

Evaluating the Cost-Effectiveness of AI-Driven Health Care Solutions

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Artificial intelligence (AI) is driving innovation in the diagnoses, delivery, and administration of health care and it appears we are only at the beginning of understanding its full potential. According to CBInsights, the median deal size for digital health investment increased 39% over 2023 to \$5.3 million while the percentage of those deals for AI-related technologies increased to 42% in 2024 from just 26% in 2020.

AI technologies are already in use to provide earlier detection of health care conditions and improve the physicians' ability to diagnose patients. Facial recognition technology is currently in place to identify anomalies of the skin that could be early signs of melanoma, basal cell carcinoma, or squamous cell carcinoma¹. The diagnosis of serious mental illness, like schizophrenia and bipolar disorder, can often take years to diagnose with traditional methods. However, applying machine learning technology on electronic health records (EHR) has the promise of accelerating these diagnoses². Voice-recognition technology is being used by care navigators and physicians to identify issues beyond the patient's primary complaint, potentially identifying underlying physical or mental health conditions not expressed by the patient seeking guidance through their health care journey^{3,4}. Other examples of the use of AI in the diagnoses of health care include emergency department triage to treat the more critical cases faster, detecting inflammation of the heart that does not show on CT scans, and smart phone applications that detect ear infections.

AI is also being used effectively in the treatment and management of care. Cancers of unknown primary represent about 5% of all cancer patients. AI can assist in detecting where cancers originate, offering the ability to prescribe the right drug therapy the first time, improving recovery time and avoiding drug wastage⁵. Hospitals are using AI to detect sepsis in patients, reducing complications and length of stays⁶. AI has been shown to reduce clinical escalations by 10.4%, improving patient recovery and reducing hospital resource allocation⁷. Video-based assessments of surgeon's performance in the operating room using AI can reduce the potential for future medical errors⁸. While the extent of the effectiveness of mobile applications to

¹ [SkinIO | Enabling Earlier Detection of Skin Cancer](#)

² [Machine Learning Model Shows Promise in Early Detection of Serious Mental Illness | Artificial Intelligence | JAMA | JAMA Network](#)

³ [Why voice recognition is the new competitive battleground in healthcare's digital transformation | Healthcare IT News](#)

⁴ [Our Platform - CirrusMD](#)

⁵ [OncoNPC - the AI tool that can identify a cancer at its source - Oncology Central](#)

⁶ [AI to detect sepsis | Hub](#)

⁷ [Efficacy of AI models in Detecting Clinical Deterioration - The Hospitalist](#)

⁸ [The what? How? And Who? Of video based assessment - The American Journal of Surgery](#)

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encourage healthier habits has been widely debated, their use in identifying patient behavioral characteristics has been shown to have some success in offering individualized solutions to better promote weight loss⁹ and smoking cessation¹⁰.

The pharmaceutical industry has also benefited greatly from AI technology. Pharmaceutical companies can now simulate patient outcomes that would have been previously identified through random control trials¹¹, cutting the time to conduct these trials from several years to months. Deep neural networks are being used to develop drugs through the prediction of protein folding, molecular interactions, and cellular disease progression¹². Both uses of AI lower research and development costs and speed up the drug development time. Machine learning algorithms are creating drugs that kills bacteria responsible for drug resistant infections¹³. Fewer infections result in better clinical outcomes and reduced cost to the health care system.

AI also provides the promise of reducing the administrative burden that is extensive in providing health care services and adjudicating insurance claims. AI is being used to create EHRs directly from patients' interactions without the need for as much staff time to generate the records as in the past¹⁴. Hospital discharge information to patients is being transformed by Large Language Models (LLMs) to create more user-friendly communications with the potential to reduce readmissions¹⁵. Health care staff are spending less time on clinical reviews and quality audits of medical claims because of AI¹⁶.

Health insurers and third-party administrators are also benefiting from the use of AI. Machine learning will enable more efficient claim processing functions, reducing the lag between the date the claim was incurred and the payment to providers. LLMs can generate call scripts, custom coverage summaries, and content for nonclinical outbound calls, reducing the resource requirements in insurance company call centers.

These examples are just a few of the benefits AI has produced in the diagnosis, delivery, and administration of health care and there are great expectations for even more advancements. Given that health care is one of the most data-intensive industries, the benefits of AI can have a significant effect on the cost of delivering and administering care to the nation's 330 million people.

⁹ [Mobile Apps for Weight Management: A Review of the Latest Evidence to Inform Practice - PMC](#)

¹⁰ [Effectiveness of Mobile Apps for Smoking Cessation: A Review - PMC](#)

¹¹ [AI Simulations Help Drug Trials](#)

¹² [Accurate prediction of protein folding mechanisms by simple structure-based statistical mechanical models | Nature Communications](#)

¹³ [Using AI, scientists find a drug that could combat drug-resistant infections | MIT News | Massachusetts Institute of Technology](#)

¹⁴ [Using AI to Improve Electronic Health Records | Achievion](#)

¹⁵ [Generative Artificial Intelligence to Transform Inpatient Discharge Summaries to Patient-Friendly Language and Format - PubMed](#)

¹⁶ [The AI Revolution In Medical Claims Processing](#)

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Despite these developments, little has been undertaken to understand the cost-effectiveness of these innovations. While cost should not be a primary consideration in the development of care delivery systems, it is imperative that we understand the cost implications as we consider new developments and make sure the savings accrue to the end-payers of health care, such as:

- Governmental entities that fund programs like Medicare, Medicaid, Veteran Affairs, etc.
- Plan sponsors that provide health benefits for a specified population like employers, associations, etc.
- Individuals that pay for a portion of the cost of care through required contributions to participate in the plan.

Evaluating the cost effectiveness of AI-driven health care solutions is imperative for several reasons. First, it will be a determining factor in the prioritizing of funding for any development. The cost to develop the solution can be weighed against the value the solution offers in terms of its clinical value as well as its value in lowering health care costs. Funding for two solutions with equivalent clinical value and expected development costs can be prioritized by its value proposition in reducing the cost of care or the administrative burden in delivering care.

Additionally, understanding the solution's value proposition will allow for an understanding of how provider reimbursements may be restructured to assure the value accrues to the end-payers through reductions in funding requirements, insurance premiums (or claim payments for self-funded entities), required contributions to participant in the plan, and cost-sharing when services are incurred. Unfortunately, the prevalent reimbursement methodology to health care providers does not allow for immediate pass-through of any cost savings. Savings may not accrue the end-payor where providers are reimbursed on pre-negotiated per capita amounts or on a fixed fee for service basis. This issue was recently explored in some detail by Kev Coleman of the Paragon Institute¹⁷.

Having knowledge a priori of the potential cost reduction opportunities can allow for its consideration in provider reimbursement negotiations while still allowing for a reasonable profit margin. Given the unlimited possibilities for AI-driven healthcare solutions to reduce the cost of care, it may be reasonable for future provider contracts to include provisions for mid-contract adjustment to reflect the reduced cost to provide patient care.

There are many actuarial methodologies available for evaluating the potential cost reduction opportunity for an AI-driven health care solution. The appropriate methodology is dependent on the nature of the solution and the available data.

¹⁷ [Lowering Health Care Costs Through AI: The Possibilities and Barriers](#)

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In conducting the analysis of the cost reduction potential, it is important to consider the following elements:

- The reduction in claim cost per patient affected by the solution
- The prevalence of the condition addressed by the solution
- The reduction in claim cost across the population with access to the solution, regardless of the ability for all individuals to benefit from the solution
- Any associated reduction in the utilization of health care services
- Changes in practice patterns due to the presence of the solution
- Change in the mix of services due to the presence of the solution
- The prevalence and cost associated with false positive results from the solution
- The prevalence and cost associated with false negative results from the solution
- Any associated change in the cost of administering health care services
- Any associated changes in the cost of administering the benefit plans
- The cost of implementing the new solution
- Any fee charged by the developers of the solution to the end-payers for use or access to the solution
- The period over which savings can be achieved as some solutions may not demonstrate savings in excess of the cost of the solution immediately.

AI-driven health care solutions can dramatically change the paradigm of a system that is already a significant financial burden on governments, employers, and individuals. For most US-based employers, health care benefits are the second most costly item in their financial statement behind salaries and are the fastest growing expense. Governments struggle to manage the long-term funding requirements of their health care programs with many programs expected to show payments exceeding available funding allocated to those programs in as little as 10 years from now. Individuals are mounting financial debt largely due to the cost of health care. Careful development of the right solutions focused on both the clinical and financial value to the health care system will be instrumental in addressing the significant financial burden of our current health care system.

Healthcare actuaries are positioned as the best resource to evaluate the cost effectiveness of AI-driven advancements in health care, including those working for governments, health plans, health care providers (e.g., hospital and physician systems), or as consultants for health plan sponsors. Initial assessments of their cost-effectiveness potential may not have the advantage of data from real-world applications, but that should not deter the actuary from making an evaluation using related study materials and initial or expected engagement with the technology. Refinement of the technology's cost-effectiveness should be assessed on an ongoing basis as usage and clinical data become available. The rapid growth potential of AI to benefit an industry whose costs continues to outpace general inflation requires immediate actuarial evaluations of its potential to understand its value to society.