## 6 ways Johnson & Johnson is using AI to help advance healthcare

Artificial intelligence is revolutionizing healthcare—from improving surgical training and procedures to equipping healthcare providers with insights and personalizing care for patients around the world. See how the company is harnessing its extraordinary power.

Using artificial intelligence (AI) in healthcare may seem cutting edge, but the technology has actually been around for decades. Research suggests the earliest incarnation of AI—the simulation of human intelligence in computers—dates back to the 1950s. Granted, the limitations of early models prevented widespread acceptance, not to mention application, in the world of medicine.

By the early 2000s, however, AI began to make good on its early promise. Healthcare workers could use AI to screen for diseases ranging from diabetic retinopathy to skin cancer with amazing accuracy. And the U.S. Food and Drug Administration (FDA) approved a number of AI firsts: the first AI-powered device for use in the operating room (OR), the first AI-powered device for cancer diagnosis, a deep-learning algorithm to interpret brain MRIs. To date, the FDA has authorized more than 900 AI/machine learning-enabled medical devices in the United States.

"In the next few years AI is going to play an even bigger role," says Jim Swanson, Executive Vice President and Chief Information Officer, Johnson & Johnson. That's especially true at Johnson & Johnson, where "the technology is currently being used to help our employees detect disease at earlier stages, accelerate drug discovery, assist with clinical trial recruitment, map a patient's anatomy before a procedure and help surgeons predict the best tool for surgery," he says.

Here are six ways Johnson & Johnson is using AI to help advance healthcare.

### 1. Analysing the operating room for efficiency and physician learning

In the OR, surgical video captured during procedures can provide medical professionals with opportunities for education, research methodologies and quality-improvement strategies.

Johnson & Johnson is developing digital solutions for the OR that use AI algorithms to essentially "cut a highlight reel of these videos" in a matter of minutes, says Shan Jegatheeswaran, Global Vice President, MedTech Digital, Johnson & Johnson. That way, surgeons can re-watch significant moments from their procedures. Without AI, this process could take hours—even days—to complete.

"Surgeons are a lot like high-performance athletes," says Jegatheeswaran. "New and learning surgeons want to see how they performed and learn from their performances and how others performed. But it's a lot of work to sit and watch hours of footage from the full procedure and cut it down to clips."

The company's Polyphonic™ digital ecosystem (shown, above), available for use in select hospitals today through a beta program, allows surgeons to connect via telepresence and share OR video with residents and peers, offering valuable post-case analysis and learning opportunities. With Polyphonic, surgeons will also be able to analyse patient data ahead of surgery, help with presurgical planning and provide real-time guidance via telepresence. Post-op, the platform will allow surgeons to track recovery by linking with patients' electronic health records. The first release of Polyphonic features applications for surgical video, telepresence and planning to help surgeons and surgical teams increase collaboration.

"Once you get enough of these enriched surgical videos, there is potential to explore algorithms on the behaviours, tactics and movements that could in the future provide further information to care teams," Jegatheeswaran says.

## 2. Improving surgical procedures

Not only is AI helping to improve procedures—by extension, it's improving patient outcomes as well.

Cardiac ablation is one example. This minimally invasive procedure delivers energy through a catheter to correct an irregular heartbeat in patients with heart conditions like atrial fibrillation (AFib). During cardiac ablation, a small flexible tube (a.k.a. catheter) is inserted into a vein in the groin and guided through the veins and/or arteries up into the heart, where the location of the abnormal tissue that is responsible for the arrhythmia is identified.

The company's CARTO™ 3 System enables electrophysiologists to create 3D maps and navigate inside the heart during AFib catheter ablation procedures. The system's newest Version 8 software incorporates deep learning: a subset of AI capabilities designed to help doctors deliver effective and efficient procedures and generate valuable case data that may help further improve patient outcomes.

Another example of AI improving surgical procedures: The company's AI-powered VirtuGuide™ software, which is currently in development and not yet commercially available, automates patient analysis and correction to treat bony deformities of the foot and ankle. By using AI to analyse the patient's anatomy, this software suggests which instrument is needed to treat the specific patient and recommends a correction plan, reducing the surgeon's planning period from weeks to a matter of days.



An electrophysiologist uses the SOUNDSTAR™ Ultrasound Catheter with CARTOSOUND FAM™ Module to create a CARTO™ 3 System map of the left atrial geometry

## 3. Speeding up the process of discovering new medicines

Traditionally, discovering and developing new drugs to treat disease is a long and complex undertaking, but AI is primed to help accelerate the process.

To develop medicines, researchers need to understand which biological and genetic variations cause diseases. By applying AI to de-identified medical datasets, such as electronic health records, lab results or genetic sequencing data, scientists can shed light on what drives specific diseases.

Once promising disease targets are identified, Johnson & Johnson is then leveraging AI to help discover molecules that could interact with the target. AI can also design and optimize those molecules to develop drug candidates that are fit to combat the disease and minimize side effects. The company is doing this through its own state-of-the-art technologies, as well as in partnership with external collaborators.

"Drug discovery is an extremely challenging process with only a small percentage of lead compounds moving into clinical trials and an even smaller percentage becoming approved medicines," says Chris Moy, Scientific Director, Oncology, Data Science & Digital Health, R&D, Johnson & Johnson Innovative Medicine. "By applying AI, we can advance the most promising drug candidates into clinical development, with the goal of improving the probability

of successfully bringing a drug to market and rapidly getting new treatments to the patients who need them the most."

**4. Enabling more targeted clinical trial recruitment**

One of the biggest challenges when it comes to running clinical trials is quickly and efficiently recruiting and enrolling patients that meet the selection criteria. Adopting AI technology into the process may help solve this problem.

At Johnson & Johnson, for example, researchers are applying AI and machine learning (ML) algorithms to large de-identified datasets to locate clinical research sites with patients who could potentially benefit from the medicines being studied. The clinical trial operations team can then work to determine the likelihood of enrolling the newly identified sites into their trials.

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Kris Standish, Senior Director, AI/ML and Computer Vision for R&D, Johnson & Johnson Innovative Medicine

"Historically, many clinical trials have largely taken place at major academic medical centers, but we know that not all patients have access to these centers," says Nicole Turner, Senior Director of Global Development, Data Science & Digital Health, R&D, Johnson & Johnson Innovative Medicine. "Our goal is to leverage the power of AI to bring trials to more patients, rather than waiting for patients to come to us."

Data and AI are also helping researchers diversify clinical trials, as advanced analytics are finding locations and healthcare institutions where diverse patients are more likely to be treated. Researchers can then prioritize recruiting eligible patients from those study sites into clinical trials. This is critical, given the importance of ensuring that medicines are studied in diverse patient populations representative of those impacted by diseases.

**5. Enabling more personalized care**

When it comes to more precisely understanding disease to deliver more personalized care, AI can be a real game changer. By applying AI to genomic and clinical data derived from or generated by common diagnostic tests such as CT scans, MRIs, electrocardiograms and echocardiograms, AI can enable more personalized targeted treatment and accelerate clinical trial enrolment.

Take, for example, bladder cancer, the tenth most common cancer worldwide. Despite the existence of treatments for patients whose tumours have a specific alteration in the FGFR gene, the uptake of testing to identify these alterations is often limited, due to various challenges. As a result, patients with FGFR-positive tumours don't always receive the targeted, personalized treatment that could significantly impact their care and outcomes.

To help address this challenge, Johnson & Johnson is developing an AI-powered biomarker test that, when applied to digitized images of biopsies, can detect whether patients' tumours are likely to have FGFR alterations. The company is evaluating the clinical utility of this technology and exploring its potential future use for patients.

"Treatment for oncology patients is becoming increasingly more personalized, thanks to big advances in both science and technology," says Kris Standish, Senior Director, AI/ML and Computer Vision for R&D, Johnson & Johnson Innovative Medicine. "Our goal is to leverage AI to find ways to help ensure patients can be connected with these tailored treatments."

**6. Helping treatments reach patients faster**

First comes the discovery and development of therapies, medications and other healthcare products. The next critical juncture? Making sure these products reach patients. AI can help with that, too.

Stocking products in hospitals, pharmacies, clinics and other healthcare facilities where they're needed requires an accurate prediction of supply and demand. This can be challenging, as a wide range of factors can affect the supply chain, including market trends, economic disruptions, supplier issues and more.

AI-powered solutions can help prioritize which locations will be greatly impacted in order to quickly respond to risk factors that may otherwise affect the ability to deliver products to people who count on them.

"It's our responsibility to make sure patients and customers have reliable access to the transformational therapies our company creates," says Vishal Varma, Director, Supply Chain Digital & Data Science and Operations Research, Johnson & Johnson Services, Inc. "AI is helping us build a stable, efficient and resilient supply chain so we can deliver on that obligation."

"When we use AI, it's always with a purpose. Our Credo states that our patients and customers come first, and that will continue as we move forward with this technology."

Jim Swanson, Executive Vice President and Chief Information Officer, Johnson & Johnson

For example, Johnson & Johnson is using advanced ML algorithms to sift through and analyse large amounts of data, including demand fluctuations and supplier performance, to help predict the impact of real-time events that may disrupt the supply chain (think severe weather events and economic disruptions).

Ensuring patients have access to the right products also requires timely communication with healthcare providers.

"Another way Johnson & Johnson is using ML is to improve our understanding of disease progression, which allows us to anticipate when a patient may benefit from one of our medicines," says Jeff Headd, Vice President and Head of Technology, Innovative Medicine Global Commercial Strategy Organization.

This application is part of a Johnson & Johnson global capability known as Engagement.ai, designed to guide the company's engagement with healthcare professionals. Engagement.ai is powered by AI and ML models trained on extensive de-identified datasets to provide insights that maximize the company's ability to support providers and their patients.

"These insights from Engagement.ai allow us to prioritize when, where and how we connect with healthcare providers to ensure they have relevant and appropriate information when making treatment decisions," says Headd.

Ultimately, that's what AI in healthcare is all about: better serving patients. "When we use AI, it's always with a purpose," says Swanson. "Our Credo states that our patients and customers come first, and that will continue as we move forward with this technology."

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