that we're seeing a clear inflection point, moving from theoretical potential to concrete results. Specifically, Gwwwenerative AI is emerging as a frontrunner in this transformation. The convergence of increased data availability, advanced computing power and the maturation of AI algorithms positions us at a pivotal moment where Generative AI can revolutionise healthcare.

Healthcare Data Boom:

The modern era has seen an exponential increase in data collection. Electronic health records (EHRs), wearable devices and genomic sequencing are generating massive amounts of data every day. These data-rich sources include patients' medical histories, biometrics, lifestyle information and more. This treasure trove of data serves as the foundation for AI to learn, model and predict. In addition, the emergence of data-sharing platforms and health information exchanges ensures a continuous and diverse flow of data, expanding the range of opportunities for AI-based insights.

Advanced Computational Power:

Cutting-edge hardware innovations, particularly in graphics processing unit (GPU) technologies, have greatly increased data processing capabilities. These advances make it possible to process and analyse large, multi-dimensional data sets in real time. Cloud-based infrastructures and distributed computing further enhance this computing power, enabling more sophisticated and complex AI models to be trained and deployed more quickly.

Maturation of AI Algorithms:

Over the past decade, artificial intelligence (AI) algorithms, particularly those involving deep learning and neural networks, have

undergone significant refinement and improvement. Methods such as transfer learning- the fine-tuning of pre-trained models for specific tasks - have minimised the need for large amounts of training data. In addition, the development of Generative Adversarial Networks (GANs) and other generative models has extended the capabilities of AI beyond basic data analysis to the generation of unique data points and the simulation of complex systems. This advancement increases precision and enables the development of drug discovery and personalised treatment plans that are specifically tailored to individual genetic and phenotypic profiles.

Emerging use cases across stakeholder groups

We will discuss the current and potential use cases of Generative AI according to the stakeholder user groups, i.e. healthcare providers, private payers and patients, and pharmaceutical companies.

Healthcare Providers

Generative AI has become a valuable tool for doctors and healthcare professionals to make accurate and informed diagnostic decisions. By analysing large medical datasets, it can identify complex patterns for early and accurate diagnosis of disease, ensuring better patient outcomes. In addition, by taking into account a patient's medical history and lifestyle, AI can tailor treatment plans to promote effective care and cost savings. Beyond patient care, AI can also improve operational aspects, such as automating scheduling and records management. Here are some current use cases where healthcare providers are utilizing Generative AI:

Knowledge Management

Generative AI enables advanced knowledge management for healthcare providers by dynamically synthesising and organising vast amounts of medical information. This supports efficient decision making, continuous learning and ensuring up-to-date medical practices.

- Glass AI is using language models to create the first digital notebook for doctors. Glass Notebook is a medical knowledge management platform that can be used for assisted medical diagnosis and clinical planning.

- DeepScribe is an AI-powered medical scribe platform that automates medical note taking for clinicians. It uses Generative AI to capture and transcribe natural clinical speech in real time, extract relevant medical information and then classify it into a complete medical note. By combining Generative AI with

rules-based NLP and three speech recognition models, DeepScribe is able to capture visits in the background as they happen, without disrupting patient visits.

- Similarly, HCA Healthcare, in partnership with Google Cloud, is testing a system that extracts data from doctor-patient conversations to help generate medical documentation. Using hands-free devices combined with an app developed by Augmedix, preliminary clinical notes are automatically generated after the consultation. After review and finalisation by the doctor, these notes are immediately uploaded to the electronic health record (EHR).

- EHR software company MEDITECH is currently integrating Generative AI technology into its EHR, MEDITECH Expanse, to improve search and summary capabilities. Their goal is to use this technology to consolidate information from multiple sources and present a comprehensive patient history. Clinicians can ask questions about a patient's condition and receive relevant results that include patient records, clinical guidelines and scientific articles. MEDITECH is optimistic about the prospects for Generative AI tools to streamline clinical documentation processes, such as creating discharge summaries or notes for nursing shift changes, ultimately helping professionals deliver efficient care.

- Huma's technology platform collects a wide range of vital statistics, biomarkers and patient feedback, which is presented on a dashboard for healthcare professionals (HCPs). This capability enables HCPs to serve a larger patient base than traditional face-to-face methods, providing a solution to staffing challenges and extending the reach of healthcare. There are also significant opportunities to improve efficiency by reducing administrative tasks that take time away from patient care. GenAI will be used to automate the creation of clinical summary reports based on incoming data, highlighting relevant details for review and streamlining documentation and sorting procedures.

AI-Driven Pathology

Generative AI enhances AI-driven pathology by digitising laboratories, enabling deeper insights into disease and paving the way for advanced diagnostic tools. Paige.AI is a company specialising in generative AI for cancer diagnosis. Their innovative AI technologies are transforming pathology and making generative AI accessible to physicians. The Paige.AI platform enables the complete digitisation of the pathology laboratory, extending the capabilities of doctors beyond what is possible with traditional pathology. Paige's generative AI is now poised to unlock the deepest secrets of cancer and usher in the next generation of diagnostic tools that will save lives.

Additionally, Generative AI can be utilized to offer transformative applications ranging from custom treatment plans to sophisticated training simulations. Here are some potential use cases that can be developed:

- **Personalized Treatment Plans:** Generative AI can be used to create personalised treatment plans for patients, taking into account their individual medical history, genetic information and current health status. This individualisation can increase treatment effectiveness and reduce side effects.
- **Automating prior authorization and auto-form filling:** Implementing Generative AI technologies can help streamline the PA process and reduce costs. Generative AI can help by analysing information in the electronic health record (EHR) and automatically completing the PA form, reducing the time and effort required by healthcare providers.
- **Simulation of Medical Procedures:** For complex or rare surgeries, generative AI can simulate the operation, allowing medical wprofessionals to practice or anticipate potential obstacles.

- **Medical education and training:** Generative models can create patient scenarios, symptoms and outcomes for medical training simulations, allowing students and professionals to practice diagnosis and treatment in a controlled, virtual environment.

- **Mental health and therapy:** AI can be used to generate therapeutic content, exercises or interventions based on a patient's specific mental health needs and progress, complementing traditional therapy.

Private Payers

Private players are using Generative AI to increase the personalisation of health insurance and improve risk management, thereby reducing their costs. Generative AI enables payers to identify trends in care and derive insights with unprecedented ease. Such advances in payer operations will not only reduce costs, but also promote a more inclusive and cost-effective healthcare system for all.

A current use case is DigitalOwl, which uses generative AI technology to extract relevant medical information needed to assess risk or manage a claim. Digital Owl has built a unique, proprietary engine that addresses a pressing need for insurers to better predict risk and claims. It removes the friction from underwriting and claims analysis, allowing carriers to replace a lengthy, manual and error-prone process with automation and accuracy. This technology reduces operational costs and turnaround times to improve affordability for payers.

Further use-cases of Generative AI is possible to improve efficiencies for payers:

- **Automated/Intelligent Claims Review and Edits:** Generative AI can improve the medical claims review process. Instead of manually sifting through claims, AI can analyse and predict typical medical coding patterns, flag discrepancies and offer edits. This automation can dramatically reduce processing time, minimise human error and ensure billing standards are consistently met.

- **Automated Prior Authorizations:** Prior authorisations are required for certain medical services to ensure that treatment is medically

necessary. Generative AI can predict and automatically generate these authorisations based on patient history and treatment protocols, speeding up the authorisation process and ensuring timely care without unnecessary delays.

- **Auto-prediction of Referral Requirements and Analysis of Provider Referral Patterns:** Generative AI can predict when a referral may be needed based on a patient's condition and medical history. In addition, by analysing trends in how providers make referrals, AI can identify patterns, ensuring optimal patient routing and potentially uncovering irregular or sub-optimal referral practices.

- **Replacement of Predominately Manual Tasks:** Tasks such as member verification, provider credentialing and accounts payable are often time-consuming. Generative AI can simulate these tasks by automatically generating necessary documentation, verifying credentials against known databases, and automating payment processes, reducing administrative overhead and improving accuracy.

- **Customer Care using Chat, Predictive Analytics, and Automated Suggestions:** Generative AI can revolutionise customer service in healthcare. AI-powered chatbots can generate responses to patient queries in real time, while predictive analytics can anticipate user needs based on previous interactions. Automated suggestions can guide patients through the healthcare journey, providing timely advice and support.

Pharmaceutical Companies

Developing new pharmaceutical products is a long and expensive process - the entire journey from concept to market can take 12-15 years and cost more than $1 billion. Generative AI is ushering in a new era for the pharmaceutical industry, particularly in drug discovery and development. By simulating interactions between molecules and biological systems, this advanced technology accelerates the identification of potential drug candidates, dramatically reducing time and cost. It can also optimise formulations, predict drug responses based on genetic make-up and facilitate personalised medicine strategies. This AI-driven revolution promises to make drug development more efficient, personalised and cost-effective.

Bayer Pharmaceuticals is exploring the potential of generative AI tools, such as Google Cloud's Vertex AI and Med-PaLM 2, to accelerate drug development. Generative AI helps scientists seamlessly access, locate and correlate data, sift through vast amounts of research data for potential connections, and even automate the tedious processes of creating clinical trial communications and translating them into different languages. In addition, generative AI holds promise for pharmaceutical companies by enabling personalised medicine, optimising clinical trial recruitment and improving manufacturing efficiency and consistency.

- **Enhanced personalised medicine:** By analysing large datasets of patient genetics and responses to treatments, generative AI can help design tailored therapeutic solutions to meet individual patient needs.

- **Facilitated clinical trial recruitment:** Generative AI can be used to analyse patient data and predict which patients are best suited for specific clinical trials, ensuring efficient trial recruitment and potentially better outcomes.

- **Optimised manufacturing processes:** Generative models can simulate and predict optimal manufacturing conditions, leading to reduced waste, faster production times and consistent drug quality.

Risks of Generative AI in Healthcare

Inherent bias

The inherent bias of generative AI poses a significant risk when applied to healthcare. AI models are trained on large datasets, and if those datasets contain bias - whether racial, gender, socioeconomic, or related to other patient demographics - the AI could perpetuate or even exacerbate that bias in its outputs. One example in medical AI is bias in data labelling during clinical assessment. For example, existing research has shown that gender stereotypes lead to women being overdiagnosed for some conditions, such as depression, and underdiagnosed for others, such as cancer. In addition, a large Danish study analysing hospital admission data for around 7 million citizens and 19 disease groups found that women are diagnosed later than men for the vast majority of diseases. Such biased algorithms could lead to misdiagnosis, inappropriate treatment or unequal care, particularly for underrepresented or marginalised groups, and raise safety concerns for end-users of health services.

Hallucinations

Hallucination, a phenomenon where generative AI produces outputs that aren't based on reality or the input data, is a real risk in healthcare applications. For example, when generating patient notes or recommendations, an AI-induced hallucination could introduce false information or omit important details, compromising patient care. In this domain, hallucinated output can jeopardise patient health and undermine trust in AI-driven medical processes.

Lack of Transparency

The lack of transparency in generative AI poses a significant risk when applied to healthcare. Often referred to as 'black box' models, these AI systems, specifically deep neural networks, are powerful but don't easily reveal how they arrive at their conclusions. In a healthcare context, where every decision can have life-changing consequences, not understanding the rationale behind an AI recommendation can be problematic. In addition, the lack of

accountability means that it is difficult to identify the source of AI errors and assign responsibility when things go wrong.

Data Privacy

In healthcare, where patient data is both sensitive and critical, generative AI poses potential risks to patient privacy. By design, generative AI models learn from large data sets, often including detailed patient records. If not handled with the utmost care, there's a possibility that the AI could inadvertently reproduce or leak identifiable information, even when generating seemingly new data. One emerging concern is the potential misuse of generative AI in the context of data repurposing, occasionally referred to as 'function creep'. While the World Health Organization warned of function creep during the COVID-19 pandemic, highlighting a scenario in Singapore where COVID-19 tracking app data was used for criminal investigations, the introduction of generative AI further complicates this landscape. The concern stems from the fact that generative AI models trained on large healthcare datasets could inadvertently generate, or be used to generate, information that could be repurposed beyond its original intent, both within and outside of healthcare parameters.

Summary

Healthcare organizations looking to harness the power of generative AI should start with a focused strategy: forming cross-functional teams to identify high-value applications, investing in robust data management tools to leverage large datasets, and building skills by hiring in-house AI experts and providing ongoing training. Strategic partnerships with technology companies are critical to leverage the latest advances in generative AI technology and cloud infrastructure.

Additionally, prioritising data security, addressing inherent risks such as bias, and promoting a 'human-in-the-loop' approach are essential to promote trustworthiness. As generative AI evolves, its convergence with other emerging technologies such as wearables could redefine healthcare, making it imperative for industry leaders to act responsibly and promptly.

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