

Commentary

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# Advantages and ethics of artificial intelligence in plastic and reconstructive surgery

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## Abstract

As artificial intelligence (AI) technologies evolve in sophistication, they offer the potential to benefit various aspects of plastic and reconstructive surgery practice. From enhancing surgical precision within the operating room to streamlining administrative tasks and supporting the diagnosis and treatment of patients, AI may grow into an invaluable tool that redefines standards of care within plastic surgery. Given the nascent and largely theoretical role of AI in plastic surgery, numerous questions arise regarding its safety, actual utility, ethical considerations, and policies needed to regulate its use. This manuscript aims to provide commentary on AI in healthcare and to discuss an alternative viewpoint of its use in plastic surgery. Americans remain hesitant about healthcare providers leveraging AI in their care. Ongoing scrutiny is required to protect patients from unintended sequelae, safeguard their privacy, mitigate bias, and reduce harm. Early legislation by the United States federal government has aimed to define a role for AI in healthcare, yet more explicit guidance is required. Uncertainty in medico-legal implications begs the question of where liability would fall if AI use causes adverse outcomes. If applied appropriately, AI may ultimately improve patient outcomes and satisfaction with their plastic surgery care. With less energy dedicated toward automatable tasks and tools that push the envelope of human performance, plastic surgeons may be better equipped to care for their patients. We advocate for a cautiously optimistic approach to AI's incorporation within plastic and reconstructive surgery.

**Keywords:** Artificial intelligence, ChatGPT, deep learning, ethics, large language models, machine learning, plastic surgery



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## INTRODUCTION

Will artificial intelligence (AI) replace the work of plastic and reconstructive surgeons? With the rapid evolution and growing role that AI models are contributing to modern life, some people have come to believe that medical doctors will face a forced, early retirement. Large language models such as ChatGPT utilize machine learning and deep neural networks to capture the intricacies of human language. This permits them to navigate specific prompts and generate contextually appropriate and accurate responses even within specialized fields<sup>[1]</sup>. While it is irrefutable that AI may significantly augment and complement the work of plastic surgeons, it remains heavily debated if we will ever actually realize their full replacement, at least anytime soon.

AI may grow to become a useful tool but not a comprehensive substitute for plastic surgeons. Surveys gauging the attitudes of medical students, ostensibly a biased subgroup, have found that future doctors are not concerned about their job security<sup>[2]</sup>. Respondents suggest that the complexity and nuances of healthcare delivery, especially in the case of surgical fields, will make it one of the last industries to fall into obsolescence. AI may have numerous practical applications in medical education, diagnosis and treatment plan formation, research, administration, and patient health literacy<sup>[3,4]</sup>. Altogether, its role could be described as a virtual assistant to healthcare professionals and laypeople alike.

Despite its potential applications, the use of AI in healthcare and plastic surgery poses major ethical and legal concerns. This will be explored further within this commentary. Questions remain as to what extent humans can impart their trust into a non-human entity, how we can protect patients from potential negative consequences associated with AI use, what type of legislation will emerge to regulate and guide the use of AI in healthcare, and what role, if any, will AI play in plastic surgery.

## TRUST OF AI IN PLASTIC SURGERY

In exploring how likely patients are to trust the use of AI in plastic surgery, it is important to discuss the concept of safety. With matters as sensitive as health, AI must demonstrate that it can reliably make correct decisions regarding healthcare management so that humans feel comfortable with its implementation in plastic surgery. Unfortunately, there is no current universal metric or threshold for this. Do we begin to trust AI when it surpasses human plastic surgeon performance, or does it need to achieve some greater level of utility?

To draw a comparison, it is worthwhile to examine the case of autonomous vehicles or self-driving cars. This example serves as an apt analogy because it represents an application of AI that directly impacts personal safety and, thus, health. According to the Centers for Disease Control and Prevention (CDC), car accidents are the leading cause of death in the United States for people aged 1 to 54<sup>[5]</sup>. These accidents occur countless times daily and are a direct result of human error. However, when a sporadic case of an autonomous vehicle hitting a pedestrian or causing a motor vehicle accident occurs, it often makes news headlines and triggers a media frenzy. Companies such as Waymo have demonstrated the capability of self-driving cars, continually iterating to improve reliability. Yet, as a society, we remain hesitant to fully embrace them. In fact, attitudes toward self-driving vehicles have worsened over time, despite improvements in the technology<sup>[6]</sup>.

Unsurprisingly, both clinicians and patients remain skeptical about AI in healthcare and plastic surgery. This stems from uncertainty about both the data used to train AI models and the appropriate applications of the technology. Pew Research Center conducted surveys to gauge American attitudes toward AI use across various healthcare domains. This demonstrated an overwhelmingly negative sentiment<sup>[7]</sup>. In fact,

their research found that nearly 60% of Americans would not want AI-powered robots to be used for surgery or in the formation of diagnoses or treatment plans. Much of this mistrust may stem from the lack of understanding of how these AI models are able to devise their proposed solutions. Distrust may stem from the observation that these models can be unpredictable at times and may “confabulate” when they do not have a clear answer to the questions being asked instead of simply stating they do not have enough information to give a reliable answer. Extensive progress must be made so that patients can trust the use of AI in matters affecting their health, particularly a greater understanding of the inner workings of AI. Furthermore, humans would like to be confident that AI will act in the best interest of humans, which is why reliable, human-centric ethical standards are essential for guiding the operation of these models.

## ACCURACY IN DECISION MAKING

The most accessible way to test AI’s medical decision making in plastic surgery is through standardized exams. These are crafted to have definitive, correct answers. Preliminary studies assessing ChatGPT’s performance on the Plastic Surgery In-Service Exams, which are annual exams taken by American plastic surgery residents to assess their knowledge base, demonstrate that ChatGPT is able to perform at a level higher than early trainees. Interestingly, however, it falls short of trainees in their last years of plastic surgery residency<sup>[8]</sup>. When comparing subsequent versions of ChatGPT, it was found that the AI model rapidly evolved in its performance and accuracy on the in-service exams, progressing toward the level of human performance. Ultimately, it was found that ChatGPT struggled with clinical scenarios where multiple correct recommendations were available, but only one was preferred by the question writers. This may be ascribed to the AI’s lack of real-world experience, missing the intuition derived from time spent in clinical practice.

An important finding from this research, though, is that models like ChatGPT currently do not meet the performance of those closer to attending plastic surgeon status. This suggests that AI models may lack the clinical and subjective insight to fully grasp patient scenarios. While AI may be well-equipped to follow algorithmic approaches, it currently lacks certain reasoning capabilities, particularly when situations are not so clearly defined. Real-life patient care in plastic surgery is filled with nuance, unlike standardized exams that are crafted to have definitive answers. Today, we still cannot confidently rely on AI to make accurate and comprehensive judgments regarding diagnosis and treatment plans.

## PATIENT HEALTH LITERACY

Health literacy and education play an essential role in enabling patients to effectively manage and advocate for their healthcare needs. Medical jargon and complexity can act as a daunting barrier to understanding one’s own health. Those with decreased health literacy are more likely to be hospitalized, visit the emergency room, underuse their prescribed medications, and suffer from higher morbidity and mortality<sup>[9]</sup>. Therefore, enhancing patients’ health literacy, both for general healthcare and in the specific context of plastic and reconstructive surgery, would have immediate and obvious benefits.

The implementation of AI as an accessible plastic surgery consultant has the opportunity to enhance patient satisfaction and outcomes. For this reason, researchers are currently exploring the utility of large language models such as ChatGPT in answering patient questions regarding their plastic surgery needs<sup>[10]</sup>. Beyond answering patient questions, AI models can effectively simplify medical jargon for patients. This facilitates an improved understanding of their medical condition(s). Ayre *et al.* demonstrated that ChatGPT was able to bring medical jargon from a grade 12.8 reading level down to a revised grade 11 level<sup>[11]</sup>. While this remains above the average reading level for Americans, this study shows the potential for AI to make complex text easier to understand for patients without compromising the integrity of its content.

## ADMINISTRATIVE EFFICIENCY

Administrative work accounts for approximately one-sixth of United States physicians' working hours. It has clearly demonstrated a negative impact on career satisfaction<sup>[12]</sup>. Specific administrative tasks in plastic surgery include but are not limited to documenting medical encounters, scheduling procedures and operating room space, coordinating clinical appointments, communicating with ancillary care teams and services, and facilitating insurance claims through accurate ICD coding. Healthcare costs associated with administrative tasks have been estimated to contribute to 15%-25% of total healthcare spending<sup>[13]</sup>. Automating these tasks can not only lead to substantial cost savings for plastic surgery practices but can also reduce the time burden associated with administration. Ultimately, this would enable plastic surgeons to better focus their energy on attending to their patients.

Companies such as Microsoft and EPIC, the provider of a popular electronic medical record system, are seeking to integrate large language models such as ChatGPT into patient charts. This collaboration aims to address critical challenges such as clinician burnout, staffing shortages, and financial pressures within healthcare systems. By leveraging Microsoft's AI technical expertise alongside Epic's electronic medical record service, the partnership may enhance clinician productivity through tools such as note summarization, ambient clinical documentation or scribing, and AI-powered data analysis<sup>[14]</sup>. This partnership is just one example of the numerous collaborations between healthcare services and AI developers. Undoubtedly, efforts like this can enrich the overall efficiency of healthcare administration.

Medicare spending reached \$944.3 billion in 2022, marking a 5.9% increase from the previous year<sup>[15]</sup>. This large financial flow presents significant opportunities for fraudulent activities. The sheer volume of transactions can make it challenging to monitor and detect improper payments effectively. The Federal Bureau of Investigation estimates that fraudulent billing accounts for three to ten percent of total health spending<sup>[16]</sup>. In order to combat this matter, machine learning engineers are currently exploring data-centric approaches to healthcare fraud. Fraud classifications are being developed using data provided by the Centers for Medicare & Medicaid Services (CMS) with the ultimate goal of developing AI fraud detection tools<sup>[17]</sup>. While these issues are not unique to plastic surgery, AI has the potential to encourage integrative billing practices within the field and smoothen interactions between plastic surgeons and insurance providers.

## INSIDE THE OPERATING ROOM

Potential employments of AI in plastic surgery are vast and still currently being explored. With broad applications across natural language processing, data analysis, deep learning, and computer vision, AI may redefine the landscape of plastic surgery within the operating room. Preoperatively, AI may prove to be a useful tool for surgical planning, ensuring consistency across patients<sup>[18]</sup>. A focus of recent research has been the tangible intraoperative application of AI through AI-driven surgical robots and navigation systems<sup>[19]</sup>. While significant advancements are required prior to their implementation, autonomous robots have the potential to assist plastic surgeons in certain surgical tasks such as wound closure. This would enable reliable results to be achieved, regardless of an individual's surgical skill, and free up time for surgeons to focus on other aspects of the operation. Three-dimensional overlays in augmented reality, possibly derived from preoperative imaging, could assist surgeons in visualizing a patient's anatomy<sup>[20]</sup>. Such a tool might help surgeons make informed decisions by highlighting critical structures and eliminating uncertainty stemming from variations in patient anatomy. Postoperatively, AI systems may be a useful tool for automated patient monitoring. For example, Fontaine *et al.* recently explored AI's ability to evaluate postoperative pain based on patient facial expression<sup>[21]</sup>. The future of AI-assisted plastic surgery within the context of operations remains unclear, but its successful incorporation holds promise of enhancing

technical proficiency, improving patient safety, reducing operative times, and leading to improved surgical outcomes.

## MEDICO-LEGAL IMPLICATIONS

Questions persist regarding the assignment of medical liability when the use of AI in plastic surgery results in negative patient outcomes. While a patient's health status may deteriorate despite receiving the accepted standard of care, there may be cases where AI algorithmically steers plastic surgeons toward incorrect or potentially negligent practices that cause untoward sequelae. In the nascent state of AI in healthcare, our medico-legal system must develop a liability model that balances patient safety with beneficial aspirations for constructive innovation. Certain policy options have been proposed. Suggestions include revision of the standard of care with the incorporation of AI or a no-fault adjudication system<sup>[22]</sup>. In all likelihood, liability in the case of malpractice will be shared among multiple parties. These parties would most probably consist of plastic surgeons leveraging AI, model developers, medical institutions, and regulatory agencies. Determining the extent of each party's culpability may be a complex task that creates obstacles to AI's ultimate relevance in plastic surgery.

Plastic surgeons, like all healthcare providers, are held to a standard of care. This necessitates the provision of consistent, accepted treatment practices as established by academic and specialty societies. Questions are raised regarding what level of proficiency is expected from plastic surgeons using AI and whether the standard of care would be adjusted to a higher level that would essentially require its use or be at risk of falling into obsolescence. Malpractice claims could arise if AI provides incorrect plastic surgery recommendations that are followed or if correct recommendations are not followed, truly an unintended catch-22 situation. Ultimately, plastic surgeons must demonstrate that they are acting reasonably and responsibly when using AI in patient care. This places immense importance on the documentation of AI assistance. Specifically, plastic surgeons should maintain detailed records of AI recommendations, their rationale for following or deviating from those recommendations, and any subsequent patient outcomes.

Regarding AI developers, they must ensure that their tools meet currently undefined safety and efficacy standards and provide adequate warnings about potential risks. A common complaint with AI models in their current state is that they provide recommendations without assigning a degree of certainty, potentially misleading the unwary user<sup>[23]</sup>. Substantial testing must be done before developers can offer their technology for commercial use in plastic surgery, to avoid hypothetical punitive action.

## EARLY LEGISLATION FOR AI IN HEALTHCARE

A few attempts have been made in the United States to impose regulations on the use of AI in healthcare. These actions have been largely pursued by the federal government, although some of the legislation has relinquished final decision-making power to state governments. An introduced but never passed piece of legislation was the Healthy Technology Act of 2023<sup>[24]</sup>. Proposed by Republican House Representative David Schweikert, this bill aimed to clarify that AI and machine learning technologies could qualify as practitioners with the authority to prescribe to patients if certain criteria were met. Specifically, the "provider" would have to be authorized by state law, and the medical devices or drugs being prescribed would need to have federal approval (i.e., FDA approval). This bill was referred to the Subcommittee on Health on January 20, 2023, but never passed a House vote.

Later in October 2023, President Biden issued an executive order (#14110) about AI development. The goal was to ensure that the United States becomes a global leader in reaping the benefits and managing risks of the blossoming technology<sup>[25]</sup>. Although not specific to healthcare, Biden's administration called for the

“safe, secure, and trustworthy development and use of AI.” Certain policies that may influence healthcare AI development include the need to maintain individual privacy, to promote civil rights and equity, to support America’s workforce, and to promote innovation. Ostensibly, this executive order suggests that Biden’s administration views AI as a way for healthcare workers to extend their impact rather than as a replacement. Additionally, the need to maintain citizens’ privacy may impose limitations on the data that can be made available to train and refine AI models.

Most recently, in February 2024, the Center for Medicare and Medicaid Services issued guidance on AI applications. It clearly mandates that insurers cannot use AI to determine patient coverage and that hospitals cannot use AI to determine the level of admission for patients<sup>[26]</sup>. It specifically necessitates the role of human review in all important medical assessments. However, the guidance was somewhat vague regarding the specific extent of human intervention. This could subject this guidance to manipulation. Nevertheless, this narrative appears to be the most restrictive stance taken by a federal agency on AI in healthcare to date. It explicitly scripts a role for human judgment.

## CONCLUSION

Prospects of AI’s incorporation in plastic surgery appear to be exciting as well as infinite. It has the potential to solve problems that transcend human capability, but questions persist regarding its application, ethical considerations, and future regulation. AI may revolutionize plastic surgery through enhanced surgical precision, data-driven diagnostics, streamlined workflow, and a strengthened patient-physician relationship. Ultimately, it could improve patient satisfaction and outcomes. Nevertheless, it is prudent to maintain a reasonable level of skepticism, given the potential risks to human health and the current uncertainties surrounding AI. Issues regarding patient consent, data privacy, and the perpetuation of systematic bias require ongoing scrutiny. We propose that plastic surgery leadership adopt a framework of cautious optimism, one that clearly defines the problems AI is trying to solve and its role in conjunction with human plastic surgeons.

## DECLARATIONS

### Authors’ contributions

Reviewed literature and made substantial contributions to the writing of the final manuscript: Treger D, Harris G

Made substantial contributions to the conception or design of the work, revised the final manuscript, and gave final approval of the version to be published: Thaller SR

### Availability of data and materials

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### Conflicts of interest

Thaller SR receives book royalties from Springer & Thieme Publishers. The other authors declared that there are no conflicts of interest.

### Ethical approval and consent to participate

Not applicable.



## Consent for publication

Not applicable.

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