Artificial Intelligence in Medicine and Healthcare

Is it the evolving or devolving of medical practice management?

BY WILLIAM "MARTY" MARTIN, PSYD, MPH, MSC, AND ARMAND MARTIN, BS

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Artificial intelligence (AI) is poised to take on new roles in medicine and healthcare. On the one hand, AI has the potential to transform how healthcare providers deliver patient care and manage their practices. AI already outperforms humans in some diagnostic tasks.[1] On the other hand, AI has the potential to disrupt medicine and healthcare in ways we cannot even forecast today. Roose[2] writes, "Leaders from *OpenAI*, *Google DeepMind*, *Anthropic*, and other AI labs warn that future systems could be as deadly as pandemics and nuclear weapons." Rosenfeld[3] writes, "AI is no longer just the future of medicine—it's already here, and over time, it will transform nearly every area of medical practice."

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AI is used to perform complex tasks that once could only be done by humans, such as playing chess or communicating with customers. In short, AI makes it possible for machines to learn from experience, adjust to new inputs, and, again, perform human-like tasks. AI seeks to perform tasks that typically require human intelligence, such as learning from data, recognizing patterns, and making decisions with minimal human intervention. In this article, we explore different types of AI, the history of AI in medicine and healthcare, the benefits and risks associated with its integration, and real-world examples of AI implementation in

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group practices and medical practice management (see the sidebar "The Black Box Problem").

Types of Artificial Intelligence

Artificial intelligence encompasses various techniques and technologies that enable machines to mimic human intelligence. In medicine and medical group practice management, its chief purpose is to improve patient outcomes, optimize resource utilization, and enhance the overall efficiency of medical practices. Five major types of AI are used in healthcare:

- *Machine learning:* Machine learning algorithms (i.e., instructions for solving a problem or computing a task) enable machines to learn from past data and improve their performance over time without explicit programming. In healthcare, this helps with tasks ranging from diagnosing to predicting no-shows.
- *Deep learning:* Deep learning, also known as deep structured learning or hierarchical learning, is a subset of machine learning that enables machines to process information in a way similar to the human brain by relying on neural networks. It is loosely based on the way neurons connect to one another to process information in animal brains. In healthcare, this helps with a range of activities, from responding to patient queries to auditing prescriptions.
- *Natural language processing:* Natural language processing enables machines to understand and interpret human language. In healthcare, natural language processing helps with tasks such as extracting data from EHRs and improving communication between patients and healthcare providers. Data also can be pulled from enterprise resource planning to enhance the experience of employees.
- *Computer vision:* Computer vision aims to enable machines to interpret visual information. Computer vision may be used in medicine to aid in diagnosis in radiology or pathology, and in hospital security (e.g., facial recognition).
- *Robotics and automation:* AI-driven robots and automation systems such as DaVinci can assist surgeons in complex procedures and perform repetitive tasks with precision. About two out of three healthcare organizations use AI to automate revenue cycle management.[5]

The Black Box Problem

The "black box" describes the unsettling reality that the transformation of inputs into outputs is not 100% explainable. In short, there is a lack of transparency, or what some describe as opaqueness.[4] This is not necessarily intentional lack of transparency, but, rather, the result of not fully understanding the mechanisms of action. The black box problem in healthcare is unique due to issues such as informed consent and the interaction between a provider and a patient in which patients often will seek to understand how the diagnosis was made and why the recommended treatment is likely to work. The provider may simply not know, and this is especially the case with deep-learning AI applications. **PM**

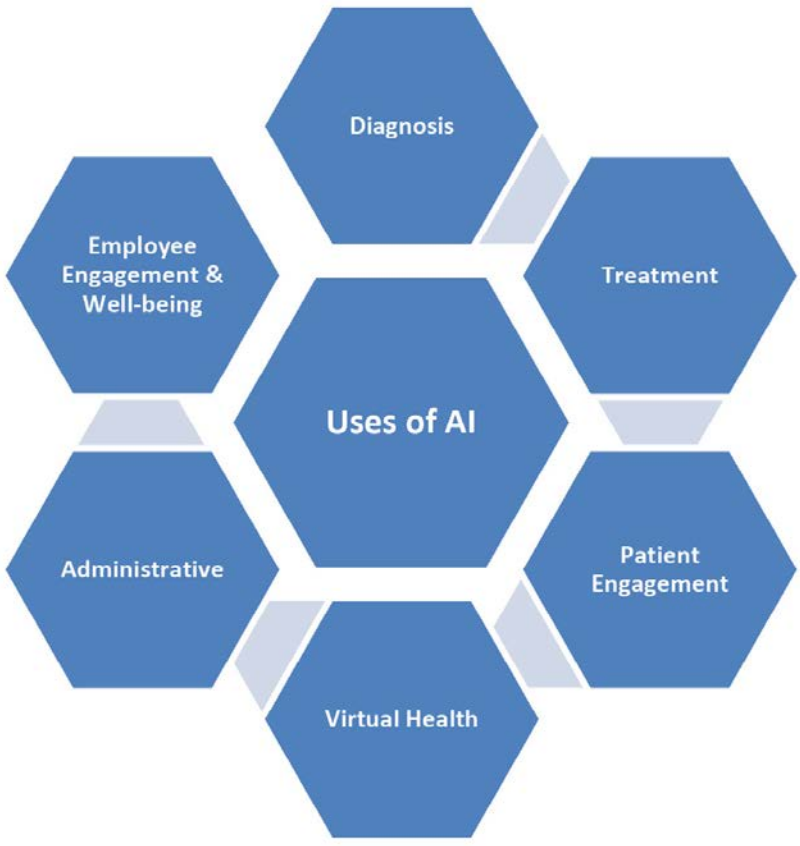

Figure 1: Uses of artificial Intelligence in medicine and healthcare.

Artificial Intelligence in Medicine and Healthcare

History

AI was born in 1956 at the Dartmouth Summer Research Project on Artificial Intelligence, which was hosted by John McCarthy and Marvin Minsky. Since that time, AI has risen and fallen in popularity, advances, application, and funding. In 1966, MIT professor Joseph Weizenbaum

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released the first chatbot, *ELIZA*—a therapeutic chatbot trained on a Rogerian style of psychotherapy. Today, we may use *Google Assistant*, *SIRI*, *Cortana*, or *ALEXA* in our daily lives and, increasingly, *ChatGPT*.

The use of chatbots accelerated during the COVID-19 pandemic, in part because of constraints of in-person and, in many cases, real-time interactions between patients and providers. The voice assistants also enabled patients to search for medical information to inform help-seeking behaviors. It must be noted that not all voice assistants are equal with regard to presenting patients with information based on trusted sources such as the CDC or peer-reviewed literature.[6]

Uses

AI has numerous applications in medicine and healthcare (Figure 1). As you can see, AI is interwoven into nearly all aspects of the running of a medical group. There are two reasons for its wide-ranging application:

1) Wherever there is human involvement in the process of running a medical group, AI might be applicable, because AI, whether software such as chatbots or hardware such as robots, can augment, automate, or even replace what the human does in this task or process.

2) Wherever there are data of any type—from structured data numerically labeled to unstructured data such as written notes in an EMR—then AI requires data to operate.

Even though AI will become increasingly available and expectations from multiple stakeholders may request or even demand the use of AI tools in medicine and healthcare, AI should not be automatically incorporated into your medical group practice without deliberation. The benefits and risks must be identified and weighed before the ultimate decision to use AI is made. The following sections present some of the benefits and risks of AI in medicine and healthcare.

Benefits

It is beyond the scope of this article to present an exhaustive review of benefits of AI in medicine and healthcare, but some of the more prominent benefits include the following:

- *Enhanced diagnosis and treatment:* AI algorithms analyze vast amounts of patient data to aid in accurate diagnosis and treatment planning.
- *Predictive analytics:* AI can predict disease outcomes, re-admissions, and potential health risks, allowing early interventions to prevent adverse events.
- *Workflow optimization:* AI streamlines administrative tasks, appointment scheduling, and billing processes, improving overall efficiency in medical practice management.
- *Personalized medicine:* AI-driven algorithms assess individual patient data to tailor treatment plans, medications, and therapies for better patient outcomes.
- *Drug development:* AI expedites drug discovery and development processes, potentially leading to more effective and personalized treatments.

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A key consideration in planning for the implementation of AI in your medical practice is to consider the ethical aspects. By identifying the benefits, you are taking into consideration one of the key bioethical principles, that is, beneficence. Consideration of the risks of AI, discussed in the next section, is aligned with another key bioethical principle, that of non-malifence.

Risks

The most notable risks are presented below:

- *Data privacy and security:* The use of AI involves handling sensitive patient data, raising concerns about data privacy and the risk of data breaches.
- *Bias and fairness:* Biases in training data can lead to AI systems providing unequal or discriminatory care, particularly for underserved populations.
- *Lack of human oversight:* Relying solely on AI for critical decision-making can raise ethical concerns and may lead to errors if proper human oversight is not employed.
- *Integration challenges:* Integrating AI systems with existing healthcare infrastructure can be complex, leading to hurdles in its implementation.
- *Challenges to informed consent:* Patients have a right to self-determination[7] and, therefore, need to be informed by the medical organization or provider of the risks, benefits, and even "mechanics" of how a diagnosis or treatment works. This is more challenging with AI due to technological novelty, rapid advances in AI, and the "black box" problem.

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Examples of AI in Group Practices and Medical Practice Management

The following examples of how AI is being implemented in group practices are illustrative only and do not fit into the category of "best practices," in part because the implementation of AI is so new that there are few best practices and a host of novel practices.

- *Chatbots for patient engagement:* Group practices use AI-powered chat-

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bots to handle patient inquiries, appointment scheduling, and follow-up care, improving patient engagement and reducing administrative burden.

• *Predictive analytics for resource allocation:* AI algorithms analyze historical patient data to predict patient demand and optimize resource allocation in group practices, ensuring efficient operations.

• *Medical imaging analysis:* AI–driven computer vision systems assist radiologists in interpreting medical images more accurately and quickly, aiding in diagnosis and reducing turnaround time for patients.

• *Virtual health assistants:* AI–powered virtual health assistants provide patients with personalized health information, medication reminders, and lifestyle recommendations, leading to better patient adherence and health outcomes.

• *Administrative task burden:* Provider burnout is associated with the performance of administrative tasks rather than clinical tasks[8] as well as the spill-over of such administrative tasks after work hours, resulting in what is known as "pajama time." AI-augmented administrative tools may lessen this administrative burden.[9] The sidebar "*ChatGPT Is Here: What's Next for Your Medical Group Practice?*" examines the use of AI in writing notes.

Conclusion

AI is transforming medical practice management, leading to improved patient care, increased operational efficiency, and better resource utilization in group practices. The history of AI in medicine shows remarkable progress, and its benefits are evident in enhancing diagnosis, treatment, and healthcare operations. However, the risks of data privacy, bias, and integration challenges must be addressed to ensure responsible and equitable AI implementation in healthcare. As technology continues to advance, AI will play an even more significant role in shaping the future of medical practice management and patient care. **PM**

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ChatGPT Is Here: What's Next for Your Medical Group Practice?

ChatGPT is a chatbot. ChatGPT and GPT-4 (Generative Pretrained Transformer 4) are popping up all over the place. The use of this AI-driven technology is as simple as asking a question (prompt) and then waiting for an answer. It's a conversational tool. Imagine pasting a written transcript of a physician-patient encounter into a GPT-4 platform and prompting the platform to create a medical note—wait for a few seconds and there it is. You can even specify that the note aligns with the SOAP note format. I have experimented with ChatGPT using information from one of my insomnia patients who has gastroparesis and a new diagnosis of sighted non-24 circadian disorder. I prompted ChatGPT to translate what I wrote as a patient education resource for sighted non-24 circadian disorder, specifying that it should be written at a sixth-grade reading level. ChatGPT converted what I wrote to a sixth-grade level, and I then edited the output to make sure that it was still accurate. Will I use ChatGPT again? Yes. Will I rely upon it without thinking and verifying? No way. The real question is as follows: What is your policy on the use of chatbots in your medical practice in clinical and administrative tasks or even patient education and community health information. **PM**

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Dr. Martin is a Professor and Director, DePaul University, Chicago, Illinois; email: wmartin@hms.harvard.edu.

Armand Martin is Software Engineer, Firefly Integrations, LLC, Middlebury Indiana.