

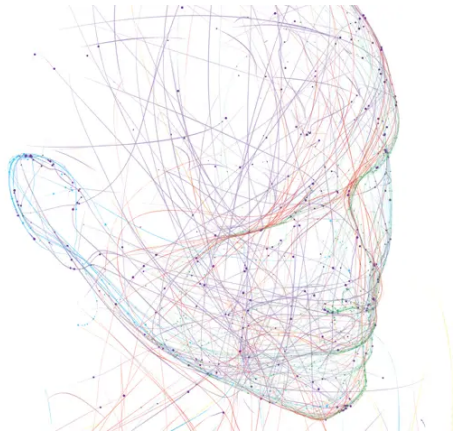


BULLETIN

## AI Is Poised to “Revolutionize” Surgery

Jim McCartney

June 7, 2023

[Watch the video.](#)

### **The daily barrage of news stories about artificial intelligence (AI) shows that this disruptive technology is here to stay and on the verge of revolutionizing surgical care.**

AI is the study of algorithms that give machines the ability to solve problems, recognize words and visual aspects within images, and make predictions based on statistical inferences. When it comes to medicine, AI is able to review large amounts of data from patient records, radiological scans, or surgical videos, and use that information to detect, classify, and predict.<sup>1</sup>

AI will have an expanding role in healthcare administration and patient care, said cardiothoracic surgeon Arman Kilic, MD, FACS, FACC, who is the director of the Harvey and Marcia Schiller Surgical Innovation Center at the Medical University of South Carolina (MUSC) in Charleston.

This technology will make hospital and health system operations more efficient and less costly and help address stresses such as workforce shortages. For example, by estimating how much time is left in the surgery, AI will help hospitals better plan their available hospital bed resources and more accurately inform the patient's family when the surgery might be completed.

AI also could reduce the need to have a nurse on call by providing a chatbot to answer patient questions, said Danielle Saunders Walsh, MD, FACS, FAAP, a pediatric surgeon and vice-chair of surgery for quality and innovation at the University of Kentucky College of Medicine in Lexington.

"A patient who wakes up at 1:00 in the morning 2 days after a surgical operation can contact the chatbot to ask, 'I'm having this symptom, is this normal?'" explained Dr. Walsh, who added that the use of chatbots has already been trialed in obstetrics with 96% of patients viewing the tool positively.

In addition, AI is expected to help enhance surgical decision-making before, after, and even during a surgical procedure by bringing integrated information from many different data sources—such as the latest surgical guidelines or research insights—to the operating table and bedside. It has the capability to review patient charts and suggest a test or a medication.

"AI can individualize healthcare in a way that we, as surgeons, can't by ourselves," she said.

## AI Is Used Mainly in Diagnostic Specialties—For Now

AI-based tools typically are used at academic medical centers that have more robust infrastructures and information technology departments. Most often, AI is used to recognize patterns, classify images, or detect objects by analyzing digital images or videos through a process called “computer vision.”

Not surprisingly, the technology’s biggest impact has been in the diagnostic specialties, such as radiology, pathology, and dermatology, said Jennifer Eckhoff, MD, the artificial intelligence and innovation fellow at the Surgical Artificial Intelligence and Innovation Laboratory at Massachusetts General Hospital in Boston.

In fact, most AI healthcare startup funding goes into a diagnostic specialty, according to Dr. Kilic.

The general goal is to identify high-risk cases that radiologists may have missed, such as metastatic nodules in CT scans. One study showed that by using AI, pathologists have decreased their error rate in recognizing cancer-positive lymph nodes from 3.4% to 0.5%.<sup>2</sup>

“It’s almost like a backup or a failsafe system that can run in the background to look at the scan and see if we missed anything,” Dr. Kilic said.

AI can help radiologists prioritize the dozens of images they face each day, reviewing in minutes a stack of chest x-rays that might take hours for clinicians to evaluate. Dr. Kilic noted a study that involved board-certified radiologists reading through hundreds of chest x-rays. On average, it took them 4 hours to examine all of the scans, while an AI algorithm developed by the research group was able to complete the same reads with similar accuracy in 90 seconds.

Most research shows that scan interpretation from AI is more robust and more accurate than those from radiologists, often picking up small, rare spots in the images.

“AI is not intended to replace radiologists—it is there to help them find a needle in the haystack,” Dr. Walsh said.

## Predictive Analytics: Delivering the Promise of Personalized Medicine

In the near future, AI is expected to be used increasingly to help assess risks and predict outcomes based on reviews of patient databases and multicenter national registries.

“Simultaneously processing vast amounts of multimodal data, particularly imaging data, and incorporating diverse surgical expertise will be the number one benefit that AI brings to medicine,” Dr. Eckhoff said.

To evaluate a surgical patient’s risks and benefits, including risk of postoperative complications, surgeons have long used patient databases and multicenter registries, such as The Society of Thoracic Surgeons National Database, the ACS National Quality Improvement Program (NSQIP®), and others, to develop risk models.

Among the risk-assessment tools in use are the ACS NSQIP Surgical Risk Calculator, the University of Florida’s MySurgeryRisk algorithm, and the Predictive OpTimal Trees in Emergency Surgery Risk (also known as POTTER) application.

AI and machine learning offer the potential to tap these large, complex data pools to develop even more robust predictive algorithms. By analyzing millions of historic surgeries along with patient characteristics, AI will help surgeons stratify the risks of a particular surgery for a specific patient.

“AI could help inform decisions and better inform patients and providers about their individualized risks and benefits of certain surgeries,” said Christopher J. Tignanelli, MD, MS, FACS, FAMIA, a general surgeon and scientific director of the Program for Clinical AI at the University of Minnesota in Minneapolis.

One of the first AI risk models is the Epic Sepsis Model, part of Epic’s electronic health record platform, which calculates the probability of sepsis, he said. The model is used by 170 customers representing hundreds of hospitals.<sup>3</sup>

Dr. Kilic and his team at MUSC are working on developing AI algorithms to help identify high-risk patients in need of organ transplants, evaluate potential donors, and match donor organs and recipients. A visual analytics platform merges interrelated data showing probable outcomes if they accept or reject the donor organ, he said.

“All of that currently is done through just clinician judgment and prior experience,” Dr. Kilic said, adding that the ultimate goal is to use AI to make better transplant decisions and optimally allocate scarce resources—donor organs.



Dr. Jennifer Eckhoff says that through comprehension of spatial, temporal, and conceptual aspects of surgical workflow, AI holds the potential to change minimally invasive surgery.

### **Intraoperative Assistance: Guidance and Execution of Simple Tasks**

By highlighting tools, monitoring operations, and sending alerts, AI-based surgical systems can map out an approach to each patient’s surgical needs and guide and streamline surgical procedures. AI is particularly effective in laparoscopic and robotic surgery, where a video screen can display information or guidance from AI during the operation.

“AI will analyze surgeries as they’re being done and potentially provide decision support to surgeons as they’re operating,” Dr. Tignanelli said. For example, during a colonoscopy, AI will be able to identify a potential polyp.

Based on its review of millions of surgical videos, AI has the ability to anticipate the next 15 to 30 seconds of an operation and provide additional oversight during the surgery, explained Dr. Eckhoff, who is part of a research team that worked on prediction of the next surgical phases in a laparoscopic cystectomy. In the future, anticipation of surgical events could allow surgeons to change their courses of action, if necessary.

There’s an international project to use AI to make laparoscopic cholecystectomies safer by placing an overlay on the surgeon’s video screen during an operation to suggest where it is safer or less safe to operate, Dr. Walsh said. AI also can guide surgeons if they get lost during an operation. Or it might offer suggestions such as “put in a drain” or “do a bubble test.”

“It might say to you, ‘Warning, you’re about to cut the common bile duct. Do you really want to do that?’” Dr. Walsh said.

In robotic surgery, AI also will be able to perform simple tasks through the robot, including closing a port site and tying a suture or a knot.

“You get it ready, click the button, and then the robot does that step for you,” Dr. Tignanelli said. Last year, the first laparoscopic surgery without human help, which involved reconnecting two ends of a pig intestine, was performed at The Johns Hopkins University in Baltimore, Maryland.<sup>3</sup>

Most AI and robotic surgery experts seem to agree that the prospect of an AI-controlled surgical robot completely replacing human surgeons is improbable. After all, AI is intended to augment the surgeon’s decision-making and execution skills, not replace them.

### **AI’s Role in Medical Education and Training**

AI can provide learning tools for surgeons at all stages of their careers, tracking their performance or teaching them new skills.

It also could help supplement the limited teaching capacity of specialized trained surgeons. Earlier this year, ChatGPT—an advanced AI chatbot made available to the public in late 2022—passed the US Medical Licensing Exam. The model achieved the passing threshold of 60% accuracy without specialized input from clinician trainers, according to researchers.

In addition, AI can function as an expert escort of sorts. During an operation, AI may offer information about similar cases, explain what is happening, and predict what may happen next. In this way, AI can serve as

a guide not only for medical students, residents, or other surgeons who are watching the operation, but also for all the members of the surgical team involved in the operation.

More information about how this technology can inform clinical decision-making and help surgeons more accurately assess risk, predict disease progression, and manage patients is available through the ACS online course, Artificial Intelligence and Machine Learning: Transforming Surgical Practice and Education. The program includes eight modules. Visit [facs.org/for-medical-professionals/education/programs/artificial-intelligence-and-machine-learning-transforming-surgical-practice-and-education](https://facs.org/for-medical-professionals/education/programs/artificial-intelligence-and-machine-learning-transforming-surgical-practice-and-education) for more information.

### **The Perils of AI: Accountability, Trust Issues, Data Bias**

Although AI has enormous potential in surgery, it also poses a variety of ethical, legal, and regulatory issues. In addition, the rapid development of AI continues to be ahead of the process to develop the appropriate infrastructural frameworks to deploy it, Dr. Eckhoff said.

The following questions highlight key issues that surgeons may face as AI continues to evolve.

#### **Who is accountable if an AI-guided patient case goes wrong?**

Who do we hold responsible if AI leads a physician to a decision that results in a bad outcome? The programmer who created the software? The company that markets the software? The hospital that bought the software? Or the physician who used it? Opinions may differ depending on how the tool is used.

“We may have to look at the degrees of responsibility and how the tool impacts our decision-making,” said Dr. Walsh.

For some, the answer is clear—since AI is a decision-support tool, the ultimate decision must lie with the clinician.

“Anyone who deploys AI models needs to make sure that the people using them understand their performance and their limitations,” Dr. Tignanelli said.

Dr. Eckhoff agreed, “At the end of the day, physicians are accountable.”

#### **How can we overcome resistance to change from surgeons and patients?**

AI algorithms and other tools will have little effect if practitioners don’t regularly use them.

Unfortunately, skepticism and the natural resistance to change threatens to slow the incorporation of AI in medicine.

“Everybody is nervous about new technologies,” Dr. Walsh said.

Implementation science—the scientific study of how to facilitate the uptake of evidence-based practice and research—can help promote AI usage, said Dr. Kilic, who is doing research in this area. Simulation exercises can determine what surgeons like or don’t like about various AI tools, and why they would or wouldn’t use them, he added.

Most Americans are already leery of AI—60% of Americans would be uncomfortable if their provider relied on AI for their healthcare, according to a recent Pew Research Center poll.<sup>4</sup> As a result, surgeons will need to learn how to effectively engage with patients about AI and explain how AI can help assess risks and benefits, Dr. Walsh said.

This apprehension about AI could be reinforced when the inevitable story of a poor patient outcome related to AI garners media attention. It won’t matter how rare the occurrence is or how well AI performs on average, Dr. Kilic shared.

“If AI is associated with a mistake in somebody’s healthcare, that’s going to be a big deal, and it’ll gather a lot of visibility,” he said.

#### **What can we do about data limitations and bias?**

“Garbage in, garbage out” has long been axiomatic in computer science. That is, a computer’s output is only as good as the data on which it is based. Research shows that a limited database can lead to biased conclusions.

“If you create AI software based on one population, it may not apply well to another population,” Dr. Walsh said. “It depends on how big the sample set was, what kind of demographics were involved, where it was done, and what biases were created intentionally or unintentionally in doing so.”

For example, Epic’s Sepsis Model was trained on data from three hospitals. Such a small sampling does not represent the makeup of every hospital in the US, Dr. Tignanelli said.

“AI models are only as good as the data that they were trained on or what they’ve seen before,” he added.

In addition, AI models should be externally validated before they are published. Before those models are put into practice, there should be, at a minimum, evaluations for performance, equity, and fairness.



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Jim McCartney is a freelance writer.

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### References

1. Loftus TJ, Altieri MS, Balch JA, Abbott KL, et al. Artificial intelligence-enabled decision support in surgery: State-of-the-art and future directions. *Ann Surg*. March 23, 2023. [Epub ahead of print].
2. Ting Sim JZ, Fong QW, Huang W, Tan CH. Machine learning in medicine: What clinicians should know. *Singapore Med J*. 2023;64(2):91-97.
3. Graham C. Johns Hopkins robot performs first laparoscopic surgery without human help. *Scientific American*. January 26, 2022. Available at: <https://hub.jhu.edu/2022/01/26/star-robot-performs-intestinal-surgery/>. Accessed May 18, 2023.
4. Tyson A. 60% of Americans would be uncomfortable with provider relying on AI in their own health care. Pew Research Center. February 22, 2023. Available at: <https://www.pewresearch.org/science/2023/02/22/60-of-americans-would-be-uncomfortable-with-provider-relying-on-ai-in-their-own-health-care/>. Accessed May 18, 2023.

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